पंडित रविशंकर शुक्ल विश्वविद्यालय, रायपुर छत्तीसगढ़ भारत
Pt. Ravishankar Shukla University, Raipur Chhattisgarh, India
Estd-1964 – recognized by UGC U/s 2(f) and 12 (B)
NAAC "A" Grade

Syllabus 2018-2019

School of Regional Studies and Research

Syllabus

Post Graduate Diploma in Regional Planning and Development
Session: 2018-2019

Pt. Ravishankar Shukla University, Raipur -492010
Chhattisgarh, India

School of Regional Studies and Research
Pt. Ravishankar Shukla University, Raipur (C.G.)
Post Graduate Diploma in Regional Planning and Development
Syllabus
2018-2019
Scheme of Examination

Sem.	Course code	Paper No.	Name of the Paper	Teaching Learning Methodology	External marks	Internal Marks	Total Marks	Credit	Passing Marks
I	PGDRPD 101	I	Regional Planning and Development	Lecture through ICT, Case Study, Group Discussion (Student Centric Approach)	80	20	100	4	20
	PGDRPD 102	II	Research Methods and Computer Applications	Lecture through ICT, Case Study, Group Discussion (Student Centric Approach)	80	20	100	4	20
	PGDRPD 103	III	Tribal Development	Lecture through ICT, Case Study, Group Discussion (Student Centric Approach)	80	20	100	4	20
	PGDRPD 104	IV	Field based Minor project on Urban Planning	Field Visit, Participatory Approach, PLA	80	20	100	8	20
Sub-Total (Sem.-I)					320	80	400	20	80
II	PGDRPD 201	I	Research and Development Based Regional Needs	Lecture through ICT, Case Study, Group Discussion (Student Centric Approach)	80	20	100	4	20
	PGDRPD 202	II	Rural Marketing & Finance	Lecture through ICT, Case Study, Group Discussion (Student Centric Approach)	80	20	100	4	20
	PGDRPD 203	III	Dissertation / Field Report	PLA, Collection of date, Analysis of data, Report Writing	80	20	100	8	20
	PGDRPD 204	IV	Viva	-	80	20	100	4	20
Sub-Total (Sem.-II)					320	80	400	20	80
Grand Total (Sem.-I + Sem.-II)					640	160	800	40	160

Note:

1. In PG Diploma, 80% marks in each theory paper will have equal marks for 4 questions.

2. 20% marks in each subject, internal marks awarded to a student in any particular paper shall be based on his/her performance in all the tests, assignments and seminars conducted during a semester and shall be awarded (average of marks best two test in each paper) at the end of the semester.

3. The percentage of marks secured by a student in a particular paper shall be converted to a grade and grade point for that course by the university.

4. The Credit of the Core Subject is mandatory based on the Course selected.

Post Graduate Diploma in Regional Planning and Development

Session: 2018-19
Semester- I
Paper-I
Course Code: PGDRPD 101
Title: Regional Planning and Development

Maxi. Marks: 80
Min. Marks: 16

Credit: 4

Learning Objectives:

At the end of the course the students will be to:

1. understand the concept, scope and objectives of regional planning.
2. know the theories, approaches and strategies of regional planning.
3. understand the five year plans of regional policies and 12th five year plan.

Unit - I

Regional Planning: Concept, Scope and Objectives, Types of Regional Planning, Failure of Regional Planning, Concept of Sustainable Development. Regional Planning in India, Regional imbalances and Inequalities. Indicators of Regional Development and Regional Imbalance

Unit - II

Theories of Regional Planning, Development Models, Environmental Pollution : Concept, Types and Strategies of prevention, Environmental laws and their implementation, Policy instruments for controlling water and air pollution, The environment protection Act, Social forestry in India: Rationale and Benefits.

Unit – III

Approaches and Strategies of Regional Development: Growth Model - Meaning and Objectives, Types of Model, Rural Development Planning, Metropolitan planning (With reference to India) Balance and unbalanced Growth.

Unit – IV

Regional Policies in Five Year Plans, Introduction to 12th Five Year Plan, Globalization and its impact on India. Role of Regional Planning in National Development, Regional Planning in different fields: Irrigation and Regional Planning. Energy resources and Regional Planning

Books Recommended:

1. Desai. Vasant. **Rural Development in India.** New Delhi: Himalaya, 2005.

2. IGNOU. **Rural Development: Indian Context.** New Delhi: IGNOU, 2005.

3. Narwani, G. S. **Training for Rural Development**, New Delhi: Rawat Publications, 2002.

4. Rao K. Hanumantha , **Rural Development Statistics : 2007-08,** National Institute of Rural Development Ministry of R. D., Govt. of India, Rajendra Nagar, Hyderabad – 30 July, 2008.

Paper-II
Course Code: PGDRPD 102
Title: Research Methods and Computer Application

Maxi. Marks: 80
Min. Marks: 16

Credit: 4

Learning Objectives:

At the end of the course the students will be to:
1. understand the meaning, importance and purpose of research.
2. describe the nature of research and identify the areas of rural development in which research is being increasingly undertaken.
3. know the uses of computer application for research work.
4. write a research report.

Unit - I

Social Research: Concept, Objectives, Types, Importance, Scope, Selection of Research problem. Hypothesis. Social Survey Method

Unit - II

Tools and Techniques of data Collection-Observation, Interview, Questionnaire and Schedule, and Content Analysis. Sample and Sampling techniques. Measures of Central Tendency

Unit - III

Introduction to Computers: Types of Computers, Computer hardware and software.
DOS, Windows: Features, Desktop, Taskbar, Start Menu, My Computer, Recycle bin.

Unit - IV

MS Office: MS Word, MS Excel, Power Point, Outlook Express. SPSS (Evolution version).
Uses of Computer Applications in Research.

Paper-III
Course Code: PGDRPD 103
Title: Tribal Development (with special reference to Chhattisgarh)

Maxi. Marks: 80
Min. Marks: 16

Credit: 4

Learning Objectives:

At the end of the course the students are expected to:

1. know the geographical distribution of tribal population.
2. understand the concept and objectives, plans, programmes & strategies of tribal development.
3. critically review the forest policies of tribals and identify the problems of tribes.

Unit - I

Definition of Tribe, Characteristics, Classification – Geographical, Linguistics, Economic and Racial, Difference between Tribe and Scheduled Tribe, Constitutional Safeguards for Scheduled Tribes.

Unit - II

Tribal Development: Concept and Objectives, Tribal Development Plans, Programmes and their Implementation, Tribal Sub-Plan, Scheduled and Tribal Area, Role of Non-Governmental Organization (NGO) in Tribal Developments.

Unit - III

Major Tribes of Chhattisgarh: Gond (Muria, Maria), Oraon, Kawar, Halba, Binjhwar. Primitive Tribes of Chhattisgah : Abujhmaria, Pahari Korwa, Kamar, Baiga, Birhor. Their Social Organization: Family, Marriage, Economic, Religious, Political, Youth Dormitories etc.

Unit - IV

Forest and Tribals, Critical review of Forest policies, Deforestation and Tribal Forest, Forest Management, Tribal Problems: Different approaches to Tribal problems, Major Tribal Problems: Land alienation, Displacement and Rehabilitation. Industrialization and Urbanization, Naxal Problem in Tribal Area.

Recommended Readings:

1. Verrier Elwin, **Muria and Their Ghotul: Kingdom of the young** (abridged edition), New Delhi: Vanya Prakashan, 1991.

2. Verrier Elwin , **The Baiga,** New Delhi: Gyan Publishing House, 2002.

3. Verrier Elwin , **Maria, Murder and Suicide**, New Delhi: Vanya Prakashan, 1991

4. Vidhyarthi & Rai. **The Tribal Culture of India.** New Delhi: Concept Publishing Company, 1985.

5. Nadeem Husnain, **Tribal India,** Delhi: Palka Prakashan, 2006,

6. Sir Wilfrid Grigson , **The Maria Gonds of Bastar,** New Delhi: Vanya Prakashan, 1991.

7. R.C. Verma, **Indian Tribes Through the Ages,**. New Delhi: Publication, Division, Govt, of India, 1995.

8. Majumdar, D.N.,**Reces and Cultures of India,** New Delhi: Kalyani Publishers, 1990.

9. उपाध्याय एवं घर्माए भारत की जनजातीय संस्कृति, भोपालः म.प्र. हिन्दी ग्रंथ अकादमी, 2004.

10. पी.आर. नायडू, भारत के आदिवासी विकास की समस्याऍं, नई दिल्लीः राधा पब्लिकेषन, 2002.

Recommended Readings:

1. Crabtree & Miller (ed.). **Doing Qualitative Research.** New Delhi: Sage Publications, 2000.

2. Denzin & Lincoln (eds.). **Handbook of Qualitative Research.** New Delhi: Sage Publications. 2000.

3. Herekar. P.M. **Research Methodology and Project Work .** Kolhapur: Phadke Prakashan. 2004.

4. Kumar. P.S.G. **Research Methods and Statistical Techniques**. Delhi: B.R. Publishing Co.. 2004.

5. Marshall & Rosaman, **Designing Qualitative Research.** New Delhi: Sage Publications. 1999.

Course Code: PGDRPD 104
Title: Dissertation: Field based Minor Project on Urban Planning

Maxi. Marks: 80
Min. Marks: 16

Credit: 8

Learning Objectives:

The completed project work should provide proof of students' understanding of:

1. research design as applicable to urban planning.

2. issues concerning sampling, quantitative and qualitative analysis of data.

3. compile the analyzed data and present in the form of a report.

The course is designed to make the student carry out field work in the Urban Planning of project proposal, data collection, data analysis and report writing under the guidance of teacher assigned by the Head of the department using conventional and scientific methods at various stages of the field dissertation. The course aims at capacity building of the student in taking up independent research programmes. The students are required to work with the community for a period of 7-10 days . Two typed copies of analyzed data is to be submitted in the department in the form of a Field work Report.

Post Graduate Diploma in Regional Planning and Development
Session: 2018-19
Semester- II
Paper-I
Course Code: PGDRPD 201
Title: Research and Development based Regional Needs

Maxi. Marks: 80
Min. Marks: 16

Credit: 4

Learning Objectives:

At the end of the course the students are expected to:
1. understand the meaning, importance and purpose of regional needs..
2. describe the nature of research and identify the areas of rural development in which research is being increasingly undertaken.
3. know the role and importance of statistics in research.

Unit I

Human Resources: Meaning, Importance in Regional Development.
Health in Rural Area: Problems and Solution, Role of Research in Health Problem.

Unit II

Applied and Action Research: Meaning, Differences between Applied and Action Research.
Use of Applied and Action Research in Regional Development.

Unit III

Data Analysis: Definition of Data, Types of Data, Tabulation and Graphical Presentation of Data, Report Writing.

Unit IV

Role and Importance of Statistics in Research, Measures of Central Tendency: Mean, Mode, Median.

Recommended Readings:

1. Crabtres & Miller (ed.). **Doing Qualitative Research.** New Delhi: Sage Publications, 2000.

2. Denzin & Lincoln (eds.). **Handbook of Qualitative Research.** New Delhi: Sage Publications, 2000.

3. Herekar. P.M. **Research Methodology and Project Work.** Kolhapur: Phadke Prakashan, 2004.

4. Kumar. P.S.G. **Research Methods and Statistical Techniques.** Delhi: B.R. Publishing Co., 2004.

5. Marshall & Rosaman, **Designing Qualitative Research.** New Delhi: Sage Publications, 1999.

Paper-II
Course Code: PGDRPD 202
Title: Rural Marketing & Finance

Maxi. Marks: 80
Min. Marks: 16

Credit: 4

Learning Objectives:

At the end of the course the students are expected to:

1. understand the concept, characteristics and scope of rural marketing and agriculture marketing.

2. know the agencies & mediators of rural marketing and agriculture marketing.

3. identify the rural finance institutions and agencies.

Unit-I

Rural Marketing: Concept, characteristics and scope of Rural Marketing, Factors of Rural Markets, Problem of Rural Marketing and Remedies.

Unit-II

Agriculture Marketing, Concept, Nature & types of Agricultural Marketing, Factors of Agricultural Marketing, Significance & Problems of Agricultural Marketing.

Unit-III

Agencies in Agriculture Marketing, Marketing Inter –mediators, Commission on Agriculture costs & prices (CACP). Agricultural Agencies:-
1. FCI (Food Corporation of India)
2. APMC (Agriculture Price & Marketing Council)
3. NAFED (National Federation)

Unit-IV

Rural Finance: Concept of Rural Finance, Basic Economic Problem, Deductive and Inductive Positive and Normative Economics Static and Dynamic Equilibrium, Concept of Equilibrium: General Equilibrium v/s Partial Equilibrium Walrasian theory of General Equilibrium, NABARD.

Recommended Readings:

1. Badi, V. Narayan. Badi, V. Narayan, **Rural Marketing**, Himalaya Publishing, 2014.

2. Hasnain, Nadeem ,**Janjatiya Bharat (in hindi)**, Jawahar publishers and Distribution,New Delhi, 2005

3. Kashyap, P., **Rural Marketing**, Pearson Publication. 2016.

4. Rabi N. Misra. **Marketing of Tribal Products**, Discover Publishng pvt. Ltd. 2002.

5. T.P. Gopalaswamy, **Rural Marketing: Environment, Problems and Strategies**, Vikas Publication. 2014.

6. Marothia, D.K. and Gauraha, A.K. **Marketing of Denationalized Minor Forest Products in Tribal Economy.** Indian Journal of Agricultural Marketing,1992, 6(2) 84-91

Paper-III
Course Code: PGDRPD 203
Title: Dissertation /Field Report

Maxi. Marks: 80
Min. Marks: 16

Credit: 8

Learning Objectives:

The completed dissertation should provide proof of students' understanding of:

1. research design as applicable to a specific topic.

2. issues concerning sampling, quantitative and qualitative analysis of data.

3. compile the analyzed data and present in the form of a report.

The course is designed to make the student carry out field work and research in the planning of the projects proposal, data collection, data analysis and report writing under the guidance of teacher assigned by the Head of the department in the area of Regional Planning and Development. The course aims at capacity building of the student in taking up independent research programmes to create a pool of professionals who could provide services to the local governments and NGOs working in the rural and urban areas for development of the region.
Presentation of the Dissertation in the presence of External examiner and Internal examiner.

Paper – IV
Course Code: (PGDRPD 204)
Title: Viva

Maxi. Marks: 80
Min. Marks: 16

Credit: 4

Learning Objectives:

At the end of the course the students are expected to:

1. learn public speaking and good presentation skills.

2. learn how to face reply the public in their understandable manner on the work they did.

School of Regional Studies and Research

Syllabus

M. Phil. in Rural Development
Session: 2018-2019

Pt. Ravishankar Shukla University, Raipur -492010
Chhattisgarh, India

School of Regional Studies and Research
Pt. Ravishankar Shukla University, Raipur (C.G.)
M. Phil. in Rural Development

Syllabus
2018-19
Scheme of Examination

Paper	Title	Teaching Learning Methodology	External Marks	Internal Marks	Total Marks
Paper I	Rural Development: Concepts and Dimensions	Lecture, Group Discussion	80	20	100
Paper-II	Rural Development Policy and Strategies	Lecture, Case Study, Group Discussion	80	20	100
Paper-III	Research Methodology Theory and Techniques	Lecture, Case Study, Group Discussion	80	20	100
Total Marks(A)					**300**
Paper-IV	Community based Dissertation Report	Lecture, Case Study, Field Survey, Interview, Schedule, Participation and Report Writing	100	-	100
Paper-V	Seminar: Based on Dissertation	-	50	50	100
Paper-VI	Seminar: Based on Theory	-	-	50	50
Paper-VII	Dissertation Viva-voce	-	25	25	50
Total Marks (B)					**300**
Grand Total (A+B)					**600**

M. Phil. in Rural Development
Session: 2018-19
Paper-I
Title: Rural Development: Concepts and Dimensions

Maxi. Marks: 80
Min. Marks: 40

At the end of the course the students are expected to:

1. understand the concepts of concepts and dimensions of rural development

2. identify the educational status in rural areas.

3. analyze the facilities of rural areas

UNIT - I

Concepts of Rural Area and Rural Development Definition and Scope of Rural Development, Causes of Rural Backwardness Need for Rural Development Historical Evolution of the concept of Rural Development in Indian Context.

UNIT – II

Population Growth in India, Analysis of Trends and Changes in the Composition of Rural Population. Rural Work Force, Problems of Unemployment and Underemployment in Rural Areas. Conditions and Problems of Agricultural Labour. Levels of Living of Rural People Poverty indicators Measurement of Rural Poverty Line. Integrated Rural Poverty.

UNIT – III

Education in Rural areas: Literacy Rates Educational Institutions Formal and Non-formal Education: Qualitative and Quantitative Aspects. Health Services in Rural Areas Structure Accessibility, Maternal and Child Health Nutrition ICDS, Eradication of Contagious Diseases Issues in Community Health AIDS Control Programme National Health Policy of India.

UNIT – IV

Housing in Rural Areas: Rural Housing Programmes, Low Cost Housing, Appropriate Technologies in Rural Housing. Drinking Water Supply: Sources, Problems, Programmes to Solve Drinking Water Problems, and Problems of Sanitation in Rural Areas, Low cost toilets.

UNIT –V

Case Study on Rural Education

Recommended Readings:

1. Desai, Vasant, **Rural Development in India.** New Delhi: Himalaya, 2005.
2. Narwani, G. S. **Training for Rural Development**, New Delhi: Rawat Publications, 2002.
3. Rao K. Hanumantha , **Rural Development Statistics : 2007-08,** National Institute of Rural Development Ministry of R. D., Govt. of India, Rajendra Nagar, Hyderabad –2008.
4. K. Khanna B.S. -**Rural Development in South Asia: Policies, Programmes and Organizations**, 2007
5. Vasant Desai Jain - **A Study of Rural Economy, New Delhi, Himalaya**, 2005
6. S.C. Das Kumar - **Rural Development through Decentralization**, 1990

Paper-II
Title: Research Methodology Theory and Techniques

Maxi. Marks: 80
Min. Marks: 40

At the end of the course the students are expected to:

1. necessary skills to apply appropriate methods to the research in hand

2. basic knowledge about sampling methods and acquire skills to analyse the quantitative and qualitative data

3. write a research report

UNIT - I

Research: Definition, Importance and Meaning of research, Characteristics of research, Types of Research. Steps in research, Identification, Selection and formulation of research problem, Research questions – Research design – Formulation of Hypo Dissertation, Review of Literature.

UNIT – II

Sampling techniques: Sampling theory, types of sampling – Steps in sampling – Sampling and Non-sampling error – Sample size – Advantages and limitations of sampling.

Collection of Data: Primary Data – Meaning, Data Collection methods, Secondary data – Meaning, Relevance's, Limitations and Cautions.

UNIT – III

Statistics in Research – Measure of Central tendency, Dispersion, Skewness and Kurtosis in research. Hypo Dissertation, Fundamentals of Hypo Dissertation testing, Standard Error, Point and Interval estimates, Important Non-Parametric tests: Sign, Run, Kruskal, Wallis tests and Mann. Whitney test.

UNIT – IV

Para metric tests: Testing of significance, mean, Proportion, Variance and Correlation, testing for Significance of difference between means, proportions, variances and correlation co-efficient. Chi-square tests, ANOVA, One-way and Two-way.

UNIT– V

Research Report: Types of reports, contents, styles of reporting, Steps in drafting reports, editing the final draft, evaluating the final draft.

Recommended Readings:

1. S.P. Gupta - **Statistical Methods,** 2014.

2. C.R. Kothari - **Research Methodology Methods and Techniques**, 2013
3. B.N. Gupta - **Statistics (Theory and Practice)**, 2015
4. Santosh Gupta - **Research Methodology Methods and Statistical Techniques**, 2002

<center>

Paper-III
Title: Rural Development Policy and Strategies

</center>

Maxi. Marks: 80
Min. Marks: 40

At the end of the course the students are expected to:

1. know the development theories

2. understand the rural development policy and strategies

3. write a case study in rural development

UNIT -I

Development Theories: Characteristics of LDCs Growth and Equity issues Balanced Vs. Unbalanced growth Theories of development - Critical Minimum Bigpush and Dualistic Theories - Arthar Lewis and Ranis - Fei - Rostow Process of development - Transformation in the social structure - Urbanization - Development of Market structure.

UNIT-II

Approach to Development: Backward Area - Rural development - Integrated Rural Development –Systems approach - Rural Constructions. Community development and Rural Development - overview of problems and Challenges.

UNIT – III

Issues in Development Problem and measures for Human Resource Development - PQLI and Education, Poor and poverty line, Unemployment and Under-employment population and illiteracy - Food and Nutritional security.

UNIT – IV

Policies to Rural Development: Rural Development policy Agrarian structure and reforms - Land ceiling distribution -Agrarian movements - Local level bodies, Co-Operatives NGOs and the other rural Organizations. Contributions of democratic process, people's participation empowerment of rural women.

UNIT – V

Case studies in Rural Development: Rural development in developing countries India, Nepal, Malaysia, Sri Lanka and African countries.

Recommended Readings:

1. Gaur K.D - Dynamics of Rural Development, Mittal Pub. New Delhi 1992

2. Gupta, Shanti Swarup - Concept, New Delhi 1922.

3. Higgins, Benjamin - Economic Development, W.W.Norton & Co. New York.Reprint 1998

4. Jagdish R.Barel - Integrated Rural Development - Nepal," New Delhi, Sterling Pub., 1989

5. Michael P. Todaro - Economic Development in the Third World Countries" McGraw Hill Book Co, New York, 1989

6. Nagpal C.S. Mittal A.C - Rural Development" Ammoh pub. Ltd. New Delhi 1993

7. Ramachandra H. - Integrated Rural Development in Asia. Learning from Recent Experience." concept New Delhi 1991

8. Satya Sundaram - Rural poverty and Area Planning " B.R. publishing Corporation, New Delhi 1989

9. Setty E.D.Rural Development Problems and prospects" BRDC, New Delhi 1998

School of Regional Studies and Research

Syllabus

Ph. D. Course Work 2017

Pt. Ravishankar Shukla University, Raipur -492010
Chhattisgarh, India

School of Regional Studies and Research
Pt. Ravishankar Shukla University, Raipur (C.G.)
Ph.D. Course Work Syllabus

Ph. D. Course Work 2017

DURATION: SIX MONTHS   **M.M. 200**

	COURSE	MARKS
COURSE I	Research Methodology & Fundamental of Computer	100
COURSE II	Project Based on Review of Research work	50
	Seminar	50
	TOTAL	**200**

School of Regional Studies and Research
Pt. Ravishankar Shukla University, Raipur (C.G.)
Ph.D. Course Work Syllabus
Course-I Research Methodology & Fundamental of Computer

Max Mark-100

UNIT-I
Social Research: Concept & Objectives, Types of Research, Interdisciplinary Research Approach, Social Survey and Field Work (Tribal, Rural & Urban Area) Selection of Research problem & formulation of Hypothesis. Research Design

UNIT-II
Nature & Types of Data- Primary & Secondary data, Quantitative & Qualitative data. Use of Secondary Sources: Census, Survey Report of different Govt. Dept/Agency and Non-Govt. Organization,(NGO) Documents & Records. Sampling techniques: Meaning & significance of sampling, Types of Sampling, Merits & demerits of different sampling methods.

UNIT-III
Tools & Techniques of Data Collection observation, Interview, Questionnaire & Schedule, Case study.

UNIT- IV
Qualitative data analysis methods: Content analysis, Tabulation & Interpretation of Data, Report writing, Basic Knowledge of computer Application.

UNIT-V
Elementary Statistics

Measures of central tendency: Mean, Mode, Median
Measures of Variability: Range, Average deviation, standard deviation
Test of Significance: t-test, Chi-square Test.
Karl Pearson's Correlation Coefficient

Recommended Readings :

1. Goode & Hall (1983). Methods in Social Research, Mcgrew Hill, International Japan.
2. Young, P.V.(1984) Scientific Social Survey and Research Prentice Hall of Indian, New Delhi
3. MacConuik,L., Elementray Social Statistics
4. Raja Raman,V. (1996) Fundamental of Coputer Prentiee Hall of India, New Delhi
5. Kenneth D. Bailey, 1982, Methods of Social Research, The free Press, London
6. Piergiorgio earbetta – 2003, Social Research: Theory, Methods & Techniques sage Publication, New Delhi.

1. PROJECT BASED ON REVIEW OF RESEARCH WORK: Use of Literature, Knowledge of National and International Journals, Impact Factor, Citation Index, SCI Journals. (To be Supervised and evaluated by Guide Concerned).
   Literature search by SCOPUS, Google Scholar and Web of Science.

2. SEMINARS: Open Seminar, evaluation will be done by member of DRC.

COURSE OF STUDIES FOR M.A. EXAMINATION IN SOCIOLOGY (UNDER SEMESTER SYSTEM IN UNIVERSITY TEACHING DEPARTMENT AND AFFILETED COLLEGES OF PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.) ACADEMIC SESSION (2018- 19)

M.A. Examination in Sociology shall be conducted in four semesters, each having 500 hundred marks, totaling to 2000 marks. The detailed Course Structure Semester wise is mentioned below.

Sl. No.	Paper No.	Title	Marks			
A. FIRST SEMESTER:						
S. No.	Paper	Subject	I	T	Total	CC
1	Paper-I/CC1	Classical Sociological Tradition	20	80	100	
2	Paper-II/CC2	Philosophical and Conceptual Foundation of Research Methodology	20	80	100	
3	Paper-III/CC3	Social Change in India	20	80	100	
4	Paper-IV/CC4	Rural Sociology	20	80	100	
5	Paper-V/P 1	Practical-I			100	
B. SECOND SEMESTER(effective from Jan 2018)						
6.	Paper-VI/CC5	Classical Sociological Thinkers	20	80	100	04
7.	Paper-VII/CC6	Quantitative Research Techniques in Sociology	20	80	100	04
8.	Paper-VIII/CC7	Sociology of Development	20	80	100	04
9.	Paper-IX/CC8	Indian Rural Society	20	80	100	04
10.	Paper-X/P2	Practical-II			100	04
C. THIRD SEMESTER (effective from Jun 2018)						
11.	Paper-XI/CC9	Classical Sociological Theories	20	80	100	04
12.	Paper-XII/CC10	Social Movements in India	20	80	100	04
13.	Paper-XIII/CC11	Perspectives of Study to Indian Society	20	80	100	04
14.	Paper-XIV/CC12	Industry and Society in India	20	80	100	04
15	Paper-XV/CC13	Criminology	20	80	100	04
D. FOURTH SEMESTER(effective from Jan 2019)						
16	Paper-XVI/CC14	Modern Sociological Theories	20	80	100	04
17	Paper-XVII/CC15	Comparative Sociology	20	80	100	04
18	Paper-XVIII/CC16	Contemporary Issues in Industry	20	80	100	04
19	Paper-XIX/CC17	Criminology: Correctional administration	20	80	100	04
20	Paper-XX/P3	Project Report	-	-	100	04

2-6-2018

Head,
S.O.S. in Sociology & Social Work,
Pt. Ravishankar Shukla University,
Raipur. (C.G.)

1

Paper No. I/CC1   Marks-80

CLASSICAL SOCIOLOGICAL TRADITION

Unit-I: Historical Background of The Emergence of Sociology
  a. Traditional Feudal Economy and Social Structure
  b. Impact of Industrial Revolution and New Mode of Production on Society and Economy.
  c. Emergence of Capitalist Mode of Production- Nature and Feature of Capitalism
  d. Enlightenment and It's Impact on Thinking and Reasoning

Unit-II: Auguste Comte
  a. Social Statics and Dynamics
  b. Law of Three Stages
  c. Hierarchy of Sciences
  d. Positivism

Unit-III: Emile Durkheim
  a. Social Facts
  b. Division of Labour, Mechanical and Organic Solidarity
  c. Religion
  d. Theory of Suicide

Unit-IV: Vilfredo Pareto
  a. Logical and Non- Logical Action
  b. Residues and Derivations
  c. Theory of Social Change
  d. Contributions to Methodology

Unit-V:Herbert Spencer
  a. Social Darwinism
  b. Evolution
  c. Organic Analogy
  d. Militant and Industrial Societies

References:

1. Abraham, F and Morgan, J.H. 1985 — Sociological Thought from Comte to Sorokin Macmillan, New Delhi.
2. Adams, B.N. and Sydie, R.A. 2002 — Sociological Theory Vistaar Publications, New Delhi
3. Aron, R. 1965 — Main Currents in Sociological Thought Vol. I and Vol.II Penguin, New Delhi.
4. Coser, L.A. 2001 — Masters of Sociological Thought Rawat Publishers, Jaipur
5. Rex, John 1973 — Discovering Sociology Routledge and Kegan Paul, London
6. Turner, J.H. 2001 — The Structure of Sociological Theory Rawat Publishers, Jaipur.

2

| 7. | Zeitlin, I.M. 1981 | Ideology and the Development of Sociological Theory, Prentice Hall, London. |
| 8. | _____ 1998 | Rethinking Sociology: A Critique of Contemporary Theory. Rawat Publishers, Jaipur. |

Paper-II /CC2   **Marks-80**

PHILOSOPHICAL AND CONCEPTUAL FOUNDATION OF RESEARCH METHODOLOGY

Unit-I: Philosophical Roots of Social Research

a. Issues in the Theory of Epistemology: Forms and Types of knowledge, Validation of knowledge
b. Positivism and It's Critique: Contributions of Comte, Durkheim and Popper.
c. Methodological perspectives in Sociology.

Unit-II:Social Research and Scientific Method

a. Concept and Importance of Social Research.
b. Types of Social Research
c. Concept and Characteristics of Scientific method.
d. Social Phenomeno of Scientific method

Unit-III: Nature of Social Reality and Approaches to It

a. Research Design: Steps and Processes of It's Formulation
b. Type of Research Design: Exploratory, Descriptive, Explanatory, Diagnostic and Experimental
c. Role of concepts and Hypotheses
d. Problems of Objectivity

Unit-IV: Qualitative Methods in Social Research

a. Techniques and methods of Qualitative Research: Observation and Interview Guide
b. Case study, Content Analysis
c. Participatory Rural Appraisal (PRA)
d. Encounters and Experiences in Field work

Unit-V: Issues in Social Research

a. Inter disciplinary Research
b. Issues in Qualitative Research
c. Theoretical Vs. Applied Research
d. Processing of Data: Classification, Tabulation and Interpretation.

References:

1.	Bailey, K.D. 1979	Methodology of Social Research Macmillan, Free Press- London
2.	Barnes, J.A. 1979	Who should known what? Social Science, Privacy and Ethics, Penguin, London.
3.	Beteille, A Madan, T.N. 1975	Encounter and Experience: Personal Accounts of field work, Vikas, new Delhi

3

4.	Bose, P.K. 1995	Research methodology, ICSSR, New Delhi.
5.	Bryman, A 1988	Quality and Quantity in Social Research Unwin Hyman, London.
6.	Madge, J 1970	The Origins of Scientific sociology Tavistock, London
7.	Mukherjee, P.N. 2000	Methodology in Social Research: Dilemmas and perspectives Essays in Honour of Ramakrishna Mukherjee Sage, New Delhi.
8.	Mukherjee, R.K. 1979	What will it be? Explorations in Inductive Sociology Allied, Bombay.
9.	_____ 1993	Systemic Sociology Sage, New Delhi.
10.	Popper, K 1999	The Logic of Scientific Discovery Routledge and Kegan Paul London
11.	Punch, K 1986	Introduction to Social Research Sage, New Delhi
12.	Sjoberg, G and Roger, N., 1997	Methodology of Social research Rawat, Jaipur
13.	Srinivas, M.N. and Shah, A.M., 1979	Field worker and the Field Oxford, New Delhi.
14.	Weber, M 1974	The Methodology of Social Sciences Free Press, Chicago
15.	Young, P.V. 1977	Scientific Social Surveys and Research Prentice Hall, New Delhi.

Paper No. III/CC3   Marks-80

SOCIAL CHANGE IN INDIA

Unit-I: Conceptual and Theoretical Frame work
a. Concept, Meaning, Definition, Characteristic of social Change.
b. Forms of Social change- Evolution, Progress, Development, Transformation, Revolution
c. Linear Theory of Social Change- August Comte, Herbert Spencer, Morgan
d. Cyclic Theory of Social Change- Vilifred Pareto, P. Sorokin

Unit-II: Factors of Social change
a. Techno- Economic
b. Socio- Psychological
c. Cultural and Religious
d. Media

Unit-III: Trends and Processes of Change in Modern India
a. Sanskritization- Concept, Characteristics and means of Social Change.

4

b. Secularization –Concept, Characteristics and importance

c. Gandhian- Swalamban, Sarvodaya, Trustiship and importance

d. Globalization- Concept, Characteristic and a process of Social change

Unit- IV: Changes in Tribal and Rural India

a. Tribal Economy- Concept, Characteristics of Tribal Economy, base of Tribal Economy and recent changes in Tribal Economy

b. Rural Economy- Concept, Characteristics of Rural Community, base of Rural Economy and recent changes in Rural Economy

c. Changes in Socio Cultural Spheres

d. Land Alienation- Concept and Cause of Land Alienation, Land Alienation in Rural and Tribal Area.

Unit-V:-Changes in Urban and Industrial India

a. Migration - Concept, Characteristics and types of Migration, In Migration and Growth of informal sector.

b. Slums - Concept, Characteristics of Slums , causes of development of Slums in Urban and Industrial India.

c. Crime - Concept, Characteristics of Crime and causes of development of criminal Activities in Urban and Industrial India.

d. Welfare- Concept, Characteristics of Welfare Programme,Welfare measures and Consequent Changes.

References:

1.	Beteille, A. 2003	The Idea of natural inequality and other essays. Oxford, New Delhi.
2.	Desai, AR 2001	Rural Sociology in India. Popular, Bombay
3.	Jhingan, M.L. 2003	The economics of Development and Planning. Vrinda Publications, New Delhi
4.	Kanungo, S. 2002	Making Information Technology Work, Sage, new Delhi
5.	Mathur, H.M. (ed) 1994	Development, Displacement and Resettlement: focus on Asian experiences Vikas, New Delhi.
6.	Preston, P. 2001	Reshaping communications, Technology Information and Social Change. Sage, New Delhi.
7.	Ramachandran, P.S. et al (ed) 2002	Traditional Ecological Knowledge for managing Bio-sphere reserves in south and central Asia. Oxford, New Delhi.
8	Reid, Suctitus 1976	Crime and Criminology, Illiois: Deyen Press
9.	Schuurman, F.J. 1999	Globalization and Development, Vistaar, new Delhi.
10.	Parekh, B 1999	Colonialism, Tradition and Reform: An analysis of Gandhi's Political Discourse Sage, New Delhi.
11.	Sharma, K.L. 1997	Social Stratification in India: Issues and Themes. Sage, New Delhi.
12.	Shiva, V. and Bedi,	Sustainable Agriculture and food scarcity Sage,

13.	Singh, Y. 1999	Modernization of Indian tradition Rawat, jaipur.
14.	_____ 2003	Culture Change in India Rawat, Jaipur
15.	Singharoy, D.K. et al (ed) 2000	Social Development and Empowerment of Marginalised groups, Sage, New Delhi.
16.	Srinivas, M.N. 1998	Social Change in Modern India. Orient and Longman, New Delhi.
17.	Vidyarthi, L.P. and Rai, B.K., 1977	Tribal culture in India Concept Publication Company New Delhi.

Paper No. IV/CC 4   **Marks-80**

RURAL SOCIOLOGY

Unit-I: Characteristics and Approaches
    a. Concept andCharacteristics of Peasant Society
    b. Concept andCharacteristics of Agrarian Society
    c. Caste and Jamani Approach
    d. Sub- Altern Approach

Unit-II: Agrarian Institutions
    a. Land Ownership and Its Types:After Independence
    b. Agrarian Relations and Modes of Production
    c. Agrarian Social Structure

Unit- III: Planned Change
    a. Rural leadership
    b. Factionalism
    c. Panchayati Raj before and after 73rd Amendment
    d. Five Year's Plans in India

Unit-IV: Rural Development and Change
    a. Green Revolution
    b. Land Reform
    c. Globalization and its Impact on Agriculture

Unit-V:Welfare measures and consequent Changes
    a. Self-help Group(SHG)
    b. MNREGA
    c. SSA

References:
1.	Basu, K. (ed) 2000	Agrarian Questions Oxford, New Delhi.
2.	Berberglu, B. (ed) 1992	Class, State and Development in India sage, New Delhi.
3.	Beteille, A.	Six essays in comparative sociology oxford, New

6

	1974	Delhi.
4.	_____ 1974	Studies in Agrarian social structure oxford, New Delhi.
5.	Breman, J. 1974	Patronage and Exploitation oxford, New Delhi.
6.	Desai, A.R. (ed) 1977	Rural sociology in India popular, Mumbai.
7.	_____, (ed) 1977	Rural society in transition Popular, Mumbai.
8.	Gough, K and Sharma, H.P.(Ed) 1973	Imperialism and Revolution in South Asia, Monthly Reviewed Press, New York.
9.	Guha, r (ed) 1999	Subaltern Studies Oxford, New Delhi.
10.	Joshi, P.C. (ed) 1976	Land Reforms in India Allied, New Delhi.
11.	Long, N. 1982	An Introduction to the sociology of Rural development, Tavistock, London.
12.	Mencher, J.P. (ed) 1983	Social Anthropology of peasantry Somaiya Publications New Delhi
13.	Patnaik, U. 1990	Agrarian Relations and Accumulation: the Mode of production debate in India.
14.	Shanin, T. (ed) 1971	Peasants and Peasant Societies, Penguin, London.
15.	Thorner, D. 1956	The Agrarian prospects in India University press, New Delhi.
16.	_____ 1962	Land and labour in India, Asia publications, Mumbai.

Paper No. V/P1
PRACTICAL-I
Marks-100

Practical based on Field Work & Preparation of tools
Interview Guide and case study

Scheme of Evaluation- 50% by Internal Examiner and rest 50% by Viva-Voce Examination evaluated both by the Internal and External Examiner.

7

SECOND SEMESTER

Paper No. –VI/CC 5   Marks-80

CLASSICAL SOCIOLOGICAL THINKERS

Unit-I: Karl Marx
a. Materialistic Interpretation of History
b. Class and Class Struggle
c. Alienation.
d. Surplus Value and Exploitation.

Unit-II: Thurstein Veblen
a. Theory of Leisure class
b. Concepts of Social Change
c. Comparison of Marx and Veblen's theories.

Unit-III: Max Weber
a. Theory of Social Action
b. Concepts of Status, Class and power
c. Sociology of Religion and Economic Development
d. Ideal Type

Unit-IV Talcott Parsons
a. Social Action
b. Pattern variables
c. Social System
d. Mechanisms of social Control.

Unit-V: Robert K. Merton
a. Reference Group
b. Social structure and Anomie
c. Paradigms of Functionalism
d. . Bureaucracy

References:
1. Abraham, F and Morgan, J.H. 1985 — Sociological Thought from Comte to Sorokin Macmillan, New Delhi.

2. Aron, R. 1965 — Main Currents in Sociological Thought Vol. I and II Penguin, London.

3. Adams, B.N. and Sydie, R.A. 2001 — Sociological theory Vistaar, New Delhi.

4. Collins, R. 1997 — Theoretical Sociology Rawat, Jaipur

5. Coser, L.A. 2001 — Masters of Sociological Thought Rawat, Jaipur

6. Giddens, A. 1977 — Capitalism and Modern Social Theory: An Analysis of Writings of Marx., Durkeheim and Weber Cambridge University press. London.

7. Rex, J. 1973 — Discovering Sociology Routledge and Kegan Paul London.

8. Simmel George and The Sociology of George Simmel, Glancoe,

8

	Kurt H.Wdff,1950	IIIFree Press
9.	Simmel George and Kurt H.Wdff,1922	Conflict and the web of Group Glancoe, IL,Freepress.
10	-----------------1972	On Individuality and Social Forms, Chicago, University of Chicago Press.
11.	Turner, J.H. 2001	The Structure of Sociological Theory Rawat, jaipur
12.	Zeitlin, I.M. 1981	Ideology and the Development of Sociology Prentice Hall, London.
13.	_____ 1996	Rethinking Sociology Rawat, Jaipur.

Paper No.-VII/CC6   **Marks-80**

QUANTITATIVE RESEARCH TECHNIQUES IN SOCIOLOGY

Unit-I: Sampling
   a. Rational
   b. Types
   c. Sampling error
   d. Survey Vs. Sampling based study in sociology

Unit-II: Quantitative method and survey Research
   a. Techniques of Survey Research: Interview
   b. Tools of Research; Preparation of Questionnaire and Interview Schedule
   c. Processing of Data:Editing ,Classification,Tabulation and Interpretation
   d. Use of Computer in Data Processing

Unit-III: Measurement and Scaling Techniques
   a. Levels of Measurements: Types of Scales- Nominal and Ordinal
   b. Reliability and Validity of Scaling
   c. Measures of Social Distance: Thurstein, Lickert and Bogardus Scale
   d. Sociometry

Unit-IV: Statistics in Social Research
   a. Measures of Central Tendency: Mean, Median and Mode
   b. Measures of Dispersion- Standard Deviation
   c. Correlation Analysis- Chi Square Test
   d. Quantitative Vs. Qualitative research in sociology

Unit-V:Qualitative and Quantitative research method
   a. Triangulation;mixing Qualitative and Quantitative methodologies
   b. Social Research, Action research and Participatory research
   c. Application of computers in Social research; MS office.
   d. Ethical issues in social research.

References:
1. Bailey, K.D. 1979   Methodology of social Research Macmillan, Free Press.
2. Bryman, Allan1988   Quality and Quantity in Social ResearchUnwin,

9

	Hyman, London.
3. Ethance, D.M.	Fundamental of Statistics
4. Irvine, J. M et al (ed) 1979	Demystifying social statistic, Pluto Press, London.
5. Lutz, G, M 1983	Understanding Social Statistics, Macmillan Publishing co., Inc., New York.
6. Mukharjee, R, 1979	What will it be? Explorations in inductive sociology, Allied Publishers, Bombay.
7. Mukherjee, P.N, 2000	Methodology in Social Research Dilemamas and Perspectives, Essays in honour of Ramakrishna Mukharjee, Sage Publication, New Delhi.
8. Wilkinson, T.S. and Bhandarkar, P.L.	Methodology and Techniques of Social Research: Himalaya Publication House, Bombay,
9. Young, P.V. 1977	Scientific Social Surveys and Research. Prentice Hall of India, New Delhi.

Paper No. –VIII/CC7   **Marks-80**

SOCIOLOGY OF DEVELOPMENT

Unit-I: Perspectives on Development
  a. Concept and Defining development
  b. Element of Development
  c. Path and Agency of Development: Capitalist, Mixed Economy, Gandhian
  d. Theories; Modernization , Marxist, Dependency.

Unit-II: Changing Concept of Human Development
  a. Mainstream vs. Indigenous Model of Development
  b. Human Indicator Index
  c. Sustainable Development: Socio- Cultural, environmental and economic.
  d. Impact of Bio-Technology and Information Technology on Development.

Unit-III: Indian Experience of Development
  a. Sociological Appraisal of Five Year Plans
  b. Social Consequences of Economic Reforms
  c. Socio- Cultural Impact of Globalization
  d. Social Implication of InfoTech and Bio-Tech Revolution

Unit-IV: Consequences of Development
  a. Development and Displacement- concept, causes and consequences of Displacement
  b. Development and Socio- Economic Disparities: health, Education , Per capita Income
  c. Ecological Degradation: concept, causes and consequences of Degradation

10

d. Development and Migration: concept, causes and consequences of Migration.

Unit-V:Issues in development in Contemporary India.
  a. Social Exclusion
  b.Gender Discrimination
  c. Privatization and un favourable Service condition.
  d. Sustainability and development

References:

1. Alavi, H. and Shanin, T., 1982 — Introduction to the study of Developing societies Macmillan, London
2. Amin, Samir-1979 — Unequal Development, New Delhi
3. Apter, D.C. 1987 — Rethinking development Sage, New Delhi
4. Appadurai, A. 1997 — Modernity at Large: Cultural Dimensions of Globalisation, Oxford, New Delhi
5. Berberglu, B. (ed) 1992 — Class, State and Development in India, Sage, New Delhi
6. Bhatnagar, S., 2000 — Information and Communication: Technology in Development, Sage, New Delhi.
7. Carmen, R 1996 — Autonomous Development Vistaar, New Delhi
8. Desai, A.R 1985 — India's path of development: A Marxist Approach, Bombay, popular Prakashan.
9. Dreze, J and Sen, A. 1996 — India: Economic Development and social Opportunity Oxford, New Delhi
10. Encyclopaedia of Social Sciences (Relevant Portions), Macmillan
11. Frank, A 2002 — Reorient Vistaar, New Delhi
12. Haq, M.V. 1991 — Reflections on Human Development Oxford, New Delhi
13. Melkote, S.R. 1991 — Communications for Development in Third WorldSage, New Delhi
15. Naidu, R. 1971 — Values in Models of Modernisation Vikas, New Delhi
16. Pieterse, N.J. 2001 — Development Theory: Deconstruction/Reconstruction , Sage, New Delhi
17. Preston,P.W,1996 — Development Theory- An Introduction Oxford Blackwell.
18. Rege, S. (ed) 2003 — Sociology of Gender Sage, New Delhi
19. Sachs, I 2000 — Understanding Development Oxford, New Delhi
20. Saha, G et al (ed) — Development and Deprivation in Gujarat

11

	2002	Sage, New Delhi
21.	Schuurman, F.J. 2003	Globalisation and Development Vistaar, New Delhi
22.	Singharoy, D (ed) 2001	Social Development and Empowerment of Marginalised Groups Sage, New Delhi.
23.	Sings, C.C. And Denemark, R.A.	The Underdevelopment of Development Sage, New Delhi.
24.	Sharma ,S.L1986	Development: socio-Cultural Dimensions, Jaipur,Rawat Publications.
25	-----------------1994	Perspective on Sustainable Development in South Asia, KualaLumpur, ADIPA

Paper No. IX/CC8   Marks-80

INDIAN RURAL SOCIETY

Unit-I: Tribal Society as Agrarian Society
  a. Tribe Concept and Characteristic
  b. Tribe class
  c. Changing problems of Tribal Land

Unit-II: Social Issues
  a. Migration
  b. Land Alienation
  c. Loss of Livelihood

Unit-III: Contemporary Issues
  a. Health
  b. Education
  c. Changing status of Rural Women
  d. Inequality

Unit-IV: Peasant Movement
  a. Causes
  b. Types
  c. Tebhaga
  d. Telengana

Unit-V: Naxlite movement in Contemporary India.
  a. Origin and affected area
  b. Causes
  c. Present status; Governments measures and peoples response.

References:

1.	Beteille, A. 1986	Inequality and Social Change Oxford, New Delhi.
2.	Bardhan, p.	Poverty, Agrarian Structure and Political Economy in India.
3.	Desai, A.R. 1979	Rural Society in Transition Popular, Mumbai

12

4. _____   Peasant Struggle in India
   1979   Oxford, New Delhi

5. _____ (ed)   Rural Sociology in India
   2003   Popular, Mumbai

6. Dreze, J and Sen A.   India : Development and Participation, Oxford
   2002   New Delhi.

7. Gough, K and   Imperialism and Revolution in South Asia.
Sharma, H.P. (ed)   Monthly Reviewed Press, New York.
   1973

8. Gulati, A and   The Subsidy Syndrome in Indian Agriculture
Narayanan, S.   Oxford, New Delhi.
   2003

9. Joshi, P.C.   Land Reforms in India
   2003   Allied, New Delhi.

10. Leiten, G.K.   Power, Politics and Rural Development
   2002   Manohar, New Delhi

11. Patel, M.L.   Changing land Problems of Tribal India, Progress
   1974   Publisher, Bhopal.

12 Prakash Singh 2007   The Naxalite Movement in India, Rupa
   Publication

13. Rao, M.S.A. (ed)   Social Movements In India, Manohar, New Delhi.
   1978

14. Schuurman, F.J.   Globalization and Development Vistaar, New
   2003   Delhi.

15. Singhroy, D et al   Social development and the empowerment of
   2001   mariginalised groups, Sage New Delhi.

16. Thorner, A.   Daniel Thorner, Memorial Lecturers,
   2002   Manohar, New Delhi.

17. Vidyarthi, L.P. and   Tribal Culture in India, Concept Publishing
Rai, B.K.   Company, New Delhi.
   1977

Paper No. X/P2   **Marks-100**
PRACTICAL-II

Practical based on Field Work & Preparation of tools

Questionnaire, Interview Schedule Preparation and Tabulation.

Scheme of Evaluation- 50% by Internal Examiner and rest 50% by Viva-Voce Examination evaluated both by the Internal and External Examiner.

13

THIRD SEMESTER

Paper No. XI/CC9   Marks-80

CLASSICAL SOCIOLOGICAL THEORIES

Unit-I: Positivism
a. Concept and Characteristics of positivism
b. Contributions of Comte
c. Contributions of Durkheim
d. Criticism

Unit-II: Functionalism
a. Concept and Characteristics of functionalism
b. Contributions of Parsons
c. Contribution of Merton
d. Criticism

Unit-III: Conflict theory
a. Concept and Characteristics of Conflict theory
B Contributions of Karl Marx
c Contribution of Dahrendorf
d Randell Collins

Unit-IV: Structuralism
a. Concept and Characteristics of Structuralism
b Contribution of Red Cliff Brown
c Contribution of Levistrauss
d Criticism

Unit-V:Exchange Theory
a. Concept and Characteristics of Exchange Theory
b. Contribution of Peter Blau
c. Contribution of George Homans.
d. Criticism

References:

1. Abraham, M.F. 2001   Modern Sociological Theory: An Introduction Oxford, New Delhi.

2. Alexander, J.C. 1987   Twenty Lectures; Sociological theories since World War- II Columbia University press- New York.

3. Coser, L.A. 2001   Masters of Sociological thoughts Rawat, Jaipur

4. Collins, R. 1997   Sociological theory Rawat, jaipur

5. Craib, I 1992   Modern Social Theory: From parsons to Habermas, Harvester, London.

6. Giddens, A.   Central Problems in Social theory, Action,

14

1983	Structure and contradiction in social analysis. Mac Millan, London.
7. _____, 1996	Capitalisation and modern social theory Cambridge University Press. London.
8. Godelier, M.	Structural Anthropology Tavistock, London.
9. Sturrock, J (ed) 1979	Structuralism and since: from Levistrancess to Derrida Oxford, London.
10. Turner, B.S. 1999	Classical sociology sage, New Delhi
11. Turner, J.H. 2001	The structure of sociological theory Rawat, Jaipur
12. Zeitlin, I.M. 1998	Rethinking sociology: A critique of contemporary Theory Rawat, Jaipur.

Paper No.XII/CC10   **Marks-80**

SOCIAL MOVEMENTS IN INDIA
Unit-I: Nature and Types
a. Characteristics
b. Types
c. Reasons
d. Power Structure and Social Movements
Unit –II:Basis of Social Movement
a.Class, Caste, Ethnicity and Gender
b.Types of leadership and relationship between leaders and masses
c. Political institution and social movement.
d. Role of media in social movement.

Unit-III: Theoretical Perspectives
a. Marxian and Post-Marxian
b. Structural-Functional
c. Postmodernist
d.Post-Structuralist

Unit-IV: Traditional Social Movements
a. Labour and Trade Union
b. Tribal
c. Peasant
d. Nationalist
Unit-V: New Social Movements
a. Dalit
b. Women
c. Ethnic
d. Environmental
e. student movements.

15

References:

1.   Banks, J.A., 1972; The Sociology of Social Movements (London : Macmillan)

2.   Desai, A.R., Ed., 1979; Peasant Struggles in India (Bombay : Oxford   University Press)

3.   Danagare, D.N., 1983; Peasant Movements in Indian 1920-1950 (Delhi : Oxford University Press.

4.   Gore, M.S., 1993; The Social Context of an Ideology : Ambedkar's Political and Social Thoughts (New Delhi : Sage)

5.   Oomen, T.K., 1990 : Protest and Change : Studies in Social Movements   (Delhi : Sage).

Paper No.XIII/CC11   Marks-80
PERSPECTIVES OF STUDY TO INDIAN SOCIETY
Unit-I: Indological / Textual
   a. G.S. Ghurye;- Origin, Theory and Characteristics of caste , caste and Race.
   b. Louis Dumont:- Homohierarchius in caste system in India
   c. Criticism of Ghurye and Dumont.
Unit-II: Structural Functionlism
   a. M.N.Srinivas:- Dominant Caste, Sanskritization , Secularization and Social Change.
   b. S.C.Dube:-Social Change and Modernization
   c. Criticism of M.N. Srinivas and S.C.Dube
Unit-III: Marxism
   aD.P.Mukharjee:- Approach to study Indian Economy and Society
   b.A.R. Desai:- Approach to study rural society and Economy in India.
   cCriticism of D.P.Mukherjee and A.R.Desai
Unit-IV: Subaltern Perspective
   a. B.R. Ambedkar :- Characteristics of Caste, Demerits of Caste, Annihilation of Caste
   b. David Hardiman:- Characteristics of Indian Society, Subaltern Approach to study Indian Society.
   c. Comparision between Ambedkar and Hardiman's Subaltern Approach
Unit-V: Civilizational Approach
   a. N.K.Bose
   b. Surjeet Sinha
   c. Criticism of N.K. Bose and Surjeet Sinha

References:

16

1.	Das, V. 1982	Structure and Cognition aspects of Hindu caste and rituals Oxford, New Delhi.
2.	Desouza, P.R. (ed) 2000	Contemporary India Transitions. Sage, New Delhi.
3.	Dhanagare, D.N. 1993	Themes and Perspectives in Indian Sociology Rawat, Jaipur
4.	Dube, S.C. 1967	The Indian village Routledge, London
5.	_____ 1973	Social Sciences in a chanign society. Lucknow university press, Lucknow
6.	Dumont, L. 1970	Homo Hierarchicus: the caste system and its implications Vikas, New Delhi.
7.	Hardiman, D 1987	The coming of the Devi: Adivasi Assertion in western India Oxford, New Delhi
8.	_____ 1996	Feeding the Bania: Peasants and usurers in western India. Oxford, New Delhi.
9.	Momin, A.R. 196	The legacy of G.S. Ghurye Popular, Mumbai
10.	Mukharjee, D.P. 1958	Diversities PPH, New Delhi
11.	Oommen, T.K. and Mukharjee, P.N. 1986	Indian Sociology: Reflection and Introspection popular, Mumbai.
12.	Singh, y. 1986	Indian Sociology: Social conditioning and Emerging concerns, Vistaar, New Delhi.
13.	Srinivas, M.N. 1960	India's Villages Asia publishing House, Bombay.

Paper No.XIV/CC12   Marks-80

INDUSTRY AND SOCIETY IN INDIA

Unit-I: Industrial Sociology and Classical Sociological Tradition
   a. Scientific Management
   b. Division of Labour
   c. Bureaucracy and Rationality
   d. Production Relations and Alienation

Unit-II: Industrial Organizations
   a. Formal and Informal Organizations: Structure and Functions
   b. Line and Staff Organization
   c. Contemporary Organization Realities

Unit-III: Impact of Industrialization on:
   a. Family
   b. Stratification
   c. Habitat and Settlement
   d. Environmental

17

Unit-IV: Subjective Experience of Work
 a. Work Ethics, Work Value, Work Attitude and Work Process
 b. Motivation to Work,
 c. Work Satisfaction, Incentives and Its Effects

Unit-V: Technological Change and Automation
 a. Technology and Social Structure in Industry
 b. Organizational Choice and Technological Change
 c. Resistance to Automation and Change

References:
1. Agrawal R.D. 1972 — Dynamics of Indian labour relations in India (A Book regarding Mc-Graw Hill, Bombay)
2. Aziz Abdul 1984 — Labour problems of developing economy Ashis Publishing house, New Delhi
3. Gilbert S.J. 1985 — Fundamentals of Industrial Sociology Tata Mc-Graw hill Bombay
4. Karnik V.B. 1990 — Indian trade Union A survey, Popular Prakashan-Bombay
5. Laxmana, C et al 1990 — Workers Participation and industrial democracy: Global perspectives: Ajanta publication, New Delhi.
6. Memoria, C.B. and Memoria 1992 — Dynamics of Indian Relations in India Himalaya publishing house: Mumbai
7. Miller, D.c. and Farm W.M. 1964 — The Sociology of Industry George Allen and Onwin, London
8. Philip H and Mellissa T 2001 — Work Post Modernism and organization Sage, New Delhi
9. Ramaswamy E.A. 1977 — The worker and His union, Allied New Delhi
10. _____, 1978 — Industrial Relations in India OUP, new Delhi
11. Thiwait, P.K. 1987 — Social Structure of a Planned Town, Institute of Social Research and Applied Anthropology, Calcutta.
12. Watson K. Tony 1995 — Sociology, work and industry Routlodge and Kagan Paul, London.

Paper No.XV/CC13   Marks-80
CRIMINOLOGY
Unit-I: Conceptual and Theoretical Approaches
 a. Legal, and Sociological concept of Crime
 b. Crime Causes prevention and Control
 c. Theories on Crime Causation; Sociological and Geographical

18

Unit-II: Type of Criminals and Crime
a. Juvenile delinquency
b. Women and Crime
c. White collar crime

Unit-III: Changing Profile of Crime and Criminals;
a. Corruption: Types, Causes, and Consequences.
b Cyber Crime: Causes, Prevention and Control
c Crime Against Women: Causes, Prevention and Control

Unit-IV: Theories of Punishment
a. Retributive, Deterrent: Theories and Criticism
b. Reformative Theory: Probation and Parole
c. Open Prison- Its Success and Failure

Unit-V: Terrorism
a. Concept of Terrorism and Its Characteristics
b. Terrorism in India
c. Social and Legal Measures for Its Prevention and Control

References:
1. Ahuja, R. 1969 — Female offenders in India Meenakshi Prakashan, Meerut
2. Madan, G.R. 1985 — Indian social problems-I Allied Publishers, New Delhi
3. Mahapatra, S. 2002 — Rays of Hope: Forum for fact finding documentation and Advocacy Raipur.
4. Mishra, R and Mohanty, S. 1992 — Police and Social change in India Ashish publishing House, New Delhi.
5. National Crime records Bureau 2000 — Crime in India, New Delhi.
6. National human rights commission 2000-2001 — Annual Report Sardar Patel Bhawan. New Delhi.
7. Reid, Suctitus 1976 — Crime and Criminology, Illiois: Deyen Press
8. Singh, S. and Srivastava, S.P. (ed) 2001 — Gender equity through women's empowerment. Bharat book center, Lucknow.
9. Sirohi, J.P.S. 1992 — Criminology and Criminal Administration Allahabad Law agency. Allahabad.
10. Vadackumchery, J. 1996 — The police and Delinquency in India. APH Publishing corporation, New Delhi.

19

FOURTH SEMESTER

Paper No. XVI/CC14   Marks-80

MODERN SOCIOLOGICAL THEORIES

Unit-I: Symbolic Interactionism
   a. Concept and Characteristics of Symbolic Interectionism
   b. Contributions of G.H. Mead
   c. Contribution of H.Blumer
   d. Criticism

Unit-II: Phenomenology
   a.Concept and Characteristics of Phenomenology
bContributions of Alfred Schutz
cContributions of Peter Berger
dCriticism

Unit- III:Ethnomethodology
a Concept and Characteristics of **Ethnomethodology**
b.Contribution of Harold Garfinkel
c Contribution of Irving Goffman
dCriticism

Unit-IV: Critical Theory
   a. Concept and Characteristics of **Critical Theory**
   b. Contributions of Adorno
   c. Contributions of Habermas
   d. Criticism

Unit-V: Post Modernism
   a. Concept and Characteristics of Post Modernism
   b. Contributions of Michel Foucault
   c. Contributions of Jacques Derrida
   d. Criticism

References:

1. Abraham, M.F. 2001 — Modern Sociological Theory: An introduction Oxford, New Delhi
2. Adams, B.N. and Sydie, R.A. 2001 — Sociological Theory, Vistaar, New Delhi
3. Alexander, J.C. 1987 — Twenty lecturers: Sociological theories since world war-II Columbia Univ. Press New York
4. Apadurai, A. 1996 — Modernity at large: Cultural Dimensions of Globalisation University of Minnesota Press, Minneapolis
5. Bottomore, T. 1984 — The Frankfurt School, Tavistock, London
6. Bourdieu, P. 1995 — Sociology in Question, Sage, London.
7. Coser, L.A. — Masters of Sociological thought Rawat, Jaipur.

2001

8. Collins, R.   Sociological Theory Rawat, Jaipur
   1997

9. Craib, I   Modern Social Theory; From parsons to habermas
   1992   Harvester, London.

10. Giddens, A.   Central Problems in social theory, action,
    1983   structure and contradictions in social analysis
                       Macmillan, London.

11. _____   Capitalism and Modern Social Theory,
    1996   Cambridge University Press, Cambridge.

12. Kumar, K.   From Post-Industrial to post- modern Society,
    1997   Black Well Publishers, Oxford, UK.

13. Lash, S.   Sociology of Post Modernism Routledge and
    1996   Kegan Paul, London.

14. Podogorecki, A and Multi Dimensional Sociology Routledge and
    Los, M.   Kegan Paul, London.
    1979

15. Sturrock, J (ed)   Structuralism and since from Levistrauss to
    1984   Derrida Oxford, New York

16. Turner, B.S.   Classical Sociology Sage, New Delhi.
    1999

17. Turner, J.H.   The structure of sociological theory
    2001   Rawat, Jaipur

18. Zeitlin, I.M.   Rethinking Sociology, A critique of contemporary
    1998   Theory. Rawat, Jaipur.

Paper No. XVII/CC15   Marks-80
COMPARATIVE SOCIOLOGY
Unit-I: Historical and Social Context of Emergence of Sociology in the West
   a. Emergence of Sociology in West
   b. Eurocentric base of western Sociological Tradition
   c. Americanization of Sociology
   d. National Tradition in Sociology

Unit-II: Central Themes in Comparative sociology
   a. Modernity and Development:- Concept, Characteristics and issues
   b .Diversity and multi Culturalism:- Concept, Characteristics and issues
   c. Enviornment:- Concept, Characteristics and issues
   d. Globalization; Concept, Characteristics and issues
Unit-III: Theoretical Concern,s in Comparative sociology
   a. Problems of theoring in sociology
   b. Theoretical and Methodological approaches in sociology
   c. Policy issues: Formulation and Evalution
Unit IV: Current Debates
   a. Contextitualization- Iravati Karve

b. Indianization- G.S.Ghurye, K.M.Kapadia

c. Use of Native Categories- M.N.Srinivas , A.Beteille

d. Criticism and present status

Unit-V: Debate on "For Sociology of India"

a. Sociology of India- D.P.Mukherjee,R.K.Mukherjee

b .Sociology in India-School of Sociology in Bombay, Lucknow and Delhi

c. Sociology For India- Louis Dumont,Pocock,Yogendra Singh and Indra Deva

d. Criticism and present status

References:

1	Anderski, S 1961:	Elements of Comparative Sociology(London , Widenfeld and Nicolson)
2	Beteille, Andre 1987:	Essays in Comparative Sociology(New Delhi: Oxford University Press)
3	Beteille, Andre 1992:	Society and Policies in India: Essays in Comparative Sociology(New Delhi: Oxford University Press)
4	Berremen, G.D 1981:	The Politocs of Truth : essays in Critical Anthopology, New Delhi: South Asian Publishers)
5	Dube, S. C. 1973:	Modernization and Development: The search for alternative paradigm (New Delhi: Vistar)
6	----------------1973:	Social Sciences in a chanign society. Lucknow university press, Lucknow
7	Ferreira, J.V. and A.R.Momineds: 1983:	Nemesis–CulturalPerspectives on modernization (Bombay, Ramkrishna Publication)
8.	Genov, Nikolai, 1989:	National Traditions in Sociology (Delhi: Sage)
9	Kiely R and Phil Marfleet, eds. 1998:	Globalization and the third world (London: Routledge)
10	Kothari,Rajan1988 :	Rethinking Development: In search of Human Alternatives Delhi: Ajanta.
11	Kuper A 1996 :	Social Science Encyclopaedia, (London: Routledge)
12	MohanR.P and A.S.Wilke, eds.1994:	International Hand book of Contemporary Developments of Sociology (London : Mansell)
13	Oommen,T.K.& P.N. Mukherjee eds. 1986:	Indian Sociology: Reflection and Introspection popular, Mumbai.
14	Parekh, Bhikhu 2000	Rethinking Multiculturalism: Cultural Diversity and Political Theory(London: Macmillian)
15	Saraswati B.N.1994:	Interface of Cultural Identity and Development (New Delhi: Indira Gandhi National Centre of the Arts)
16	World Commission on environment and	(New Delhi: Oxford University Press)

Development, 1987:

| 17 | Wallerstein, Immanuel 1974: | Modern World System (New York: Oxford University Press) |

Paper No.XVIII/CC16   Marks-80

CONTEMPORARY ISSUES IN INDUSTRY

Unit-I: Industrial Relation
a. Importance of Human Relations at work
b. Conflict: Causes and Types, Resolution of Conflict
c. Conciliation and Collective Bargaining
d. Worker's Participation in Management

Unit-II: Trade Union and Industrialization
a. History of Trade Unionism in India
b. Objectives and Functions
c. ILO and Trade Unions in India
d. Trade Unionism in Globalization

Unit-III: Industry and Society
a. Impact of Industry on Family
b. Impact of Industry on Stratification
c. Industrialization and Migration
d. Industrialization and Religion

Unit-IV: Industrilization in Third world Countries in the Era of Globlization
a. FDI and Third World
b. International Agencies: World Bank and Third world countries
c. Status of Industries in Third World Countries

Unit-V: Contemporary Issues
a. Industrialization and Women Labour
b. Industrialization and Child Labour
c. Industrialization and Environment
d. Problem of Industrialization in Developing Countries

References:

1.	Agrawal R.D. 1972	Dynamics of Indian labour relations in India (A Book regarding Mc-Graw Hill, Bombay)
2.	Aziz Abdul 1984	Labour problems of developing economy Ashis Publishing house, Hew Delhi
3.	Gilbert S.J. 1985	Fundamentals of Industrial Sociology Tata Mc-Graw hill Bombay
4.	Karnik V.B. 1990	Indian trade Union A survey, Popular Prakashan-Bombay
5.	Laxmana, C et al	Workers Participation and industrial democracy:

	1990	Global perspectives: Ajanta publication, New Delhi.
6.	Memoria, C.B. and Memoria 1992	Dynamics of Indian Relations in India Himalaya publishing house: Mumbai
7.	Miller, D.c. and Farm W.M. 1964	The Sociology of Industry George Allen and Onwin, London
8.	Philip H and Mellissa T 2001	Work Post Modernism and organization Sage, New Delhi
9.	Ramaswamy E.A. 1977	The worker and His union, Allied New Delhi
10.	_____, 1978	Industrial Relations in India OUP, new Delhi
11.	Thiwait, P.K. 1987	Social Structure of a Planned Town, Institute of Social Research and Applied Anthropology, Calcutta.
12.	Watson K. Tony 1995	Sociology, work and industry Routlodge and Kagan Paul, London.

Paper No.-XIX/CC17   Marks-80

CRIMINOLOGY: CORRECTIONAL AND ADMINISTRATION

Unit-I: Roots of Correction to prevent Crime
   a. Socialization
   b. Family values: Truth, Obedience, honesty, integrity, morality, ethics.
   c. Role of education

Unit-II: Correction and It's Forms
   a. Meaning and Significance of Correction; Prison Based and Community Based
   b. Correctional Programmes in Prison; History of Prison Reforms in India
   c. After Care and Rehabilitation Programme.

Unit-III: Problem of Correctional Administration
   a. Overcrowding; Lack of Inter Agency Co-Ordination among Police Prosecution, Judiciary and Prison
   b. Prison Offences
   c. Problem of Criminal Justice Administration

Unit-IV: Victimological Perspective
   a. Victrim's Responsibility in Crime
   b. Violation of Prisoner's Human Rights
   c. Problems of Women Offenders.

Unit-V: Community Policing
   a. Concept andObjectives
   b. Types
   c. Significance

References:

1. Ahuja, R. 1981 — The Prison System Sahitya Bhawan, Agra

2. _____, 1997 — Contemporary Social problems in India Rawat, Jaipur.

3. Advani, NH, 1978 — Perspectives on Adult Crime and correction. Abhinav Publication, New Delhi.

4. Bedi, K. 1998 — It is always possible sterling, New Delhi.

5. Devasia, L and Devasia, V.V. (ed) 1989 — Female criminals and Female Victims: An Indian Perspective Dattsons, Nagpur.

6. Gosmami, B.K. 1983 — Criminology and Penology Allahabad

7. Mohanty, S 1990 — Crime and Criminals in India Ashish Pub. House New Delhi.

8. Reid, S. 1976 — Crime and Criminology Deydan press, Illinayse

9. Shankardas, R.D. 2000 — Punishment and the Prison: India and International perspective, Sage, New Delhi.

10. Sutherland, E.H. and Donald, R.C., 1968 — Principles of Criminology The Times of India Press, Bombay.

11. William, H.E. 1990 — The correction Profession Sage, New Delhi.

Paper No.-XX/P3   Marks-100
PROJECT REPORT

On Rural and Urban Problems

Scheme of Evaluation- 50% by Internal Examiner and rest 50% by Viva-Voce Examination evaluated both by the Internal and External Examiner.

SYLLABUS OF ANNUAL EXAM
ORDINANCE NO. 13
Master of Arts Examination

1. The Examination for the degree of master of Arts shall consists of two parts
   (a) The Previous Examination, and
   (b) The Final Examination.

2. A candidate who after taking his Bachelor's degree of the University or an examination of any statutory University in India which has been recognised by the University and has completed a regular course of study in the teaching department of the University or in a College in the subject in which he offers himself for examination for one academic year shall be admitted to the Previous Examination for the degree of Master of Arts.

   A candidate after passing a graduate examination under 11 +3 scheme or any other examination recognised by the University as equivalent there to shall be eligible for admission to a post-graduate course of studies where graduation is minimum qualification only after passing. one year Bridge Course prescribed for the purpose. This shall apply to students graduation in 1991 main examination.

3. A candidate who after passing the M. A. Previous Examination of the University, has Completed a regular course of study for one academic year in a teaching department of the University or in a colleges shall be admitted to the Final Examination for the degree of master of Arts in the subject in which he/she passed the Previous Examination.

   A candidate who has passed the Previous. Examination for the degree of Master of Arts of another University may also be admitted to the Final Examination for the degree of Master of Arts after obtaining necessary permission from the Kulpati, provided that he offered for his Previous Examination a course of study of an equivalent standard with almost identical syllabus as required for one Previous Examination of the University and has attended a regular course of study for one academic year in a College affiliated to the Unitersity or a teaching department of the. University.

4. Besides regular students and subject to other compliance with this Ordinance, exe=students and non-collegiate candidates shall be eligible for admission to the Examination as per provisions of Ordinance No.6 relating to Examination (General).Provided that in the subject where field work or practical work is prescribed only such candidates will be permitted to appear as non-collegiate candidates as have obtained permission of the Head of the University Teaching Department or Principal of the College teaching such subject.

   Provided that non-collegiate candidates-shall be permitted to offer only such subjects/ papers as are thought to' the regular students at any of the University Teaching Department or College. .

5. The subject of the examination shall be one of the following:
   (i) English
   (ii) Hindi.
   (iii) Economics
   (iv) Political Science

2-6-2018

Head,
S.O.S. In Sociology & Social Work,
Pt. Ravishankar Shukla University,
Raipur. (C.G.)

1

    (v)   History
- (vi) Philosophy
- (vii) Sanskrit
- (viii) Mathematics
- (ix) Linguistics
- (x) Geography
- (xi) Sociology
- (xii) Anthropology
- (xiii) Classics
- (xiv) Ancient Indian Hostory, Culture and Archeology
- (xv) Public Administration
- (xvi) Defence Studies
- (xvii) Statistics

A candidate securing 60% or more marks in the M.A./M.Com. Previous Examination will be eligible to offer dissertation in lieu of one of the, optional papers for the Final. A regular candidate can offer dissertation with the permission of the Professor and the Head of Department of his Institution, while a private candidate will have to secure the prior permission in writing of anyone of the Professors of the subject working in an institution within the jurisdiction of the University and will work under supervision of that Professor after obtaining prior permission of the University to that effect.

6. A candidate who has passed the M. A. Examination of the University inany subject shall be allowed to present himself for the M.A. Examination in qny,one or more of the optional papers in tha1 subject not taken by him at the said examination and is successful will be given a certificate to that effect.

No Candidate shall be allowed to offer more than two additional papers in any one year.

7. For both the Previous and Final Examination a candidate will be declared successful If he/she obtains atlesast 36% of the aggregate marks in the, subject. In subject, in which both Theory and Practical Examinations are held the examinee must pass separately- in the Practical Examination obtaining not less than 36% marks.

8. No division wil'l be assigned on the result of the Previous E'xamination, The division in which a candidate is placed shall be determined on the basis of aggregate of marks obtained in both the M. A. Previous and. the M.A. Final Examination.

9. Successful candidate who obtain 60% or more of the aggregate marks shall be placed in the First Division, those obtaining less than 60% but not less than 48% in the Second. Division and all other successful candidates obtaining less than 48% in the Third Division.

10. Candidates who have passed .the M.A. Examination of the University in any, subject in Third or Second Division and desire to appear at the.M.A. Examination in the sa.me subject for improving division without attending a regular course of study in a college affiliated to the University or in a teaching Department of the University be allowed to appear at the aforesaid examination as non-collegiate student on the following Conditions:-

    (i)   There shall be only two Divisions for such candidates the First Division and Second Divsion. The marks required for obtaining these divisions shall be sameas

2

prescribed in the Ordinance i. e. examinees who .are successful in Final of fhe Examination and ha.ve obtained 60% or more aggregate of the marks in Previous and Final Examination taken together shall be placed in the First Division and examinees who are successful in Final Examination and have obtained less than 60% but not lessthan 48% of aggregate marks Previous and Final Examinations taken together shall be placed in the Second Division.

(ii) The result of the candidates obtaining less than 48% of the aggregate marks in Previous and Final of the examination taken together shall not be declared.

(iii) Candidates shall be option to appear at both the Previous and Final Examinations in one and the same year and for being successful at the examination, the candidates shall obtain 48% of the aggregate marks.Provided that such candidates who up to appear in Previous and Final Examinations separately shall have to obtain minimum aggregate required for the Previous Examination but he will have to obtain atleast 48% in the aggregate of Previous and Final Examinations taken together or else his result will be cancelled.

(iv) The syllabus for the examination shall be the same as prescribed for the year in which the examination is held.

(v) Not more than two attempts shall be allowed to such a candidate. Failure or non-appearance at the examination after permission has been accorded by the University, shall be counted as an attempt.Provided however such candidates who up to appear at the Previous and Final examination separately will be allowed only one attempt at the previous examination and two attempts at the Final Examination.

(vi) Candidates who wish to avail the opportunity given in foregoing paras will have to apply for permission as required in theOrdinance relating to admission of Non-collegiate students to the. University examinations, alongwith requisite registration fee.

(vii) In case, a student improves his division under provision of this para, the fresh Degree will be issued after canceling his first Degree.

11. Transitory Provisioll; The reblaced Ordinance relating to Master of Arts Examination shall remain effecting till the examination of 1991, and this new Ordinance shall be Applicable from the examination 1992.

USE OF CALCULATORS

The students of Degree/P.G. classes will be permitted to use Calculator in the examination-hall on the. Following conditions as per decision of the standingCommittee of the Academic Council at its meeting held on 31-1-1986.

1. Student will bring their own Calculators.
2. Calcultors will not be provided either by the University or examination centres.
3. Calculators with memory and following variables be permitted; +, sqare, reciprocal, expotential log, square root, trignometric functions viz. sine, cosine tangent etc. factorial summation, xy, yx and in the light of objectivge approval of merits and demerits of the viva only Will be allowed.

- - - - - - -

3

M.A. PREVIOUS (Code-021)
SOCIOLOGY

एम.ए.पूर्व समाजशास्त्र में निम्नलिखित पांच प्रश्न–पत्र होगे

कमां	प्रश्न–पत्र	प्रश्न–पत्र का नाम	कोड	पूर्णाक
1.	Paper - I	Classical Sociological Tradition	(0323)	100
2.	Paper - II	Methodology of Social Research	(0324)	100
3.	Paper - III	Sociology of Change and Development	(0325)	100
4.	Paper - IV	Rural Society in India	(0326)	100
5.	Paper - V	Urban Society in India	(0327)	100

PAPER - I
CLASSICAL SOCIOLOGICAL TRADITION
(Paper Code - 0323)

UNIT-1 Historical Socio- Economical background of the emergence of Sociology.

Traditional feudal economy and social structure.

Impact of Industrial revolution and of new mode of production on society and economy.

The emergence of capitalistic mode of production nature and features of capitalism.

August Comte positivism, Law of three stages, Hierarchy of Science.

UNIT-2 Karl Marx;

Marxian Dialectical materialism as a philosophical perspective of change and its laws Materialistic interpretation of history; As a perspective of explaning transformation of human society through different stages.

Mode of Production and social structure.

Basic structure and super structure.

Concept of surplus value and exploitation.

Emergence of classes and class conflict.

Proletariat revolution and future of capitalism classless society.

Alienation in the capitalist society- Factors responsible for alienation and its social implications.

Views on political power. The state in relation to social classes.

Future of the state after proletariat revolution.

Marx and sociology of Knowledge.

UNIT-3 Emile Durkheim ;

Intellectual background. His preoccupation with the order and disintegration of society. Social disintegration as a legacy of industrial revolution. Increasing division of labour in the capitalist.

Mechanical and organic solidarities. Explanantion of increasing divisioin of labour.

Pathological forms of division of labour.

Theory of suicide; Review of earlier theories of suicide, Suicide rate.

Types of suicide, Problem of integration of the individual with society.

4

Theory of religion; Earlier theories of the emergence and role of religiion, structure of religiion, sacred and profane, source of sacredness of the sacred things as symbols   of ultimate values. Society as a supreme God. Religious rituals-their types. Social   role of religious beliefs and rituals.

Contribution to the methodology of sociology- Sociology as a science. Concept of social facts.

UNIT-4 Max Weber;- Intellectual background. Theory of social action. Types of social action.

Views on the role of ideas and values in social change with reference to the relationship

between protestant ethic and emergence of capitalism.

Theory of Authority. Authority and power. Types of authority Theory of Bureaucracy. Capitalism and growing rationalism and emergence of modern bureaucracy.

Relationship between political leaders and bureaucracy.

Contribution to the methodology of social science.Concepts of Verstehen and ideal type.

UNIT-5 Vilfredo Pareto

Intellectual background

Contribution to the methodology - his logico-experimental method.

Classification of logical and non-logical actions.

Explanation of non-logical actions in terms of his theory of Residues and Derivatives. Classificatiion of Residues and Derivations.

Theory of social change, Elites and masses. Types of elites, their classification, Circulation of Elites.

BOOKS RECOMMENDED :

1. Parsons, Talcott : The structure of social action Vol. I & II, Mcgraw Hill, New Yark, 1937-1949.
2. Nisbet : The Sociological Tradition. Heinemann Educational Book Ltd. London, 1966.
3. Zeitlin, Irvin : Ideology and the Development Sociological theory, Prentice Hall, 1981.
4. Dahrendorf, Ralph : Class and class conflict in an Industrial Society, Stanford University Press 1959.
5. Bendix, Rinehard : Max Weber : An Intellectual portrait, Double Day, 1960.
6. Popper, Karl : Open Society and its Enemis, Routledge, London, 1945.
7. Aron, Reymond : Main Currents in Sociological Thought, Vol. I & II, Penguin, 1965-1967.
8. Coser, L.A. : Masters of Sociological thought, Harcourt Brace, New York 1977.
9. Giddens, Anthony : Capitalism and Modern Social theory - An Analysis of writings of marx, Durkheim and Weber, Cambridge University Press, 1997.
10. Hughes John A. : Martin Peter, J. and Sharrock, W.W. : Understanding Classical Sociology- Marx Weber and Durkheim, Sage Publication, London, 1995.

PAPER -II

METHODOLOGY OF SOCIAL RESEARCH

(Paper Code - 0324)

UNIT-1   Philosophy of social science; Enlightenment, reason and science, Cartesian philosophy, structure of scientific revolution (Kulin). Positivism and its critique; contributiion of Comte, Durkheim and popper positivism, Critique of positivism;

5

Fayerband and Giddens

UNIT-2 Logic of Inquiry in social science research

Inductive and Deductive

Theory building Scientific method in social research

Objectivity/value neutrality. Hypothesis

UNIT-3 Quantitative methods and survey research;

Survey techniques. Limitations of survey. Operationalization and research design.

Sampling design. Questionnaire Construction, Interview schedule.

Measurement and scaling. Reliability and Validity.

UNIT-4 Qualitative Research Techniques.

Techniques and methods of qualitative research.

Participant observation ethnography, interview Guide.

Case study method. Content analysis. Oral history, narratives.

Life history, genealogy.

Encounters and experiences in field work.

Data processing.

Reliability and validity in qualitative research.

UNIT-5 Statistics in Social Research;

Measures of central tendency; Mean, Median, Mode.

Measures of Dispersion; Standard Deviation.

Correlational Analysis; Tests of Significance and covariance.

Social Research, Action Research, Participatory Research.

Ethical issues in Social Research.

BOOKS RECOMMANDED :

1. Barnes, John A. ; Who Should know what ? Social Science, Privacy and Ethics, Harmondsworth : Penguin, 1979.
2. Bose, Pradip Kumar, ; Research Methodology. ICSSR, New Delhi, 1995.
3. Bryman, Alan ; Quality and Quantity in Social Research, Unwin Hyman, London, 1988.
4. D.A. De vaus : Surveys in Social Research, George Relen and Unwin, London, 1986.
5. Irvine, J., I. Miles and J. Erveans (Eds.); Demystifying Social Statistics, Pluto Press, London, 1979.
6. Madge, John ; The Origins of Scientific Sociology, Tavistock, London, 1970.
7. Marsh, Catherine ; Exploring Data, Polity Press, Cambridge, 1988.
8. Punch, Keith : Introduction to Sociol Research, Sage Publication, Londan, 1986.
9. Srinivas, M.N. and A.M. Shah : Field Worker and the Field, Oxford University Press, New Delhi, 1979.
10. Beteille A. and T.N. Madan : Encounter and Experience : Personal Accounts of Field work, Vikas Publishing House Pvt. Ltd., New Delhi, 1975.
11. Kuhn, T.S., The Structure of Scientific Revolutions, The University of Chicago Press, London, 1970.
12. Mukhergee, P.N. (ed.) : Methodology in Social Research ; Dilemmas and Perspectives, Sage, New Delhi, 2000.
13. Popper, K. : The Logic of Scientific Discovery , Routledge, London, 1999.
14. Shipman, Martin : The Limitations of Social Research, Longman, London, 1988.
15. Sjoberg, Gideon and Roger Nett : Methodology for social research, Rawat, Jaipur, 1997.
16. Smelser, Neil J. : Comparative Methods in Social Science.

6

PAPER-III
SOCIOLOGY OF CHANGE AND DEVELOPMENT
(Paper Code - 0325)

UNIT-1 Meaning and forms of social change; Evolution, Progress, transformations
Theories of social change; Linear, Cyclical
Factors of social change ; Demographic economic, religious, infotech and media.

UNIT-2 Social Change in contemporary India; Trends of change, processes of change
Sanskritization, Westernization, Modernization, Secularization.
Changing Conceptions of Development; Economic growth, human development,
social development; Sustainable development, the question of sustainability.

UNIT-3 Theories of Development and underdevelopment; modernization theories, centre-
peripheri, world systems, unequal exchange.
Paths and Agencies of Development; Capitalist, socialist, mixed economy,
Gandhian; state, market, non- governmental organizations.

UNIT-4 Social Structure and Development; structure as a facilitator/ inhibitor, development
and socio-economic disparities, gender and development.
Culture and development; Culture as an aid, development and displacement of
tradition.

UNIT-5 Indian Experience of development; sociological apprairal of Five-Year plans, social
consequences of economic reforms, socio- cultural repercussions of globalization,
social implications of info-tech revolution.
Formulating social policies and programmers; policy & project planning,
implementations.

BOOKS RECOMMENDED :

1. Abraham, M.F. : Modern Sociological Theory : An Introduction, OUP, New Delhi, 1990.
2. Agarwal B. : A Field of One's Own : Gender and Land Rights in South Asia, Cambridge University Press, Cambridge, 1994.
3. Appadurai, Arjun : Modernity at Large : Cultural Dismensions of Globalization. OUP, New Delhi, 1997.
4. Dereze, Jean and Amartya Sen : India : Economic Development and Social Opportunity, OUP, New Delhi, 1996.
5. Desai, A.R. : India's Path of Development : A Marxist Approach, Popular Prakashan Bombay, 1985.
6. Giddens, Anthony : Introduction to Sociology IInd Ed., W.W. Norton & Co. New york, 1996.
7. Harrison D. : The Sociology of Modernization and Development, Sage, New Delhi,1989.
8. Haq, Mahbub ul : Reflections on Human Development, OUP, New Delhi, 1991.
9. Moore, Wilbert and Robert Cook : Social Change, Prentice Hall, New Delhi, 1967.
10. Sharma S.L. : Development Socio-Cultural Dimensions, Rawat, Jaipur, 1986.
11. Srinivas, M.N. : Social Change in Modern India, University of Berkley, 1966.
12. Amin, Samir : Unequal Development OUP, New Delhi, 1979.
13. Giddens, Anthony : The Consequences of modernity, Polity Press, Combridge, 1990.
14. Kiely, Ray and Phil Marfleet (eds) : Globalization and the third World, Routledge, London, 1998.

7

15. UNDP : Human Development Report, Oxford University Press, New York, 1997.
16. UNDP : Sustainable Development, OUP, New York.

17. Wallerstein Imnanual : The Modern World System, OUP, New York, 1974.
18. World Bank : World Development Report, New York, 1995.

PAPER- IV
RURAL SOCIETY IN INDIA
(Paper Code - 0326)

UNIT-1 Rural society in India as agrarian and peasant social structure.
Basic characteristics of peasant and agrarian society.
UNIT-2 Family, caste, religions, habitat and settlement, in rural society in India.
Debates of mode of productiion and agrarian relation-tenacy lands and labour.
UNIT-3 Agrarian legislation and rural social structure.
Rural poverty, emigration, landless labour.
UNIT-4 Planned change for rural society.
Panchayati Raj Role of women in panchayati Raj. Rural development strategies (I R D P). Integrated Rural Development Programme.
UNIT-5 Major agrarian movements in India-a critical analysis.
Globalisation and its impact on agriculture.
Water and agriculture; Irrigation management practices.

BOOKS RECOMMENDED :
1. Berch, Berberogue Ed : Class State and Development in India, sage, New Delhi, 1992.
2. Desai A.R. : Rural Sociology in India, Popular Prakashan, Bombay, 1977.
3. Mencher J.P. : Social Anthropology of Peasanty Part - III, OUP, 1983.
4. P. Radhakrishnan, : Peasant Struggles : Land Reforms and Social Change in malabar 1836-1982, Sage Publications, New Delhi, 1989.
5. Thorner, Daniel and Thorner Alice : Land and Labour in India, Asia Publications Bombay, 1962.
6. Andre Betille : Six Essays in Comparitive Sociology, OUP New Delhi, 1974.
7. Dharagare D.N. : Peasant Movements in India, OUP New Delhi, 1988.
8. Ashish Nandy : Ambiguous Journey to the Ciry, New Delhi, OUP, 1999.

PAPER - V
URBAN SOCIETY IN INDIA
(Paper Code - 0327)

UNIT-I Classical sociological traditions as urban and city dimensions, Emile Durkahiem, Karl Marx, Max Weber and Tonnies.

Urban community and spatial dimensions. Park, Burgers and Mc Kenzie.

8

George Simmel : Metropolis, Louis - Wirth Urbanism and Redfield Rural-Urban continum as cultural form.

UNIT-II Urban sociology in India ; Emerging trends in urbanisation, Factors of urbanisation, sociological dimentions of urbanisation, Social consequences of urbanisation.

UNIT-III Classification of urban centres, cities and towns, City industrial urban-base, its growth and special features, Industry centered developments.

UNIT-IV Changing occupational structure, and its impact on social stratification - class, caste Gender, family Indian city and its growth, migration, problems of housing, slum development, urban environmental problems, urban poverty,

UNIT-V Urban planning and problems of urban management of India. Urban institutions, Factors affecting planning, regional planning and the links between social and spatial theory.

BOOKS RECOMMENDED :

1. Quinn J.A., Urban Sociology, S Chand & Co., New Delhi 1955.
2. Pickwance C.G. (ed), Urban Sociology ; Critical Essays, Methuen 1976.
3. Saunders peter, Social Theory and Urban Question, Hutuchionson 1981.
4. Bose Ashish, Studies in India urbanisation 1901-1971, Tata McGraw Hill 1978.
5. Abrahimson M., Urban Sociology, Englewood, Prentice Hall 1976.
6. Ronnan, Paddison, Handbook of Urban Studies, Sage : India 2001.
7. Bharadwaj, R.K. : Urban Development in India. National Publishing House 1974.
8. Gold, Harry, : Sociology of Urban life. Prentice Hall, Englewood Cliff 1982.
9. Colling Worth, J.b. : Problems of Urban Society VOL. 2 George and Unwin Ltd 1972.
10. Alfred de Souza. The Indian City ; Poverty, ecology and urban development Manohar, Delhi 1979.
11. Desai A.R. and Pillai S.D. (ed) Slums and Urbanisation, Popular Prakashan, Bombay 1970.
12. Castells M, : The Urban Question, Edward Arnold, London 1977.
13. Ramachandran R. ; Urbanisation and Urban Systems in India, OUP, Delhi 1991.
14. Ellin Nan Post Modern Urbanisim, Oxford UK 1996.
15. Edward W. Soja, Post Metropolis ; Critical Studies of cites and regions. Oxford Blakcwell 2000.
16. Fawa F. Sylvia, : New Urbanism in World Perspectives - a Reader. T.Y. Cowell, New York 1968.

9

एम.ए. अंतिम समाजशास्त्र

एम.ए. अंतिम समाजशास्त्र में निम्नलिखित पांच प्रश्न–पत्र होगे

क्रमांक	प्रश्न–पत्र	प्रश्न–पत्र का नाम	कोड	पूर्णांक
1.	Papar I	Theoritical Perspectives in sociology	(0329)	100
2.	Papar II	Perspectives on Indian Society	(0330)	100
3	Papar III	Industry and Society in India.	(0332)	100
4.	Papar IV	Criminology	(0333)	100
5.	Papar V	Political Sociology.	(0334)	100

PAPER - I
THEORETICAL PERSPECTIVES IN SOCIOLOGY
(Paper Code - Code-0329)

UNIT-I Introduction

Nature of sociological theory- Levels of theorisation in sociology- Relationship between theory and research.

Structural-Funtionalism

The idea of social structure : A.R. Radcliffe-Brown- The problems of role analysis S.F. Nadel- Functional dimensions of social system : T. Parsons - Codification, critique and reformulation of functional analysis : R.K. Merton - Neofunctionalism : J. Alexander.

UNIT-II Conflict Theory

Marx critique and dialectics of conflict : R. Dahrendorf - Functional analysis of conflict L. Coser- Conflict and social change : R. Collins

UNIT-III   Neo Marxism :

Structuralism Marxism : L. Althusser : Action Theory. Pareto, Max Weber and Parsons.

UNIT-IV   Interactionist perspective

Symbolic Interactionism : G.H. Mead and H. Blumer - Phenomenological Sociology : A. Schutz - Social construction of reality : P. Berger and T.G. Luckmann, Ethnomethodology : H. Garflinkel

UNIT-V Recent trends in sociological theorizing

Structuration : Anthony Giddens - Habitus and field : Bourdieu - Postmodernism- Focault and Botrilard.

BOOKS RECOMMENDED :

1. Alexander, Jaffery C., Twenty lectures : Sociological theory since world war II. New York, Columbia University Press 1987.
2. Bottmore, Tom. : The Frankfurt school, Chester, Sussex : Ellis Horwood and London : Tavistock Publications 1984.
3. Craib, Ian. : Modern social theory : From Parsons to Haberman (2nd edition). London : Harvester Press 1992.

10

4. Collins, randall, (Indian edition) : Sociological theory, Jaipur and New Delhi. Rawat 1997.
5. Giddens, Anthony, : Central problems in social theory : Action, structure and contradiction in social analysis, London, Macmillan 1983.
6. Kuper, Adam. : Antrhopologists and anthropology : The British school, 1922-72 Harmondsworth, Middlesex : Penguin Books 1975.
7. Kuper, Adam and Jessica Kuper (eds.). (2nd edition) : The social science encyclopaedia, London and New York : Routledge 1996
8. Ritzer, George. (3rd edition) : Sociological theory, New York : Mc Graw-Hill 1992.
9. Sturrock, John (ed.) : Structuralism and sinc : From Levi Strauss to Derida. Oxford : Oxford University Press 1979.
10. Turner, Jonathan H. (4th edition) : The Structure of sociological theory, Jaipur and New Delhi : Rawat 1995.
11. Zeitlin, Irving M. (Indian edition) : Rethinking sociology : A critique of contemporary theory, Jaipur and New Delhi : Rawat 1988.

PAPER - II
PERSPECTIVES ON INDIAN SOCIETY
(Paper Code - 0330)

THEORETICAL PERSPECTIVES

UNIT-I Indological/Textual (G.S. Ghure)

Conceptulizing Indian Society in terms of certain distinguishtive characteristics and configuration Dharma, Varna, Ashrama, Karma, Rhen and Purushartha.

UNIT-II Synthesis of Textual and Field views (Irawati Karve, K.M. Kapadia)

Linkage and Network building reasons group and community family, marriage, kinship system and Indian social organization.

UNIT-III Structural functionalism (M.N. Srinivas, S.C. Dube)

The village as a nucleus of Indian Society, Social Hierarchy, Caste System, Caste and Class in Contemporary India.

UNIT-IV Civilizational View (N.K. Bose)

The scal of magnitude of culture; religions, Institutionals and Linguistic, Diversity in India. Tradition and modernity as a continuty between past and present institutions.

UNIT-V Subaltern perspectives (B.R. Ambedkar)

Elites, Backward classes, Minorities and Tribes, Problems of Scheduled caste and scheduled tribe, Indian society and Legislation, Casteism, Untouchability communalism, Regionalism and National integration.

ESSENTIAL READINGS :

1. DeSourza, P.R. ed. Contemporary India - Transitions (New Delhi : Sage) 2000.
2. Dhanagare, D.N. : Themes and Perspectives in India Sociology (Jaipur Rawat) 1993.
3. Dube, S.C. : Social Sciences in a Changing Society (Lucknow University Press) 1973.
4. Dube, S.C. : The Indian Village (London : Routledge, 1955) 1967.
5. Durnont, Louis : Homo Hierarchicus : The Caste System and its implications (New Delhi:

Vikas) 1970.
6. Karve, Irawati : Hindu Society : An Interpretation (Poona : Deccan College) 1961.
7. Momin, A.R. : The Lagacy of G.S. Ghurye : A Centennial estschrift Popular Prakashan, Bombay) 1996.
8. Mukherjee : D.P. : Divesities People's Publishing House, Delhi 1958.
9. Oommen, T.K. and P.M. Mukherjee, eds. : Indian Sociology : Reflections and Introspections, Popular Prakashan, Bombay 1986.

11

10. Singh, K.S. : The People of India : An Introduction, Seagull books, Calcutta 1992.
11. Singh, Y. : Indian Sociology : Social Conditioning and Emerging Concers, Delhi Vistaar 1986.
12. Singh, Y. : Modernisation of Indian Tradition, Delhi, Thomson Press 1973.
13. Srinivas, M.N. : India's Villages Asia Publishing House, Bombay 1960.
14. Tylor, Stephen : India : An Anthropological Perspective.
15. Hardiman, David : Feeding the Bania : Peasants and Usurers in Western India Oxford University Press 1996.
16. Hardiman, David : The coming of the Devi : Adivasi Assertion in Western India, Oxford University Press 1987.
17. Lannoy, Richard : The Speaking Tree, A Study of Indian Culture and Society, London, Oxford University Press 1971.
18. Marriott, McKim : Indian through Hindu Categories Sage, Delhi 1990.
19. Mohan, McKim : India through Hindu Categories Sage, Delhi 1990.
20. Mohan, R.P. and A.S. Wilke, eds. : International Handbook of Contemporary Developments in Sociology London, Mansell 1994.
21. SInger, Milton and Bernard Cohn. eds. : Structure and Change in Indian Society, Chicago : Aldine Publishing Company 1968.
22. Singer, Milton : When A Great Tradition Modernizes, Delhi, Vikas 1972.

PAPER-III
INDUSTRY AND SOCIETY IN INDIA
(Paper Code - 0332)

COURSE OUTLINE :

UNIT-I Classical sociological tradition on industrial dimensions of society, Division of labour, Anomie, Bureaucracy, rationality, production relations surplus value and alienation. E, Durkiem KMarx and M Weber

UNIT-II Family, religion, stratification, habitat, settlement and environmental problems through industrialisation process.

UNIT-III Work, work process, technology and labour, work culture work ethics and human relation work.

The concept of organisation (formal and informal organisation) its structure and functions, personel management scope and function.

UNIT-IV Industrial relations, conflicts, causes and types Resolution of conflict, conciliation, collective bargaining.

Trade union, their growth, functions and their role in industrial organistion.

UNIT-V Participatory management - varieties of such management, Industrial community labour migration, Women and child labour, family, Industrial city, social and environmental issues.

BOOK RECOMMONDED :

1. Zetlin Irwing, : Ideology and the development of Sociolical theory VOL 1 & VOL 2. Basic Books, New York 1969.
2. Watson,k Tony, : Sociology work and industry, Routeledge Kegan, paul 1995.
3. Ramaswamy E.A. : Industry and Labour OUP 1988.
4. Ramaswamy E.A. : Industrial relations in India, New Delhi 1978.
5. Karnik V B : Indian trade union, A survey, Popular Prakashan, Mumbai 1970.

12

6. Mamoria C B and Mamoria : Dynamics of Industrial Relation in India, Himalay Publishing House, Mumbai 1992.
7. Ramaswamy E.A. : The worker and his Union, Allied, New Delhi 1977.
8. Ramaswamy E.A. : The worker and Trade Union Allied, New Delhi 1977.
9. Agarwal R.D : Dynamics of Labour Relations in India,A book readings, Tata Mc Graw Hill 1972.
10. Laxmanna, C et all : Workers Participation and industrial democracy. Global perspective Ajantha Publications 1990.
11. Philip Hancock, Melissa Taylor : Work Post Modernism and Organisation Sage India 2001.
12. Aziz Abdul : Labour problems or developing Economy Ashish publishing house 1984.
13. Miller and Form : Industrial Sociology, Harper and Row, New York 1964.
14. Parker S.R Brown K Chield and Smith, M.A. : The Sociology of Industry, George Allen and Urwin Ltd. London 1964.
15. Gilbert S.J. : Fundamentals of Industrial Socilogy Tata Mc Graw Hill Publishing co. Ltd. New Delhi 1985.

CRIMINOLOGY-IV
(Paper Code - 0333)

UNIT-I Conceptual Approaches to Crime : legal, behavioral and sociological ; deviance, crime and delinquency ; types of crime - economic, violent, white-collar.

UNIT-II Perspectives on Crime Causation : classical, positivist, psychological, sociological, marxian, geographical ; recent theoretical advances - the criminal personality, labelling theory

UNIT-III Changing Profile of Crime and Criminals : organized crimes, crimes against women and children, cyber crimes, corruption, changing socio-economic profile of criminals in contemporary India.
Theories of punishment : retributive, deterrent, reformative, futility and cost of punishment

UNIT-IV Correction and its Forms : meaning and significance of correction : forms of correction-prison-based, community-based
Correctional Programmes in prisons : history of prison reforms in India, national policy on prisons : scientific classification of prisoners ; modernization of prison industry and involvement of private sector ; correctional programmes - educational, vocational, psychiatric, meditation, recreation, etc. New Delhi Model of Correction

UNIT-V Problems of Correctional Administration : antiquated jail manual and prison act. overcrowding, custodial mindset : lack of inter-agency coordination among police, prosecution, judiciary and prison ; human rights and prison management, limitations and prospects of correction . Alternatives to Imprisonment : probation, parole, open prisons, after-care and rehabilitation

BOOKS RECOMMONDED :
1. Bedi, Kiran It Is Always Possible. New Delhi : Sterling Publications Pvt. Ltd. 1998.
2. Gill, S.S. : The Pathology of Corruption. New Delhi : Harper Collins Publishers (India) 1998.
3. Goel, Rakesh M. and Manohar S. Powar, Computer Crime : Concept, Control and Prevention. Bombay : Sysman Computers Pvt. Ltd. 1994.

13

4. Lilly, J, Robert, Francis T, Wallen and Richard Ball A. Criminological Theory, Context and Consequences. New Delhi : Sage Publications 1995.
5. Makkar, S.P. Singh and Paul C. Friday, Global perspectives in Criminology, Jalandhar : ABC Publications 1993
6. Ministry of Home Affairs, Crime in India. New Delhi : Government of India 1998.
7. Reid, Suetitus. Crime and Criminology, Ikkinayse : Deydan Press 1976.
8. Shankardas, Rani Dhavan, Punishment and the Prison : India and International Perspective. New Delhi : Sage Publications 2000.
9. Sutherland, Edwin H. and Konald R. Cressey. Principles of Criminology. Bombay : The Times of India Press 1968.
10. Walklete, Sandra, Understanding Criminology. Philadelphia : Open University Press 1998.
11. Williamsan, harald E. Criminological Theory. New Jersey : Prentice-Hall 1990.
12. Williamsan, Harald E. The Correction profession, New Delhi : Sage Publications 1990.
13. Bequai, August. Computer Crime. Tononto : Lesington Books 1978.
14. Buckland, John. Combating Computer Crime : Prevention, Detection and Investigation, New Delhi : McGraw Hill 1992.
15. Drapkin, Ismail and Viano, Emilio. Victimology : A New Focus. London, Lesington press 1975.
16. Hallman, Taryl A. The Economics of Crime. New York : St. Martin's Press 1950.
17. Inciarti James A. and Pottieger Anne E. 1978. Violent Crime : Historical and Contemporary Issues. London : Sage Publications.
18. Ministry of Home Affairs. Report of the All India Committee on Jail Reforms. 1980-83, New Delhi : Government of India.
19. Pace, Denay F. Concept of Vice, Narcotics and Organised Crime. London Prentrice - Hall 1991.
20. Revid, Jorathan. Economic Crime. London, Kegan Paul 1995.
21. Ryan, Ptrick J. and George Rush. Understanding Organized Crime in Global Perspective. London : Sage Publications 1997.
22. Weisburd, Dand and Kip Schlegal. White Collar Crime Reconsidered. Boston Northeastern University Press 1990.

PAPER -V
POLITICAL SOCIOLOGY
(Paper Code - 0334)

UNIT-I Definition and subject matter of Political Sociology, distinctive approach of Political Sociology, Interrelationship between political system and society.
Democratic and totalitarian systems : socio-economic conditions conducive for their emergence and stability.

UNIT-II Political Culture : meaning and significance, political socialization-meaning, significance and agencies.
Elite theories of distribution of power in society (with reference to Mosca, Pareto, R. Mitchels and C.W. Mills and Others)
Intellectuals : Political role of intellectuals - significance.

UNIT-III Pressure groups and interests groups - Nature, bases, political significance. Bureaucracy, its characteristics, its types, its significance in political development with special reference to India.

UNIT-IV Political Parties : Characteristics, social composition of parties, recruitment, mass participation, political apathy, its causes and consequences (with special reference to India.)

UNIT-V Political Process in India : Role of caste, Religion, Regionalism and language in Indian Politics.

14

Public Opinion : Role of mass media, problems of communication in illiterate societies ; its reference on parties and polity, politicization of social life.

ESSENTIAL READINGS :

1. Dowse, R.E. & Hughes : Political Sociology, New York, Basic Book 1971.
2. Horowitz, Irving L. : Foundation of Political Sociology, New York, Harper and Row 1972.
3. Ruciman W.G. : Social Sciences and Political Theory, Cambridge University Press, London 1965.
4. Eisenstadi, S.N. (ed.) : Political Sociology, New York, Basic Book 1971.
5. Krrnhauser, W. : The Politics of Mass Society, Penguin 1971.
6. Kothari R. : Politics in India, Orient Longmans Ltd 1979.
7. Merton, R.K. (ed.) : Reader in Bureaucracy : Gienco The Free Press1952.
8. Key V.O. : Politics, Parties and Pressure Groups, Crowell, New York 1964.
9. Mills C.W. & Hans Gerth : Essays in Sociology, Oxford, New York 1946.
10. Samuel P., Huntington: Political Order in Changing Societies, Yale University Press, New Haven 1969.
11. Almond A. Gabriel et.al. : Crises, choice and change : Historical studies political development, Boston 1973.
12. P. Blau : Bureaucracy in Modern Society : Random House, New York 1956.
13. Lipset S.M.: Political Man, H.E.B 1959.
14. William Riker et.al. : An Introduction to Positive Political Theory, Englewood Cliff 1973.
15. Robert Michels : Political Parties, Glencko Free Press 1949.
16. Benedict Anderson : Imagined Communities : Reflections on the origin spread of Nationalism, Beso, London 1983.
17. Dipti Kumar Biswas : Political Sociology, Firma KLM Private, Calcutta 1989.
18. Rajani Kothari (ed.) : Caste in Indian Politics : Orient Longmans Ltd 1973.
19. Barrington Moore Jr. : Political Power and Social Theory, Cambridge, Hall University Press 1958.
20. Mitra, Subratha K. : Power protest and participation : Local Elides and politics of development in India, Routledge 1992.

Examination Scheme for Master of Social work

ACADEMIC SESSION (2018- 19)

MSW (MASTER of SOCIAL WORK) Ist SEMESTER

Paper/CC	Title of the Paper	I	T	Total
I/CC1	Social work History and Ideology- Indian Perspective	20	80	100
II/ CC2	Population and Environment	20	80	100
III/ CC 3	Working with Groups / Group Work	20	80	100
IV/ CC 4	Social work Research – Qualitative Method	20	80	100
V/ CC5	Human Growth and Development	20	80	100

MSW (MASTER of SOCIAL WORK) II SEMESTER(effective from Jan 2018)

Paper/ CC	Title of the Paper	I	T	Total
VI/ CC 6	Social work History and Ideology- Western Perspective	20	80	100
VII/ CC 7	Political Economy of Development	20	80	100
VIII/ CC 8	Process and Evaluation of Group Formation	20	80	100
IX/ CC 9	Social work Research –Quantitative Method	20	80	100
X/P 1	Social Work Practicum	-	-	100
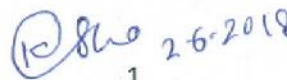
MSW (MASTER of SOCIAL WORK) III SEMESTER(effective from Jun 2018)

Paper/ CC	Title of the Paper	I	T	Total
XI/ CC 10	Sociology for Social Work in India	20	80	100
XII/ CC 11	Social Work Personal, Training and Development	20	80	100
XIII/ CC 12	Family Social Work	20	80	100
XIV/ CC 13	Social Policy in India	20	80	100
XV/ CC14	Legal System in India	20	80	100

MSW (MASTER of SOCIAL WORK) IV SEMESTER(effective from Jan 2019)

Paper/ CC	Title of the Paper	I	T	Total
XVI/ CC 15	Social Control and Change in India	20	80	100
XVII/ CC 16	Social Development	20	80	100
XVIII/ CC 17	Social Planning in India	20	80	100
XIX/ CC 18	Integrated Social Work Practice	20	80	100
XX/ P 2	Research Project With Block Placement and Field Work Report	-	-	100

MSW (MASTER of SOCIAL WORK) Ist SEMESTER

26-2018

1

Head,
S.O.S. in Sociology & Social Work,
Pt. Ravishankar Shukla University,
Raipur. (C.G.)

Paper/CC	Title of the Paper	I	T	Total
I/CC1	Social work History and Ideology- Indian Perspective	20	80	100
II/ CC2	Population and Environment	20	80	100
III/ CC 3	Working with Groups / Group Work	20	80	100
IV/ CC 4	Social work Research – Qualitative Method	20	80	100
V/ CC5	Human Growth and Development	20	80	100

Paper I/CC 1   Social work History and Ideology- Indian Perspective

UNIT -I   Indian History of Social Work Education
a)Concept of Social work education   b)Beginning of Social work education: History
c)Welfare   orientation in social work
d)Development orientation in Social Work.

UNIT-II   Professionalization of:-

a)Social work values   b)Social work Education   c) Social work Knowledge

d)Professional Association of social work in India.

UNIT-III   Social Work

a)Goals and values of social work

 b)function/ role   of social work

c) process   of social work

d)interface between professional and voluntary social work

UNIT-IV   Indian history of Ideology for social change

a)Social change: Concept Causes and theory

b) Social Change in Ancient period.

c) Social Change in medieval period

d) Social Change in modern Period

2

UNIT-V   Ideology of Social Change

        a)Gandhian ideology and Sarvoday movement

        b)Nationalism and Social Change

        c)Ideology of Indian Constitution and Social Change

        d)Ideology of Voluntary organization and voluntary action

REFERENCES:-

1	Agrawal, M.M 1998	Ethics and Spirituality, Shimal: Indian Institute of Advanced Study
2	Chatterjee, P. 1996	Approaches to the welfare State, Washington D.C: National Association of Social workers
3	Desai M,2000	Curriculam development on history of ideologies for Social Change and Social work, Mumbai: Social work education and Practice Cell
4	Diwakar, V.d(Ed) 1991	Social Reform Movement in India: A historical Perspective, Bombay Popular Prakashan.
5.	Feibleman,J.K.1986	Understanding Philosophy: A popular history of ideas, New York Souvenir Press
6	Ganguli, B.N 1973	Gandhi's Social Philosophy, Delhi: Vilas Publishing House.
7	Gore, M.S. 1993	The Social Context of Ideology: Ambedkar's social and political Thought, New-Delhi: Sage.
8	Kappen, S. 1994	Tradition Modernity Counter culture: An Asian Perspective, Bangalore: Visthar.
9.	Panikkar ,K/N.1995	A History of Indian People, London: Methuen.
10	University Grants Commission 1980, 1990	Review of Social work education in India: Retrospective and Prospect, New Delhi: UGC, Curriculum development Centre Reports New-Delhi, UGC.
11	Woodrofe, K. 1962	From Charity to Social work , London: Routledge and Kegan Paul
12	Borgatta , E.F (Ed)	Encyclopedia of Sociology, New-York: Macmillan

1992

13	The Cultural Heritage....	The Cultural Heritage of India (Vol 1-6) ,Calcutta: The Ramkrishna Mission
14	Encyclopedia of Social Work 1987	Encyclopedia of Social Work in India, New delhi: Ministry of welfare.
15	Economic and Political weekly	Human scape, The Indian Journal of Social work, Lokayan

Paper II/CC 2   Population and Environment

UNIT-I   Characteristics of Population & population Policy

Population   growth, Determinants of population growth

Population policy, Family size, Family Planning, Family Planning methods

World Action plan, Population policy and programme implementation.

UNIT-II   Population & Environment: A Global Challenge

Human population and its impact on environment

Concept of Environment : Social and Physical environment

Lifestyle, degradation. Environment management and maintaining life style.

Current issues of environment.

UNIT-III   Organizations & Their roles

Role of Govt and NGO for environmental protection.

International treaties and agreements legislation in India.

Environment movement in India.

UNIT-IV   Natural resources and diversity

Forest, Land, Water, Air, energy and human resources.

Treatment and Prevention of natural resources

Waste material- Recycling and Renewal.

Waste material –disposal technique and methods.

UNIT-V   Population and Environment protection Laws

Environment Protection laws: water ,land, forest, noise, air

Unplanned urbanization and its impact on society.

REFERENCES

1	Kaplan P S 1988	The Human Odyssey: life Span development , St . Paul West publishing Company.
2	Kapur M 1955	Mental Health of Indian Children, Delhi : Sage Publication.
3	Le. Francois G.R 1990	The Life Span 3rd EDS. University of Alberta.
4	Magmesson D and Allen VC 1983	Human development : An International Perspectives, New-York, Academic Press.
5	Maier HW 1965	Three Theories of child development, N.Y Haper & Row
6	Misra G 1990	Social Psychology in India , N.D Sage Publication.
7	Rapoport Rhona 1980	Growing through Life , Life cycle book , N.Y Haper & Row
8	Rogers D 1977	Child Psychology, Monterry C.A Brooks / Cole Publishing Co.
9	Schiamberg L.B 1985	Human development , N.Y l mac Millian Publishing
10	Seifert K Hoffnung R.J 2000	Life Span Development (2nd Eds) N.Y Hoghton Miffin Co.
11	Sharma N 1999	Adolescent Girl Child in India , News Bulletin of the Indian Council of Child welfare.
12	Sheehy G 1976	Passages : Predictable Crises of Adult Child Life, New-York Bantam Books.
13	Sigclman C.K and Shaffer,	Life Span human development 2nd ed. Pacific grove, CA Brooks / Cole Publishing Co.

5

Paper III /CC3   Working with Groups/ Group Work

UNIT-I   Introduction of Social Group

a)understanding of groups

b)Characteristics & Significance of Groups

c)Definition of Social Group work d) Purpose of Social Group work

Unit-II   Theories of Social Group

a)Historical Evolution of social group with special emphasis on the Indian context

b)Theories applicable to group work

c)Models in group work

UNIT-III   Types , Characteristics of Group/ group work

a)Types, objectives and purpose of group work.

b)Type of membership

c) Analysis of group process

UNIT-IV   Principles of Group/ group work

a)Principles in group work   b)Values in Social Group work

c)Factors of group formation   d)Formulation of goals.

e) Identification of problem for work

Unit- V   Initial phase of group work

a)Planning Model

b)Characteristics of pre-Group Phase

c) Characteristics of Initial Phase

d)Group Structure

REFERENCES:-

1   Alissi,A.S.1980   Perspectives on social group work practice; A book of reading, New York: The free press.

2   Balgopal,   Groups in social work- An ecological perspectives, New

6

	P.R.and Vassil 1983	T.V. York: Macmillan Publishing Co. Inc.
3	Bradler ,S and Roman C.P 1991	Group work Skills and strategies for effective Interventions New York: The Howorth Press.
4	Garland, J.A (Ed) 1992	Group work reaching out: people, places and power , New York: The Howorth Press
5	Garwin , C.1987	Contemporary group work, New York: Prentice- Hall inc.
6	Kemp C.G.1970	Perspectives of the group process, Boston: Houghton Mifflin C.
7	Klein ,A.F.1970	Social Group work : A helping process , Prentice Hall Inc
8	Konopka ,G. 1963	Social Group work : A helping process, School of social welfare- Albany: State University of New –York.
9	Kurland R and SalmonR 1998	Teaching a method course in social work with group. Alexandria; Council of social work education.
10.	Middleman, R.R 1968	The Non- Verbal method in working with groups.
11	Northern ,H.1969	Social work with group, New-York: The Howorth Press
12	Pepell, C.P and Rothman,	Social work with group, New-York:: Columbia University
13	Toselane, R.W.1984	An Introduction to group work Practice, New-York: MacMillan Publication Co.
14.	Treker, Harleigh b 1990	Social Group Work: Principles and Practice, New-York: Association Press
15	Wilson, G. Ryland G 1949	Social Group Work Practice, Boston: Houghton Mifflin .Co.

Paper IV/CC 4   Social work Research – Qualitative Method

Unit-I   Scientific Inquiry

Scientific meaning and assumption. Scientific approach to inquiry in

Comparisons to the native or common sense approach : Science and the study of social phenomena

7

UNIT-II   Hypotheses and theories.

a) Hypothesis : Meaning , attributes of a sound hypothesis, role in explanatory research.

b)Theory –Meaning: Inductive and deductive theory, construction.

UNIT-III   Social work research- meaning, purpose, the research process, scope and importance

Qualitative research- General characteristics, use of Qualitative methods in inquiry,. Case study and content analysis.

UNIT-IV   Research design:

Meaning, process, types and significance.

UNIT V   Sampling Technique

Sampling : Meaning, types, Characteristics and utility; General coordination in the determination of sample size.

REFERENCES:-

1	Ackoff, R.L.1962	Scientific Method: Optimising Applied, research designs, New-York: John Wiley and Sons.
2	Anderson J1970	Thesis and Assignment writing, New-Delhi: Wiley Eastern limited.
3	Bailey, Kenneth ,D 1987	Methods of social Research, New-York, The free Press.
4	Blaikle, Norman, 1993	Approaches in social enquiry, Cambribge: Policy Press
5	Blalock, H.M and Blalock A.M.(Eds) 1968	Methodology in social research, New-York, MacGraw Hill
6	Collidge, Frederick L 2000	Statistics: A gentle introduction, New-delhi: Sage Publications.
7	Crabtres, B.F and Miller	Doing Qualitative Research, New-Delhi: Sage W.L.(EDS) 2000 Publications.

8	Cranstein A and PhillipsW.R 1978	Understanding Social research An Introduction, Boston: Allwyn and Bacon.
9	Field, Andy 2000	Discovering statiscs using SPSS for windows: Advanced techniques for beginning , New-Delhi: Sage Publication.
10	Forster, J.J1998	Data Analysis using SPSS for windows: A beginners guide, New-Delhi :Sage Publications.
11	Reid, William J and Smith Andry D 1981	Research in social Work, New-York : Columbia University Press.
12	Rosenberg M 1968	The Logic of Survey Analysis , New-York Basic Books.
13	Rubin A and Babbie K 1993	Research methods for social work, California ,Brooks Cole Publication.
14	Shah. F.V.1977	Reporting Research, Ahmedabad: Rachna Prakashan
15.	Shaw, Lan and Lisman Joyce (eds) 1999	Evaluation and social work Practice, New-Delhi Sage Publication.
16	Silver David (eds) 1997	Qualitative research , New-Delhi: Sage publication
17	Society for Participatory research in Asia 1995.	Participatory research: an Introduction, Participatory research Network Series No.3 New-Delhi PRIA.
18	Stewart, Alex 1998	The ethnnographer'sMethod, New-Delhi: sage Publication
19	Yin Robert K 1994	Case study Research: Design And Methods, New-Delhi: sage Publication

Paper-V /CC5   Human Growth and Development

UNIT-I   Life Span Heredity and environment

      a) Stages of Life Span, life span perspectives and the systems approach.

      b) Principles of Growth and Development.

UNIT-II   Theories of Human Development.

A critical look at the theories of Human development like those of Freud's Psycho-sexual theory, Erikson's Psycho-Social theory, Learning Theories and Piaget's Theory Maslow.

UNIT-III   A) Indian Concept:

a)Prenatal stage and genetic factors, infancy and adjustment to immediate world.

b)   Early child hood, growth Play , relationship with family .

c)   Indian Youth and Hazards life –style effects.

UNIT-IV   a)Adulthood: -growth, personal and social adjustment, health, sexuality

b) vocational and mental adjustment.

c)Aging:- Aging Characteristics, Adjustment to physical and mental health, and aging problems.

UNIT-V   Relevance to social work Practice , across the stages of development, and Method of assessment.

REFERENCES:-

1	Baltes, P.B 1978	Life Span development and Behaviour, New-york: Academic Press Inc.
2	Bronfenbrenner, U 1979	The ecology Human Development, Cambridge, Harward University Press.
3	Chowdary D.P 1992	Aging and the Aged, New-Delhi: Inter-India Publication.
4	Clarke- Stewart, A FriedmanS and Koch J 1985	Child development : A topical Approach (for UNIT-I)
5	Dash and Dash	The Psychology of Poverty.
6	Garg, P and Parikh I 1970	Indian Youth at the Cross Road; profiles in Identity.

7	Gore, M.S 1978	Changes in the Family and the process of Socialization in India in Anthony E.J. & Colette C .The child in his Family , Wiley, 365-574
8	Kail, R.V and Cavanangh,	Human Development, Pacific Grove, CA Books/ Core Publishing Company.
9	Kakar S 1979	Indian Child Hood, Cultural Ideals and social reality, Delhi Oxford University Press.
10	Kakar S 1982	Identity and Adulthood, Delhi Oxford University Press
11	Kakar S 1970	Conflict & choice-Indian Youth in a Changing Society, Bombay: Somaiya Publications
12	Kakar Sudhir 1978	Images of the life cycle and adulthood in Anthony E.J. & Colette C .The child in his Family , Wiley, 319-332
13	Kaplan P S 1988	The Human Odyssey: life Span development , St . Paul West publishing Company.
14	Kapur M 1955	Mental Health of Indian Children, Delhi : Sage Publication.
15	Le. Francois G.R 1990	The Life Span 3rd EDS. University of Alberta.
16	Magmesson D and Allen VC 1983	Human development: An International Perspectives, New-York, Academic Press.
17	Maier HW 1965	Three Theories of child development, N.Y Haper & Row
18	Misra G 1990	Social Psychology in India , N.D Sage Publication.
19	Rapoport Rhona 1980	Growing through Life , Life cycle book , N.Y Haper & Row
20	Rogers D 1977	Child Psychology, Monterry C.A Brooks / Cole Publishing Co.
21	Schiamberg L.B 1985	Human development , N.Y l mac Millian Publishing
22	Seifert K Hoffnung R.J 2000	Life Span Development (2nd Eds) N.Y Hoghton Miffin Co.

23	Sharma N 1999	Adolescent Girl Child in India , News Bulletin of the Indian Council of Child welfare.
24	Sheehy G 1976	Passages : Predictable Crises of Adult Child Life, New-York Bantam Books.
25	Sigclman C.K and Shaffer,	Life Span human development 2nd ed. Pacific grove, CA Brooks / Cole Publishing Co.

MSW (MASTER of SOCIAL WORK) II SEMESTER

Paper/ CC	Title of the Paper	I	T	Total
VI/ CC 6	Social work History and Ideology- Western Perspective	20	80	100
VII/ CC 7	Political Economy of Development	20	80	100
VIII/ CC 8	Process and Evaluation of Group Formation	20	80	100
IX/ CC 9	Social work Research –Quantitive Method	20	80	100
X/P 1	Social Work Practicum	-	-	100

Paper VI/CC6   Social work History and Ideology- Western Perspective

UNIT- I   **Western history of Ideology for Social Change**

a) Beginning of Social work education in Western Country

b)Charity Organization

c)Clinical social work   d) Ecological Social work

UNIT-II   a)Attributes of profession & Professionalization

b)Social work education , Knowledge and Professional association

c) Goals ,values, function/ role and process of Social work

UNIT-III   Western history of Social work Profession

a)   History of social work in America

b)   History of social work in England

12

c)Secular humanism and Protestantism

UNIT-IV   Modern period -I

a)Rationalism and welfarism

b)Liberalism and Democracy

UNIT-V   Modern period -II

a)Utilitarianism and social Darwinism

b)Socialism and human rights

REFERENCES:-

1	Agrawal, M.M 1998	Ethics and Spirituality, Shimal: Indian Institute of Advanced Study
2	Chatterjee, P. 1996	Approaches to the welfare State, Washington D.C: National Association of Social workers
3	Desai M,2000	Curriculum development on history of ideologies for Social Change and Social work, Mumbai: Social work education and Practice Cell
4	Diwakar, V.d(Ed) 1991	Social Reform Movement in India: A historical Perspective, Bombay Popular Prakashan.
5.	Feibleman,J.K.1986	Understanding Philosophy: A popular history of ideas, New York Souvenir Press
6	Ganguli, B.N 1973	Gandhi's Social Philosophy, Delhi: Vilas Publishing House.
7	Gore, M.S. 1993	The Social Context of Ideology: Ambedkar's social and political Thought, New-Delhi: Sage.
8	Kappen, S. 1994	Tradition Modernity Counter culture: An Asian Perspective, Bangalore: Visthar.
9.	Panikkar ,K/N.1995	A History of Indian People, London: Methuen.
10	University Grants Commission 1980, 1990	Review of Social work education in India: Retrospective and Prospect, New Delhi: UGC, Curriculum development Centre Reports New-Delhi, UGC.
11	Woodrofe, K. 1962	From Charity to Social work , London: Routledge and Kegan Paul
12	Borgatta , E.F (Ed)	Encyclopedia of Sociology, New-York: Macmillan

1992

13	The Cultural Heritage....	The Cultural Heritage of India (Vol 1-6) ,Calcutta: The Ramkrishna Mission
14	Encyclopedia of Social Work 1987	Encyclopedia of Social Work in India, New Delhi: Ministry of welfare.
15	Economic and Political weekly	Human scrape, The Indian Journal of Social work, Lokayan

Paper VII/CC7   Political Economy of Development

UNIT -I   Introduction to Political Economy

Meaning of Political Economy

Significance of the study of Political Economy

Meaning and Characteristics of development and under development

UNIT-II   Development –A human Right Perspective

Social ideals of Indian Constitution

Fundamental rights

Human rights

UNIT-III   Socio economic order and Comparative economic system,

Capitalism, Socialism and Mixed economy, their features, merits and demerits.

UNIT-IV   Poverty in India – A Structural Problem its Causes , effects and implications.

Entitlement approach to understanding poverty.

UNIT-V   Approaches to development

Modernization, Capitalist, Socialist and Gandhian approaches to development.

REFERENCES

| 1 | Agrawal A.N Lal Kundan 1989 | Economics and development and planning , New-Delhi: Vikas publishing house private limited. |

14

2	Augushine, John S 1989	Strategies for third world development, New-Delhi: Sage Publication.
3	Chakraborty Bimal 1996	The united nations and the third world, New-Delhi: Tata Mac Graw Hill Publishing Co.
4	Descrochers , John 1977	Methods of Social Analysis, Bangalore: Centre for Social Action.
5	Elsenhans, Hartmut 1991	Development and Under Development: the History , economics and politics of North –South Relations, New-Delhi, Sage Publication.
6	Nagarda., S.P 1994	Development and Change , New-Delhi: Concept publishing Company.
7	Nana Poku Lioyd	Rebuilds up the third world, London, Mac Millian Press Limited.
8	Rao, V Lakshmana 1994	Essays on Indian economy, New-Delhi, Asian Publishing House.
9	Reddy D.V. 1994	Development and new International economic order, New-Delhi.
10	Rugman Alan 2000	The end of Globalization, London, Random House.
11	Seltz John L 1990	The political of development, Bombay, Popular Prakashan.
12	Sharma S.L 1986	Development : Socio Cultural Dimensions, Jaipur: Rawat publication
13	Tandon BB KK Tandon	Indian Economy, New-Delhi Tata MacGraw Hill Publishing Co.

Paper –VIII/CC8   Process and Evaluation of Group Formation

UNIT-I   **Group Process-I**

   a)Importance of group Process

   b)Typical pattern

   c)process in different types of group

   d)workers skills in identifying and understanding process

UNIT-II   **Group Process-II**

a)Bond, Subgroup Role

b)Leadership   c) Isolation

d)Decision making   e) Contagion   f) Conflict

g)Communication h) relationship

Unit -III **Middle Phase**

a)Characteristics of middle phase

b)Group structure c) Group dynamics

d)Role of group workers e) facilitation skills

a) comparison across phases

UNIT-IV **Use of Programme**

a)Concept and principle b) Programme Planning

c)principle of recording d) type of recording

UNIT-V **Evaluation of Group/ Termination Phase**

a)Method of Evaluation b) Importance and types of Evaluation

c) Need of termination

d)Type of termination and Characteristics of termination phase

REFERENCES:-

1	Alissi,A.S.1980	Perspectives on social group work practice; A book of reading, New York: The free press.
2	Balgopal, P.R.and Vassil T.V. 1983	Groups in social work- An ecological perspectives, New York: Macmillan Publishing Co. Inc.
3	Bradler ,S and Roman C.P 1991	Group work Skills and strategies for effective Interventions New York: The Howorth Press.
4	Garland, J.A (Ed) 1992	Group work reaching out: people, places and power , New York: The Howorth Press
5	Garwin , C.1987	Contemporary group work, New York: Prentice- Hall inc.
6	Kemp C.G.1970	Perspectives of the group process, Boston: Houghton Mifflin C.

16

7	Klein ,A.F.1970	Social Group work : A helping process , Prentice Hall Inc
8	Konopka ,G. 1963	Social Group work : A helping process, School of social welfare- Albany: State University of New –York.
9	Kurland R and SalmonR 1998	Teaching a method course in social work with group. Alexandria; Council of social work education.
10.	Middleman, R.R 1968	The Non- Verbal method in working with groups.
11	Northern ,H.1969	Social work with group, New-York: The Howorth Press
12	Pepell, C.P and Rothman,	Social work with group, New-York:: Columbia University
13	Toselane, R.W.1984	An Introduction to group work Practice, New-York: MacMillan Publication Co.
14.	Treker, Harleigh b 1990	Social Group Work: Principles and Practice, New-York: Association Press
15	Wilson, G. Ryland G 1949	Social Group Work Practice, Boston: Houghton Mifflin .Co.

Paper IX /CC9   Social Work Research –Quantitative Methods

UNIT -I   **Data and its sources-**

Source of data: primary and secondary, Methods and instruments of Data collection. Qualitative and Quantitative observation; Participant observation life histories, Group Interview (Including telephonic interview)

UNIT-II   **Measurement**

Participatory and rapid Appraisal technique; triangulation levels of measurement

Scales: Need for scales, Some prominent scaling procedures(Thrustone-type, Likert- type, Bogurdus –type, Semantic differentials

UNIT-III   **Data processing , presentation and research Report**

Graphical, tabular: Analysis and interpretation, use of computers.

Participatory and Evaluatory Research.- Conducting participatory

Research: Monitoring and research

Research Report: writing research Abstracts, Research proposals

Ethics- Ethics in research

UNIT-IV **Statistical Tools and their use**

Use of statistical tools and techniques - Descriptive and inferential uses and limitations of statistics

Proportion of Percentage, Ratio

Measurement of central tendency:- Mean, Mode, Median

Unit -V **Measures of dispersion**

Range, Quartile Deviations, Mean Deviations

Standard Deviations. The index of qualitative variation

18

REFERENCES:-

1. Ackoff, R.L.1962 — Scientific Method: Optimising Applied, research designs, New-York: John Wiley and Sons.

2. Anderson J1970 — Thesis and Assignment writing, New-Delhi: Wiley Eastern limited.

3. Bailey, Kenneth ,D 1987 — Methods of social Research, New-York, The free Press.

4. Blaikle, Norman, 1993 — Approaches in social enquiry, Cambribge: Policy Press

5. Blalock, H.M and Blalock A.M.(Eds) 1968 — Methodology in social research, New-York, MacGraw Hill

6. Collidge, Frederick L 2000 — Statistics: A gentle introduction, New-delhi: Sage Publications.

7. Crabtres, B.F and Miller — Doing Qualitative Research, New-Delhi: Sage W.L.(EDS) 2000 Publications.

8. Cranstein A and PhillipsW.R 1978 — Understanding Social research An Introduction, Boston: Allwyn and Bacon.

9. Field, Andy 2000 — Discovering statiscs using SPSS for windows: Advanced techniques for beginning , New-Delhi: Sage Publication.

10. Forster, J.J1998 — Data Analysis using SPSS for windows: A beginners guide, New-Delhi:Sage Publications.

11. Reid, William J and Smith Andry D 1981 — Research in social Work, New-York : Columbia University Press.

12. Rosenberg M 1968 — The Logic of Survey Analysis , New-York Basic Books.

13. Rubin A and Babbie K 1993 — Research methods for social work, California ,Brooks Cole Publication.

14	Shah. F.V.1977	Reporting Research, Ahmedabad: Rachna Prakashan
15.	Shaw, Lan and Lisman Joyce (eds) 1999	Evaluation and social work Practice, New-Delhi Sage Publication.
16	Silver David (eds) 1997	Qualitative research , New-Delhi: Sage publication
17	Society for Participatory research in Asia 1995.	Participatory research: an Introduction, Participatory research Network Series No.3 New-Delhi PRIA.
18	Stewart, Alex 1998	The ethnnographer'sMethod, New-Delhi: sage Publication
19	Yin Robert K 1994	Case study Research: Design And Methods, New-Delhi: sage Publication

Paper X /P1   Social Work Practicum

	Social work Practicum	Comprises of Maximum Marks (Internal)
i.	Agency Placement (to develop the knowledge of Administration, Management, Training)	15
ii	Rural Camp	05
iii	Visits	15
iv.	Social work in Communities	15
		Total: 50(internal)
*	Valuation of Complete Report & Viva-Voce	50(external)
		Total : 100

In social work practicum, each student must prepare a complete "Report" valuation of Social work practicum "Report" & Viva voice by External Examiner appointed by university.

21

MSW (MASTER of SOCIAL WORK) III SEMESTER

Paper/ CC	Title of the Paper	I	T	Total
XI/ CC 10	Sociology for Social Work in India	20	80	100
XII/ CC 11	Social Work Personal, Training and Development	20	80	100
XIII/ CC 12	Family Social Work	20	80	100
XIV/ CC 13	Social Policy in India	20	80	100
XV/ CC14	Legal System in India	20	80	100

Paper XI/CC 10   Sociology for Social Work in India

UNIT -I   a) Meaning, Scope and significance

b) Sociology- its relationship to other disciplines such as history, Economics, Political science, psychology, anthropology and social work

UNIT-II   Society and Culture:-

a) Society-meaning, Characteristic, society as a system of relationship

b) Social status and role: meaning and importance.

c) Culture – Meaning and content: Traditions, Customs, norms Folk-ways and mores

d) Socialization- Meaning, Process and agencies

UNIT-III   Indian Society

a) Composition of Indian society

c) The Concept of unity in Diversity

d) Social Classification in India- tribal, rural and Urban Division

UNIT-IV   Social Group

a) Social Stratification in India- Meaning and bases of stratification Caste, Class and gender.

b) Meaning characteristics and types of primary and Secondary

22

groups.

Unit-V   Institution

a)Concept of Institution: Characteristics,functions,significance.

bType of Social Institution: Marriage, Family, religion, state and Law.

REFERENCES

1	Bert N Adams. 1975	A sociological Interpretation, Chicago: Rand McNally College.
2	Bharadwaj,A.N.1979	Problems of SC/ST in India, New-Delhi Light and Life publication.
3	Broom , Leonard Charles, M.Bonjean, Dorothy,H.Broom,1990	Sociology, Wadswort Publication Co, Belmout
4	Deshpandey, Shrinivasan narain,1978	Society economy of Polity in India, Mumbai: University of Mumbai
5	Ely Chinoy.1967	Society-An Introduction to Sociology, New-York: Randon House
6	Haralombos, Michael ,1980	Sociology, Delhi: Oxford University Press
7	Jain ,P.C.1991	Social Movements among tribal's, New Delhi Rawat Publication.
8	Kapadia ,K.M 1966	Marriage and family in India, London : Oxford University Press
9	Kinsley David,1969	Human Society, New York
10	Pauline,K.1987	Regional differences in Family structure in India, Jaipur: Rawat Publication.
11	Kuppuswamy, B	Social Change in India
12	Maudelbaum, David M 1970	Society in India vol. I & II , University of California Press.
13	Narang , B.S. Dhawan R.C. 1983	Introduction to social sciences, Delhi: C.B.S Publishers
14	Pandey, A.K.1997	Tribal Society in India , New- Delhi: Manak Publishers
15	Pandey Rajendra, 1986	The Caste System In India – Myth and reality, New- Delhi: Criterion Publication
16	Ross, Aileen d 1961	The Hindu family in its urban setting, Delhi: Oxford University Press

23

17	Sharma S 1985	Social movements of Social change, B.R. Delhi Publishing House
18	Sharma.K.L(ed)1999	Caste and Race in India, Mumbai, Popular Prakashan.
19	Sharma , R.K.1997	Indian Society institution and change , New-Delhi Atlantic Publishers
20	Singh K.S. 1985	Tribal Society in India , New-Delhi ,Manohar Publishing House.
21	Shrinivas M.N 1996	Village, Caste, gender and Method(essay in Indian social Anthropology) Delhi: Oxford University Press
22	Social Change, Issues and Perspectives (Journal of the council for social Deelopment

Paper-XII/CC11	Social Work Personnel- Training and Development

UNIT-I   **Training for Personnel**

Training- meaning and concept

Need for personnel training

Social work educational curriculum ,Role of Social Work-educational curriculum in changing society.

Levels of Social work ,and levels of Training, Role of training for Social Workers.

UNIT-II   **Principles of learning**

Concept of learning and adult learner

The adult learner and principles of adult learning.

Practice learning: Instructional Process, educational and supportive aspects:

Orientation: Role of Orientation for adult learner.

UNIT-III   **Curriculum Designing**

Concept of Curriculum Designing

Principles and process of Curriculum Designing

Education Technology: Methods and tools

Social work practice learning instruction

24

UNIT-IV **Traning Programme Design and Training Effectiveness.**

Training Designing- Concept and steps.

Implementing and evaluating training programmes for social work personnel.

Training and its Characteristics.

Enhancing trainer, Effectiveness: Facilitation Skills.

Assessment of Training- Tool, method and technique.

UNIT-V **Staff Development**

Staff development –concepts and needs

Process of staff development, Short term services .

Technique and methods of Staff development, Role of motivation for staff development.

REFERENCES:-

1   Asian and Pacific Association for social work education (APASWE 1994) : Social work profession: reflection and future directions, Mumbai TISS.

2   Baldwin, J and Williams   Active learning: A trainers Guide, England:
    H 1988   Blackwell Education.

3   Barer- Stein T , Draper J   The craft of teaching Adults.
    1988

4   Bercher H 1988   Staff development in Human Service Organization. New Jersey, Prentice Hall Inc.

5. Bourner, T.M, V and   Workshop that work London: Mac Graw Hill.
    Race P 1993

6   Cafarella, 1988:   Programme Development and evaluation resource book for Trainers, New York : John Willy and Sons

7   Draper, J   Adult education : A focus for the social sciences.

8   Elkins D 1978   Teaching people to love them selves. New York: Growth Associates.

9   Hokenstad M and Rigby   Training of Trainers: Participate in Teaching and
    B 1977   learning, An ideal book for social work, New-York

25

10	Jacob, K 1994	Social work education in India retrospect and prospect, Delhi, Himanshu Publication.
11	Johnson D 1981	Joning together: group theory and group Skills, New-Jersey, Prentice Hall Inc.
12	Kadushim 1976	Supervision in Social work ......New-York Columbia University.
13	Knowles m 1973	The Adult Learner, A neglected Species.
14	Kroehnert G 1995	Basic Training for Trainers: A Hand book for New Trainers New-York: MacGraw Hill Book Co.
15	Martin R 1983	Skills and Strategies , Hand Book for working with people. Engle wood Cliffs: Prentice Hall Inc.
16	Nandurbar : trace Team : TRACE (Training Animators in Conscientization and Education) Nandurbar: Trace Team.	
17	Percival F & Ellington H 1985	Hand Book of educational Technology, London Kogan Paul.
18	Rigby B 1978	Short Tern Training for Social Development , New-York: International Association of Schools of Social work.
19	Siberman M 1990	Active Training ; A handbook of techniques, design Cade ex, New-York.
20	Society for Participatory Research in Asia (PRIA) 1987Training for Trainers : A Manual for participatory training methodology in Development, New-Delhi: Society for Participatory Research	

| Paper-XIII/CC12 | **Family Social Work** |

UNIT-I   **Theoretical and conceptual frame work to study family.**

Concept and Characteristics of Family

Concept and objective of Marriage.

Origin and evolution of family and marriages.

Ideology of family rights and responsibilities.

UNIT-II	**Normative Family Functions And Structure, And Changes**
	Normative Family Functions and structure, ethnicity and socio-economic background.
	Social change and changes in family and marriage functions and structure.
	Implications for the family and its members.
UNIT-III	**Alternative family and Marriage patterns and structure.**
	Dual earner/ Career families , Single parent Families
	Female headed house holds , Childless families
UNIT-IV	**Family socialization of child, Family**
	Socialization- Concept, Characteristics ,Stages, Agencies and theories
	Family interactions
	Family development/ Family life Cycle.
UNIT-V	**Family assessment and creating public awareness for promoting family rights and Responsibility**
	Some methods and its implications
	Modes of awareness building- workshop, seminar, value education in school.

REFERENCES:-

1	Desai M 1994	Family and Intervention: A Course Compendium, Bombay: Tata Institute of Social Sciences.
2	Engles F 1944	Origin of the Family, Private Property and the state, Bombay, People's Publishing House.
3	Hartman A and Laird J 1983	Family Centered Social Work Practice, New-Your. The free press.
4	Horchschild A 1989	The second shift; working parents and revolution at Home, New-York.
5	India: Ministry of welfare 1994: India's Commitment of Family well being,	

An overview of the report of the national seminars on the International year of the family, 1994, Bombay: Tata Institute of Social Sciences

6 Khasgiwala A 1993   Family Dynamica: Social work Perapectives, New – Delhi Anmol.

7 Klein D .M and White J.M 1996   Family Theories : An Introduction

8 LLM Monographs International 1992-94 – Raju M.L and Krishna G.R (eds) 1996: Future of Indian Family Challenges for Social work education Tirupati, Sri Padmavati Mahil Visvadidyalayam.

9 Tata Institute of Social Sciences 1993: Special issues of the Indian Journal of Social work on FAMILY DEVELOPMENT 54(1) Mumbai . Tata Institute of Social Sciences

10 Tata Institute of Social Sciences 1993: Special issues of the Indian Journal of Social work on FAMILY 56(2) Mumbai . Tata Institute of Social Sciences

11 Uberoi P 2000   The family in India: Beyond Nuclear V/s Joint debate. Occational paper in sociology , Delhi: Institute of social Growth

12 Unit of Family Studies 1994:   Enhancing the role of the family as an agency for social and economic development , Mumbai . Tata Institute of Social Sciences

Paper-XIV/CC13	Social Policy In India

UNIT-I   **Concept of social policy, sectoral policies and social services**

a)Evolution of social policy in India in a historical Perspective.

b)Relationship between social policy & social development.

UNIT- II   Social policy and planning   on the constitutional provisions ie. The directive Principles of the state policy and Fundamental Rights and the Human Rights.

UNIT-III   **Policy formulation**

a)Approaches to social policy unified , integrated

b) Different models of social policy and their applicability to the

Indian situation.

c)The process of social policy formulation, the contribution of research, the role of interest groups , the problem of conflict of interest and it's solution.

UNIT- IV   Different Sectoral Policies -I

Different sectoral policies and their implementation eg. Policies concerning education, health, social welfare, women, children , welfare of backward classes,

UNIT-V   Different Sectoral Policies –II

Social security, housing, youth, population an family welfare, environment and ecology , urban and rural development, tribal development and poverty alleviation.

REFERENCES:-

1   Bhanti,R 1993   Social policy and development in Rajastan, Udaipur, Himanshu Publication.

2   Blumer, M 1989   The Goals of social policy, London, Unwin Hyman.

3   Dimtto, D.M 1991   Social welfare: politics and public policy New-Jersey, Prentice Hall

4   Ganapathy R.S 1985   Public policy and policy analysis in India . Delhi Sage publication.

5   Ham,C Hill M 1993   The policy process in the modern capitalist state 2nd New-York,

29

Harvester.

6	Hebsur R.K	Social intervention for justice, Bombay TISS
7	Huttman E.D 1981	Introduction to social policy , New-York, MacGraw Hill.
8	International Labour Office 1973: multinational enterprise and Social policy , Geneva ILO
9	Jenks W 1876	Social policy in changing world Geneva:ILO
10	Joness K 1983	Issues in social policy, London: Routledge & Kegan paul
11	Kahn A.E 1973	Social policy and social services, New-York, Random House.
12	Kulkarni P.D1979	Social policy and development in India Madras Association of School of social work in India .
13	Kulkarni P.D1952	Social policy in India, New-York, MacGraw Hill.
14	Lindblom, C.E 1980	The policy making process, New-Jersey, Prentice Hall
15	Livingstance, A 1969	Social policy in developing countries, London, Routledge & Kegan paul
16	Madison B.Q 1980	The meaning of social policy, London:Croom Helm.
17	Macpherson S 1980	Social policy in the third world, LondonWheat Speat Brooks.

18	Mathur k Bjorkman	Top Policy makers in India , New-Delhi Concept publishing co.
19	Mundle S 1993 -Policies, Paradigms and development Debate at the close of twentieth Century, Economic and political weekly, Vol.XXVII No26 Sept.4 1993	
20	Mishra, R 1977	Society and social policy, London Mac Millan ltd.
21	Mullard M and Spicker 1988	Social policy in a changing society, London, Routledge & Kegan paul
22	Rao V –Social Policy: The means and ends question , Indian journal of public administration vol. L No.1 Jan-Mar 1994.	
23	Rao, V & Mandar H	An Agenda for caring; Interventions for the Marginalized, New-Delhi.
24	Yadav C.S 1986	Urban planning and polities Part A New-Delhi Concept publishing Co.

Paper –XV/ CC 14 Legal System in India

UNIT -I   Rights and Role of Social workers

Concept of rights, Legal rights, Civil rights

Rights of children, women and Schedule Caste and Schedule Tribes.

Role of Social worker, Social work interventions,

UNIT-II   Defines the rights and duties of each individual, criminal code (Penal code)

Procedure law; when a crime is committed , the procedure law is activated (Cr.Pc.Evidence Act etc)

31

Civil Law (Private wrongs) like those for inheritance, divorce, juvenile justice laws

UNIT-III   Criminal Justice System

Criminal justice system in the country, police, prosecution, judiciary & correction.

Courts: Structure and Functions District Court, Session Court, High Court, supreme Court.

UNIT-IV   The components

Police; Structure, reporting registration, investigation, arrest (how and what can be done) power of the police, bail and critique.

Correction: structure, Functions, Treatments, Rehabilitation and critique.

UNIT-V   Legal aid , public interest litigation

History of legal Aid, concept of legal aid, need for legal aid, who needs legal aid schemes and problems.

History of public interest litigation with special reference to India, meaning and concept of public interest litigation process & problems of public interest litigation

REFERENCES:-

1   Aranha,T   Social Advocacy –perspective of Social work, Bombay , college of social work

2   Buxi, U 1982   Alternatives in development; Law the crises of the Indian legal System, New-Delhi: Vikas Publishing house.

3   Bayley D.M 1969   The police and political development in India , New-Jersey

32

Prienceton.

| 4 | Curry, J.C. 1977 | The Indian police, New-Delhi: Manu Publications. |

| 5 | Desai A.E 1986 | Violation of Democratic rights in India vol 1 |

| 6 | Flemming M 1978 | Of Crimes and rights, New-York W.W Norton Co. |

| 7 | Iyer VRK 1980 | Some half hidden aspects of Indian social Justice, Lucknow:Eastern Book Company |

| 8 | Iyer VRK 1981 | Law versus Justice:Problems and solutions, New-Delhi, Deep &Deep. |

| 9 | Khanna H R 1980 | Justice and Beyond, New-Delhi IIPA |

| 10 | Mathew P.D | Legal Aid series, delhi, Indian social Institute. |

| 11 | Mc.Donald W.F 1979 | The Presentator, California , Berkeley Hill |

| 12 | Newman G 1999 | Global report on crime & justice, New-York: Oxford university press. |

| 13 | Nirmal Anjali 1992 | Role & Functioning of Central police organization, New-Delhi |

| 14 | Peak,K.J 1988 | Justice Administration- Police, Courts and Correction, New-Jersey: Prenctice Hall |

| 15 | Singh L.M 1973 | Law and Poverty: Cases and materials, Bombay |

| 16 | Western P.B 1975 | The criminal Justice System , A introduction and Guide lines, California: Good year publication. |

17 Government of Gujrata : 1971: Report of the Legal Aid Committee.

18 Government of India 1973: Report of the Legal Aid Committee.

MSW (MASTER of SOCIAL WORK) IV SEMESTER

Paper/ CC	Title of the Paper	I	T	Total
XVI/ CC 15	Social Control and Change in India	20	80	100
XVII/ CC 16	Social Development	20	80	100
XVIII/ CC 17	Social Planning in India	20	80	100
XIX/ CC 18	Integrated Social Work Practice	20	80	100
XX/ P 2	Research Project With Block Placement and Field Work Report	-	-	100

Paper XVI /CC 15   Social Control and Change in India

UNIT-I   **Social Control**

a)Meaning   b)functions

Unit-II   **Theories of Society**

a)Significance of a theoretical understanding of society

UNIT-III   **Social Change**

a)Concept of Social Change   b) Characteristics

c)Factors of social change :Demographic, Cultural, Technological and Mass Media.

UNIT-IV   **Social Movement in India**

a) Concept of social movement

b)Factors of social movement

c)Social reform movement and Contribution of social reformers

UNIT- V   **Type of Movement and Change**

a)Peasant Movement   b) Trade Union Movement

c)Social Movement and Social Change in India

34

REFERENCES

1	Bert N Adams. 1975	A sociological Interpretation, Chicago: Rand McN
2	Bharadwaj,A.N.1979	Problems of SC/ST in India, New-Delhi Light and publication.
3.	Broom , Leonard Charles, M.Bonjean, Dorothy,H.Broom,1990	Sociology, Wadswort Publication Co, Belmout
4	Deshpandey, Shrinivasan narain,1978	Society economy of Polity in India, Mumbai: Univ Mumbai
5	Ely Chinoy.1967	Society-An Introduction to Sociology, New-York: House
6	Haralombos, Michael ,1980	Sociology, Delhi: Oxford University Press
7	Jain ,P.C.1991	Social Movements among tribles, New Delhi Raw Publication.
8	Kapadia ,K.M 1966	Marriage and family in India, London : Oxford Ur Press
9	Kinsley David,1969	Human Society, New York
10	Pauline,K.1987	Regional differences in Family structure in India, . Rawat Publication.
11	Kuppuswamy, B	Social Change in India
12	Maudelbaum, David M 1970	Society in India vol. I & II , University of Califorr
13	Narang , B.S. Dhawan R.C. 1983	Introduction to social sciences, Delhi: C.B.S Publ
14	Pandey, A.K.1997	Tribal Society in India , New- Delhi: Manak P
15	Pandey Rajendra, 1986	The Caste System In India – Myth and reality, Ne' Criterion Publication
16	Ross, Aileen d 1961	The Hindu family in its urban setting, Delhi: Oxi University Press
17	Sharma S 1985	Social movements of Social change, B.R. Delhi P House
18	Sharma.K.L(ed)1999	Caste and Race in India, Mumbai, Popular Praka
19	Sharma , R.K.1997	Indian Society institution and change , New-Delhi Publishers
20	Singh K.S. 1985	Tribal Society in India , New-Delhi ,Manohar Pub

House.

21   Shrinivas M.N 1996   Village, Caste, gender and Method(essay in Indian social Anthropology) Delhi: Oxford University Press

22   Social Change, Issues and Perspectives (Journal of the council for social Deelopment

Paper XVII/CC 16 Social Development

UNIT-I   **Concept of Social Development**

a) Defining social Development.

b)Theory of Development

c) Development Indicators

d). Current debates on Social Development

UNIT-II   **Social Development Around the World And in India-I**

a) Historical Experience of development process

b)Social and economic transformation in India.

c)The Historical and social context- Development in Indian Sub-Continent in pre Independence Phase.

UNIT-III   **Social Development in India-II**

a) The post Independence Phase: Government measures and five year plans.

b) Political economy and social structural change.

c) Demographic Transition.

Unit-IV   **Development Sectors and understanding of nature of Intervention themes-I**

a) Rural Development: Agrarian and Land reforms Green Revolution

b) Industrialization and Urban development

UNIT-V   **Development Sectors and understanding of nature of Intervention themes-II**

a) Labour Relations in organized sector.

36

b) Gender Issues

c) Environmental Issues (Land, water, Forest)

d) Education and Health

References;-

1	Bagchi, A.K 1982	Political economy of Underdevelopment, Cambridge; Cambridge University Press.
2	Desai v 1988	Rural development (vol.i) Mumbai; Himalaya Publishing House
3	Fidelma, A 1999	Contemporary Social and Political theory: An Introduction, Buckingham: Open university press.
4	Government of India	Five year Plan Documents New-Delhi
5	Jacob K.K 1992	Social development Perspectives
6	Joshi P.C 1976	Land reforms in India
7	Leonard P 1977	Postmodern Welfare; Recon structuring an Emancipatory project, London: Sage.
8	Meadows D.H 1972	The limits to growth, New-York university Broks,
9	Phillips D.R 1994	Health and development, London Rout ledge and Kegan Paul.
10.	Rao, D.B (ed)1998	World Summit for Social Development.
11.	Roychoudhary T 1982	The Cambridge economic History of India Vol I &II New-Delhi
12	Singh RR1995	Whither Social Development? New-Delhi ASSWI
13	Singh Y 1974	Modernization of Indian Tradition, del;hi Thomas Press.
14	The Probe Team 1999	Public report on basic education in India , New-Deldi Oxford University Press.
15	UNDP	Human development Reports, Oxford University Press

| 16 | World Bank | World development reports (Annual) Oxford University Press |

Encyclopedia of Social Sciences

Encyclopedia of Social Work

Paper- XVIII /CC17   Social Planning in India

UNIT-I   **Planning-**

a)Concept of Social and Development planning.

b)Scope of Social planning

c)Linkage between social policy and planning- planning as an instrument and source of policy making in India.

d)Role of Ideology.

UNIT-II   **Planning Process I**

a)Indian planning in a historical Perspective

b)Federal political system and the planning process

c)The Constitutional position of planning in India. The legal Status of the planning commission.

UNIT- III   **Planning Process II**

a)Coordination between centre and the state and the need for decentralization.

b)Panchayat raj,   people participation.

c)Role of political, Social movement and voluntary action.

UNIT-IV   **The planning, Machinery and monitoring plans & programmes**

a)Planning of Monitoring- Concept and Characteristics

b)Planning of evaluation- Concept and Characteristics

c) Need for decentralization

UNIT- V   a)A broad review of the five year plans

b)objectives of growth and social justice and with special reference to the areas of health and family welfare, education,

c)social welfare ,anti poverty programmes and advocacy

REFERENCES:-

1   Bhanti,R 1993   Social policy and development in Rajasthan, Udaipur, Himanshu Publication.

2   Blumer, M 1989   The Goals of social policy, London, Unwind Hyman.

3   Dimtto, D.M 1991   Social welfare: politics and public policy New-Jersey, Prentice Hall

4   Ganapathy R.S 1985   Public policy and policy analysis in India . Delhi Sage publication.

5   Ham,C Hill M 1993   The policy process in the modern capitalist state 2nd New-York, Harvester.

6   Hebsur R.K   Social intervention for justice, Bombay TISS

7   Huttman E.D 1981   Introduction to social policy , New-York, MacGraw Hill.

8   International Labour Office 1973: multinational enterprise and Social policy , Geneva ILO

9   Jenks W 1876   Social policy in changing world Geneva:ILO

10   Joness K 1983   Issues in social policy, London: Routledge & Kegan paul

11   Kahn A.E 1973   Social policy and social services, New-York, Random House.

12   Kulkarni P.D1979   Social policy and development in India Madras Association of School of social work in India .

13   Kulkarni P.D1952   Social policy in India, New-York, MacGraw Hill.

14   Lindblom, C.E 1980   The policy making process, New-Jersey, Prentice Hall

15   Livingstance, A 1969   Social policy in developing countries, London, Routledge & Kegan paul

16   Madison B.Q 1980   The meaning of social policy, London:Croom Helm.

17   Macpherson S 1980   Social policy in the third world, LondonWheat Speat Brooks.

18   Mathur k Bjorkman   Top Policy makers in India , New-delhi Concept publishing co.

19   Mundle S 1993 -Policies, Paradigms and development Debate at the close of twentieth Century, Economic and political weekly, Vol.XXVII No26 Sept.4 1993

20   Mishra, R 1977   Society and social policy, London Mac Millan ltd.

21   Mullard M and Spicker 1988   Social policy in a changing society, London, Routledge & Kegan paul

22   Rao V –Social Policy: The means and ends question , Indian journal of public administration vol. L No.1 Jan-Mar 1994.

23   Rao, V & Mandar H   An Agenda for caring; Interventions for the Marginalized, New-Delhi.

24   Yadav C.S 1986   Urban planning and polities Part A New-Delhi Concept publishing Co.

Paper   **Integrated Social Work Practice**
IXX/CC 18

UNIT-I   **System and Social Work**

Concept of Social work

Characteristics of social Systems, Units of social work

40

Individual, Family, Groups, communities and Organization

UNIT-II   Approaches To Integration

The system Approach , Environmental approach

Understanding of life sustaining elements and their inter-relationships,

UNIT-III   Social Work Roles

Concept and types of Role, Role of Social worker.

Roles –theories- theoretical insights.

Role tasks, skill and techniques, outcomes.

UNIT-IV   Action for and Action In

The client system, the problem, process and phases.

Initiating contact, collecting data, assessment, negotiation of contract.

Problem solving, termination and evaluation for integrated practices.

Unit-V   Social Work Professional and Practice

Concept of Social Work Profession.

Social work professional as a single change actor as one in the team

Integrated social work practice,

REFERENCES:-

1   Barborka, G.A 1972:   The Devine Plane, Adyar ,Chennai, India, The Therosophical Publishing House.

2   Barlett Harriett, 1970   The common base of social work practice., National Association of social workers.

3   Connaway Ronda, S 1988   Social work Practice , New Jersey: Prentice Hall.

4   Goldsterin, Howard 1973:   Social Work Practice: A Unitary Approach, Columbia University.

5   Johnson Louise C 1983.   A Generalist Approach (3rd) Eds. Boston

6 Lippit, R.J Watson 1958   The dynamics of planned changes, New York.

7 Parsons Ruth, J Jorgensen 1984   The Integrated social work practice,,California

8 Pincus, Allen and anne minaham 1973   Social work practice: Model And Method, Illnois .

9 Specht. Harry and Anne Vickery 1977   Integration Social Methods, London: George Allen and Unwin.

10 Swamy Chinmayananda 2000   Atema Bodha –A Contemporary of Swamy Chinmayananda Mumbai Central Chinmaya Mission Trust.

11 Uberroi N.K 1995   Professional Competency in Higher education, Centre for Professional Development in Higher education

42

	Paper XX/P2 **Research Project With Block Placement and Field Work**	
	Marks distribution of paper XX	Maximum marks
1	Block Placement	25
2	Study Tour/field work	15
3	workshop	10
	Total	50(Internal)
4	Research project	50(External)
5	Grand total	100

Out of 50 marks allotted for research project; valuation of research project and viva-voice will be examined by external examiner appointed by university.

43

M.Phil . SOCIOLOGY
SCHOOL OF STUDIES IN SOCIOLOGY
Pt.RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR
2018-2019

Marks-100

Sl. No	Papers	Marks
1.	Research Methodology: Quantitative Techniques,Computers	100
2.	Contemporary Indian Social Problems	100
3.	Gender and Society	100
4.	Seminar based theory	50
5.	Dissertation	
	a. Seminar based Dissertation	50
	b. Script,writing	75
	c. Viva-Voce	25
	TOTAL	500

PAPER – I: Research Methodology: Quantitative Techniques, Computer

Unit I. Science and Social Science Research
a) Nature of Science, Scientism as a process of Science, Ideal type v/s Reality
b) Methodological approaches to social world; Values, Science and Sociology, Ethics in Social Research.

Unit II. Logic of Scientific Reasoning
a) Elements of Logic and Reasoning; Terms, Propositions and Arguments
b) Deductive and Inductive reasoning.

Unit III. Formulation of Research proposal
a) Formulations of Research Problems
b) Monitoring and Evaluation.

Unit IV. Statistical Tools, Quantification and Interpretation
a) Mean, Median, Mode, Standard Deviation, Correlation, Chi-Square
b) Data Processing : Interpretation and drawing of conclusions,

Unit V. Computer:
a) Organization and Working of a computer – Hardware: RAM, ROM, PROM, EPROM, EEPROM, primary and secondary data storage, Software: operating systems – Windows-Ward, Power Point, Excel

2-6-2018

1

Head,
S.O.S. In Sociology & Social Work,
Pt. Ravishankar Shukla University,
Raipur (C.G.)

b)Internet and Social Science Information :Advantages of networking and Internet, E-Mail, World Wide Web, Browsing, Search Engines, Important Social Science Portals

References:
1. Manheim, Henry L.1977, Sociological Research: Philosophy and M Dorsey Press. Illinois.
2. Singleton Royve Jr. Straits, Margeret M. Mc Allister,
3. Ronald J.1988: Approaches to Social Research, Oxford University Press,
4. Godde I. William, J. and Hall, Paul K.1952, Methods In Social Research, M Kogakusha Ltd. Tokyo.
5. Mukherji, Parthanath. 2000. Methodology in Social Research, Dilemmas and Perspectives, Sage Publication.
6. Madge, John.1953. Tools of Social Science, Longman Group Ltd. London.
7. Bailey, K.D. Methodology of Social Research, Free Press, New York.
8.Timothy, J and Linda O'Leary: Micro computing, New York: McGraw-Hill,1995
9.Tolwer, Romela et. al: Microsoft Office 2000, New York: Addison Wesley, 2000

Marks-100

PAPER-II: Contemporary Indian Social Problems

Unit I. Tribal India
a. Discruption of Tribal Economy, Vulnerability and Loss of Livelihoods
b. Protest Movements: Naxal Movement and Counter Movement

Unit II. Rural India
a. Agricultural and Educational Backwardness and Response of the State
b) Vulnerability, Farmers Suicide, Distressed Migration

Unit III. Urban India
a) Over- crowdedness, Crimes, Ethnic and Linguistic Divide
b) Slums, Environmental Degradation,

Unit IV. Development Based Issues
a) Displacement, Human Rights, Social Exclusion and Sustainability
b) Response of the State-RTI, MNREGA, NRHM, Inclusive Policies

Unit V. Problems of Senior Citizens of India.
a. Gerentological Problems-Social, Economic, Psychological and Health
b. Response of the Community, Family , State and Civil Society

References:
1. Journal of the Natural Human Rights Commission, India, Vol.1, 2002, New Delhi-110001.
2. Natural Human Rights Commission, Annual Report, 2000-2001, New Delhi-110001.
3. G.R. Madan, Indian Social Problems, Vol, I Allied Publishers Pvt, Ltd, New Delhi.
4. V.S.Katyar Environmental Concerns: Depleting Resource and Sustainable Development, Aviskar Publishing's Distributors, Jaipur

2

5. R.N.Pati and B. Jena (ed) Aged in India. Ashish Publication House, New Delhi.
6. The state of Indian Environment II Centre for Science and Environment. New Delhi
7. Rogers, John J.W & P.G.,!998, People and The Earth Barie Issues in the Sustainable of Resource and Environment, Cambridge University

Marks-100

PAPER-III:GENDER AND SOCIETY

Unit-I: Social Construction of Gender and Emergence of Women's   Studies
   a. Gender Vs. Biology, Equality Vs. Difference, Women in the Family: Socialization, Nature Vs. Culture, Gender Roles
   b. Patriarchy as Ideology and Practice, Emergence of Women's Studies

Unit-II: Theories on Feminism
   a. Feminist Liberalism, Feminist Essentialism
   b. Feminist Socialist, Feminist Post-modernist

Unit-III: Gender and Society in India
   a. Economy: Marginalisation of women and Sexual Division of Labor, Polity: Reservation for Women
   b. Religion and Culture: Women as Repositories of cultural practices and Traditions, Marriage, Dowry and Property, Health and Education: problems women Encounter.

Unit-IV: Contemporary situation of women in India
   a. Constitutional provisions and National Policy on Women Empowerment
   b. Women Welfare Organizations and Agencies

Unit-V: Women in the Era of Globalization
   a Impact of Liberalization and Globalization on Women,
   b Women's Movements

References:

1. Altekar, A.S. 1983 — The Position of Women in Hindu Civilization Motilal Banarasidas, New Delhi
2. Desai, N. and Krishnaraj, M. 1987 — Women and Society in India Ajanta, New Delhi
3. Dube, L et al (ed) 1986 — Visibility and power: Essays on women in Society and Development , Oxford, New Delhi.
4. Mc Cormack, C and Strathern, M (ed) 1980 — Nature, culture and Gender Cambridge Univ. Press, London
5. Myers, K.A. et al (ed) 1998 — Feminist Foundations: towards Transforming Sociology. Sage, New Delhi.
6. Mills, M. 1980 — Indian Women and patriarchy: conflicts and Dilemmas of Students and Working Women Concept, New Delhi.
7. Rege, S.2003 — Sociology of Gender, Sage, New Delhi.

3

COURSES WORK FOR THE Ph.D (Sociology)

2017-2018

Sl.No	Papers	Marks
1	**Methodological aspect of Sociological Research**	**100**
2	**Practical**	**100**
	a. Review of Concerned Literature :(Marks-20)	
	b Seminar :(Marks-20)	
	c Project Work (Marks 60) **{External –40}&{Internal –20}**	
	TOTAL MARKS	**200**

PAPER –I: Methodological aspect of Sociological Research (Max. Marks 100)

UNIT-I
　　　　i.　Research –Concept and types.
　　　　ii　Motivation of research
　　　　iii　Criteria of a good research
UNIT II　　**Research Methodology**
　　　　i　Scientific method
　　　　ii　Research Design
　　　　iii　Sampling.
UNIT-III
　　　　i　Formulation of research Problem
　　　　ii　Data Collection- Method, Tool, technique
　　　　iii　Data processing
Unit-IV　　**Computer application in Social Research**
　　　　i　Statistical Tool
　　　　ii　Statistical Software
　　　　iii　Data entry and Commands for Analysis
Unit- V　　**Research Writing Style**

Paper-II:Practical (Max. Marks 100)

Part-I-　Review of Concerned Literature :(Marks-20)
 The candidate shall review minimum 20 research articles of a broad research area from referred journals of the discipline. After reviewing the research articles the candidate shall submit a summary chronologically developing the arguments to the Department within two months from the beginning of the Course. On the basis of the review of literature the candidate shall prepare a Synopsis Including.
　　　i. Research Topic.
　　ii. Review of Literature.

  iii. Gaps in earlier Studies.
  iv. Statement of Problem.
   v. Objectives
  vi. Hypotheses
 vii. Methodology
viii. Plan of the Study

Part-II-Seminar :(Marks-20)
    The candidate shall present a seminar on the basis of Part-I

Part-III: Submission of Project Report :(Marks-60- External Examiner-40 Marks Internal Examiner-20 Marks)

    The candidate shall submit a project report on the basis of the suggestions made in the seminar. Final examination will be conducted with the help of an external examiner in the presence of the internal examiner.

PT. RAVISHANKAR SHUKLA UNIVERSITY: RAIPUR
SCHOOL OF STUDIES IN STATISTICS

Syllabus and Scheme of Examination
M.A./M.Sc. (Statistics) Semester Course 2018-19

The M.A./ M.Sc. Course in Statistics shall be spread over four semesters. Each semester shall have four theory and two practical courses except the fourth semester. The fourth semester shall have four theory courses, one practical and one project course. Each theory course will be of 4 hours teaching per week carrying 4 credits. The theory course examination will be of 3 hours duration and shall carry 100 marks each out of which 20 marks will be based on internal assessment. Each practical course will be of 4 hours duration per week carrying 2 credits. The examination of each practical course will be of 4 hours duration and shall carry 100 marks out of which 10 marks shall be fixed for viva -voce and 20 marks for practical record. The project course shall be of 100 marks having 2 credits.

Along with above courses, in Semesters II and III, there will be one additional optional paper of 3 credits to be offered from other programs under Choice Based Credit System.

FIRST SEMESTER

S. No.	Paper	Subject	Theory Exam Marks	Internal assessment Marks	Total Marks	Credit points
1	I	Real Analysis	80	20	100	04
2	II	Statistical Methods	80	20	100	04
3	III	Applied Statistics	80	20	100	04
4	IV	Probability and Measure	80	20	100	04
5	V	Lab Course I : Practical Based on Courses II			100	02
6	VI	Lab Course II :Practical Based on Courses III			100	02
				Total Credit points		20

SECOND SEMESTER

S. No.	Paper	Subject	Theory Exam Marks	Internal assessment Marks	Total Marks	Credit points
1	I	Linear Algebra	80	20	100	04
2	II	Stochastic Processes	80	20	100	04
3	III	Statistical Computing	80	20	100	04
4	IV	Sampling Theory	80	20	100	04
5	V	Lab Course I :Practical Based on Courses I & III			100	02
6	VI	Lab Course II :Practical Based on Courses IV			100	02
				Total Credit points		20
		Choice Based Credit System (Minor Elective from other Subject)	80	20	100	03

THIRD SEMESTER

S. No.	Paper	Subject	Theory Exam Marks	Internal assessment Marks	Total Marks	Credit points
1	I	Multivariate Analysis	80	20	100	04
2	II	Inference - I	80	20	100	04
3	III	Operation Research-i	80	20	100	04
4	IV	Statistical Quality Control	80	20	100	04
5	V	Lab Course I : Practical Based on Courses I and II			100	02
6	VI	Lab Course II :Practical Based on Courses III and IV			100	02
				Total Credit points		20
		Choice Based Credit System (Minor Elective from other Subject)	80	20	100	03

FOURTH SEMESTER

S. No.	Paper	Subject	Theory Exam Marks	Internal assessment Marks	Total Marks	Credit points
1	I	Design of Experiment	80	20	100	04
2	II	Inference-II	80	20	100	04
3	III	Operation Research II	80	20	100	04
4	IV	Any of the following (Major Elective) (a) Reliability and Life Testing (b) Demography (c) Econometrics	80	20	100	04
5	V	Lab Course : Practical Based on Courses I, II, and III			100	02
6	VI	Project Work			100	02
				Total Credit points		20

Grand Total of Credit Points = 86

FIRST SEMESTER

Paper I: Real Analysis
Paper II: Statistical Methods
Paper III: Applied Statistics
Paper IV: Probability and Measure
Paper V: Lab Course I: Practical Based on Papers II
Paper VI: Lab Course II: Practical Based on Papers III

Paper–I
Real Analysis

UNIT-I

Recap of elements of set theory; Introduction to real numbers, Introduction to n-dimensional Euclidian space; open and closed intervals (rectangles), compact sets, Bolzano - Weirstrass theorem, Heine - Borel theorem. Sequences and series and their convergence.

UNIT-II

Real valued function, Properties of real valued continuous function on R^n, Uniform continuity, Sequences and series of functions, Uniform convergence. Power series and radius of convergence.

UNIT-III

Differentiation, maxima - minima of functions; functions of several variables, constrained maxima - minima of functions. Multiple integrals and their evaluation by repeated integration, Dirichlet and Lioulle's Theorem. Change of variables in multiple integration.

UNIT-IV

Reimann-Stieltjes integral of real valued function & its properties, Mean value theorem, Integration by parts and change of variables, Term by term integration, Differentiation & integration under the integral sign. Improper integral, Uniform convergence in improper integrals, Test for absolute and conditional convergence.

UNIT-V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Apostol, T.M. (1985). Mathematical Analysis, Narosa, Indian Ed.
2. Courant, R. and John, F. (1965). Introduction to Calculus and Analysis, Wiley.
3. Miller, K.S. (1957). Advanced Real Calculus, Harper, New York.
4. Rudin, Walter (1976). Principles of Mathematical Analysis, McGraw Hill.
5. Hewitt and Stromberg : Real and Abstract Analysis.
6. G. Das and S. Pattanayk : Fundamental of Analysis, TATA Mc Graw Hill.
7. Shanti Narayan: A course of mathematical analysis. S. Chand & Co. Ltd.

Paper -II

Statistical Methods

UNIT-I

Frequency distribution, measures of location, dispersion and skewness, Moments and cumulats, moment generating function.

Simple correlation coefficient, Intra class correlation, Multiple and Partial Correlation. Linear and Multiple Regression, and their application.

UNIT-II

Testing of hypothesis, Level of significance, degrees of freedom, Central and Non-central chi-square, t and F- distributions, their properties and related tests. Sampling distributions of mean and variance of a sample from a normal population, sampling distribution of simple correlation coefficient in null case.

UNIT-III

Definition of probability, Bayes' theorem, Basic distribution function probability mass function, probability density function, joint, marginal and conditional p.m.f. . Random Variables and its mathematical expectations, conditional Expectation, Expectation of sum and multiplication of random variables, Markov Holder-Jensen and Liapounov inequalities.

Standard Discrete Distributions- Bernoulli, Binomial, Poisson, Geometric, Hyper geometric and Multinomial distribution. Limiting form of Binomial and Poisson distributions.

UNIT-IV

Standard continuous distributions-Uniform, Exponential, Normal Beta, Gamma and Cauchy distributions. Order Statistics-their distributions and properties. Joint & Marginal distributions of Order-Statistics.

UNIT V

Four short notes, one from each UNIT will be asked. Students have to answer any two.

REFERENCES

1. Dudewicz, E.J. and Mishra, S.N.(1988) : Modern Mathematical Statistics, Wiley, Int'l Student's Edition.

2. Rohatgi, V.K. (1984) : An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
3. Rao, C.R. (1973) : Linear Statistical Inference and its Applications, 2/e, Wiley Eastern.
4. Weather ,Burn,C.E.   : A first Course in Mathematical Statistics.
5. Keany,J.F. and Keeping,E.S. : Mathematics of Statistics Pt. I and II
6. Kendali,M.G. and stuart A   : Advanced Theory of Statistics.
7. Mood ,gybrill and Boes   : Introduction to theory of Statistics
8. Hogs and Craig   : Mathematical Statistics
9. Goon,gupta and Dasgupta : Fundamental of Mathematical statistics Vol.I

Paper -III

Applied Statistics

UNIT-I

Sources of demographic data –census, register, adhoc survey, hospital records, measurement of mortality ,crude death rate, age specific death rates, standardized death rate infant mortality rates, Complete and abridged life table-Kings method, Greville's method and method of Reed and Merrel, Construction of life table.

UNIT-II

Laws of mortality-Fitting of Makeham's law, Measurement of fertility-crude birth rate, general fertility rate ,age-specific birth rate, total fertility rate ,gross reproduction rate. The Stable and Stationary populations, Logistic curve for population growth, Population Projection.

Unit III

Different Component of time series, Measurement of secular trend: Fitting of mathematical curves, method of moving average, variate difference method, effect of elimination of trend ,merits and demerits of different methods of trend estimation. seasonal components, Determination of cyclical component., Periodogram analysis, Yule-Slutsky effect, correlogram Analysis.

Unit IV

Index number :meaning and costruction of index number,different formulae for constructing index numbers, tests of consistency of index number formulae, Chain base index numbers, Cost of living index numbers, Whole sale price index numbers. Demand Analysis: Demand and supply curves, Price elasticity of demand and supply, determination of demand curves from market data, Engel' Law and Engle's Curve.

Unit V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES
1. O. S. Srivastava (1983) – A text book of demography ,Vikas Publishing House.
2. Parimal Mukhopadhaya (1999) – Applied Statistics, Books and Allied (P) Ltd.
3. V. K. Kapoor and S. C. Gupta: Applied Statistics, Sultan Chand and Sons.

Paper -IV

PROBABILITY AND MEASURE

UNIT-I

Random experiment, Definition of Probability, Additive and multiplicative theorems of probability, Axiomatic approach to probability, Bayes Theorem. Classes of sets, fields, sigma-fields, minimal sigma-field, Borel sigma-field in R_k, sequence of sets, limsup and liminf of a sequence of sets. Measure, Probability measure, properties of a measure, Lebesgue and Lebesgue- Steljes measure on R_k.

UNIT-II

Measurable set, Measurable functions, Random variables, sequence of random variables, almost sure convergence, convergence in probability (and in measure). Integration of a measurable function with respect to a measure, Monotone convergence theorem, Fatou's lemma, Dominated convergence theorem.

Unit III

Borel-Cantelli Lemma, Independence, Weak law and strong law of large numbers for iid sequences, Definition and examples of Markov dependence, Chebychev's Inequality, Probability generating function.

Unit IV

Convergence in distribution, characteristic function, uniqueness theorem, Levy's continuity theorem (statement only), CLT for a sequence of independent random variables under Lindeberg's condition, CLT for iid random variables.

UNIT-V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Ash, Robert.(1972): Real Analysis and Probability. Academic Press.
2. Billingsley, P.(1986): Probability and Measure. Wiley.
3. Dudley, R. M. (1989): Real Analysis and Probability, Wadsworth and Brooks/Cole.
4. Kingman, J F C and Taylor, S.J. (1966). Introduction to Measure and Probability. Cambridge University Press.

Paper V : Lab Course I – Practical Based on Paper II
Paper VI : Lab Course II – Practical Based on Paper III

SECOND SEMESTER

Paper – I	: Linear Algebra
Paper - II	: Stochastic Processes
Paper - III	: Statistical Computing
Paper - IV	: Sampling Theory
Paper-V: Lab Course - I	**: Practical based on Papers I and III**
Paper-VI: Lab Course -II	**: Practical based on Papers IV**
CBCS Paper	: Minor Elective from other Subject

Paper -I

Linear Algebra

UNIT-I

Fields, vector spaces, subspaces, linear dependence and independence, basis and dimension of a vector space, finite dimensional vector spaces, completion theorem, examples of vector spaces over real and complex fields, linear equations. Determinants.

UNIT-II

Vector spaces with an inner product, Gram-Schmidt orthogonalization process, orthonormal basis and orthogonal projection of a vector. Linear transformations, algebra of matrices, row and column spaces of a matrix, elementary matrices, rank and inverse of a matrix, null space and nullity, partitioned matrices, Kronecker product.

UNIT-III

Hermite canonical form, generalized inverse, Moore-Penrose generalized inverse, Idempotent matrices, Solutions of matrix equations. Real quadratic forms, reduction and classification of quadratic forms, index and signature, triangular reduction of a positive definite matrix.

UNIT-IV

Characteristic roots and vectors, Cayley-Hamilton theorem, minimal polynomial, similar matrices, algebraic and geometric multiplicity of a characteristic root, spectral decomposition of a real symmetric matrix, reduction of a pair of real symmetric matrices, Hermitian matrices. Singular values and singular value decomposition, Jordan decomposition, extrema of quadratic forms, vector and matrix differentiation.

UNIT-V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Graybill, F.A.(1983). Matrices with applications in statistics, 2nd Ed. Wadsworth.
2. Rao, C.R.(1973). Linear statistical inference and its applications, 2nd ed. John Wiley and Sons, Inc.
3. Searle, S.R. (1982). Matrix Algebra useful for Statistics. John Wiley and Sons. Inc.
4. Shanti Narayan: Matrices
5. Vashishtha, A. R.: Matrices

Paper – II
Stochastic Processes

UNIT-I

Introduction to stochastic processes (sp's).; classification of sp's according to state space and time domain. Countable state Markov chains (MC's), Chapman-Kolmogorov equations; calculation of n-step transition probability and its limit. Stationary distribution, Classification of states; transient MC; Probability generating function. Properties of probability generating function .Laplace transform & its properties.

Unit II

Random walk and Gambler's ruin problem ; Applications from social, biological and physical sciences. Renewal theory: Elementary renewal theorem and applications. Statement and uses of key renewal

theorem; study of residual life time process. Martingle in discrete time, inequality, convergence and smoothing properties.

Unit III

Discrete state space continuous time MC ; Kolmogorov- Feller differential equations ; Poisson process, birth and death process ; Applications to queues and storage problems. Wiener process as a limit of random walk; first - passage time and other problems.

UNIT-IV

Stationary process: weakly stationary and strongly stationary processes; Moving average and auto regressive processes. Branching process : Galton-Watson branching process, probability of ultimate extinction, distribution of population size. Statistical inference in MC and Markov processes.

UNIT-V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Adke, S.R. and Manjunath, S.M. (1984): An Introduction to Finite Markov Processes, Wiley Eastern.
2. Bhat, B.R. (2000): Stochastic Models: Analysis and Applications, New Age International, India.
3. Cinlar, E. (1975): Introduction to Stochastic Processes, Prentice Hall.
4. Feller, W. (1968): Introduction to Probability and its Applications, Vol.1, Wiley Eastern.
5. Harris, T.E. (1963): The Theory of Branching Processes, Springur-Verlag.
6. Hoel, P.G., Port, S.C. and Stone, C.J. (1972): Introduction to Stochastic Processes, Houghton Miffin & Co.
7. Jagers, P. (1974): Branching Processes with Biological Applications, Wiley.
8. Karlin, S. and Taylor, H. M. (1975): A first Course in Stochastic Processes, Vol.1, Academic Press.
9. Medhi, J. (1982): Stochastic Processes, Wiley Eastern10. Parzen, E.(1962): Stochastic Processes, Holden-Day.

Paper - III

Statistical Computing

UNIT I

FORTRAN Language: Constants & Variables, Control statements, Subroutine & Function subprograms Use of Excel for Statistical methods and graphical representation of data.

Unit II

Programming in C and in C^{++}: All Syntax ,Pointers, Arrys, Functions and Input / Output statements. Use of Statistical package. SPSS for large sample data analysis.

Unit III

Numerical Analysis : Finite differences & interpolation, Interpolation with unequal intervals, Central differences Interpolation-Gauss's, Stirling's and Bessel's Formulae.

UNIT IV

Numerical differentiation and integration, Trapezoidal rule, Simpson's one third, 3/8 rule, Weddle's rule, Euler-Maclaurin Summation Formula, Newton-Cotes Formula, Gauss formula for approximation to factorials, Difference equation of first and second order.

UNIT V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Balagurusamy,E.: Programming in ANSI C .Tata McGraw Hill.
2. Kanetkar ,Y.P.:Working with C.BPB Publication.
3. Reddy,R.N. and Ziegler,C.A.: FORTRAN-77 With Application for Scientiests and engineers,JAICO Publishing House Bombay,Calcutta & Madras.
4. Rajaraman: Computer Programming in FOTRAN-77,Prentice Hall.
5. B.W. Kernighan and D.M. Ritchie (1988). The C Programming Language, Second Edition. Prentice Hall.
6. W.H. Press, S.A. Teukolsky, W.T. Vellering, and B.P. Flannery (1993). Numerical Recipes in C, Second Edition. Cambridge University Press.
7. R.A. Thisted (1988). Elements of Statistical Computing. Champman and Hall.
8. Rajaraman,V.: Computer Oriented Numerical Methods.
9. Grewal, B. S.: Numerical methods.
10. Saxena, H. C.: Finite differences.

Course -IV

Sampling Theory

UNIT-I

Sample Surveys : concept of population sample and properties of estimator for finite populations, need for sampling, census and sample survey ,sample selection and sample size,Basic finite population sampling techniques ,simple random sampling with and without replacement, Estimation of population proportion ,Non-sampling errors, estimation of population mean in presence of non-response. Randomised response technique: Warner's method.

UNIT-II

Stratified sampling, systematic sampling and related results on estimation of population mean/total. Allocation problem in stratified sampling. Optimum allocation, Neyman allocation and Proportional allocation, estimation of gain in precision due to stratification, Post Stratification, Construction of strata, Effect of increasing number of strata. Comparison of stratified, systematic and simple random sampling, Systematic sampling under a linear model.

UNIT-III

Ratio regression estimators based on srswor and stratified methods of sampling. Bias of ratio estimate and optimum property of ratio estimate, Ratio estimate in stratified sampling, Regression estimate with pre-assigned and with estimated regression coefficient, comparison of ratio and regression estimate with sample mean. Unequal probability sampling: pps wr/wor methods [including Lahiri's scheme] and related estimators of a finite population mean [Desraj estimator and Murthy's estimator].

UNIT-IV

Cluster sampling. One stage cluster sampling, variance and cost functions ,sampling with probability proportional to cluster size,Hurwitz-Thompson estimation , two stage cluster sampling ,Allocation of sample to two stages :equal first stage UNIT comparison of two stage with one stage sampling. Double sampling ratio and regression estimate with and without cost aspect .

UNIT-V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Cochran, W.G. : Sampling Techniques [3rd Edition, 1977). Wiley
2. Des Raj and Chandak (1998) : Sampling Theory. Narosa
3. Murthy, M.N. (1977). Sampling Theory & Methods. Statistical Publishing Society, Calcutta.
4. Sukhatme et al (1992). Sampling Theory of Surveys with Applications. Iowa State University Press & IARS.
5. Singh, D. and Chaudhary, F.S. (1986). Theory and Analysis of Sample Survey Designs. New Age International Publishers.

<div align="center">

Paper V : Lab Course I – Practical Based on Paper I and III
Paper VI : Lab Course II – Practical Based on Paper IV
CBCS Paper : Minor Elective from other Subject

</div>

<div align="center">

THIRD SEMESTER

</div>

Paper – I	:	**Multivariate Analysis**
Paper - II	:	**Inference I**
Paper - III	:	**Operations Research I**
Paper - IV	:	**Statistical Quality Control**
Paper-V: Lab Course - I	:	**Practical based on Papers I and II**
Paper-VI: Lab Course – II	:	**Practical based on Papers III and IV**
CBCS Paper	:	**Minor Elective from other Subject**

<div align="center">

Paper I

Multivariate Analysis

</div>

UNIT-I

Gauss- Markov set-up, Estimability condition, best point estimates/interval estimates of estimable linear parametric functions ,Normal equations and Least squares estimates, Gauss-Markov Theorem, Introduction to fixed, mixed and random effects linear models. Analysis of variance for one way and two way classified data with equal and unequal number of observations per cells, Analysis of covariance model.

UNIT-II

Multivariate Normal Distribution and its properties, Reproductive property, transformation by a vector, singular /non-singular matrix, conditional distribution of a sub-set of multivariate normal variable/ Random sampling from a multivariate normal distribution. Maximum likelihood estimators of parameters. Distribution of sample mean vector. Wishart matrix - its distribution and properties, Characteristic function of Wishart distribution ,chi-square distribution as a particular case of Wishart distribution.

UNIT-III

Distribution of sample generalized variance. Null and non-null distribution of simple correlation coefficient. Null distribution of partial and multiple correlation coefficient. Distribution of sample regression coefficients. Distribution of Hotelling's T^2 statistic. Application in tests on mean vector for one and more multivariate normal populations and also on equality of the components of a mean vector in a multivariate normal population, Fisher-Behran statistic, Mahalanobis D^2 Statistic.

UNIT-IV

Multivariate linear regression model-estimation of parameters, tests of linear hypotheses about regression coefficients. Classification and discrimination procedures for discrimination between two multivariate normal populations - sample discriminant function, probabilities of misclassification and their estimation, classification into more than two multivariate normal populations. Principal components, Dimension reduction, Canonical variables and canonical correlation - definition, use, estimation and computation. Factor Analysis. An Introduction to cluster Analysis.

UNIT-V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Cook, R.D. and Weisberg, S. (1982). Residual and Influence in Regression. Chapman and Hall.
2. Draper, N.R. and Smith, H.(1998). Applied Regression Analysis. 3rd Ed. Wiley.
3. Gunst, R.F. and Mason, R.L.(1980). Regression Analysis and its Applications – A Data Oriented Aproach. Marcel and Dekker.
4. Rao, C.R.(1973). Linear Statistical Inference and Its Applications. Wiley Eastern.
5. Weisberg, S. (1985). Applied Linear Regression. Wiley.
6. Andrson, T.W.(1983) : An Introduction to multivariate statistical analysis. 2nd Ed. Wiley. Giri, N.C.(1977) : Multivariate Statistical inference. Academic Press.
7. Kshirsagar, A.M. (1972) : Multivariate Analysis. Marcel Dekker.
8. Morrison, D.F. (1976) : Multivariate statistical methods. 2nd Ed. McGraw Hill.
9. Muirhead, R.J.(1982) : Aspects of multivariate statistical theory, J. Wiley.
10. Seber, G.A. F.(1984) : Multivariate observations. Wiley.
11. Sharma, S.(1996) : Applied multivariate techniques. Wiley.
12. Srivastava, M.S. and Khatri, C.G. (1979).: An introduction to multivariate statistics. North Holland.
13. Johnson, R. and Wychern (1992): Applied multivariate Statistical analysis, Prentice Hall, 3rd Ed.

PAPER - II

INFERENCE- I

UNIT- I

Unbiasedness , Consistency, efficiency and sufficiency of point estimator ,. Fisher –Neymann factorization theorem, Cramer Rao inequality, Bhattacharya bounds, Minimum Variance unbiased estimators, Minimal sufficient statistics,

Unit –II

Liklihood function, examples from standard discrete and continuous distributions. such as Bernoulli, Binomial, Possion, normal, exponential gamma etc) Methods of estimation – Method of maximum likelihood estimators, properties of maximum likelihood estimators. Method of scoring,

method of moments, method of minimum chi-square, method of minimum variance, B.A.N. estimators.

Unit- III

Rao Blackwell theorem. Completeness of sufficient statistics. Completeness and Bounded Completeness, Koopman's theorem (Distributions admitting sufficient statistics),.Lehmann-Scheffe theorem, Invariant estimators. Confidence interval and confidence coefficients, Theory of confidence set, Relationship with the theory of hypothesis testing, Confidence interval for large samples.

Unit-IV

Loss function, Risk function, admissibility Minimax rule, Bays rule, Structure of Bay's rule, Construction of a Minimax rule, point and interval estimation as decision problem. State of nature, payoff opportunity loss or regret, expected monitory value(EMV) criterion for decision making, maximum, maximax and minimax regret strategy, expected value of perfect information (EVPI).

UNIT-V

Four short notes, one from each unit will be asked. Students have to answer any two.

Reference :

1. Kale, B.K. (1999): A first Course on Parametric Inference, Narosa Publishing House.
2. Rohatgi V. (1988): An Introduction to Probability and Mathematical Statistics. Wiley Eastern Ltd. New.Delhi (Student Edition)
3. Lehmann, E.L.(1986)-(Latest): Theory of point Estimation (Student Edition).
4. Lehmann, E.L.(1986): Testing Statistical hypotheses (Student Edition).
5. Rao, C. R. (1973): Linear Statistical Inference.
6. Zacks, S. (1971): Theory of Statistical Inference, John Wiley and Sons, New York.
7. Dudewicz, E.J. and Mishra, S.N. (1988). Modern Mathematical Statistics. Wiley Series in Prob. Math. Stat., John Wiley and Sons, New York (International Student Edition)
8. Ferguson, T.S. (1996). A course on Large Sample Theory. Chapman and Hall, London.
9. Ferguson, T.S. (1967) : Mathematical Statistics, Academic Press.

Paper - III

Operation Research I

UNIT-I

Definition and scope of Operational research ; phases in Operations Research ; models and their solutions ; decision-making under uncertainty and risk, use of different criteria ; The structure and formation of a linear programming problem,Graphical and simplex procedure,Two phase methods, and charne's-M method with artificial variables ; duality theorem .

Unit II

Transportation and Assignment problems, Routing and traveling salesman problem .

Unit III

Inventory problems – Deterministic models of inventory , Economic Lot size formula ,instantaneous production case ,finite production rates situation ,cases when shortages are allowed /not allowed. Stochastic inventory models – a single period model with no set up cost.

UNIT IV

Basic characterics of queuing systems, Steady-state solutions of M/M/1 and M/M/c models with associated distributions of queue-length and waiting time. M/G/1 queue and Pollazcek Khinchine result. Steady-state solutions of M/Ek/1 and E_k/M/1 queues, Machine interference problem. Transient solution of M/M/1 queue .

Decision-making in the face of competition, two-person games, pure and mixed strategies, existence of solution and uniqueness of value in zero-sum games, finding solutions in 2x2, 2xm and mxn games. Non-zero sum games, co-operative and competitive games, equilibrium solutions and their existence in bi-matrix games. Nash equilibrium solution. ;

UNIT V
Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES
1. Taha H.A. (1982) Operational Research : An Introduction ; Macmillan.
2. Hillier F.S. and Leiberman G.J. (1962) Introduction to Operations Research ; Holden Day.
3. Kanti Swarup, Gupta, P.K. and Singh M.M. (1985) Operations Research ; Sultan Chand& Sons.
4. Philips D.T., Ravindran A. and Solberg J. Operations Research, Principles and Practice.
5. Churchman C.W., Ackoff R.L. and Arnoff E.L.(1957) Introduction to Operations Research ; John Wiley.
6. Kleinrock L. (1975) Queueing Systems, vol. 1, Theory ; John Wiley
7. Saaty T. L. (1961) Elements of Queueing Theory with Applications ; McGraw Hill
10. Hadley G.and Whiting T.M. (1963) Analysis of Inventory Systems ; Prentice Hall
11. Starr M.K. and Miller D.W. (1962) Inventory Control-Theory and Practice ; Prentice Hall
12 . Mckinsey J.C.C. (1952) Introduction to the Theory of Games ; McGraw Hill
13. Wagner H.M. (1973) Principles of O.R. with Applications to Managerial Decisions ; Prentice Hall
14. Gross, D. and Harris, C. M. (1974) Fundamentals of Queueing Theory ; John Wiley

Paper - IV
Statistical Quality Control

UNIT-I
Basic concept of process monitoring and control, process capability and process optimization. General theory and review of control charts for attribute and variable data ; O.C. and A.R.L. of control charts, control by gauging ;

UNIT-II
Moving average and exponentially weighted moving average charts ; Cu-sum charts using V-masks and decision intervals ; Economic design of X-bar chart. Capability indices C_p, C_{pk} and C_{pm} ; estimation, confidence intervals and tests of hypotheses relating to capability indices for Normally distributed characteristics.

UNIT-III
Acceptance sampling plans for attribute inspection ; single, double and sequential sampling plans and their properties ; Bayesian sampling plan.

UNIT-IV
Plans for inspection by variables for one-sided and two-sided specifications ; Continuous sampling plans of Dodge type and Wald-Wolfiwitz type and their properties. Use of Design of Experiments in SPC ; factorial experiments, fractional factorial designs, construction of such designs and analysis of data. Multivariate quality control ; use of control ellipsoid and of utility

UNIT V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Montgomery, D.C. (1985) Introduction to Statistical Quality Control ; Wiley
2. Ott, E.R. (1975) Process Quality Control ; McGraw Hill
3. Wetherill, G.B. (1977) Sampling Inspection and Quality Control ; Halsted Press
4. Wetherill, G.B. and Brown, D.W. (1991) Statistical Process Control, Theory and Practice ; Chapman and Hall.
5. Duncan, A. J.(1986): Quality Control and Industrial Statistics. 5th ed., Richard D. Ervin, Homewood, Illiions.
6. Ekambaram, S.K. (1963): The Statistical basis of quality control charts. Asia Publishing House, London.
7. Grant, E.L. & Leavenworth, R.S. (1988): Statistical Quality Control. 6th ed., McGraw-Hill Book Co., New York.
8. Bowker, A.H. & Goode, H.P. (1952): Sampling inspection by variables. McGraw-Hill Book Co., New York.
9. Schilling, E.G. (1982): Acceptance sampling in quality control. Marcel Dekker, Inc., New York.

Paper V: Lab Course I – Practical Based on Papers I and II
Paper VI: Lab Course II – Practical Based on Papers III and IV
CBCS Paper : **Minor Elective from other Subject**

FOURTH SEMESTER

Paper -I	:	**Design of Experiment**
Paper - II	:	**Inference II**
Paper - III	:	**Operation Research II**
Paper -IV	:	**Reliability and Life Testing**
Paper-V: Lab Course - I	:	**Practical based on Papers I, II and III**
Papers-VI: Lab Course-II:		**Project Work**

Paper - I

Design of Experiment

UNIT I

Introduction to design of experiments, Principle of design of experiments, Completely ranomized design, Ranomize block design, Latin square design. Missing plot technique - general theory and applications, efficiency of design.

UNIT II

Graeco Latin Square design, Cross-over designs, Analysis of covariance: Applications to standard designs with one concomitant variable, Testing the homogeneity of a group of regression coefficients. Split plot and split block experiments, efficiency of whole plot and sub plot treatments, merits and demerits of split plot experiments in comparison to factorial experiments.

UNIT III

General factorial experiments, factorial effects; best estimates and testing the significance of factorial effects ; study of 2 and 3 factorial experiments in randomized blocks ; Complete and partial confounding. Fractional replication for symmetric factorials, 2^n experiment with 2^k blocks per replicate, 3^2 experiment.

UNIT IV

General block design and its information matrix. criteria for connectedness, balance and orthogonality, BIBD- Analysis with intrablock information and recovery of interlock information ; PBIBD, Youden design - intrablock analysis.
Application areas: Response surface experiments; first order designs and orthogonal designs.

UNIT-V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Aloke Dey (1986) :Theory of Block Designs, Wiley Eastern.
2. Angela Dean and Daniel Voss (1999) : Design and Analysis of Experiments, Springer.
3. Das, M.N. and Giri, N.(1979) : Design and Analysis of Experiments, Wiley Eastern
4. Giri, N. (1986) : Analysis of Variance, South Asian Publishers
5. John, P.W.M. (1971) : Statistical Design and Analysis of Experiments, Macmillan.
6. Joshi, D.D. (1987) : Linear Estimation and Design of Experiments, Wiley eastern.
7. Montgromery, C.D.(1976): Design and Analysis of Experiments, Wiley, New York.
8. Pearce, S.C. (1984): Design of Experiments, Wiley, New York.

Paper-II
Inference II

Unit I

Test of Hypothesis: Concepts of critical regions, Test functions, two kinds of errors. Size function, power function, level, M. P. and U,M.P. Test, Neymann Pearson Lemma, M.P. test for simple null against simple alternative hypothesis ,UMP test for simple null hypothesis against one sided alternatives in one parameter exponential family .Unbiased test, UNIFORMELY most powerful unbiased test ,Type "A" critical region or locally most powerful unbiased test. Generalized form of Neyman Pearson lemma.

Unit II

Composite Hypothesis and similar regions, similar regions and complete sufficient statistics, Construction of most powerful similar regions, Unbiased critical regions, optimum regions and Sufficient Statistics. Likelihood ratio test, properties of likelihood ratio test, Likelihood ratio test for the mean of normal population, LR test for equality of means and variances of two and several normal populations.

Unit III

Sequential analysis: Wald's sequential probability ratio test (SPRT) with prescribed errors of two types, OC and ASN function of SPRT

Unit IV

Non parametric test, Rank test, Wilcoxon test, Median test, Sign test, Mann-Whitney U test, Wald-Wolfowitz run test, Kolomogorov-Smirnov test, One sample location problem, chi square test of goodness of fit.

UNIT-V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Kale, B.K. (1999): A first Course on Parametric Inference, Narosa Publishing House.
2. Rohatgi V. (1988): An Introduction to Probability and Mathematical Statistics. Wiley Eastern Ltd. NewDelhi (Student Edition)
3. Lehmann, E.L.(1986)-(Latest): Theory of point Estimation (Student Edition).
4. Lehmann, E.L.(1986): Testing Statistical hypotheses (Student Edition).
5. Rao, C. R. (1973): Linear Statistical Inference.
6. Zacks, S. (1971): Theory of Statistical Inference, John Wiley and Sons, New York.
7. Gibbons,J.D.(1985) : Nonparametric statistical inference 2nd Ed.,Marcel dekker,Inc.
8. Dudewicz, E.J. and Mishra, S.N. (1988). Modern Mathematical Statistics. Wiley Series in Prob. Math. Stat., John Wiley and Sons, New York (International Student Edition)
9. Ferguson, T.S. (1996). A course on Large Sample Theory. Chapman and Hall, London.
10. Ferguson, T.S. (1967) : Mathematical Statistics, Academic Press.

Paper –III

Operations Research II

Unit I

Repllacement problems : Replacement of items that fails and those that deteriorate ,group and individual replacement policies

Unit II

Network analysis,-Shortest Path Problem, Project planning and control with PERT and CPM

Unit III

Integer programming-Branch and Bound technique. Dynamic programming , Deterministic and Probabilistic Dynamic programming: decision tree and Bellman's Principle of optimality, models of dynamic programming,

Unit IV

Quadratic programming ,Kuhn-Tucker conditions for quadratic programming problem, Wolf's modified simplex method, Beale's method Goal Programming simulation :Monte Carlo method.

UNIT V

Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCES

1. Taha H.A. (1982) Operational Research : An Introduction ; Macmillan.
2. Hillier F.S. and Leiberman G.J. (1962) Introduction to Operations Research ; Holden Day.
3. Kanti Swarup, Gupta, P.K. and Singh M.M. (1985) Operations Research ; Sultan Chand& Sons.
4. Philips D.T., Ravindran A. and Solberg J. Operations Research, Principles and Practice.
5. Churchman C.W., Ackoff R.L. and Arnoff E.L.(1957) Introduction to Operations Research ; John Wiley.

Paper – IV
Any one of the following (Major Elective)
(a) Reliability and Life Testing
(b) Demography
(c) Econometrics

Paper – IV (a)
RELIABILITY AND LIFE TESTING (Major Elective)

Unit I

Reliability concepts and measures ; reliability function ; hazard rate ; components and systems ; coherent systems ; reliability of coherent systems ; cuts and paths ; modular decomposition ; bounds on system reliability ; structural and reliability importance of components.

Unit II

Life distributions ; common life distributions-exponential, Weibull, gamma etc. Estimation of parameters and tests in these models. Notions of ageing ; IFR, IFRA, NBU, DMRL, and NBUE Classes and their duals ; loss of memory property of the exponential distribution ; closures or these classes under formation of coherent systems, convolutions and mixtures.

Unit III

Univariate shock models and life distributions arising out of them ; bivariate shock models ; common bivariate exponential distributions and their properties. Reliability estimation based on failure times in variously censored life tests and in tests with replacement of failed items .

Unit IV

Stress-strength reliability and its estimation. Maintainability and availability, Maintenance and replacement policies ; availability of repairable systems ; modeling of a repairable system by a non-homogeneous Poisson process. Reliability growth models; Hollander-Proschan and Deshpande tests for exponentiality; tests for HPP vs NHPP with repairable systems. Basic ideas of accelerated life testing.

Unit V

Four short notes, one from each unit will be asked. Students have to answer any two.

References

1. Barlow R.E. and Prochan F.(1985) ,Statistical theory of reliability and life testing ,Rinehart and Winston
2. Lawless J.F. (1982) ,Statistical Models and Methods of Life time data ; John Wiley .
3. Bain L.J. and Engelhardt (1991) ;statistical Analysis of Reliability and Life testing Models ,Marcel Dekker.
4. Nelson ,W (1982) ;Applied Life data analysis ; john Wiley .
5. Zacks S.;Reliability Theory ,Springer.

Paper – IV(b)
DEMOGRAPHY (Major Elective)

UNIT – I

Coverage and content errors in demographic data, Chandrasekharan-Deming formula to check completeness of registration data, adjustment of age data-use of Whipple, Myer and UN indices, Population transition theory.

UNIT – II

Measures of fertility; Stochastic models for reproduction, distributions of time of birth, inter-live birth intervals and of number of births (for both homogeneous and homogeneous group of women), estimation of parameters; estimation of parity progression from open birth interval data.

UNIT – III

Measures of Mortality; construction of abridged life tables, infant mortality rate and its adjustuemts, model life table. Stable and quasi-stable populations, intrinsic growth rate. Models of population growth and their filling to population data.

UNIT – IV

Internal migration and its measurement, migration models, concept of international migration. Methods for population projection, component method of population projection, Nuptiality and its measurements.

References:

1. Kumar, R.(1986): Technical Demography, Wiley Eastern Lts.
2. Benjamin, B.(1969): Demographic Analysis, George, Allen and Unwin.
3. Chiang, C.L.(1968): Introduction to Stochastic Progression.
4. Cox, P.R. (1970): Demography, Cambridge University Press.
5. Keyfitz, N. (1977): Introduction to the Mathematics of Population-with Revision, Addison-Wesley, London.
6. Spiegelman, M.(1969): Introduction to Demographic Analysis, Harvard University Press.
7. Wolfenden, H.H.(1954): Population Statistics and Their Compilation, Am Actuarial Society.

<div align="center">

Paper – IV(c)
ECONOMETRICS (Major Elective)

</div>

UNIT – I

Nature of econometrics, the general linear model (GLM) and its extensions, ordinary least squares (OLS) estimation and prediction, generalized least squares (GLS) estimation and prediction, heteroscedastic disturbances, pure and mixed estimation.

UNIT – II

Auto correlation, its consequences and tests. Theil BLUS procedure, estimation and prediction, multicollinearity problem, its implications and tools for handling the problem, ridge regression. Linear regression and stochastic regression, Instrumental variable estimation. Errors in variables.

UNIT – III

Autoregressive linear regression, lagged variables, distributed lag models, estimation of lags by OLS method, Koyck's geometric lag model, Simultaneous linear equations model and its generalization, identification problem, restrictions on structural parameters, rank and order conditions.

UNIT – IV

Estimation in simultaneous equations model, recursive systems, 2 SLS estimators, limited information estimators, k-class estimators. 3 SLS estimator, full information maximum likelihood method, prediction and simultaneous confidence intervals.

References:

1 Apte, P.G.(1990): Text books of Econometrics, Tata Mcgraw Hill.
2 Cramer, J.S.(1971): Empirical Econometrics, North Holland.
3 Gujarathi, D.(1979): Basic Econometrics, McGraw Hill.
4 Intrulligator, M.D.(1980): Econometric models-Techniques and applications, Prentice Hall of India.
5 Johnston, J.(1984): Econometric methods. Third edition, McGraw Hill.
6 Klein, L.R. (1962): An introduction to Econometrics, Prentice Hall of India.
7 Koutsoyiannis, A. (1979): Theory of Econometrics, Macmillan Press.
8 Malinvaud, E. (1966): Statistical methods of Econometrics, North Holland.
9 Srivastava, V.K. and Gelies D.A.E.(1987): Seemingly unrelated regression equations models, Maicel Dekker.
10 Theil, H. (1982): Intruduction to the theory and practice of Econometrics, John Wiley.
11 Walters, A. (1970): An introduction to Econometrics, Macmillan & Co.
12 Wetherill, G.B.(1986): Regression analysis with application, Chapman Hall.

Paper V : Lab Course I : Practical based on Papers I, II and III
Paper VI :   **Project Work**

PT. RAVISHANKAR SHUKLA UNIVERSITY: RAIPUR
SCHOOL OF STUDIES IN STATISTICS

Syllabus and Scheme of Examination
M.Phil (Statistics) Course, 2018-19

Scheme of Examination

S.No.	Title of the Paper	Max.Mark
1.	Paper – I(Compulsory): Research Methodology ,Quantitative Methods & Computer application	100
2.	Paper – II (Optional) : Advanced Operations Research	100
3.	Paper III: Lab Course : Practical Based on Theory Papers I & II	100*
4.	Paper IV : Dissertation	200
5.	Paper V : Seminar & Viva-voce on Dissertation	100
	Total Marks	**600**

* The examination of Lab Course will be of 4 hours duration and shall carry 100 marks out of which 10 marks shall be fixed for viva -voce and 20 marks for practical record.

Paper-I (Compulsory)

Research Methodology ,Quantitative Methods & Computer applications

Unit I : Research methodology: An introduction ,meaning of research ,objective of research, Research Methods versus Methodology, Selection of research problem, Necessity of defining the problem. Technique involved in Defining a problem.

Methods of Data Collection: Collection of Primary data, construction of questionnaire, Collection of data through questionnaire, Difference between questionnaires and schedules ,Some other methods of data collections, Collection of Secondary data, Processing and analysis of data. Use of Statistical packages, SPSS for data analysis.

Unit II: A review of Simple Random Sampling, Estimation of population proportion, Stratified sampling, Optimum Allocation, Practical difficulty in adopting Neyman Allocation, formation of strata. Systematic sampling.

Unit III: PPS sampling , Desraj Estimator, Horwitz-Thompson estimator and its variance estimation, Yates-Grundy form, Midzuno sampling scheme, Rao- Hartley- Cochran's Procedure. Multistage sampling.

Unit IV: Ratio and Regression methods of estimation in various sampling designs. OIkin's multivariate ratio estimator, Multivariate regression estimator. Product method of estimation. Quenouille method of bias reduction. Introduction to super population models. Properties of Ratio and Regression estimators under super population models. Multiphase sampling.

UNIT-V: Four short notes, one from each unit will be asked. Students have to answer any two.

References :

1. Freedman,P.,"The Principles of Scientific Research,2nd ed.,new York Pergamon Press,1960

2. Gaum,Carl G.,Graves ,Harod F.,and Hoffman ,Lyme,S.S.,Report Writing ,New York : Barnes & Noble ,Inc,1956.
3. Weller;S.;Romney,A,"Systematic Data Collection ",(Qualitative Research Method Series 10)
4. C.R.Kothari,"Research Methodology", Second Edition, Wishwa Publication, Wiley Eastern Limited, New Delhi.
5. Mukhopadhyay, P. (1998): Theory and methods of Survey Sampling , Prentice-Hall of India Pvt. Ltd. New Delhi.
6. Sukhatme ,P.V. Sukhatme,B.V. Sukhatme S. and Ashok,C.(1984):Sampling Theory of Survey with Applications, IASRI Publication, New Delhi.

Paper-II (Optional)

Operations Research

Unit I : Definition and scope of Operational Research ; phases in Operations Research; models and their solutions ; decision –making under uncertainty and risk, use of different criteria; The structure and formation of a linear programming problem, Graphical and simplex procedure, Two phase method and Charne's M-method.

Unit II: Review of LPP Advanced Linear Programming, Validity Proofs of the Simplex Method , Generalized Simplex Tableau in Matrix Form, Efficient Computational Algorithms,

Duality LPP, Goal Programming, A Goal-Programming Formulation, Goal-Programming Algorithms, Integer Linear Programming, Applications of Integer-Programming and Solution Algorithms.

Unit III: Decision Environments, Decision-Making under Certainty, Decision-Making under Risk, Decision under Uncertainty. Concept of games and strategy , Pure and mixed strategies, saddle point of a matrix game, Graphical method, Dominance Principle, LPP method for solving games.

Unit IV : Project Management : PERT and CPM, Basic Differences between PERT and CPM, Steps of PERT/CPM Techniques, PERT/CPM Network Components and Precedence Relationships, Critical Path Analysis, Probability in PERT Analysis Project Time Cost Trade off, Updating of the Project, Resource Allocation.

UNIT-V
Four short notes, one from each unit will be asked. Students have to answer any two.

REFERENCE :

1.   Hamdy A. Taha : Operations Research an : Introduction. Prentice-Hall India

2.   J. K. Sharma : Operations Research : Theory and Applications. Macmillan India Limited.

3.   Olvi L Mangasarian : Non Linear Programming : Tata McGraw-Hill Publishing Company Ltd.

PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR

SCHOOL OF STUDIES IN STATISTICS

Syllabus for Ph. D. Course Work in Statistics, 2016-17

The Ph.D. Course in Statistics shall be of six months.. This course shall have two papers.. Paper I is theory paper and Paper II is project course work. Each paper is of 100 marks .Theory paper will be of 3 hours duration. In paper II, 40% marks will be assigned to seminar which will be evaluated by departmental research committee and 60% marks will be assigned to project work which will be evaluated by external and internal examiner jointly.

Scheme of Examination	
Paper I : **Research Methodology , Quantitative Methods & Computer Applications**	:**100 Marks**
Paper II : **Review of Literature concerning the topic of research and Seminar/Project report** **(a) Seminar** **(b) Project work and Viva Voce**	:**100 Marks** 40 marks 60 marks
Total Marks	**200** Marks

Paper I

Research Methodology, Quantitative Methods & Computer applications.

Unit I: Research methodology: An introduction, meaning of research ,objective of research, Research Methods versus Methodology, Selection of research problem, Necessity of defining the problem. Technique involved in Defining a problem. Methods of Data Collection: Collection of Primary data, construction of questionnaire, Collection of data through questionnaire, Difference between questionnaires and schedules, Some other methods of data collections, Collection of Secondary data, Processing and analysis of data. Use of Statistical package, SPSS for data analysis.

Unit II: A review of Simple Random Sampling, Estimation of population proportion, Stratified, Optimum Allocation, Practical difficulty in adopting Neyman Allocation, formation of strata. Systematic sampling. PPS sampling, Multistage sampling. Ratio and Regression methods of estimation in various sampling designs.

1

Unit III: The structure and formation of a linear programming problem,Graphical and simplex procedure,Two phase methods, and charne's-M method with artificial variables ; duality theorem. **T**ransportation and Assignment problems, Routing and traveling salesman problem. Inventory problems – Deterministic models of inventory , Economic Lot size formula ,instantaneous production case ,finite production rates situation ,cases when shortages are allowed /not allowed. Stochastic inventory models – a single period model with no set up cost.

UNIT-IV
Acceptance sampling plans for attribute inspection ; single, double and sequential sampling plans and their properties ; Bayesian sampling plan. Plans for inspection by variables for one-sided and two-sided specifications; Continuous sampling plans of Dodge type and Wald-Wolfiwitz type and their properties

UNIT-V: Life distributions ; common life distributions-exponential, Weibull, gamma etc. Estimation of parameters and tests in these models. Notions of ageing ; IFR, IFRA, NBU, DMRL, and NBUE Classes and their duals ; loss of memory property of the exponential distribution ; closures or these classes under formation of coherent systems, convolutions and mixtures. Univariate shock models and life distributions arising out of them ; bivariate shock models ; common bivariate exponential distributions and their properties. Reliability estimation based on failure times in variously censored life tests and in tests with replacement of failed items.

References:

1. Freedman,P.,"The Principles of Scientific Research,2nd ed.,new York Pergamon Press,1960

2. Gaum,Carl G.,Graves ,Harod F.,and Hoffman ,Lyme,S.S.,Report Writing ,New York : Barnes & Noble ,Inc,1956.
3. 3. Weller;S.;Romney,A,"Systematic Data Collection ",(Qualitative Research Method Series 10)
4. C.R.Kothari,"Research Methodology",Second Edition,Wishwa Publication,Wiley Eastern Limited,New Delhi.
5. Mukhopadhyay, P. (1998): Theory and methods of Survey Sampling , Prentice-Hall of India Pvt. Ltd. New Delhi.
6. Sukhatme ,P.V. Sukhatme,B.V. Sukhatme S. and Ashok,C.(1984):Sampling Theory of Survey with Applications, IASRI Publication, New Delhi.

PT. RAVISHANKAR SHUKLA UNIVERSITY RAIPUR (C.G.)

B.Ed. SYLLABUS 2018-19

SL.NO.	PAPER	EXTERNAL	INTERNAL
			THEORY/PRACTICAL
SEMESTER I	**THEORY**		
Paper I	Philosophical Perspectives of Education	80	20
Paper 2	Learner and Learning Process	80	20
Paper 3	Pedagogy Part I	80	20
	PRACTICUM		
	Preparation of Teaching Aids		50
	Community Activities		50
SEMESTER II	**THEORY**		
Paper 4	Sociological Perspectives of Education	80	20
Paper 5	Curriculum and Knowledge	80	20
Paper 6	Elective I	80	20
Paper 7	Art Education	80	20
	PRACTICUM		
	Internship (One Month)		50
	School Experience –		
	a) Observation of School Doc.		
	b) Mentor's Report		
SEMESTER III	**THEORY**		
Paper 8	Pedagogy Part II	80	20
Paper 9	Assessment in Learning	80	20
	PRACTICUM		
	Internship (4 Months)		100
	Reflective Diary & Supervisor's Assessment		50
SEMESTER IV	**THEORY**		
Paper 10	Gender, School and Society	80	20
Paper 11	Language Proficiency	100	
Paper 12	Elective II	80	20
	PRACTICUM		
	Training in Yoga and Sports & Games		50
	Psycho-Metric Assessment	50	
	Viva Voce on Teaching Experience	100	
	TOTAL	1130	220 + 350 = 570
	GRAND TOTAL	1700	
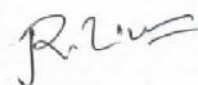
Curriculum Framework

B.ED. TWO YEAR COURSE 2018-2020.

Curriculum Organization based on NCTE framework			
Semester I	*Semester II*	*Semester III*	*Semester IV*
THEORY	THEORY	THEORY	THEORY
(C) Philosophical perspectives of Education (4 credits)	(C) Sociological perspectives of Education (4 credits)	(S) Pedagogy II (4 credits)	(C S) Gender, School & Society (4 credits)
(C) Learner & Learning Process (4 credits)	(C) Curriculum & Knowledge (4 credits)	(T E) Assessment in Learning (2 credits)	(T E) Language proficiency (4 credits)
	(E) Elective I (4 credits)		(E) Elective II (4 credits)
(S) Pedagogy I (4 credits)	(T E) Arts Education (2 credits)		
PRACTICUM	PRACTICUM	PRACTICUM	PRACTICUM
Preparation of Teaching Aids (2 credits) Community Activities (2 credits)	Internship (4 Weeks) (4 credits) School Experience I (2 credits) a) Observation report of school documents b) Mentor's Report.	Internship (16 Weeks) (10 credits) Reflective Diary (2 credits) Supervisor's Assessment (2 credits)	Psycho-Metric Assessment (2 credits) Teaching Exam & Viva Voce on Teaching
12 + 4 = 16 Credits	14 + 6 = 20 Credits	6 + 14 = 20 Credits	12 + 2 = 14 Credits
C: Core Paper, E: Elective Paper, TE: Teacher Enrichment, CS: Contemporary Study			

B.ED. SYLLABUS (SEMESTER I)

PAPER - I

PHILOSOPHICAL PERSPECTIVE OF EDUCATION

COURSE OBJECTIVES:

To enable the student- teacher understand

1. The relationship between Philosophy and Education and implications of philosophy on education.

2. The importance and role of education in the progress of Indian society.

3. The contribution of great educators to the field of education.

4. The need to study education in a sociological perspective. The process of social change and socialization to promote the development of a sense of commitment to the teaching profession and social welfare.

5. Their role in creation of a new social order in the country and learn about various social welfare opportunities in which they can participate helpfully.

6. The means and measures towards the promotion of National integration and protection of human rights.

COURSE CONTENTS:

UNIT-I: AIMS OF EDUCATION

> Education Nature and Meaning its objectives/ aims in relation to the time and place.

> Educational aims in the Western context: with specific reference to Russell, Dewey. Their impact on educational thought and class room practices, in term of progressive trends in educa- tion.

> Educational aims in the Indian context with specific reference to Indian thinkers such as Gandhi, Tagore.

> Philosophy and Education: Significance of studying philosophy in understanding educational practices and problem.

UNIT – II: PHILOSOPHICAL SYSTEMS

Major Philosophical systems - their salient features and their impact on education.

a) Realism with reference to Aristotle and Jainism.

b) Naturalism with reference to the view! of Rousseau and Rabindra Nath Tagore.

c) Idealism with reference to Plato. Socretes and Advaita Philosophy.

d) Pragmatism with reference to Dewey "instrumentalism & Experimentalism"

e) Humanism: Historical, Scientific and Buddhists.

UNIT-III : INDIAN THINKERS

➢ Educational thinkers and their contribution in developing principles of education.

➢ M.K. Gandhi Basic tenets of Basic education.

➢ Gijju Bhai The world of the child.

➢ Swami Vivekananda : Man making education.

➢ Sri Aurobindo Integral education, its basic premises; stages of development.

➢ J. Krishna Murthy; Child Centered Education.

UNIT – IV: WESTERN THINKERS

❖ JJ Rousseau

❖ John Dewey

❖ Antonio Gramsci (Neo- Gramscian Theory)

❖ Paulo Friere (Democratic Education)

UNIT – V: CONTEMPORARY THOUGHT
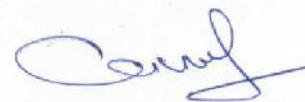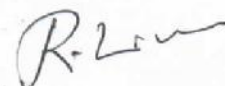
➢ Critical and comparative study of the period and socio- political perspective of the western and Indian Thinkers.

➢ Contemporary philosophical perspectives of Education; Modernization, globalization in thought and education

REFERENCES:

1. Anand C.L. et.al. : Teacher and Education in Emerging India, NCERT, New Delhi.

2. Anant Padmnabhan : Population Education in Classrooms, NCERT, New Delhi.

3. Bhatnagar, S.: Adhunik Bhartiya Shiksha Aur Uski Samasyayen, Lyall Book Depot, Meerut.

4. Chakravorty M.: Gandhian Dimension in Education Daya Publishing House New Delhi.

5. Mani R.S.: Educational ideas and ideals of Gandhi and Tagore, New Book Society, New Delhi.

6. Ministry of Human Resource Development: National Policy on Education, 1896, New Delhi.

7. Mohanty Jagannath: Indian Education in Emerging Society, Sterling Publication, New Delhi.

8. Pandey, Shyam Swaroop: Shiksha ki Darshanik evam Samajik Shastriya Pursht Bcomi Vinod Pustak Mandir, Agra.

9. Pathak and Tyagi : Shiksha ke Samnya Siddhant, Vinod Pustak Mandir, Agra.

10. Pathak, RD. and Tyagi, I.S.D. Shiksha ke Samariya Siddhant. Vinod Pustak Mandir, Agra.

11. Saxena, N.R. Swaroop Shiksha Ke Samanya Siddhant, Lall Book Depot, Meerut.

12. Singh B.P.: Alms of Education in India, Ajanta Publication New, Delhi.

13. Agrawal, J.C.: Nai Shiksha Niti. Prabhat Prakashan, Delhi.

14. Bhatnagar, R.P. Technology of Teaching, International Publishing House, Meerut.

15. Freire, Paulo; Pedagogy of the oppressed, Translated by Myra Bergaman Ramos, The Continuum Publishing Corporation, New York, NY, 1987.

16. Freire, Paulo; Thepolitics of Education- Culture, Power, Liberation, Translated by Donoldo Mecedo, Bergin & Garvey, New York, NY, 1985.

17. Bhatnagar, Suresh Shiksha Ki Samasyaen, Lyall Book Depot, Meerut.

18. Bhooshan, Shailendra & Anil Kumar: Shikshan Taknik. Vinod Pustak Mandir, Agra.

19. Manav Sansadhan Vikas mantralaya: Rashtriy Shiksha Niti 1986. New Delhi.

20. Safaya. Raghunath,. School Sangathan, Dhanpat Ram & Sons, Delhi.

21. Sampath, K.: Introduction to Educational Technology, Sterling Publishers, New Delhi.

22. Saxena, N.R. Swaroop, Shikshan Kala Ewam Paddatiyan. Lyall Book Depot, Meerut.

23. Sharma & Sharma Secondary Education and teacher Functions, Radha Publisher Mandir Agra.

24. Higher Education in India ; Albach

CORE STUDY (SEMESTER I)

PAPER 1I- LEARNER AND LEARNING PROCESS COURSE OBJECTIVES

To enable teachers trainee to -

1. Acquire knowledge and understanding of stages of human development and developmental tasks; with special reference to adolescents learners.

2. Develop understanding of process of children learning in the context of various theories of learning.

3. Understand intelligence, motivation and various types of exceptional children.

4. Develop skills for effective teaching learning process and use of psychometric assessment.

UNIT-I

Nature of psychology and learners

- Psychology : Its meaning, nature, methods and scope; functions of educational psychology.

- Stages of human development ;stage specific characteristics and developmental tasks.

- Adolescence in Indian context - characteristics and problems of adolescents; their needs and aspirations.

- Guidance and counselling for adolescents.

UNIT-II
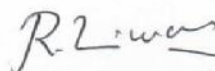
Learning

- Nature of learning; learning theories with specific reference to Piaget (Cognitive) Theory and Vigotsky's social learning.

- Factors influencing learning and teaching process: learner related; teacher related: process related and content related.

UNIT-III

Intelligence

- Nature and characteristics of intelligence and its development.

- Theories of intelligence; two factor theory - Multifactor Theory (PMA) and SI Model.

- Measuring intelligence - Verbal, non-verbal and Performance tests (one, representative of group test and individual test of each),

- Creativity - definition, measurement.

UNIT-IV

Exceptional Children
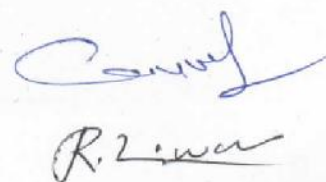
- Concept of exceptional children - types, and characteristics of each type including Children with learning disabilities.

- Individual differences - Nature; accommodating Individual differences in the class-room. Learner centered techniques for teaching exceptional children.

- Personality- Definition, meaning and nature; development of personality; type and trait theories of personality.

- Group Dynamics. Psycho-analysis.

UNIT-V: Socialization, Culture and Education in Indian context

- History of Indian psychology with specific reference to religions and epics.

- Durganad Sinha's cognitive development

- Understanding diversity in Indian culture

REFERENCES

1. Bhatia, H.R.: Elements of Educational Psychology, Orient Langman Ltd., Bombay.

2. Chauhan, S.S.: Advance Educational Psychology, Vikas publishing House. New Delhi.

3. Chauhan, S.S.: Psychology of Adolescence, Allied Publishers, New Delhi.

4. Garrett, H.E.: Statistics in Psychology and Education, Vakils, Fetter and simo Ltd. Bombay

5. Gulati, Sushma: Education for Creativity, NCERT, 1985.

6. Huriock, E.B.: Adolescent Development, McGraw Hill. New York.

7. Kapil, H.K.: Sankhiyiki ke Mool Tatva, Vinod pustak Mandir, Agra.

8. Kulshrenta S.P.: Educational Psychology.

9. Mangal, S.K.: Psychological Education, Prakash Brother, Ludhiana.

10. Mathur, S.S.: Educational Psychology, Vinod Pustak Mandir, Agra.

11. Mathur, S.S.: Shiksha Manovigyan, Lyoll Book Dept Meerut

12. Srivastava, G. N. P.: Recent Trends in Educational Psychology, Psycho, Research Cell. Agra.

13. Tripathi, S. N.: Prathiba Aur Srijntmakta, Mcmillan Co.. Bombay.

14. Psychology in a Third world country: the Indian experience by Durganand Sinha

15. Motivation and Rural development by Durganand Sinha

PAPER III : PEDAGOGICAL STUDIES (SEMESTER I)

PEDAGOGY OF MATHEMATICS (Part I)

Total Marks: 100

Aims of the Course

After completion of course the students will be able to:

- Develop insight into the meaning, nature, scope and objective of mathematics education;

- Appreciate mathematics as a tool to engage the mind of every student;

- Appreciate mathematics to strengthen the student's resource;

- Appreciate the process of developing a concept;

- Appreciate the role of mathematics in day-to-day life;

- Learn important mathematics: mathematics is more than formulas and mechanical procedures;

- Channelize, evaluate, explain and reconstruct their thinking;

- See mathematics as something to talk about, to communicate through, to discuss among themselves, to work together on;

- Pose and solve meaningful problems;

- Appreciate the importance of mathematics laboratory in learning mathematics;

- Construct appropriate assessment tools for evaluating mathematics learning;

- Develop ability to use the concepts for life skills;

- Stimulate curiosity, creativity and inventiveness in mathematics;

- Develop competencies for teaching-learning mathematics through various measures

- Focus on understanding the nature of children's mathematical thinking through direct observations of children's thinking and learning processes; and

- Examine the language of mathematics, engaging with research on children's learning in specific areas.

COURSE OUTLINE: Part I

UNIT 1: NATURE AND SCOPE OF MATHEMATICS

Meaning and scope of mathematics, A mathematical theorem and its variants—converse, inverse and contra-positive, proofs and types of proofs, Difference between proof and verification; Deductive nature of mathematics; History of mathematics with special emphasis on teaching of

mathematics, contribution of Indian mathematicians; Aesthetic sense in mathematics and beauty in mathematics.

UNIT 2: EXPLORING LEARNERS

Cultivating learner's sensitivity like intuition, encouraging learner for probing, raising queries, appreciating dialogue among peer -group, promoting the student's confidence (Carrying out examples from various mathematical content areas, such as Number Systems, Geometry, Sets, etc.).

UNIT 3: AIMS AND OBJECTIVES OF TEACHING SCHOOL MATHEMATICS

Need for establishing general objectives for teaching mathematics; Study of the aims and general objectives of teaching mathematics vis-a-vis the objectives of school education; writing specific objectives and teaching points of various content areas in mathematics like Algebra, Geometry, Trigonometry, etc.

UNIT 4: SCHOOL MATHEMATICS CURRICULUM

Objectives of curriculum, principles for designing curriculum, designing curriculum at different stages of schooling, Some highlights of curriculum like vision of school mathematics, main goal of mathematics education, core areas of concern in school mathematics, curricular choices at different stages of school mathematics education, construction of syllabi in various disciplines of mathematics, for example, Algebra, Geometry, etc.; Pedagogical analysis of various topics in mathematics at various level of schooling—Arithmetic (Development of Number Systems), Algebra, Trigonometry, Statistics and Probability, etc.

UNIT 5: APPROACHES AND STRATEGIES IN TEACHING AND LEARNING OF MATHEMATICAL CONCEPTS
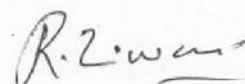
Nature of concepts, concept formation and concept assimilation, Moves in teaching a concept—defining, stating necessary and/or sufficient condition, giving examples accompanied by a reason. Comparing and contrasting; Giving counter examples; Non-examples; Planning and implementation of strategies in teaching a concept like teaching of algebra, geometry, trigonometry, mensuration, etc.; Difference between teaching of mathematics and teaching of science.

REFERENCES

1. The history & concept of mathematical proof- Steven G.2007

2. One of the oldest Extent digrams from Euclid - Bill Casselman 2008

3. How to teach mathematics –S.K.Arora (Bhimani) : Shanti Publisher's 1998

4. How children learn mathematics – Capeland (New York): M.C.Millan Pub. 1979

5. Mathematics for modern mind – W.R.Fuch (New York): M.C.Millan Pub. 1967

6. Vidyalaya Ganit ke liye sau prayog – J.N.Kapoor (New Delhi): Arya book Depot 1968

7. How to teach mathematics in secondary school – W.B.Saunders (Company) 1967

8. The spirit of mathematics J.N.Kapoor (New Delhi): Arya book Depot 1964

9. Indian Mathematics – Ashok Jhunjhunwala (New Delhi) Wiley Eastern Ltd. 1993

10. Curricullum and teaching of mathematics in secondary school , (R.C.Sexena) NCERT 1970

11. The teaching of mathematics in the new Education – N.K.Ayangar

12. Teaching of essentials of mathematics, Ballard,p.b.

13. The development of mathematics, Bell,E.T.

14. The teaching of mathematics, Chadha,B. N.

15. The teaching of secondary mathematics,BUTTER & WREN

16. The teaching of arithmetic, C.POTTER,F.F.

17. MATHEMATICS FOR CLASS 9TH NCERT

18. MATHEMATICS FOR CLASS 10TH NCERT

19. TEACHING OF MATHEMATICS(ENG\HINDI),Dr. S.K. MANGAL

20. TEACHING OF MATHEMATICS (ENG/HINDI), Dr.A.B. BHATNAGER

21. TEACHING OF MATHEMATICS, A.K. KULSHESTHA.

PAPER III : PEDAGOGY OF BIOLOGICAL SCIENCE

Total Marks: 100

Aims of the Course:
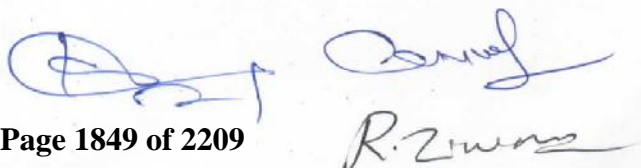
After Completion of Course the Students will be able to:

❖ Develop insight on the meaning and nature of biological science for determining aims and strategies of teaching-learning;

❖ Appreciate that science is a dynamic and expanding body of knowledge;

❖ Appreciate the fact that every child possesses curiosity about his/her natural surroundings

❖ Identify and relate everyday experiences with learning biological science;

❖ Appreciate various approaches of teaching-learning of biological science;

❖ Explore the process skill in science and role of laboratory in teaching– learning;

❖ Use effectively different activities/experiments/demonstrations/ laboratory experiences for teaching–learning of biological science;

❖ Integrate the biological science knowledge with other school subjects;

❖ Analyse the contents of biological science with respect to its branches, process skills, knowledge organisation and other critical issues;

❖ Develop process-oriented objectives based on the content themes/units;

❖ Identify the concepts of biological science that are alternatively conceptualised by teachers and students in general;

❖ Explore different ways of creating learning situations for different concepts of biological science;

❖ Formulate meaningful inquiry episodes, problem-solving situations, investigatory and discovery learning projects based on upper primary, secondary and higher secondary stages, facilitate development of scientific attitudes in learners;

❖ Examine different pedagogical issues in learning biological science;

❖ Construct appropriate assessment tools for evaluating learning of biological science;

❖ Stimulate curiosity, inventiveness and creativity in biological science;

❖ Develop ability to use biological science concepts for life skills; and

❖ Develop competencies for teaching, learning of biological science through different measures.

Course Outline Part I:

UNIT I: NATURE AND SCOPE OF BIOLOGICAL SCIENCE

Science as a domain of enquiry, dynamic body of knowledge and as a process of constructing knowledge; Biological Science for environment and health, peace, equity; History of biological

science, its nature aknowledge of biological science independent of human application; Origin of life and evolution, biodiversity, observations and experiments in biological sciences; Interdisciplinary linkages, biological sciences and society.

UNIT II: AIMS AND OBJECTIVES OF BIOLOGICAL SCIENCE

Developing scientific attitude and scientific temper; Nurture the natural curiosity, aesthetic senses and creativity in biology; Acquire the skills to understand the methods and process that lead to exploration; Generalisation and validation of scientific knowledge in biological science; Relate biology education to environment (natural environment, artifacts and people) and appreciate the issues at the interface of science technology and society; Imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment; Solving problems of everyday life; Know the facts and principles of biology and its applications consistent with the stages of cognitive development of learners; Specific objective of different content areas in biology.

UNIT III: EXPLORING LEARNERS

Motivating learner to bring his/her previous knowledge in science/biology gained through classroom/environment/parents and peer group Cultivating in teacher-learner the habit of listening to child; Generating discussion, involving learners in teaching-learning process, encouraging learners to raise questions, appreciating dialogue amongst peer groups, encouraging learners to collect materials from local resources and to develop/fabricate suitable activities in biological science (individual or group work); Role of learners in negotiating and mediating learning in biology.

UNIT IV: SCHOOL SCIENCE CURRICULUM (BIOLOGICAL SCIENCE)

Trends in Science curriculum; Consideration in developing learner-centred curriculum in biology; Analysis of textbooks and biology syllabi of NCERT and States/UTs at upper primary, secondary and higher secondary stages; Analysis of other print and non-print materials in the area of biological science used in various states.

UNIT V: APPROACHES AND STRATEGIES OF LEARNING BIOLOGICAL SCIENCE
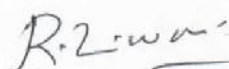
Pedagogical shift from science as fixed body of knowledge to process constructing knowledge, scientific method - observation, enquiry, hypothesis, experimentation, data collection, generalisation (teacher-educator will illustrate taking examples from different stage-specific content areas keeping in mind the variation, e.g. structure and function, molecular aspects, interaction between living and non living, biodiversity, etc.); Communication in biological sciences; Problem solving, investigatory approach, concept mapping, collaborative learning, and experiential learning in biological science (teacher- learner will design learning experiences using each of these approaches); Facilitating learners for self-study.

References:

1. Modern Methods of Teaching Biology. Sarup Teaching Series Sarup & Sons, New Delhi.

2. Bhaskara Rao, D (2000): Teaching of Biology, Nagarjuna Publishers, G4.

3. Moha, Radha(2004):Innovative Science Teaching, Prentice Hall of India, New Delhi

4. New Unesco Source Book for Science Teaching (1978), Oxford & IBH, New Delhi.

5. Sharma, R.C. & Shukla C.S.(2002): Modern Science Teaching, Dhanpat Rai, Publishing Company, New Delhi.

6. Sood, K.J.{1989): New Directions in Science Teaching, Kohli Publishers, Chandigarh

7. Vaidya, N(1996): Science Teaching for the 21st Century Deep & Deep Publications, New Delhi.

8. Gupta S.K. (1983): Technology of Science Education, Vikas Publishing House Pvt Ltd, Delhi

9. www.wikipedia.com Chikara, M.S. and S.Sarma(1985): Teaching of Biology, Prakash brothers, Ludhiana unter

10. S.K. Mangal: Teaching of Biological Science.

11. Dr. Shoti Shivendra Chandra: Contemporary Science Teaching.

12. R.A. Yadav, Siidiqui: Teaching of Science.

13. Prof. S.K. Tyagi : Teaching of Biological Sciences.

14. Dr. A.K. Kulshrestha: Teaching of Biological Sciences.

15. All NCERT Science Text Books from class IX to XII.

PAPER III: PEDAGOGY OF PHYSICAL SCIENCE

Total Marks: 100

Aims of the Course:

After Completion of Course the Students will be able to:

- Gain insight on the meaning and nature of physical science for determining aims and strategies of teaching-learning;

- Appreciate that science is a dynamic and expanding body of knowledge;

- Appreciate the fact that every child possesses curiosity about his/her natural surroundings;

- Identify and relate everyday experiences with learning physical science;

- Appreciate various approaches of teaching-learning of physical science;

- Understand the process of science and role of laboratory in teaching-learning situations;

- Use effectively different activities/demonstrations/laboratory experiences for teaching-learning of physical science;

- Integrate in physical science knowledge with other school subjects;

- Analyse the contents of physical science with respect to its branches, process skills, knowledge organisation and other critical issues;

- Develop process-oriented objectives based on the content themes/units;

- Identify the concepts of physical science that are alternatively conceptualised by teachers and students in general;

- Explore different ways of creating learning situations in learning different concepts of physical science

- Formulate meaningful enquiry episodes, problem-solving situations, investigatory and discovery learning projects based on upper primary, secondary and higher secondary school science/physics and chemistry

- Facilitate development of scientific attitudes in learners;

- Examine different pedagogical issues in learning physical science; and

- Construct appropriate assessment tools for evaluating learning of physical science.

Important: Various Concepts of Pedagogy of Physical Science listed in Units 1 to 10 (PART I & PART II) given below will be evolved around the concepts given at upper primary, secondary and higher secondary (Physics and Chemistry) Science syllabi.

Course Outline Part I

UNIT I: NATURE OF SCIENCE

Science as a domain of enquiry, as a dynamic and expanding body of knowledge; Science as a

process of constructing knowledge; Science asinterdisciplinary area of learning (Thermodynamics, Biomolecules, Surface Chemistry, etc.); Facts, concepts, principles, laws and theories—their characteristics in context of physical science (citing examples for each); Physical science for environment, health, peace, equity; Physical sciences and society; Contribution of eminent scientists—Isaac Newton, Dalton, Neils Bohr, De Broglie, J. C. Bose, C. V. Raman, Albert Einstein, etc.

UNIT II: AIMS AND OBJECTIVES OF PHYSICAL SCIENCE

Developing scientific attitude and scientific temper, Nurture the natural curiosity, aesthetic senses and creativity in Science (secondary stage)/ Physics and Chemistry (higher secondary stage); Acquire the skills to understand the method and process of science/physical science that lead to exploration, generation and validation of knowledge in science/physical science; Relate Science/Physics and Chemistry education to the environment (natural environment, artifacts and people) and appreciate the issues at the interface of science technology and society; Imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment, Solving problems of everyday life; Know the facts and principles of science/physics and chemistry and its applications consistent with the stages of cognitive development of learners, (e.g. Mechanics, Heat, Electricity, Magnetism, Light, Acid, Bases and Salts, Thermodynamics,Metallurgy, Physical and Chemical Changes, Nature and States of Matter, etc.); Specific objective of different content areas in science/physics and chemistry.

UNIT III: EXPLORING LEARNERS

Motivating learners to bring his/her previous knowledge gained in science/ physics and chemistry through classroom/environment/parents and peer group; Cultivating in teacher-learner the habit of listening to child; Generating discussion, involving learners in teaching-learning process; Encouraging learners to raise questions, appreciating dialogue amongst peer group; Encouraging learners to collect materials from local resources (soil, water, etc.) and to develop/fabricate suitable activities in science/ physics and chemistry (individual or group work); Role of learners in negotiating and mediating learning in science/physical science.

UNIT IV: SCHOOL SCIENCE CURRICULUM (PHYSICAL SCIENCE)

Trends in Science curriculum; Consideration in developing learner-centred curriculum in physical science, Analysis of science/physics and chemistry syllabi and textbooks of NCERT and States (at upper primary, secondary and higher secondary stage); Analysis of other print and non-print materials used in various states in the area of physical science.

UNIT V: APPROACHES AND STRATEGIES OF LEARNING PHYSICAL SCIENCE

Pedagogical shift from science as fixed body of knowledge to process of constructing knowledge, scientific method—observation, enquiry, hypothesis, experimentation, data collection, generalisation (teacher-educator will illustrate each taking examples from specific contents of science/physics and chemistry, such as Solutions, Colloids, Chemical Equilibrium, Electrochemistry, Mechanical and Thermal Properties of Matter, Reflection, Refraction, Wave Optics etc.); Communication in Science/Physical science, Problem solving, investigatory approach, concept mapping, collaborating learning and experiential learning in science/ physics and chemistry (teacher-learner will design learning experiences using each of these approaches), facilitating learners for self-study.

References:

1. Moha, Radha(2004):Innovative Science Teaching, Prentice Hall of India, New Delhi

2. New UNESCO Source Book for Science Teaching (1978), Oxford & IBH, New Delhi.

3. Sharma, R.C. & Shukla C.S.(2002): Modern Science Teaching, Dhanpat Rai, Publishing Company, New Delhi.

4. Sood, K.J.{1989): New Directions in Science Teaching, Kohli Publishers, Chandigarh

5. Vaidya, N (1996): Science Teaching for the 21st Century Deep & Deep Publications, New Delhi.

6. Gupta S.K. (1983): Technology of Science Education, Vikas Publishing House Pvt Ltd, Delhi

7. www.wikipedia.com Chikara, M.S. and S.Sarma(1985): Teaching of Biology, Prakash brothers, Ludhiana unter

8. Dr. Shoti Shivendra Chandra: Contemporary Science Teaching.

9. R.A. Yadav, Siidiqui: Teaching of Science.

10. All NCERT Science Text Books from class IX to XII.

11. New UNESCO Source Book for Science Teaching (1978), Oxford & IBH, New Delhi.

12. Sharma, R.C. & Shukla C.S.(2002): Modern Science Teaching, Dhanpat Rai, Publishing Company, New Delhi.

13. Sood, K.J.{1989): New Directions in Science Teaching, Kohli Publishers, Chandigarh

14. Vaidya, N (1996): Science Teaching for the 21st Century Deep & Deep Publications, New Delhi.

15. Gupta S.K. (1983): Technology of Science Education, Vikas Publishing House Pvt Ltd, Delhi

16. S.K. Mangal: Teaching of physical Science.

17. Prof. S.K. Tyagi: Teaching of physical Sciences.

18. Dr. A.K. Kulshrestha: Teaching of physical Sciences.

19. All NCERT Science Text Books from class IX to XII.

20. S.K. Mangal: Teaching of physical Science.

21. Dr. Shoti Shivendra Chandra: Contemporary Science Teaching.

22. R.A. Yadav, Siidiqui: Teaching of Science.

23. Proff. S.K. Tyagi: Teaching of physical Sciences.

24. Dr. A.K. Kulshrestha: Teaching of physical Sciences.

PAPER III: PEDAGOGY OF SOCIAL SCEINCES

Total Marks: 100

This course in the teaching of Social Sciences introduces student teachers to matters of both content and pedagogy. Some emphasis on content seems necessary in view of the fact that many student teachers may not be having sufficient exposure to four major disciplines of Social Sciences. In fact, the pedagogy of a field of enquiry cannot be separated from its content. This course will help student teachers understand key concepts of the various Social Sciences as well as related pedagogical issues. Furthermore, student teachers should be encouraged to see interconnections between the different Social Sciences, i.e. see Social Sciences as an integrated area of study.

Social and economic issues and the concerns of Indian society have been introduced through real-life situations and primary sources of information. *Student-teachers are encouraged to grasp concepts and to develop thinking skills.* That is why, in certain cases, Case Studies for the transaction of topics have been indicated.

Aims of the Course

❖ To develop an understanding of the nature of Social Sciences, both of individual disciplines comprising Social Sciences, and also of Social Sciences as an integrated/ interdisciplinary area of study;

❖ To acquire a conceptual understanding of the processes of teaching and learning Social Sciences

❖ To enable student teachers examine the prevailing pedagogical practices in classrooms critically and to reflect on the desired changes;

❖ To acquire basic knowledge and skills to analyse and transact the Social Sciences curriculum effectively following wide-ranging teaching-learning strategies in order to make it enjoyable and relevant for life;

❖ To sensitize and equip student teachers to handle social issues and concerns in a responsible manner, e.g., preservation of the environment, disaster management, promoting inclusive education, preventing social exclusion of children coming from socially and economically deprived backgrounds, and saving fast depleting natural resources (water, minerals, fossil fuels etc.).

Course Outline Part I

UNIT I: SOCIAL SCIENCES AS AN INTEGRATING AREA OF STUDY: CONTEXT AND CONCERNS

- Distinguishing between Natural and Social Sciences: Major Social Sciences disciplines in Schools.

- What is 'social' about various Social Sciences?

- Uniqueness of disciplines vis-a-vis interdisciplinarity

- Linking child's natural curiosity with natural phenomena like weather, flora and fauna; spatial and temporal contexts; important social and economic issues and concerns of the present-day Indian society.

- Multiple perspectives/plurality of approaches for constructing explanations and arguments.

UNIT II: TEACHING-LEARNING RESOURCES IN SOCIAL SCIENCES

- People as resource: The significance of oral data.

- Types of Primary and Secondary Sources: Data from field, textual materials, journals, magazines, newspapers, etc.

- Using the library for secondary sources and reference material, such as dictionaries and encyclopaedias.

- Various teaching aids: Using atlas as a resource for Social Sciences; maps, globe, charts, models, graphs, visuals.

- Audio-visual aids, CD-Rom, multimedia, internet.

UNIT III: SOCIAL SCIENCES CURRICULUM FOR SCHOOLS IN INDIA

- Curriculum development process: National and State levels.

- Studying the Social Sciences syllabus - aims and objectives, content organisation and presentation of any State Board and CBSE for different stages of school education.

UNIT IV: TEACHING-LEARNING OF GEOGRAPHY—SPACE, RESOURCES AND DEVELOPMENT
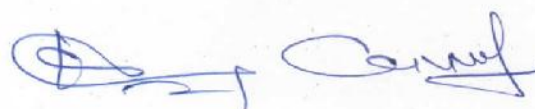
- Meaning, Nature and Scope of Geography: Current Trends

- Teaching and Learning Major Themes and Key Concepts in Geography

- LOCATION: Absolute (Grid system of latitudes and longitudes) and relative location: two ways of describing the positions of places and people on the earth's surface. Differentiating between sites (location) and situation (place).

- PLACE: Distinct physical and human characteristic of places that distinguish one from the other.

- MOVEMENTS: Interdependence and interaction across space, migration of people, transport and communication; trade and commerce, patterns of centres, pathways and hinterlands.

- REGIONS: Formation and change.

- The above content may be used to understand teaching, learning strategies and skill development in Geography.

- Developing Skills in Geography

- Observation, recording and interpretation of physical and social features and phenomena;

Reading and interpreting geographical information through tables, figures, diagrams, photographs; Map reading and interpreting using scale (distance), direction, symbols, point, line and area; Visual-to-verbal and verbal-to-visual transformation leading to mental mapping; Identifying, constructing and asking geographical questions; Developing and gathering relevant information and data and analysing them to answer geographical questions and offering explanations and interpretations of their findings; applying acquired knowledge and skills for understanding the wider world and taking personal decisions; taking up activities to study environmental degradation in the local area and its preservation methods; studying any disaster involving all factors at the local/global levels.

- Teaching Strategies in Geography

- Questioning; Collaborative strategies; Games, simulations and role plays; Values clarification; Problem-solving and decision-making.

- METHODS: Interactive verbal learning; Experiential learning through activities, experiments; Investigative field visits based on students' own interests with teacher's support as facilitator; Engagement with 'places' at an emotional or sensory level using art, poetry and literature.

- TECHNIQUES: Using textbooks and atlas as a part of oral lessons, non-oral working lessons; using medium and large scale maps; using pictures, photographs, satellite imageries and aerial photographs; using audio-visual aids, CDs, multimedia and internet; case study approach.
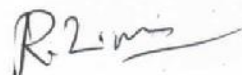
UNIT V: TEACHING-LEARNING OF ECONOMICS: STATE, MARKET AND DEVELOPMENT

- As a branch of social science, economics is concerned with people. It studies how to provide them with means to realise their potential. This unit on economics deals with the broad themes of state, market, and development. Market and state are interrelated as instruments of development. The course endeavours to introduce the learners to key economic concepts and issues that affect their everyday lives.

- Meaning, Nature and Scope of Economics: Current Trends Key Concepts in Economics

- Scarcity and choice, opportunity cost, productivity, demand, supply and market mechanism, Division of labour and specialisation.

- Classification of Economic System

- Capitalism, Socialism, mixed economy (case study: India)

- Developmental Issues in Economics

- Sustainable Development—economic growth and economic development— indicators of measuring the well-being of an economy; Gross Domestic Product; economic planning; Poverty; Food Security; Price rise; Role and functions of Money—formal and informal financial institutions and budget; Classification of Production Activities—primary, secondary and tertiary;

- Economic Reforms and Globalisation (discuss these developmental issues with reference to India).

- The above content may be used to undertstand the teaching, learning strategies and skill development in economics.

- Teaching-Learning Methods in Economics

- In addition to usual methods like lecture, discussion, storytelling, other methods like problem-solving, simulation games, use of media and technology, concept mapping, project and activities like field visits (e.g. visit to a construction site for data on wages and employment), collection of data from documents (e.g. Economic Survey, Five Year Plan), analysing and interpreting data (using simple tables, diagrams and graphs) can be undertaken. Self-study and collaborative learning activities should be encouraged.

- Teaching-Learning Materials

- Using textbook, analysis of news (Newspaper, TV, and Radio); documents (e.g. Economics Survey, Five Year Plan), Journals and News Magazines.

PAPER III

PEDAGOGY OF LANGUAGE (ENGLISH)

Total Marks: 100

School education and teacher-education share a symbiotic relationship. To have qualitative improvement in education, both teacher-education and school education need to mutually reinforce each other. NCF-2005 and the Right to Education Act, 2009 suggest a rethinking in the area of teacher-education as well. A need to review and redesign the B.Ed. Syllabus was felt as NCF-2005 expects the teacher to look at school education in a holistic manner. It advocates learner-centred learning rather than teacher- centred teaching. Teacher's attitude, aptitude and motivation play an important role because the teacher needs to engage with the learning process of the learner. Teacher as a facilitator helps learners construct their knowledge. The teacher should be able to participate meaningfully to transact the syllabus and textbooks effectively along with teaching- learning materials. Therefore, the teacher should be well-versed not only with the subject content but also with the pedagogy of learning.

Aims of the Course:

After completion of Course the student will be able to-

* Understand the different roles of language;

* Understand the relation between literature and language;

* Understand and appreciate different registers of language;

* Develop creativity among learners;

* Understand the role and importance of translation;

* Examine authentic literary and non-literary texts and develop insight and appreciation;

* Understand the use of language in context, such as grammar and vocabulary;

* Develop activities and tasks for learners;

* Understand the importance of home language and school language and the role of mother tongue in education;

* Use multilingualism as a strategy in the classroom situation;

* Develop an understanding of the nature of language system;

* Understand about the teaching of poetry, prose and drama;

* Identify methods, approaches and materials for teaching English at various levels in the Indian context;

- Understand constructive approach to language teaching and learning;
- Develop an insight into the symbiotic relationship between curriculum syllabus and textbooks;
- Develop and use teaching aids in the classroom both print and audio-visual material, and ICT (internet and computer technology);
- Understand the process of language assessment;
- Understand need and functions of language lab;
- Sensitise teacher-students about emerging issues,.such as right to education for children,
- Peace and environment education in context with language teaching; and familiarise students with our rich culture, heritage and aspects of our contemporary life.
- Language classroom and texts have a lot of scope to make students sensitive towards surroundings, people and the nation.

Course Outline (Unit 1-5)

UNIT I: ROLE OF LANGUAGE

1. LANGUAGE AND SOCIETY: Language and Gender; Language and Identity; Language and Power; Language and Class (Society).

2. LANGUAGE IN SCHOOL: Home language and School language; Medium of understanding (child's own language); Centrality of language in learning; Language across the curriculum; Language and construction of knowledge; Difference between language as a school- subject and language as a means of learning and communication; Critical review of Medium of Instruction; Multilingual classrooms; Multicultural awareness and language teaching.

3. CONSTITUTIONAL PROVISIONS AND POLICIES OF LANGUAGE EDUCATION: Position of Languages in India; Articles 343-351, 350A; Kothari Commission (1964-66); NPE- 1986; POA-1992; National Curriculum Framework-2005 (language education).

Activities:

Discussion on Position paper on 'Teaching of English'

➢ Position paper on 'Teaching of Indian Languages'

➢ 'Multilingualism as a Resource'

➢ Analysis of advertisements aired on Radio/Television on the basis of language and gender.

➢ Take a few passages from Science, Social Science and Maths textbooks of Classes VI to VII and analyse:

(i) How the different registers of language have been introduced?

(ii) Does the language clearly convey the meaning of the topic being discussed?

(iii) Is the language learner-friendly?

(iv) Is the language too technical?

(v) Does it help in language learning?

➢ Now write an analysis based on the above issues.

Project
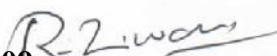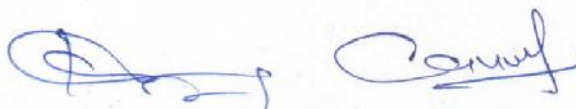
- Prepare a report on the status of languages given in the Constitution of India and language policies given in Kothari Commission, NPE-SYLLABUS FOR TWO-YEAR BACHELOR OF EDUCATION 1986, and POA-1992.

- Visit five schools in the neighbourhood and prepare a report on the three language formula being implemented in the schools.

- Teaching Practice

- Talk to the students and find out the different languages that they speak.

- Prepare a plan to use multilingualism as a strategy in the English classroom.

- On the basis of the English Textbooks (VI to XII) prepare a list of Topics and activities given on: (i) Language and Gender (ii) Language and Peace. Write a report on their reflection in the textbooks.

UNIT II: POSITION OF ENGLISH IN INDIA

- ROLE OF ENGLISH LANGUAGE IN THE INDIAN CONTEXT: English as a colonial language,

- English in Post-colonial times; English as a language of knowledge; Position of English as second language in India; English and Indian languages; English as a link language in global context; challenges of teaching and learning English.

- Activities

  ➢ Discuss in groups how the role of English language has changed inthe twenty-first century.

  ➢ Topic for Debate: Globalisation and English

  ➢ Discussion on the topic 'War Begins When Words Fail'

  ➢ Keeping in view the topics given in this unit, prepare a questionnaire.

  ➢ Interview ten people and write a report on 'English Language in India'.

- Project:

  ➢ Do a survey of five schools in your neighbourhood to find out:

    1. Level of Introduction of English

    2. Materials (textbooks) used in the classroom

  ➢ Prepare a report on the challenges faced by the teachers and the learners in the teaching- learning process.

UNIT III: AN OVERVIEW OF LANGUAGE TEACHING

1. DIFFERENT APPROACHES/THEORIES TO LANGUAGE LEARNING AND TEACHING (MT & SL)

- Philosophical, social and psychological bases of approaches to Language acquisition and Language learning; inductive and deductive approach; whole language approach; constructive approach; multilingual approach to language teaching (John Dewey, Bruner, J. Piaget, L. Vygotsky, Chomsky, Krashen), and Indian thought on language teaching.

2. A CRITICAL ANALYSIS OF THE EVALUATION OF LANGUAGE TEACHING METHODOLOGIES:

- Grammar translation method, Direct method, Structural-situational method, bilingual method, communicative approach.

- Activities
  - ➤ Discussion on the topic 'Mother Tongue and Other Tongue'

- Project
  - ➤ Do a comparative study of positive features and weaknesses of different approaches to language learning.

- Teaching Practice

- Prepare four activities keeping in view 'Constructivism in a Language Classroom'.

UNIT IV: NATURE OF LANGUAGE

1. ASPECTS OF LINGUISTIC BEHAVIOUR: Language as a rule-governed behaviour and linguistic variability; Pronunciation—linguistic diversity, its impact on English, pedagogical implication; Speech and writing.

2. LINGUISTIC SYSTEM: The organisation of sounds; The structure of sentences; The concept of Universal grammar; Nature and structure of meaning; Basic concept in phonology, morphology, syntax and semantics; Discourse.

Activities

- Have a discussion on the topic 'Difference Between Spoken and Written Language'.

UNIT 5: ACQUISITION OF LANGUAGE SKILLS

1. Grammar in context; vocabulary in context

2. Acquisition of language skills: Listening, speaking, reading and writing.

- Listening and Speaking: Sub skills of listening: Tasks; Materials and resources for developing the listening and speaking skills: Storytelling, dialogues, situational conversations, role plays, simulations, speech, games and contexts, language laboratories, pictures, authentic materials and multimedia resources

- Reading: Sub skills of reading; Importance of understanding the development of reading skills; Reading aloud and silent reading; Extensive and intensive reading; Study skills, including using thesauruses, dictionary, encyclopedia, etc.

- Writing: Stages of writing; Process of writing; Formal and Informal writing, such as poetry, short story, letter, diary, notices, articles, reports, dialogue, speech, advertisement, etc; Reference skills; Study skills; Higher order skills.

- Activities
  - ➤ Collect ten examples of Grammar in context from English Textbooks of Classes VI to

VIII and have a group discussion.

- ➢ Teaching Practice
- ➢ Prepare activities for listening, speaking, reading and writing. (5 Each)
- ➢ Prepare three activities to develop the reading skills of Class VI students.
- • Project
  - ➢ Keeping in view the needs of the children with special needs prepare two activities for English teachers.

REFERENCES:
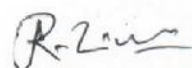
Suggested Reading:

1. Bond, L G et al (1980): Reading Difficulties – Their Diagnosis and Correction, New York, Appleton – Century Crafts.

2. Valdmen., (1987) "Trends in Language Teaching, New York, London Mac Graw Hill.

3. Johnson, K (1983): Communicative Syllabus Design and Methodology, Oxford, Pergamon Press.

4. Widdowson, HG (1979): Teaching language as Communication, London, OUP.

5. David, E (1977): Classroom Techniques- Foreign Languages and English as a Second Language, New York, Harcourt Brace. 30

6. Parrot, M (1993): Tasks for the Classroom Teacher, London, Pergamon.

7. Grillett, M (1983): Developing Reading Comprehension, London, CUP.

8. Byrne, D (1975): Teaching Writing, London, Longman.

9. Morgan & Rinvoluri (1991): New Ways of Dictation, London, Longman.

10. Mukalel, J. C. (1998): Approaches to English Language Teaching, Sterling Publishing House, New Delhi.

11. Palmer, H. E.: The Principles of Language Study.

12. Sharma, K. L.: Methods of 'Teaching English in India.

13. Thomson & Wyatt HG: Teaching of English in India, University of London.

14. Varghese, Paul: Teaching of English as Second Language

15. Kohli, A. L.: Techniques of Teaching English

16. Jain, R. K.: Essentials English Teaching

17. Bhatia K. K: New Techniques of Teaching English as a Foreign Language

18. Venkateshwaran, S: Principles of Teaching English

19. Yoakum G.A. & Simpson R.G.: Modern Methods and Techniques of Teaching

20. Dave, Pratima S, (2002): Communicative Approach to the Teaching of English as a Second Language, Himalaya Publish House, Mumbai

21. Halbe Malati, (2005): Methodology of English Teaching, Himalaya Publish House, Mumbai

22. Choudhary, N.R. (2002): English Language Teaching, Himalaya Publish House. Mumbai

23. Sachdeva, M.L.: A New Approach to Teaching of English in India

24. Sunwani, V. K. (2005): The English Language and Indian Culture

25. Adams, M. J., (1990): Thinking and Learning about Print. Cambridge, Ma: MIT Press.

PAPER-III

हिंदी भाषा का शिक्षण

कुल अंक 100

एक परिचय

राष्ट्रीय पाठ्यचर्या की रूपरेखा 2005 अमयापकों की भूमिका में एक बड़ी तब्दीली की मांग करती है। पाठ्यचर्या में अब तक अमयापकों को ही ज्ञान के स्रोत के रूप में केन्द्रीय स्थान मिलता रहा है, वह सीखने–सिखाने की समूची प्रक्रिया के संरक्षक और प्रबंधक के रूप में मुख्य भूमिका निभाने का काम करते आए हैं। पर 2005 की स्कूली पाठ्यचर्या उनसे मांग करती है कि वे सूचनाओं के वितरक और ज्ञान के स्रोत बन कर न रहें बल्कि विद्यार्थियों द्वारा ज्ञान हासिल करने की प्रक्रिया में स्वयं को सहायक मानें। वे विद्यार्थियों को शिक्षा–प्रक्रिया में सक्रिय भागीदार के रूप में देखें और उनके सवालों को सुनने और समझाने की श्जरूरतों को समझें। इन सब तब्दीलियों को उनके व्यवहार का हिस्सा बनाने के लिए जरूरी है कि अध्यापक शिक्षा के पाठ्यक्रम में बदलाव आए। स्कूली व्यवस्था में बदलाव की पहल तमी संभव है जब इस व्यवस्था से जुड़े लोगों के दृष्टिकोण में परिवर्तन आए और अध्यापक की भूमिका इस व्यवस्था में सबसे महत्वपूर्ण है। इस दृष्टि से भाषा–शिक्षण का पाठ्यक्रम और भी महत्वपूर्ण हो जाता है क्योंकि भाषा पूरी शिक्षा की श्जमीन तैयार करती है जहां सिर्फ भाषा पढ़ना सीखना नहीं बल्कि भाषा के जरिये और विषयों में भी निपुणता हासिल करने की बात आती है। इसके साथ ही भाषा से जुड़े नए मुपे जैसे बहुभाषिक कक्षा, समझ का माध्यम, शांति की शिक्षा में भाषा की भूमिका आदि की समझ अध्यापकों के लिए जरूरी है जो अध्यापक शिक्षा में व्यापक बदलाव की माँग करते हैं। यह पाठ्यक्रम भाषा के नए सरोकारों और सीखने–सिखाने की नई दृष्टियों को मयान में रखकर तैयार किया गया है। हमें आशा है कि प्रशिक्षु अध्यापकों को इससे भाषा–शिक्षण की तैयारी में सहायता मिलेगी।

हिंदी भाषा–शिक्षण का पाठ्यक्रम

पाठ्यक्रम के विशेष उद्देश्य

- भाषा के अलग–अलग भूमिकाओं को जानना
- भाषा सीखने की सृजनात्मक प्रव्यिा को जानना
- भाषा के स्वरूप और व्यवस्था को समझना
- स्कूल की भाषा, बच्चों की भाषा और समझ के बीच के संबंध को जानना
- भाषा के संदर्भ में पढ़ने के अधिकार, शांति और पर्यावरण के प्रति सचेत होना
- भाषा सीखने के तरीके और प्रक्रिया को जानना और समझना
- पाठ्यचर्या, पाठ्यक्रम और पाठ्यपुस्तक का विश्लेषण कर कक्षा विशेष और बच्चों की समझ के अनुसार ढालना
- भाषा और साहित्य सम्बंध को जानना
- हिंदी भाषा के विविध रूपों और अभिव्यक्तियों को जानना

- भावों और विचारों की स्वतंत्रा अभिव्यक्ति करना

- भाषायी बारीकियों के प्रति संवेदनशील होना

- अनुवाद के महत्व और भूमिका को जानना

- विद्यार्थियों की सृजनात्मक क्षमता को पहचानना

- बच्चों के भाषायी विकास के प्रति समझ बनाना और उसे समुन्नत करने के लिए विद्यालय में तरह–तरह के मौके जुटाना

- भाषा के मूल्यांकन की प्रक्रिया को जानना

- साहित्यिक और गैर साहित्यिक मौलिक रचनाओं की समझ और सराहना

- भाषा सीखने–सिखाने के सृजनात्मक दृष्टिकोण को समझना

PAPER II: TEACHING OF HINDI

(इकाई 1–5)

इकाई – 1: भाषा की भूमिका

(बच्चा जब स्कूल आता है तो उसके पास भाषा का एक रूप मौजूद होता है। कक्षा में बच्चों की भाषा इस रूप को सम्मान देने से उसका आत्मविश्वास बढ़ेगा, यह सीखने की बुनियाद है।)

1 **समाज में भाषा** – भाषा और लिंग , भाषा और सत्ता भाषा और अस्मिता, भाषा और वर्ग

2 **विद्यालय में भाषा** – घर की भाषा और स्कूल की भाषा, समझ का माध्यम (बच्चे की भाषा) समूचे पाठ्यक्रम में भाषा ,   ज्ञान सृजन और भाषा , माध्यम भाषाः एक आलोचनात्मक दृष्टि, विषय के रूप में भाषा और माध्यम भाषा में अंतर, विविध भाषिक प्रयुक्तियाँ बहुभाषिक कक्षा, शिक्षक–शिक्षार्थी संबंध के पहलू के रूप में भाषा

3 **संविधान और शिक्षा समितियों के रिपोर्ट में भाषा** – भाषाओं की स्थिति (धारा 343–351, 350 I) कोठारी कमीशन (64 से 66) राष्ट्रीय शिक्षा नीति – 1986 , पी.ओ. 2005 (भाषा अमययन) ए–1992, राष्ट्रीय पाठ्यचर्या –

गतिविधि/पोर्टपफोलियो

प्रशिक्षण के दौरान

छोटे समूह में बांट कर भारतीय भाषाओं के लिए निर्मित पोजीशन पेपर का अध्ययन और उस पर चर्चा।

- विज्ञान, समाज विज्ञान और गणित की कक्षा VI से VII की किताबों से कुछ अंश चुनकर निम्नलिखित बिंदुओं को ध्यान में रखते हुए विश्लेषण करिए–

  ➤ विभिन्न भाषिक प्रयुक्तियों को कैसे प्रस्तुत किया गया है।

  ➤ उस अंश में प्रयुक्त भाषा विषय संबंधी भाव स्पष्ट करने में कहाँ तक समर्थ है।

  ➤ बच्चे के स्तर के अनुरूप हैं?

➤ क्या इसमें तकनीकी भाषा का बहुत इस्तेमाल किया गया है ?

➤ क्या यह भाषा सीखने में सहायक है?

कक्षा–शिक्षण के दौरान

• कक्षा–शिक्षण के दौरान बच्चों के परिवेश और उनकी भाषा के बारे में जानकारी प्राप्त करें और बहुभाषिकता को स्रोत के रूप में इस्तेमाल करते हुए हिंदी शिक्षण की एक कक्षा–प्रविधि तैयार करें

परियोजना कार्य

• संविधान में भारतीय भाषाओं संबंधी अनुसंशाएँ तथा राष्ट्रीय शिक्षा नीति, पी.ओ.ए. द्वारा संस्तुत भाषा संबंधी सिफारिशों पर एक रिपोर्ट तैयार करना ।

• कक्षा छह से बारह तक के हिंदी की किताबों में लिंग और शांति संबंधी बिंदुओं की सूची तैयार कर उसके लिए कक्षा प्रविधि तैयार करना ।

• अपने आस–पास के पांच स्कूलों का दौरा कर यह जानकारी प्राप्त करते हुए एक रिपोर्ट तैयार करें कि त्रिभाषा सूत्र की क्या स्थिति है?

इकाई – 2ः हिंदी भाषा की स्थिति और भूमिका

हिंदी भाषा की भूमिकाः स्वतंत्रता से पहले और स्वतंत्रता के बाद हिंदी , हिंदी के विविध रूप, अंतर्राष्ट्रीय स्तर पर हिंदी , ज्ञान की भाषा के रूप में हिंदी , हिंदी पढ़ने–पढ़ाने की चुनौतियॉ।

गतिविधि/पोर्टफोलियो

प्रशिक्षण के दौरान

• स्वातन्योनर भारत में हिंदी की भूमिका पर समूह में चर्चा करें।

• जब शब्द नहीं रहते तब शस्त्र उठते हैं विषय पर परिचर्चा का आयोजन

कक्षा–शिक्षण के दौरान

• चुने हुए कुछ कक्षाओं में बच्चों की भाषा का जायजा लेते हुए हिंदी के विविध रूपों पर एक रिपोर्ट तैयार करें।

• रोजमर्रा की जिंदगी में प्रयोग होने वाली कम से कम बीस क्रियाओं , जैसे नहाना, आना, पकाना, जाना आदि को कक्षा में मौजूद बच्चे किस–किस तरह से प्रयोग करते हैं – इस आधार पर सूची बनाएँ

परियोजना कार्य

• इस इकाई में दिए गए विषयों को ध्यान में रखते हुए एक प्रश्नावली तैयार करें, दस व्यक्तियों का साक्षात्कार करे इस साक्षात्कार के आधार पर हिंदी की स्थिति पर एक रिपोर्ट लिखें।

- हिंदी भाषा के विकास में क्षेत्रीय जनपदीय हिंदी की भूमिका पर आलेख पाठ करें। (हरेक विद्यार्थी अपने क्षेत्र विशेष को ध्यान में रखते हुए आलेख तैयार करे।)

इकाई – 3ः भाषा शिक्षण पर एक दृष्टि

(हिंदी में विज्ञान, गणित, समाज विज्ञान और कला सब कुछ है पर ये विषय स्वयं हिंदी या भाषा नहीं हैं।)

भाषा सीखने सिखाने की विभिन्न दृष्टियाँ– भाषा अर्जन और अधिगम का दार्शनिक, सामाजिक और मनोवैज्ञानिक आधार, समग्र भाषा दृष्टि, रचनात्मक दृष्टि, भाषा सीखने–सीखाने की बहुभाषिक दृष्टि आदि (जॉनदुई, ब्रूनर, जे. प्याजे, एल. वायगात्स्की, चॉम्स्की आदि) भारतीय भाषा दृष्टि (पाणिनी, कामता प्रसाद गुरु, किशोरी दास वाजपेयी आदि)

भाषा शिक्षण की प्रचलित विधियाँ/प्रणालियाँ और उनका विश्लेषण – व्याकरण अनुवाद प्रणाली, प्रत्यक्ष प्रणाली, ढाँचागत प्रणाली, प्राछतिक प्रणाली, उदेश्यपरक (अन्तर्विषयक/अन्तअनुशासनात्मक) संप्रेषणात्मक प्रणाली आदि।

गतिविधि/पोर्टपफोलियो

प्रशिक्षण के दौरान

- 'मातृभाषा और अन्य भाषा' विषय पर छोटे समूह में चर्चा करें।

कक्षा शिक्षण के दौरान

- भाषा की कक्षा में रचनात्मक दृष्टिकोण को मयान में रखते हुए चार गतिविधियाँ तैयार करें।

परियोजना कार्य

- विविध राजभाषा शिक्षा प्रणालियों का अध्ययन करते हुए उनका विश्लेषण कीजिए।

इकाई – 4ः भाषा का स्वरूप

(कोई व्याकरण भाषा की चाल को बदल नहीं सकता। भाषा लोक व्यवहार से परिचालित होती है।)

1. भाषायी व्यवहार के विविध पक्ष– नियमबद्ध व्यवस्था के रूप में भाषाः भाषायी परिवर्ननशीलता (उच्चारण वेफ संदर्भ में) हिंदी की बोलियाँ वाक् तथा लेखन।

2. भाषायी व्यवस्थाएँ– सार्वभौमिक व्याकरण की संकल्पना, अर्थ की प्रकृति तथा संरचना, वाक्य विज्ञान तथा अर्थ विज्ञान की मूलभूत संकल्पनाएँ स्वनिम विज्ञान और रूप विज्ञान, (उपयुक्त उदाहरण देकर पढ़ाए जाएंगे)

गतिविधि/पोर्टपफोलियो प्रशिक्षण/कक्षा शिक्षण के दौरान

- 'लिखित और मौखिक भाषा में अंतर' विषय पर समूह में चर्चा करें

इकाई –5: भाषायी दक्षताएँ

1. **संदर्भ में भाषा** – संदर्भ में व्याकरण और संदर्भ में शब्द

2. **भाषायी दक्षताएँ–** सुनना, बोलना, पढ़ना और लिखना

- **सुनना और बोलना** – सुनने का कौशल, बोलने का लहजा– भाषाई विविधता और हिंदी पर इसका प्रभाव, पढ़ने–पढ़ाने पर इसका प्रभाव , सुनने और बोलने के कौशल विकास के स्रोत और सामग्री, रोलप्ले, कहानी सुनाना, परिस्थिति के अनुसार संवाद, भाषा लैब, मल्टीमीडिया तथा मौलिक सामग्री की सहायता से संप्रेषणात्मक वातावरण का निर्माण

- **पढ़ना** – पढ़ने के कौशल, पढ़ने के कौशल विकास में समझ का महत्व, मौन और मुखर पठन, गहन–पठन, विस्तृत पठन, आलोचनात्मक पठन, पढ़ने के कौशल विकास में सृजनात्मक साहित्य (कहानी, कविता आदि) सहायक, थिसॉरस, शब्दकोश और इन्साइक्लोपीडिया का उपयोग / महत्व

- **लिखना** – लिखने के चरण, लेखन–प्रक्रिया, सृजनात्मक लेखन, औपचारिक और अनौपचारिक लेखन (कहानी, कविता, संवाद, डायरी, पत्र, रिपोर्ट, समाचार आदि)

गतिविधि / पोर्टपफोलियो

- सभी भाषायी कौशलों के सीखने से सम्बंधित 4–4 गतिविधियाँ तैयार करें और उनका कक्षा शिक्षण के दौरान प्रयोग करें।

- पढ़ने के कौशल विकास को ध्यान में रखते हुए कक्षा छह हिंदी के विद्यार्थी के लिए तीन गतिविधियाँ तैयार करें और उनका कक्षा शिक्षण के दौरान प्रयोग करें।

- सभी विद्यार्थी कक्षा छह से आठ के हिंदी पाठ्यपुस्तकों से संदर्भ में व्याकरण के दस नमूने इकट्ठा करें और उन पर समूह में चर्चा करें ।

परियोजना कार्य

- सुनने और बोलने में असमर्थ बच्चों को ध्यान में रखते हुए हिंदी शिक्षण की दो गतिविधियाँ तैयार करें ।

CORE STUDY (SEMESTER II)

PAPER IV: SOCIOLOGICAL PERSPECTIVES OF EDUCATION

MARKS-100

OBJECTIVES

i. To understand the social diversity in the state and the class room and its implication for teaching

ii. To understand and be able to use some key concepts relating to social stratification

iii. To understand the nature of caste and changes occurring in it; to focus attention on the scheduled castes and their education

iv. To understand the problems faced by the tribal communities and the issues in education of tribal children

v. To understand how poverty affects schooling prospects of children with special reference to migrant children

UNIT I: Understanding diversity in Indian society with special reference to Chhattisgarh
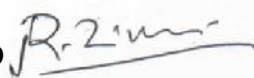
Diversity in Indian society, especially in Chhattisgarh, would be explored through case studies of some villages, regions or cities. Profile of different communities in terms of their ecology, economy, language, culture and educational status will be taken up for discussion. Special focus will be on childhood in these communities and access to education. Student teachers will be encouraged to look at this diversity as a potential pedagogic resource within the class room.

i. Diversity in this class room. Getting to know the diverse socio-cultural and linguistic background of fellow students. Getting to know about how they got themselves educated

ii. Ethnographic profiling of some five communities of the state (for example, one tribal, one scheduled caste, one artisanal community, one farming caste, one minority religious community)

iii. Children at risk educationally – profiling communities of children who have not been integrated well into schooling (non-enrolment, early dropout, low achievement).

iv. Profiling of the society of one's own village or town in terms of communities, professional groups, economic status, social respect, power, etc.

v. How can a teacher use the social background of diverse students as a resource for teaching in the class room?

UNIT II: Sociological concepts relating to social stratification

Some key sociological concepts like life opportunities, discrimination, exclusion, stratification, etc. will be discussed to enable the student teachers to use them in different social contexts.

i. Life opportunities, class, status and power: frameworks of Marx and Max Weber

ii. Social discrimination, exclusion and exploitation.

iii. Social capital, cultural capital and economic capital – the approach of P. Bourdieu

iv. Equality of opportunities and capabilities approach of Amartya Sen

UNIT III : Aims of Education

- Aims of Education in key policy and documents:

- Mudaliar commission report

- Kothri commission report

- Curriculum frame work, 1975

- National policy on education, 1986

- Curriculum frame work, 2000 and 2005

- NCFTE 2009

UNIT-IV: DEMOCRACY AND EDUCATION

- Meaning of the term "National integration and Emotional integration"its need, role of teacher & educational institution in achieving National integration through democratic integraction, explanation of cultural heritage, contributions of different religions (Hinduism,- Buddhism, Sikhism, Islam, Christianity and Jainism) for the same cause and human upliftment, equal communication, philosophy of celebration of Indian festivals.

- Sociological basis of education. Relationship between individual to individual and individual to society, in terms of Norms given by the existing social order; education as liberal utilitarian, education as a tool of economic education, as an agent of Social change, education as a means of National welfare through the Immediate welfare of the society, education and human resource development.

- Meaning of a new social order, eradication of illiteracy, objectives of NAEP; provisions made and channels started for educating socially, culturally and economically deprived; Means and measures taken for equality of opportunities in terms of castes, tribes. Disabled, Gender and Minorities:

UNIT V: The Current Concerns of Indian Education

Private public partnership (PPP); yet others relate to the status of teachers – casualization and informalisation of teachers. Student teachers will be given an opportunity to study these concerns and prospects through case studies and other academic literature:

(i) Professional ethics

(ii) Impact of privatization and Developments on Human Resources on the institution

Practicum

1. Field based surveys of status of marginalised social groups like SC, ST, migrant workers, rural and urban poor, etc and their educational prospects.

2. Action research to understand the problems faced by children of marginalised communities in schools of different kinds.

3. Action research to understand the implementation of government schemes for education of the marginalised groups.
4. Surveys to study condition of different kinds of schools and teachers and other staff working in them.
5. Surveys to understand field realities relating to policy issues under discussion
6. Role play and dramatization of issues relating to education of marginal groups

Essential Readings:

1. Position Paper of Focus Group on Education of SC and STs, NCERT
2. SC Dube, Indian Society (Also available in Hindi) NBT, Delhi
3. Russel & Hiralal, Tribes and Castes of CP & Berar
4. S. Thorat, Dalits in India, 2009
5. R Govinda, Who Goes To School? OUP, New Delhi, 2010
6. Danda, Ajit Kumar [edit.]. Chhattisgarh: An Area Study, Calcutta 1977. Anthropological Survey of India.
7. Tribal Situation in Northeast Surguja. Calcutta 1977. Anthropological Survey of India.
8. F. Haimendorf, Tribes in India, OUP
9. P. Veerbhadranaika, Revathi Sampath Kumaran, Shivali Tukdeo A.R.Vasavi 'The Education Question' from the Perspective of Adivasis: Conditions, Policies and Structures, NIAS, Bangalore 2011
10. The Social Context of Elementary Education in Rural India, Azim Premji Foundation, Bangalore, 2004
11. Praveen Jha, Whitherng commitments and Weakening Progress, State and Education in the Era of Neo liberal reforms, EPW, Aug 2005
12. Poverty and Social Exclusion in India, World Bank, 2011
13. Geetha Nambissan, Exclusion and Discrimination in Schools: Experiences of Dalit Children, UNICEF, 2009
14. Sociology, NCERT Text books for class XI and XII
15. JP Naik & S Nurullah, A Students' History of Education in India, Macmillan (available in Hindi)
16. Education policy documents and Commission Reports: Mudaliar Commission, Kothari Commission, National Commission on Teachers, Yashpal Commission, National Policy on Education 1965, 1988 & 1992

Films & Documentaries:

1. Shyam Benegal, Making of the Constitution (12 parts)
2. Shyam Benegal, Bharat Ek Khoj (relevant parts on National movement)
3. India Untouched.

CORE STUDIES (SEMESTER II)

PAPER V- CURRICULUM AND KNOWLEDGE MARKS -100

Objectives

i. To understand the nature of curriculum and its relation to syllabi, text books and class room practices

ii. To understand the nature of knowledge, moral values and skills

iii. To examine the place of work in education

iv. To understand the implications of constructivism for education

v. To develop and apply a framework for studying curriculum documents.

Unit I: Curriculum, Syllabi, Text books and Class room

a. What is a curriculum? Why do we need a curriculum?

Objectives behind framing/developing a curriculum. Aims and curriculum; the relationship between the two. Relationship between these two and pedagogy. Curriculum, syllabi and textbooks: what's the relationship between these? what are implications of this for a teacher?

b. The scope of curriculum:

Knowledge, values, skill, dispositions, etc. some general discussions about each.

c. The context/cultural embeddedness of curriculum.

Curriculum as a mode of transmission of culture and social norms. Diverse strands of culture and contestations and debates within them. Problems involved in questions about cultural choices and their implications for curriculum. Who defines culture? Who defines curriculum? (relate this to the discussion on negotiating diversity in aims of education.

d. Types of curriculum:

Liberal curriculum which seeks to develop understanding and perspectives, vocational curriculum which focusses on skills and is geared towards livlihood, mixed curriculum.

Unit II: Nature of Knowledge

a. Introduction to discussions about knowledge: What is knowledge? Knowledge as human endeavor: Curiosity, Practice and Dialogue. The nature of human curiosity, its limits; the complex interaction between knowledge and social practice; knowledge being formed through dialogues and shared with a larger community.

b. Nature of disciplines/subjects and forms of inquiry in each.

c. Sociology of knowledge: privileging of certain kinds of knowledge through curriculum and its impact upon unequal learning opportunities.

Unit III: Moral Values

a. Nature of value and morality: values are what make people consider life worthwhile. Values and morality involve choices which are arrived at by balancing diverse and often contradictory values. Even so, the choice made by one person may be very different from that made by another. Most educators agree that students need to engage seriously with the task of taking moral decisions, they also agree that preaching a set of values is tantamount to indoctrination at best or promoting hypocrisy at worst.

b. Morality in a multi-cultural, multi religious and democratic society: different cultures/religions have different value systems and preferences. Can any one of them become the basis of moral education in schools? Can there be democratic norms of dialogue between different value systems

c. Objectives of moral education: Is it to impart information about what is valuable or to train the student how to take moral decisions or is it to instill in the student a desire to be moral person? Should investigation into why it is difficult to be moral be a part of curriculum?

Unit IV: Curriculum and Productive Work

a. Understanding work as a productive activity which aims at producing tangible goods or services. Changing nature of work in recent times. Is 'work' incompatible with education?

b. Gandhian notion of education through productive work and a review of experience of its actual implementation. Can we substitute traditional crafts with modern industrial work? From Gandhian notion to 'Socially useful productive work' (SUPW).

c. Vocational Education: education as preparation for a particular field of employment Vs liberal education to prepare for adult life in general. Possibility of combining work skills of several fields as a part of general education.

d. The place of work in curriculum – its role in integrating knowledge, skill and values in real lifelike contexts. The implication of its absence from curriculum.

Unit V: Frameworks for Reviewing Curriculum Documents

- Visioning human beings and just society.

- Visioning the role of students and teachers

- Visioning the nature of knowledge and learning

- Areas of study (subjects) and the objectives of learning them

- Visioning the role of assessment and evaluation in education

- Practicum

    i. Conduct a collaborative knowledge construction class in a school and prepare a report on its basis. (some exemplar themes: 'let us find out about what kind of food we all eat and enjoy.' Or 'what is the nature of our family lives?' or 'what is the difference between a fly and an ant?' or let us find out the rules for use of masculine and feminine gender in Hindi language.')

ii. Comparative study of various curriculum documents.

iii. Prepare a report comparing national curriculum framework, the text books and class room practices in the school in which the student teacher has been interned. To what extent does the class room practice carry out the curricular objectives or the objectives set out in the text books?

Essential Readings

1. Christopher Winch, Philosophy and Education Policy, chapter 1 & 2.

2. John Dewey, Democracy and Education

3. National Curriculum Framework NCERT 2005, (Chapter 2)

4. Position Paper, National Focus Group on Curriculum, Syllabus and Text books (NCERT, 2006)

5. Position Paper, National Focus Group on Work and Education (NCERT, 2007)

6. ज्ञान शिक्षाक्रम और शिक्षाशास्त्र, डी.एड. प्रथम एवं द्वितीय वर्ष–पठन सामग्री, एस.सी.ई.आर.टी. रायपुर 2012

7. रोहित धनकर, शिक्षा और समझ, आधार प्रकाशन, जयपुर, 2007

8. रोहित धनकर, लोकतंत्र, शिक्षा और विवेकशीलता, आधार प्रकाशन, जयपुर, 2004

9. रोहित धनकर, शिक्षा के संदर्भ, आधार प्रकाशन, जयपुर, 2007

10. Ryle, G. 'Can Virtue Be Taught?' in R. E. Dearden, P. Hirst and R. S.Peters (eds) Education and the Development of Reason, London, Routledge. (1972)

11. Straughan, R. Can We Teach Children to Be Good?, London, Allen and Unwin. (1982)

12. Kohlberg, L. The development of children's orientations toward a moral order, Vita Humana, (1963).

13. R Meighan, Hidden Curriculum, in Iram Siraj-Blatchford, A Sociology of Educating,

14. Anthony Giddens, Sociology (5th Edition) Cambridge 2006 (Chapter on Education)

15. Relevant sections of 1975, 1988, 2000 and 2005 curriculum documents of NCERT.

16. Christopher Winch and John Gingell. Philosophy and Education: A Critical Introduction. Routledge, 2005.

17. Robin Barrow. An Introduction to Moral Philosophy and Moral Education. Routledge, 2007.

18. Paul Hirst. "The Demands of Moral Education: Reason, Virtues and Practices." In Education in Morality, edited by J H Halstead and T H Mclaughlin. Routledge, 1999

19. Noah Lemos. An Introduction to the Theory of Knowledge. Cambridge, 2007.

B.ED COURSE (SEMESTER II)

PAPER VI (ELECTIVE GROUP- I)

Marks 100

Note : Any one elective is to be chosen from the options.

(A)   Educational and Mental Measurement.

(B)   Educational Technology And Management

(C)   Educational Administration and Management

One elective subject to be decided by considering the following-

1. All electives must be contributing for extra capability of delivering the goods.

2. All electives should have equal difficulty level.

3. All electives should be unique in native without being covered in any other area (of paper of B.Ed.).

4. All electives should have full bearing over the latest developments of the contemporary world.

(VI A) EDUCATIONAL AND MENTAL MEASUREMENT

COURSE OBJECTIVES:

1. To acquaint the student teacher with the basic scientific concepts and practices in educational and mental measurement.

2. To enable the student to tabulate and find out some standard meaning from the raw scores by using statistical procedures.

3. To develop skills and competencies in the student teacher for the use of the techniques in the field.

4. To enable the student teacher to interpret the result of educational measurement.

5. To enable the student understand about various educational and mental measurement tools.

COURSECONTENTS:

UNIT- I

- Concept of measurement : testing and evaluation.
- Scales of measurement : nominal, ordinal, interval, and ratio scales.
- Discrete and continuous variables.
- Qualities of a test - reliability, validity and usability of a test: item analysis, procedures and item selection.

UNIT-II

- Educational statistics: measures of central tendency from grouped and non-grouped data.
- Measures of variability – range , quartile deviation, standard deviation.
- Graphical Representation of Data.

UNIT- III

- Techniques of test conduct
- Importance of establishment of rapport with the students, arranging the seats and distribution of questions for minimum pilguage and copying; techniques for avoiding guessing in answering; objective scoring.

UNIT- IV

- Interpreting measurement: normal probability curve, skewness and kurtosis.
- Percentiles and percentile ranks.
- Standard scores,
- Co-efficient of correlation by Spearman's method and its interpretation.

UNIT-V

- Achievement tests : construction of standardized achievement tests.
- Types of test items.
- Measurement of intelligence: Concept of intelligence, Binet test, concept of IQ.
- Individual and group tests of intelligence:
- Aptitudes and personality tests: Use of aptitude tests - overview.
- Use of interest inventories.
- Assessment of personality: interview, self-report inventories, rating scale, projective techniques. (Note - Some basic concepts and items covered, under compulsory core courses have been dropped here to avoid repetition although these are relevant).

PRACTICUM

- Administration of a psychological test and interpretation of test results.
- Determination of. reliability or validity of any self made test.
- Construction of a test battery with at least five types of test items and trying out of the same on a class/group of students.

REFERENCE

1. Asthana, Biptn & Agrawal, R. N. : Mapan ewam moolyankan. Vinod Pustak Mandir, Agra.
2. Asthana, Bipin and Agrawal, R. N. : Measurement and Evaluation In Psychology and Education, Vinod Pustak Mandir, Agra
3. Bhagwan, Mahesh : Shiksha mein Mapan ewam moolyannkan, Vinod Pustak Mandir Agra
4. Lindeman, R. H. annd Merenda, P.F. : Educational Measurement, Scott foreman & Company, London,
5. Rawat, D.L. : Shaikshlk Mapan ki Naveen Rooprekha, Gaya Prasad and Sons, A9ra
6. Sharma, R:A.: Measurement and Evaluation In Education and psychology, Lyall Book Depot Merrut
7. Sharma Shiksha tatha Manovigyan nain mapan Evam moolyankan. Lyall Book Depot Merrut.
8. Verma R.S.: Shaikshik Moolyankan. Vinod Pustak Mandir. Agra.

(VI B) Educational Technology and Management

Course Objectives:

1. To obtain a total perspectives of the role of technologies in modern educational practices.

2. To equip the student - teacher with his various technological applications available to him/her for improving instructional practices.

3. To help the teacher to obtain a total gender of his role of scientific management in education.

4. To provide the teacher the skills required for effective instrutional and institutional management.

5. To develop the professional skills required for guiding pupils in the three initial areas educational, penal and victual.

Syllabus

Unit – I: Concept of Educational Technology

- Meaning
- Nature
- Scope
- Functions
- Need for educational technology in the schools of chhhattisgarh.

Unit – II: Communication Technology

- Concept
- Nature
- Process
- Principles
- Componenets
- Types
- Barriers

Allied Skills Required - Micro Teaching and other skill based techniques

Unit - III System Approach

- Concept and characteristics
- System approach , System Analysis, System Design

Physical Resources of an instructional System

- Concept
- Classification (Project/Non Project/hardware/software)

Hardware - Chalkboard, tape recorder, Educational radio, Educational Television, VCR, Instant Slide mker, OHP, Film Strip, Slide Projector, Epidiascope, Interactive Video, Computers, Reprographic Equipement.

Software - Scripts (Audio& Video), slides, Programs, lerning Materials, Film Strips,

Transperencies, News Paper, Text Books, Maps etc.

Unit - IV Innovations in Educational Technology

- Video lessons and Talk Back, CAI
- Language laboratory
- Tele conferencing
- Tele-Text and Video Text
- Telephone Conferencing
- Computer Networking

Strategies - Tutorials, Seminar, Brain-Storming, Role-Play, discussion, Conference, Workshop

Unit - V Human Resources of an Educational System & Management

- Identification of the Human Resources, resources within and outside the school system

Meaning of Management in Education
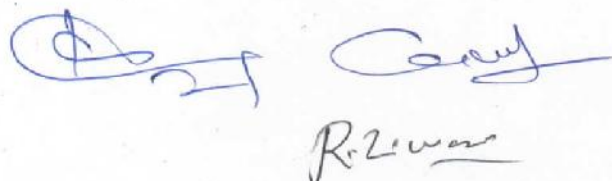
- Managing curriculum, managing co-curriculum, Managing school discipline and Managing physical resources.
- Developing performance profiles of institutions

Assignments

1. Tutorial/Term paper/Symposium
2. Developing Software - Transparencies/Slides/Scripts/Scenarios
3. Workshop on handling Hardware
4. Preparation of low-cost/improvised material
5. Conducting a lesson - Using OHP/Slide projector or computer

References:

1. Brown, J.W, Lewis Pb. 7 harclerac : AV Instructional Technology: McGraw Hills, new York.
2. Davies, I.K. The Management of Learning, McGraw hills, New York.
3. Goel, D.R, Educational T V in India - Organisation and Wilization, Unpublished post doctoral Thesis, M.S. University of Baroda.
4. Jerone, P.L & Clarence, M.W.: A Guide to programmed Instruction, J. Willey & sons, New York
5. Richmond, W. Kenneth: The concept of educational Technology , A Dialogue with yourself, London, Weldenfeld and Nicols, 1970.
6. Sharma, R.A. : Technology of Teaching , Meerut, Lyall Book Depot, 1986.
7. Singh P.: Cybernetic Approach to Teaching; The progress Education, Pune, May 1984.
8. Smith K.U : Snd smith marget, F. : Cybernetic principles of learning and Evaluation, New York, Holt, Rinehart and Winston, 1966
9. Taber J.J., Glaser F4 & Schasffer, H.N: learning and programmed Instruction, Addison Waler Reading Massachuset, 1965.
10. William D.: using Mass Media in Schools, New York, Appleton century Crops 1962.

[VI C] EDUCATIONAL ADMINISTRATION & MANAGEMENT

COURSE OBJECTIVES:

1. To acquaint the student teachers with the concept and concerns of educahonal administra-tion.

2. To develop an understanding of the role of the headmaster and the teacher in school management.

3. To enable the students to understand to concept at Importance of communication and its possible barriers in educational administration.

4. To enable the student teacher to critically analyse the administrative scenario In relation to the functioning of the other secondary schools of the area.

5. To acquaint the student teacher with the scientific practices of educational management and keep him to apply it In work situation.

COURSE CONTENTS:

UNIT-I
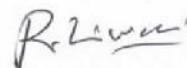
- Conceptual framework concept of educational administration.
- Concept of educational management human beings as inputs, process and products inputs.
- Nature, objectives and scope of educational aciministration

UNIT-II

- Role and functions of headmaster/teacher: Basic functions administration planning, organising directing and controlling.
- Maintenance of discipline, control management.
- Co-ordination and growth, development,
- Supervision and inspection, defects in the present supervision and inspection.
- Scope of educational supervision,
- Types of supervision.
- Providing guidance; leadership function,
- Crisis In management
- Decision making.

UNIT-III

- Communication in Educational Administration Role of communication in effective manage-ment and administration.
- Methods of communication.

- Barriers of communication in educational administration.
- Overcoming barriers to communication and effective communication In educational admin-istration..

UNIT-IV

- Management of Schools: Role of headmaster in planning of school activities, approaches to management - manpower approach, cost benefit approach, social demand approach, social justice approach.
- Involvement of other functionaries and agencies In the preparation of a plan.
- Delegation of authority and accountability.
- Role of the headmaster in monitoring, supervision and evaluation.
- Role of the headmaster in motivating the staff, in resolution of interpersonal conflicts.
- Role of the headmaster In creating resources and managing financial matters.
- Optimum use of available resources for growth and development of the school.
- Staff development programmes.
- Role of teachers in school management and administration.

UNIT-V
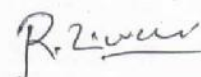
- Educational administration in the state : The administrative structure in the field of education in the state.
- Control of school education in the state - a critical analysis.
- Functions of the state government in relation to secondary and higher secondary schools.
- Functions of the board of secondary education in controlling secondary schools.
- Problems of secondary school administration in government schools.

PRACTICUM

- The student-teacher is expected to conduct a study on any issue or problem relating to a school administration. The report should be in about 700 words.

REFERENCE

1. Bhatnagar, R.P. & Verma. I.B.: Educational Administration, Lyall Book Depot Meerut.
2. Bhatnnagar, R.R & Agrawal, Vidya : Educational Administration, Supervision Planning and Financing. R. Lall nook Depot. Meerut.

(SEMESTER II)

PAPER VII: ARTS EDUCATION

Objectives:
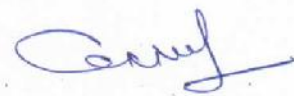
- To work together on small and large projects.
- To encourage students to free expression and creativity.
- To acquaint students with basic elements of design.
- To develop an insight towards sensibility and aesthetic appreciation.
- Joyful experience
- To develop a perspective of artistic and creative expression.

UNIT I: Art appreciation / brief history of Indian Art

- Sculptures: (Any 2 Sculptures of every period giving brief introduction).
    - Indus valley (They must have read in this till 8th standard).
    - Mauryan Period
    - Gupta Period
    - Folk Art
    - Modern / Contemporary Art
- Paintings;
    - Ajanta and the mural traditions
    - Miniature Paintings
    - Contemporary Paintings
    - Folk Art

UNIT II: Visual Arts.

- History of visual arts
- The concept and meaning of visual arts
- 2D Arts, methods and techniques, Drawing, Painting, Still life, printing, life drawing, composition, collage, wall painting, posters, Alpama / Rangoli / Mandra / Folk art forms etc.
- Tribal computer Graphics: Animations
- 3-D Arts; Methods and techniques : Relief work, clay modelling, Hand poetry, molding, sculpture, Terracotta construction with mixed materials.
- 3-D animation. Folk / Tribal Art

UNIT III: Theatre.

- Sense of theoretical / dramatic self:

    - Factors of Drama; the plot, structure, characters, available material, performance space, performance etc.

    - Street plays; script writing, song writing, clowning, cartooning.

    - Issues of identity, gender, relationships, social status.

- The roots of theatre; Ritual, Festival / Celebration, Myth, Primitive Man, Language Development.

- Modern Indian Drama; Major plays and Play wrights. UNIT IV: Music and Dance:

- Laya and Swara; Basic concepts of rhythm and note.

- Sangeet; Gayan, vadan and nritya in the context of locally known songs and dances commonly performed.

- Musical Instruments; categorization.

    ❖ Music of different geographical areas such as the desert, mountains, jungles and river-belt.

    ❖ The term 'Nritya' or 'Naach'

        a) Movement of different parts of the body

        b) Expression

        c) Literature

- Percussion instruments

- Any two regional dances

    1. Description of the region

    2. Dialect

    3. Costumes

    4. Music

    5. Tal

- Discussions on -

1.	Rajasthani Folk Dance	(ref. Tarana List CIET)
2.	Himachal Pradesh ke Lok Nritya	(ref. Tarana List CIET)
3.	Hamare Vadya Yantra Series	(ref. Tarana List CIET)
4.	Community Singing	(ref. Tarang list CIET)
5.	Song of Unity (KSSP)	(ref. Tarang list CIET)
6.	Rajasthan Folk	Langas and Manganiars

7.	Best of Carnatic	Various Instrumental
8.	Classical Dances of	(ref. Tarang List. CIET) India Series

UNIT V: Heritage Crafts

- Introduction to the crafts traditions of India, details about the different crafts, their classifications, regional distribution etc. Each of these topics will incorporate aspects such as the Philosophy and aesthetics, Materials, processes and techniques, Environment and resource management, Social structures, Economy and marketing.

- Clay, Stone work, Metal crafts, jewelry, natural fiber weaving and textile weaving.

Some Reference Books Suggested for Teachers:

1. Indian Sculpture - Chintaman Kar.

2. Exploring Sculpture - Jan Amdell Mills and Boon, London.

3. The Technique of Sculpture - John W. Mills, P.T. Patsford Ltd., London.

4. A History of Sculpture of the World - Shelden Cneey, Thames and Hudson, London.

5. Form and Space -Edward Their, Thames and Hudson, London 6.Sculpture and Ideas - Michael F. Andrews.

7. Modern Sculpture -Jean Selz, Heinemann, London.

8. Creative Carving ads. (Material techniques appreciation) - Dons Z. Meilach, Pritam Publishing in the format of Posters, magazine layout, illustration animation and television

9. Bharat Ki Chitrakala (Hindi) - Rai Krishna Das

Books published by NBT

1.	Pran Nath Mago	Contemporary Art in India: A perspective
2.	Jasleem Dhamija	Indian folk Arts and Crafts
3.	Krishna Deva	Temples of North India
4.	K.R. Srinivasan	Temples of South India
5.	Alokendranath Tagore	Abhanindranath Tagore
6.	Dinkar Kaushik	Nandalal Bose
7.	Madhu Powle	Festival of Colours
8.	Badri Narayan	Find the Half Circles
9.	Ela Datta	Lines and colours
10	Upinder Singh	Discovering Indian Art
11	Mysteries of the Past;	Archeological Sites in India
12	Niranjan Ghoshal	Name That Animal
13	Devi Prasad	Art: The Basis of Education

Publications Division, Government of India

1.	Vidya Daheja	Looking Again at Indian Art
2.		Panorama of Indian Painting
3.		Buddhist Sculptures and Monuments.
4.	A. Gosh	Ajanta murals
5.	Z.A. Desai	Mosques of India

NCERT: Raja Ravi Varma (Hindi)

Lalit Kala Monographs

SEMESTER III

PAPER VIII : PEDAGOGY OF BIOLOGICAL SCIENCE (PART- II)

TOTAL: 100

UNIT VI: PLANNING FOR TEACHING-LEARNING OF BIOLOGICAL SCIENCE

Identification and organisation of concepts for teaching-learning of biology; Determining acceptable evidences that show learners, understanding; Instructional materials required for planning teaching-learning of biological science and learners' participation in developing them; Identifying and designing teaching-learning experiences; Planning field visits, Zoo, Sea shore life, Botanical garden, etc.; Organising activities, laboratory experiences, making groups, planning ICT applications in learning biology.

UNIT VII: LEARNING RESOURCES IN BIOLOGICAL SCIENCE

Identification and use of learning resources in biological science from immediate environmental, exploring alternative sources; Developing science kit and biological science laboratory; Designing biology laboratory; Planning and organising field observation; Collection of materials, etc.; Textbooks, audio-visual materials, multimedia-selection and designing; Use of ICT experiences in learning biological science; Using community resources for biology learning; Pooling of learning resources in school complex/block/ district level; Handling hurdles in utilisation of resources.

UNIT VIII: TOOLS AND TECHNIQUES OF ASSESSMENT FOR LEARNING BIOLOGICAL SCIENCE

Performance-based assessment; Developing indicators for performance assessment in biological sciences; Learners record of observations; Field diary, herbarium and collection of materials; Oral presentation of learners work in biological science, Portfolio; Assessment of project work in biology (both in the laboratory and in the field), Assessment of participation in collaborative learning; Construction of test items (open-ended and structured) in biological science and administration of tests; Developing assessment framework in biological science; Assessment of experimental work in biological science; Exploring content areas in biological science not assessed in formal examination system and their evaluation through various curricular channels; Encouraging teacher-learners to examine a variety of methods of assessments in biological science; Continuous and comprehensive evaluation.

UNIT IX: BIOLOGICAL SCIENCE – LIFELONG LEARNING

Nurturing natural curiosity of observation and drawing conclusion; Facilitating learning progress of learners with various needs in biology; Ensuring equal partnership of learners with special needs; Stimulating creativity and inventiveness in biology; Organising various curricular activities, such as debate, discussion, drama, poster making on issues related to science/biology; Organising events on specific day, such as Earth Day, Environment Day, etc.; Planning and organising field experiences, Science club, Science exhibition; Nurturing creative talent at local level and exploring linkage with district/state/central agencies.

UNIT X: PROFESSIONAL DEVELOPMENT OF BIOLOGY TEACHER

Professional development programmes for science/biology teachers; Participation in seminar, conferences, online sharing membership of professional organisation; Teachers as a community of learners; Collaboration of school with colleges, universities and other institutions; Journals and other resource materials in biology education; Role of reflective practices in professional development of biology teachers; Field visits, visit to botanical garden, science park, science centre, zoo, National Laboratories etc.; Teacher as a researcher: Learning to understand how children learn science– action research in biological science.

NOTE: Suggested readings were given at the end of Part I of the course.

PAPER VIII: PEDAGOGY OF PHYSICAL SCIENCE (PART II)

Total Marks: 100

UNIT VI: LEARNING RESOURCES IN PHYSICAL SCIENCE

Identification and use of learning resources in physical science from immediate environment (e.g. Natural pH Indicators, Soaps and Detergents, Baking Soda, Washing Soda, Common Salts, Fruits, Fibre, Pulleys, Projectiles, Lenses and Mirrors, Interconversion of one Form of Energy to other, Propagation of waves in Solid, Liquid and Gas etc.), exploring alternative sources; Improvisation of apparatus developing science kit and laboratory in science (secondary stage), physics and chemistry (higher secondary stage); Designing laboratories, textbooks, audio-visual materials; Multimedia–selection and designing; Use of ICT experiences in learning science/physics and chemistry; Using community resources for learning science/physics and chemistry; Pooling of learning resources in school complex/block/district level, handling hurdles in utilisation of resources.

UNIT VII: TOOLS AND TECHNIQUES OF ASSESSMENT FOR LEARNING PHYSICAL SCIENCE

Performance-based assessment, developing indicators for performance-based assessment in science/physical science, learners' records of observations, field diary; Oral presentation of learners work, Portfolio; Assessment of project work in science/physical science; Assessment of participation in collaborative learning; Construction of test items in science/physical science and administration of tests; Developing assessment framework in science/physics and chemistry; Assessment of experimental work in science/physics and chemistry; Exploring content areas in physical science not assessed in formal examination system and their evaluation through various curricular channels; Encouraging teacher- learners to examine variety of methods of assessments in science/ physical science; Continuous and comprehensive evaluation–appreciating evaluation as ongoing teaching- learning process and through overall performance of child.

UNIT VIII: PLANNING FOR TEACHING-LEARNING OF PHYSICAL SCIENCE

Identification and organisation of concepts for teaching-learning of science/ physics and chemistry (on different topics, such as Motion, Work and Energy, Matter and their Measurements, Carbon and its Compounds, Periodic Properties of Elements, Atomic Structure, Dual Nature of Matter and Radiation, etc.) developing them; Identifying and designing teaching-learning experiences; Organising activities, laboratory experiences, making groups; Planning ICT applications in learning science/physics and chemistry.

UNIT IX: PHYSICAL SCIENCE–LIFELONG LEARNING

Every child has natural curiosity of observation and drawing conclusion; Identification and application of physical and chemical phenomenon in day-to-day life and human welfare, facilitating learning progress of learners with various needs in science/physics and chemistry; Ensuring equal partnership of learners with special needs; Stimulating creativity and inventiveness in science; Organising various curricular activities, such as debate, discussion, drama, poster making on issues related to science/ physics and chemistry; Organising events on specific day, such as Science Day, Environment Day, etc.; Planning and organising field

experiences , Science club, Science exhibition, nurturing creative talent at local level and exploring linkage with district/state/central agencies.

UNIT X: PROFESSIONAL DEVELOPMENT OF SCIENCE/PHYSICS/CHEMISTRY TEACHERS

Professional development programmes for science/physics and chemistry teachers; Participation in seminar, conferences, online sharing, membership of professional organisations; Teachers as a community of learners, collaboration of schools with universities; Journals and other resource materials in science/physical science education; Role of reflective practices in professional development of physics and chemistry teachers; Field visit to industries, mines, refineries; National Laboratories, power stations, science centres; etc.; Teacher as a researcher: Learning to understand how children learn science— action research in physical science.

NOTE: Suggested readings were given at the end of part I of the course.

PAPER VIII: PEDAGOGY OF SOCIAL SCIENCES (PART II)

Total Marks: 100

UNIT VI: TEACHING-LEARNING OF HISTORY

Continuity and Change over Time and Historical Construction

This Unit seeks to introduce student-teachers to some of the seminal issues and concepts of social change in Indian and World History. It also aims to explain how historians do History and how it ought to be done in schools. It, therefore, focuses on constructivist pedagogy in History and the general competencies that children are likely to develop through the study of History. Historical Methods

Evidence, facts, arguments, categories and perspective; Distinctions between fact and opinion and between opinion, bias and perspective; Evidence-based History teaching; Primary sources and the construction of History Thinking in terms of problems for analysis in History. Social Formations in History

Different social formations in History and the periodisation of World History; The periodisation of Indian History: Ancient, medieval, modern and contemporary societies State-formation and different types of states in History Capitalism, Select Issues of Social Change in Indian History Culture, social stratification and social change in India; Caste and class in Indian society Shared religious cultures and conflicts between religious communities in India

Gender differentials and how these cut across caste and class structures as well as religious communities. (Case Study: India)

The above content may be used to understand the teaching, learning strategies and skill development in History. Interactive, constructivist and critical pedagogies in History
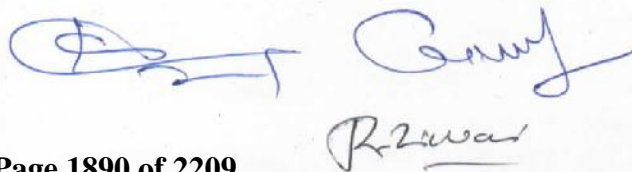
Going beyond the textbook; Getting children to craft little nuggets of History from primary sources Encouraging children to think from first principle in History.

The Lateral Development of Different Skills

Observation of skills relating to primary and secondary data; Observing coins, inscriptions (if available), the material remains of the past and visuals; Helping children to read passages from primary sources; Thinking about what all these sources might or might not reveal Learning to analyse critically and to argue; Observing how arguments have been made in the standard secondary sources and how these muster facts and evidences Helping children to develop oral and written expression.

UNIT VII: TEACHING-LEARNING OF POLITICAL SCIENCE DEMOCRACY, DEVELOPMENT, AND DIVERSITY

The Unit on Political Science deals with the broad themes of democracy, development, and diversity. These three interrelated themes are concerned with political, economic, and social aspects of our everyday life. The contents in this unit contain key political concepts and

issues. While explaining them, teachers are expected to refer to both historical and current events, processes and personalities from India and different parts of the world. They are also expected to make references to key concepts in the disciplines of Sociology, Economics, and Geography, so as to highlight the interrelationship between Political Science and these disciplines.

What is Politics?

❖ Political Science: Nature and scope, key concepts, current trends Elements of State: Population, Territory, Government, and Sovereignty

❖ Forms of Government: Democratic (Liberal and Social), non-democratic, Rule of Law, Authority, Power, Legitimacy, Civil Society, Citizenship, Rights, separation of Powers, Organs of Government: Legislature, Executive, and Judiciary.

❖ Constitutional Vision for a Democratic India .The making of the Constitution of India

❖ Justice (with special reference to Social Justice and Empowerment) Liberty, Equality, Dignity, Socialism, Secularism (Relationship between State and Religion): Western and Indian Versions

❖ Fundamental Rights (Prohibition of discrimination; Rights of Dalits, Tribes, minorities [Religious/Linguistic], Women and Children, the Disabled)

❖ Directive Principles of State Policy (with special reference to welfare of the people)Fundamental Duties.

The Working of the Government

❖ Structures and Functions of the Government at different levels Union, State/UT, District and Local Bodies (Panchayats and Municipalities)

❖ Relationship among the three organs of the Government, Relationship between the three levels of the Government, Democratic decentralisation, citizen participation.

❖ Society and Political Processe , Elections, political parties, pressure groups

❖ Social movements: Dalit movement, Tribal movement, Women's movement, environmental movement; Role of media, Role of NGOs, RTI The above content may be used to understand the teaching-learning strategies and skill development in Political Science.

Teaching-learning Strategies

The teaching-learning process needs to take into account the lived experiences of student-teachers. The issues in this Unit can be introduced by referring to the relevant items from daily newspapers (e.g. instances of violation and protection of human rights). The contents are to be transacted through participatory methods involving all participants. 'Learning by discussing' is to be followed as a regular practice in the classroom.

Social inquiry approaches can be used in teaching, learning of Political Science. The student-teachers may be encouraged to observe actual functioning of the institutions of different local Government bodies in own district and prepare reports as group projects. They may also be encouraged to undertake field research, conduct in-depth interviews, and interpret field data and critically understand political concepts.

Teaching-learning Materials: Constitution of India, atlas, political maps (World, Asia, India, States, Districts), globe, two daily newspapers, news magazines.

UNIT VIII: ASSESSMENT FOR LEARNING IN SOCIAL SCIENCES

Characteristics of Assessment in Social Sciences: Types of questions best suited for examining/assessing/understanding the different aspect of Social Sciences; Questions for testing quantitative skills, Questions for testing qualitative analysis; Open-ended questions .Open-book tests: Strengths and limitations ,Evaluating answers: What to look for? Assessing projects: What to look for? Continuous and Comprehensive Evaluation (CCE) in Social Sciences.

UNIT XI: ANALYSIS OF SOCIAL SCIENCES TEXTBOOKS AND QUESTION PAPERS
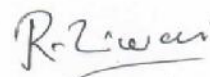
Analysing textbooks in Social Sciences in the light of the syllabus and from the perspective of the child (Textbooks of the same class may be taken up for all subjects in Social Sciences)

Analysing question papers of any State Board/CBSE and NCERT's textbooks in the light of the subject specific requirements in terms of understanding and skills.

UNIT X: INTER-DISCIPLINARITY THROUGH PROJECTS AND FIELD VISITS

➤ Projects in Social Sciences should be selected keeping in view the interconnections between the various disciplines that constitute Social Sciences. The interrelationship among various aspect of Social Sciences may be visualised as follows:

➤ Geography and Economics: Transport and communication in a region – assessing current position with reference to development needs

➤ History and Political Science: Socio-political systems; Women's rights in society Economics and History: Agrarian change in India; Industrialisation in India

➤ History and Geography: Migration of people in a particular region— nature of migration, past and present trends Political Science and Geography: Sharing resources between regions/states and nations (e.g. water)

➤ Economics and Political Science: Family budget and impact of change in prices of essential commodities.

➤ These projects are just a few examples. Similar projects may be designed by student-teachers for better understanding of various issues.

NOTE: Suggested readings were given at the end of part I of the course.

PAPER VIII: PEDAGOGY OF LANGUAGE (ENGLISH) PART II

Total Marks: 100

UNIT VI: LANGUAGE, LITERATURE AND AESTHETICS–I

Different Creative forms of English Language: Understanding different forms of literature; Literature in the school curriculum: Needs, objectives and relevance; Role and relevance of media in school curriculum; Translation: Importance and need, Translation as a creative activity: through examples of translated texts into English from different Indian languages.

Activities

- Take three editorial pieces on the same topic from different newspapers. Have a discussion on their language and presentation

- Take two translations of any piece of creative writing. Read these pieces and then translate the piece yourself

- Take any creative writing related to history, e.g. Discovery of India and prepare a flow chart on the main events

- Review any story and have a discussion in groups

- Take any piece on Geography and prepare a teaching strategy for teaching any Geographical phenomena, e.g. climate change, water.

Teaching Practice

Take any topic of your choice and write about it in any form of creative writing.

UNIT VII: LANGUAGE, LITERATURE AND AESTHETICS–II

Teaching of Different Forms of English Literature: Poetry, Prose, Drama: The relative importance of Indian, classical, popular, and children's literature in English; Developing tasks and materials for study skills in English literary forms; The study of contemporary Indian, Asian, European and African literature; Lessons planning in prose, poetry and drama at various school levels.

Activities

- Review any two stories of your choice
- Interview any local artist/poet/writer
- Collect Indian folktales in English (translated) for your portfolio
- Prepare a newsletter on the basis of your school experience programme (hand written).

Teaching Practice

Take any creative writing, e.g. a poem or a story and develop teaching strategies to teach:

(a) Same pieces for different stages; (b) Understanding any creative piece at different levels; and (c) Teaching the same piece to children with special needs.

Action Research

- Identify and list language (English) related errors common among students.

- Prepare a list of idioms, proverb in English

- Teaching any creative piece in the classroom on the basis of

  (a) Level of the students   (b) Perspective

- Prepare an outline for action research on the basis of your experience of the difficulties faced during school experience programme.

UNIT VIII: DEVELOPMENT AND ANALYSIS OF SYLLABUS AND TEXTUAL MATERIALS

Understanding the relationship between curriculum, syllabus and textbook; Selection of materials; Development of activities and tasks; Connecting learning to the world outside; Moving away from rote-learning to constructivism; Teacher as a researcher. (Develop meaningful strategies keeping in view the needs of the learners.)

Activities

➢ Do a comparative study of one textbook of English from any class (VI to VII) developed by any two states

➢ Prepare an outline for the development of the textbook for the same class for your state. Project

➢ Prepare a collection of poems and stories of your choice.

UNIT XI: TEACHING-LEARNING MATERIALS AND AIDS

Print media; Other reading materials. such as learner chosen texts, Magazines, News papers, Class libraries, etc., ICT– audio-visual aids including CALL programmes; Radio, T.V., Films; Planning co-curricular activities (discussion, debates, workshops, seminar etc.); Language labs, etc.
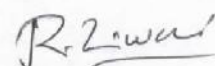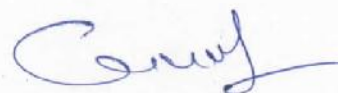
Activities

- Prepare a list of audio-visual aids related to teaching of English and use them wherever necessary

- Identify and prepare different types of teaching aids for children with special needs (speech impaired) Organise a workshop/seminar/conference on the topic 'Language of Children' or any other related topic.

Project

Prepare an outline for a school magazine development

- The material for the school magazine based on your experiences during school experience practice (Handwritten)

- Review contemporary children's literature

- Review any two magazines for women.

UNIT X: ASSESSMENT—ITS ROLE AND IMPORTANCE

➢ Progress and assessment of development of language; Continuous and comprehensive evaluation; Techniques of evaluation—oral, written, portfolio; Cloze test, Self evaluation; Peer evaluation; Group evaluation.

➢ Typology of questions; Activities and tasks (open-ended questions, MCQ, true and false etc.) reflecting—Problem solving, creative and critical thinking, Enhancing imagination and environmental awareness.

➢ Feedback to students, parents and teachers.
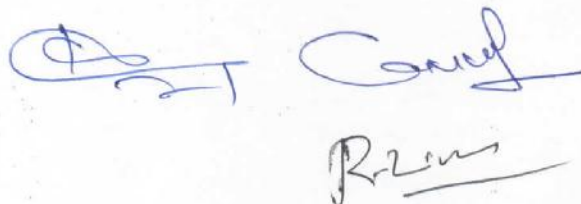
Activities

• Write a report on current practices of assessment and evaluation at the Upper Primary Stage

• Analyse the question papers of English language (Previous-3 Years)— Classes X and XII (any board) in the light of new approach of assessment

• Develop a question paper for upper primary and secondary stage to assess all the aspects of language learning

• Analyse answers given by the learners for one particular question

• Select any ten questions from the Class VI English textbook which lend scope to the creativity of the learners

• Study the key points of the Ist Term assessment of any student of Class VI

• Devise a strategy to incorporate the suggestions given in the Ist CCE report for the progress of the learner.

Note

• Project Work, Students-Teacher's Portfolio, Activities, Presentations, Workshops and Educational tours to be carried out during both the years. (Some activities have been given in each Unit as examples. Such other activities may be developed as per the need. Every student has to prepare his/her own portfolio and four projects are compulsory for each year.)

NOTE: Suggested readings were given at the end of part I of the course.

PEDAGOGY COURSES (SEMESTER III)

PAPER VIII: PEDAGOGY OF MATHEMATICS (PART II)

Total Marks: 100

UNIT VI : PLANNING FOR TEACHING-LEARNING MATHEMATICS

Organisation of concepts for teaching-learning of mathematics. Stating instructional objectives, identifying learning experiences, appropriate strategies, teaching aids (Using low-cost material – preparation of various activities, such as verification of algebraic identities, surface areas and volumes of cube, cuboids, cylinder, cone, sphere, conic sections, etc.); ICT applications; Evaluation tools and learners participation in developing instructional materials, etc.

UNIT VII: LEARNING RESOURCES IN MATHEMATICS

Textbooks audio-visual multimedia–Selection and designing; Using community resources for mathematics learning, pooling of learning resources in school complex/block/district level, handling hurdles in utilising resources.

UNIT VIII: ASSESSMENT AND EVALUATION

Informal Creative Evaluation: Encouraging learner to examine a variety of methods of assessment in mathematics so as to assess creativity, problem-solving and experimentation/activity performance; Appreciating evaluation through overall performance of the child; Self and peer evaluation.

Formal Ways of Evaluation: Variety of assessment techniques and practices Assessing Product Vs Process, Knowing Vs Doing In practice of midterm/terminal examination, practising continuous and comprehensive evaluation to test regular programmes/achievements of learner.

Assessment Framework:

Identifying and organising components for developing framework of question paper at different stages of learning; Framing questions based on concepts and sub concepts so as to encourage critical thinking, promote logical reasoning and to discourage mechanical manipulation and rote learning; Framing of open-ended questions providing the scope to learners to give responses in their own words; Framing of conceptual questions from simple questions.
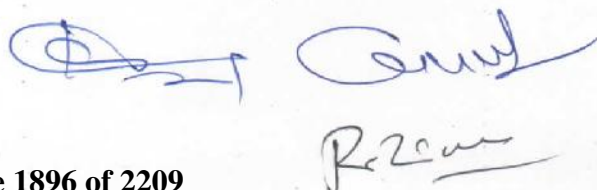
UNIT IX: MATHEMATICS FOR ALL

Identifying learners strength and weaknesses; Activities enriching mathematics learning – assisting learning, supplementary text material, summer programmes, correspondence course, mathematics club, contests and fairs, designing mathematics laboratory and its effective use, recreational activities—games, puzzles and riddles in mathematics, cooperative learning ensuring equal partnership of learners with special needs, stimulating creativity and inventiveness in mathematics.

UNIT X: PROFESSIONAL DEVELOPMENT OF MATHEMATICS TEACHERS

Types of in-service programme for mathematics teachers; Role of mathematics teacher's association; Journals and other resource materials in mathematics education; Professional growth—participation in conferences/seminars/workshops.

NOTE: Suggested readings were given at the end of part I of the course.

PAPER VIII

हिंदी भाषा का शिक्षण

भाग–दो

(इकाई 6–10)

कुल अंक 100

इकाई – 6: भाषा–साहित्य और सौंदर्य – 1

(विभिन्न अभिव्यक्तियाॅ भाषा की बारीकियों को जानने का सबसे अच्छा माध्यम है।)

1. **सृजनात्मक भाषा के विविध रूप** – साहित्य के विविध रूप को जानना, स्कूली पाठ्यक्रम में साहित्य को पढ़ना–पढ़ाना, अनुवाद कला और सौंदर्य में भाषा, स्कूली पाठ्यचर्या में मीडिया की भूमिका, उद्देश्य प्रासंगिकता, अनुवाद का महत्व और जरूरत

2. **सृजनात्मक अभिव्यक्ति के रूप** में हिंदी अनुवाद (अंग्रेजी और अन्य भारतीय भाषाओं के सदर्भ में) चुने हुए उदाहरण के आधार पर बताया जाएगा।

गतिविधि / पोर्टफोलियो
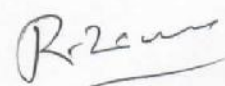
प्रशिक्षण के दौरान
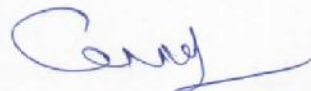
*   एक ही विषय पर किन्हीं तीन अखबारों के संपादकीय की भाषा पर बातचीत कर उनकी विषय प्रस्तुति को रेखांकित करें ।

*   एक ही अंश के तीन अनुवाद को पढ़ें और अपनी भाषा में नया अनुवाद प्रस्तुत करें

*   समूह में बंट कर मीडिया लेखन के तीन अलग–अलग नमूनों (फीचर, रिर्पोट, लेख आदि) को इकट्ठा कर उसमें समानता और अंतर को ध्यान में रखते हुए चर्चा करें ।

*   अखबार की किसी खबर के आधार पर संवाद लिखना ।

कक्षा शिक्षण के दौरान

*   पानी से संबंधित पाठ पढ़ाने के बाद जलचक्र की जानकारी देना, पानी की बचत पर बातचीत, जल की तरल अवस्था से ठोस अवस्था का हल्का होने के कारण का पता लगाने का कार्य करवाना

इकाई – 7: भाषा साहित्य और सौंदर्य – 2

साहित्यिक अभिव्यक्ति के विविध रूप – कविता को पढ़ना–पढ़ाना, गद्य की विविध विधाओं को पढ़ना–पढ़ाना, नाटक को पढ़ना–पढ़ाना, समकालीन साहित्य की पढ़ाई (बाल साहित्य, दलित साहित्य, स्त्री साहित्य) हिंदी के विविध विधाओं के आधार पर गतिविधियों का निर्माण, कविता, कहानी, नाटक, निबंध, उपन्यास की पाठ विधि तैयार करना।

गतिविधि/पोर्टपफोलियो

प्रशिक्षण के दौरान

- एक कहानी का चार अलग—अलग समूह द्वारा विश्लेषण और उसकी प्रस्तुति

- सभी विद्यार्थी किसी एक रचना की समीक्षा करें तथा एक—दूसरे की समीक्षित बिंदुओं पर कक्षा में चर्चा करें

- समूह में एक ही विषय पर अलग—अलग विधओं की रचनाओं का संकलन और उनका तुलनात्मक विश्लेषण

- वर्तमान बाल साहित्य की समीक्षा

- अपनी मनपसंद तीन कहानियों की समीक्षा

कक्षा शिक्षण के दौरान

- बच्चों से एक ही विषय जैसे 'बादल' पर स्वतंत्रा रूप से कुछ लिखने को कहें (कोई विधा न सुझाएँ).

- रचना को जानें और कक्षा विशेष को ध्यान में रखते हुए कक्षा प्रविधि तैयार करें (किसी एक रचना को सुनकर)

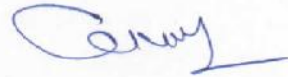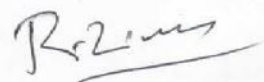(क) एक रचना अनेक स्तर ;अलग—अलग कक्षाओं में एक ही रचना को पढ़ाने से संबंधित)

(ख) एक रचना अनेक अर्थ (अलग—अलग नजरिये से एक ही रचना को पढ़ना)

(ग) एक रचना विभिन्न बच्चे (संदर्भः चुनौतीपूर्ण बच्चे)

- कोई नाटक या उपन्यास पढ़वाने के बाद उसके पात्रों के रहन—सहन, बोली आदि की चर्चा कर समाज में इनमें आए बदलाव पर चर्चा करना, विभिन्न व्यवसाय तथा व्यवसाय से जुड़े लोगों, उनके कार्यों, समस्याओं पर बातचीत

- कक्षा छह हिंदी की पुस्तक में से झांसी की रानी कविता, नौकर (निबंध) पाठ के बाद —1857 के पहले, दौरान और बाद में घटी घटनाओं का टाइम लाइन (चार्ट) बनाना, गांधी जी के जीवन की महन्वपूर्ण घटनाओं का टाइम लाइन (चार्ट), गांधी जी द्वारा चलाए गए आंदोलनों का टाइम लाइन (चार्ट)

परियोजना कार्य

- (क) विद्यालयी अनुभव कार्यक्रम के दौरान भाषा शिक्षण को लेकर आने वाली कठिनाई पर क्रियात्मक शोध

- (ख) भाषा की कक्षा में उन अनुभवों को पिरोते हुए शिक्षण योजना बनाना स्थानीय कलाकार/कवि/लेखक से साक्षात्कार

- कक्षा 6 से 12 तक की हिंदी की पाठ्यपुस्तकों में से किसी एक कविता को चुनकर परिवेश से जोड़ते हुए उसवेफ शिक्षण बिंदु तैयार करना

इकाई – 8: पाठ्यक्रम और पाठ्य–सामग्री का निर्माण और विश्लेषण

(पाठ्यपुस्तक शिक्षण का एक साधन है, एकमात्रा साधन नहीं)

पाठ्यचर्या और पाठ्यक्रम एक पाठ्य–सामग्री अनेक – पाठ्यचर्या, पाठ्यक्रम तथा पाठ्यपुस्तकों का संबंध, पाठ्यक्रम को बच्चों के अनुरूप ढालना (शिक्षण को स्कूल के बाहरी जीवन से जोड़ते हुए तथा रटंत–प्रणाली का निषेध करते हुए सामग्री चयन, गतिविधि और अभ्यास सामग्री का निर्माण), शोधकर्ता के रूप में शिक्षक (अलग–अलग बच्चों की आवश्यकताओं को ध्यान में रखते हुए)

गतिविधि/पोर्टपफोलियो

प्रशिक्षण के दौरान

➤ नवीन पाठ्यचर्या की समीक्षा और प्रस्तुतीकरण (समूह कार्य)

(क) नवीन पाठ्यचर्या में भाषा शिक्षण से संबंधित अध्याय पर चर्चा

(ख) नवीन पाठ्यचर्या में भाषा शिक्षण से संबंधित अध्याय का विश्लेषण और प्रस्तुतीकरण (समूह)

➤ 'बच्चे की भाषा' या ऐसे अन्य किसी विषय पर एक संगोष्ठी आयोजित करें

परियोजना कार्य

- विभिन्न राज्यों के हिंदी के पाठ्यक्रम का विश्लेषण और प्रस्तुतीकरण (समूह कार्य)

- अपनी मनपसंद कहानियों का संकलन तथा उनसे संबंधित लेख

- किन्ही दो राज्यों द्वारा विकसित किसी भी एक (6 से 12) कक्षा की हिंदी की पाठ्यपुस्तक का तुलनात्मक अध्ययन

इकाई – 9: सहायक शिक्षण सामग्री

प्रिंट मीडिया तथा अन्य पाठ्य सामग्री जैसे बच्चे द्वारा चुनी गई सामग्री, पत्रिकाएँ, अखबार, कक्षा–पुस्तकालय आदि, आई.सी.टी.–दृश्य–श्रव्य सामग्री, रेडियो, टेलीविजन फिल्में, भाषा प्रयोगशाला, सहसंज्ञानात्मक गतिविधियों की रूपरेखा (चर्चा, वादविवाद, खेल, कार्यशालाएं, गोष्ठी आदि)

गतिविधि/पोर्टपफोलियो प्रशिक्षण वेफ दौरान

- अपनी मनपसंद कविताओं का संकलन तथा उन पर एक लेख

- हिंदी की किन्ही दो महिला/बाल पत्रिाकाओं की समीक्षा

- सीमित संसाधनों में ऑडियो/वीडियो कार्यक्रम के कक्षा में इस्तेमाल की योजना बनाना

- अपने क्षेत्र में प्रचलित लोककथा, लोकगीतों का समूह में बॅटकर संकलन तैयार करना

कक्षा शिक्षण के दौरान

- चुनौतीपूर्ण बच्चों को ध्यान में रखते हुए दो सहायक शिक्षण सामग्री तैयार करना

- विद्यालयी अनुभव कायक्रम के दौरान विद्यार्थियों से हस्तलिखित पत्रिका का विकास या हस्तलिखित पत्रिका की रूपरेखा तैयार करवाना

- विद्यालयी अनुभव कार्यक्रम के दौरान विद्यार्थियों द्वारा हस्तलिखित समाचार-पत्र का विकास करवाना

इकाई – 10ः आकलन की भूमिका और महत्व

(मूल्यांकन की भूमिका बच्चों की मौलिकता और भाषा प्रयोग में उनकी सृजनात्मकता को पैना बनाना है।)

1. **भाषा विकास की प्रगति का आकलन–** सतत् और समग्र मूल्यांकन, स्वमूल्यांकन, आपसी मूल्यांकन, समूह मूल्यांकन, पोर्टपफोलियो

2. **प्रश्नों का स्वरूप, प्रश्नों के आधार बिंदु –** समस्या समाधान संबंधी प्रश्न, सृजनात्मक चिंतन वाले प्रश्न, समालोचनात्मक चिंतन वाले प्रश्न, कल्पनाशीलता को जीवित करने वाले प्रश्न, परिवेशीय सजगता वाले प्रश्न, गतिविधि और टास्क (खुले प्रश्न, बहुविकल्पी प्रश्न)

3. **फीडबैक** (विद्यार्थी, अभिभावक और अध्यापक **और रिपोर्ट**

गतिविधि/पोर्टपफोलियो

प्रशिक्षण के दौरान

- दसवीं और बारहवीं कक्षा के किसी भी बोर्ड की परीक्षाओं के हिंदी के प्रश्नपत्रों (पिछले तीन वर्षों) की समीक्षा करें

- एक ही सवाल पर बच्चों द्वारा अलग-अलग आए जवाबों पर समूह में चर्चा करें

- कक्षा 6 से 12 तक की हिंदी की पाठ्यपुस्तकों में से ऐसे दस प्रश्न छांटे जिनमें भाषा मूल्यांकन का सृजनात्मक रवैया परिलक्षित होता है (समूह कार्य)

कक्षा शिक्षण के दौरान

(क) कक्षा छह के किसी बच्चे की प्रथम त्रैमासिक आकलन रिपोर्ट में दिए गए सुझावों का अध्ययन करना

(ख) इन सुझावों का बच्चे के भाषायी विकास में इस्तेमाल करने के लिए युक्तियाँ सुझाना
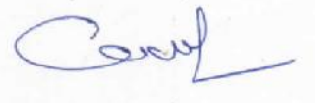
परियोजना कार्य

- उच्च प्राथमिक स्तर पर आकलन एवं मूल्यांकन की मौजूदा प्रक्रिया पर रिपोर्ट तैयार करें

- एन सी ई आर टी द्वारा प्रकाशित आकलन स्रोत पुस्तिका भाषा हिंदी पढें तथा इसमें आए आकलन संबंधी क्रियाकलापों को कक्षा 6 से 12 के अनुरूप विकसित करते हुए एक संक्षिप्त लेख लिखें

> सीखने सिखाने की प्रक्रिया में अध्यापकों की भूमिका एक सहायक और मित्र की होगी। अध्यापकों के सामने यह चुनौती होगी कि वह हरेक विद्यार्थी से एक तरह की सृजनात्मक क्षमता (उनर भी) की अपेक्षा न करें)

नोटः

परियोजना कार्य, विद्यार्थी और अध्यापक के पोर्टपफोलियो, गतिविधियाँ, चर्चा-परिचर्चा. प्रस्तुतियाँ, कार्यशाला, टूर (नमूने के तौर पर कुछ गतिविधियाँ इत्यादि प्रत्येक इकाई के साथ दी गई हैं। ऐसी अन्य गतिविधियाँ स्वयं भी तैयार कर सकते हैं। प्रत्येक विद्यार्थी को अपना पोर्टपफोलियो तैयार करना है तथा प्रत्येक वर्ष चारपरियोजना कार्य करने अनिवार्य हैं।

TEACHER ENRICHMENT (SEMESTER III) PAPER IX– ASSESSMENT IN LEARNING

Objectives

The course will enable student-teachers to

- Gain a critical understanding of issues in assessment and evaluation(from a constructivist paradigm) become cognisant of key concepts, such as formative and summative assessment, evaluation and measurement, test, examination;

- Be exposed to different kinds and forms of assessment that aid student learning;

- Become the use of a wide range of assessment tools, and learn to select and construct these appropriately; and

- Evolve realistic, comprehensive and dynamic assessment procedures that are able to keep the whole student in view;

Course Outline

UNIT 1: OVERVIEW OF ASSESSMENT AND EVALUATION

- Perspective on assessment and evaluation of learning in a constructivist paradigm

- Distinction between 'Assessment of Learning' and 'Assessment for Learning'

- Purposes of assessment in a 'constructivist' paradigm:

    (i) To engage with learners' minds in order to further learning in various dimensions.

    (ii) To promote development in cognitive, social and emotional aspects.

- Critical review of current evaluation practices and their assumptions about learning and development

- Clarifying the terms

    (i) Assessment, evaluation, test, examination, measurement

    (ii) Formative and summative evaluation

    (iii) Continuous and comprehensive assessment

    (iv) Grading.

UNIT 2: WHAT IS TO BE ASSESSED?

- Dimensions and levels of learning

- Retention/recall of facts and concepts; Application of specific skills

- Manipulating tools and symbols; Problem-solving; applying learning to diverse situations

- Meaning-making propensity; Abstraction of ideas from experiences; Seeing links and relationships; Inference; Analysis; Reflection

- Originality and initiative; Collaborative participation; Creativity; Flexibility

- Contexts of assessment ;Subject-related ;Person-related

UNIT 3: ASSESSMENT OF SUBJECT-BASED LEARNING

- Enlarging notions of 'Subject-based Learning' in a constructivist perspective
- Assessment tools
- Kinds of tasks: projects, assignments, performances
- Kinds of tests and their constructions
- Observation of learning processes by self, by peers, by teacher
- Self-assessment and peer -assessment
- Constructing portfolios Quantitative and qualitative aspects of assessment: Appropriate tools for each.

UNIT 4: TEACHER COMPETENCIES IN EVOLVING APPROPRIATE ASSESSMENT TOOLS

- Visualising appropriate assessment tools for specific contexts, content, and student
- Formulating tasks andquestions that engage the learner and demonstrate the process of thinking; Scope for original responses
- Evolving suitable criteria for assessment
- Organising and planning for student portfolios and developing rubrics for portfolio assessment
- Using assessment feedback for furthering learning.

UNIT 5: DATA ANALYSIS, FEEDBACK AND REPORTING

- Feedback as an essential component of formative assessment
- Use of assessment for feedback; For taking pedagogic decisions
- Types of teacher feedback (written comments, oral); Peer feedback
- Place of marks, grades and qualitative descriptions
- Developing and maintaining a comprehensive learner profile
- Purposes of reporting: To communicate
- Progress and profile of learner
- Basis for further pedagogic decisions
- Reporting a consolidated learner profile.

Suggested Readings:

- Asthana, Biptn & Agrawal, R. N.: Mapan ewam moolyankan. Vinod Pustak Mandir, Agra.
- Asthana, Bipin and Agrawal, R. N.: Measurement and Evaluation In Psychology and Education, Vinod Pustak Mandir, Agra
- Bhagwan, Mahesh: Shiksha mein Mapan ewam moolyannkan, Vinod Pustak Mandir, Agra
- Lindeman, R. H. annd Merenda, P.F.: Educational Measurement, Scott foreman & Company, London,
- Rawat, D.L.: Shaikshlk Mapan ki Naveen Rooprekha, Gaya Prasad and Sons, Agra
- Sharma, R. A.: Measurement and Evaluation In Education and psychology, Lyall Book Depot Merrut
- Sharma Shiksha Tatha Manovigyan nain mapan Evam moolyankan. Lyall Book Depot, Merrut.
- Verma R.S.: Shaikshik Moolyankan. Vinod Pustak Mandir. Agra.
- CBSE Grading system

CONTEMPORARY STUDIES (SEMESTER IV) PAPER X–GENDER, SCHOOL AND

SOCIETY

COURSE OBJECTIVES:

1. Understanding the role of culture (apart from biology) as determinants of gender distinction in social living
2. Awareness of factors that shape gendered roles in Indian society
3. Understand the problems of girl child education in our society
4. Developing a critical perspective on gender-based discrimination and its effects
5. To provide an introduction to and the development of an understanding of feminist approaches to the social and cultural construction of gender.
6. To develop a critical understanding of inter sectionality, including an awareness of gender and its complex intersections with other social and cultural categories, including but not limited to caste, tribe, class, sexuality and ability.
7. To equip the teacher with the ability to create more meaningful and gender just experiences for her students

CONTENT:

Unit I: Gender: Key Concepts - Social Construction of Gender
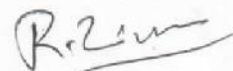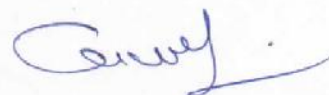
i. Examining one's own growing up as a boy or a girl
ii. Gender, sex, sexuality, patriarchy, masculinity and feminism
iii. Gender bias, gender roles and stereotyping, and its consequences
iv. Gender and other forms of inequality in relation with (caste, class, ethnicity, disability etc)
v. Female sex ratio and child sex ratio.

Unit II: Gender and Schooling

i. Schooling of girls (literacy rate, drop out rate, completion rate etc) and reasons why girls are not able to complete schooling
ii. Why do girls feel uncomfortable in schools?
iii. Can schools be different so that more girls can be educated?
iv. Gender bias in curriculum, textbooks, analysis of hidden curriculum
v. Critical examination of school and classroom processes– challenging gender biases and stereotypes
vi. Understanding relationships within the school – child-child, teacher-child and teacher peer group relationships from the perspective of gender
vii. Feminization of teaching profession

Unit III: Gender and Sexuality

i. Understanding sexuality (sexual orientation and sexual identity – third gender) and the relationship between power and sexuality
ii Violence against women - empirical examples of the graded violence against women, the impact of conflict and violence on the lives of women, efforts to deal with the issue of violence against women
iii Legal (sexual and reproductive) rights of women

Unit IV: Psychological and Sociological Perspectives

i.   Radical Feminist
ii. Socialist-Feminist
iii. Psychoanalytical and other perspectives
iv. Recent debates

Unit V: Strategies for Change
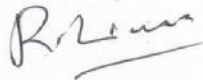
i.   Policy and management
ii. In the school
iii. Women's action groups
iv. Mass media

Suggested themes for transaction of the content (Group discussions and review of case studies etc.)

i.   Telling our own 'gendered' stories
ii. En-culturing 'gendered' roles in upbringing within different kinds of families – case studies
iii. Gender issues in school education – case studies
iv. Gender issues manifest in contemporary public spaces – case studies
v.   Responding to various forms of gender discrimination

Suggested Readings:

1. Gender Analysis of State Policies: A case study of Chhattisgarh, Dr. Sen Ilina
2. Towards Gender Equality in Education: Progress and challenges in Asia-Pacific Region, R. Govinda, National University of Educational Planning and Administration,New Delhi.
3. Bhattacharjee, Nandini (1999) Through the looking-glass: Gender Socialisation in a Primary School in T. S. Saraswathi (ed.) *Culture, Socialization and HumanDevelopment: Theory, Research and Applications in India.* Sage: New Delhi.
4. Geetha, V. (2007) *Gender*. Stree: Calcutta.
5. Ghai, Anita (2008) Gender and Inclusive education at all levels In Ved Prakash & K.Biswal (ed.) *Perspectives on education and development: Revising Education commission and after,* National University of Educational Planning and Administration: New Delhi
6. Jeffery, P. and R. Jefferey (1994) Killing My Heart's Desire: Education and Female Autonomy in Rural India. in Nita Kumar (ed.) *Women as Subjects: South Asian Histories.* New Delhi:
7. Learning, Livelihoods, and Social Mobility: Valuing Girls' Education in Central India, Peggy Froerer, Brunnel University, Anthropolgy and Education.

TEACHER ENHANCEMENT COURSE (SEMESTER IV)

PAPER XI – LANGUAGE PROFICIENCY

बी.एड. सेमेस्टर IV

विषय– भाषा प्रावीण्यता   अंक–50

यूनिट – 1 भाषा की प्रकृति   (Weightage – 2 questions 5 marks each)

— भाषा क्या है?

— हिन्दी भाषा की प्रकृति

— हिन्दी भाषा की विशेषताएँ

— आवश्यकता और महत्व

यूनिट – 2 भाषा की उपयोगिता   (Weightage 5 Questions 3 marks)

— भाषा रुपांतरण के नियम

— सारलेखन

— पत्र लेखन (औपचारिक, अनौपचारिक)

— अपठित गद्यांश

— प्रतिवेदन (रपट)

यूनिट – 3 व्यवहारिक व्याकरण   (Weightage 25 Questions 1 marks each)

— संज्ञा और सर्वनाम

— समास

— वाक्य रचना

— मुहावरे और लोकोक्तियाँ

— समानार्थी एवं पर्यायवाची शब्द

Semester – IV [B.Ed]

Language Proficiency [English Language]   **[50 Marks]**

Unit -I [Nature of Language]   (Weightage – 2questions 5 marks each)
- ❖ What is Language?
- ❖ Nature of English Language
- ❖ Need and Importance of English language

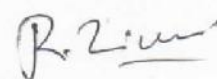### Unit-II [Utility of language]   (Weightage 5 Questions 3 marks)
- ❖ Translation: Rules of translation
- ❖ Precis writing
- ❖ Letter writing : formal, informal letters
- ❖ Comprehension
- ❖ Report writing
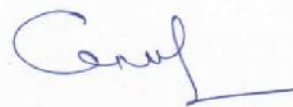
Unit-III [Grammar]   (Weightage 25 Questions 1 marks each)
- ❖ Articles (Definite & Indefinite)
- ❖ Tenses (Present, Past, Future)
- ❖ Parts of Speech
- ❖ Antonyms, Synonyms
- ❖ Modals

ELECTIVE GROUP- II (SEMESTER IV) PAPER XII

Marks 100

Note : Any one elective is to be chosen from the options.
(D)   COMPUTER EDUCATION
(E)   INCLUSIVE EDUCATION
(F)   TEACHING OF VALUES

XII (D) COMPUTER EDUCATION

COURSE OBJECTIVES:

To enable the teacher-trainees:

1. To appreciate the role of computer education in the context of modern technological society,
2. To develop understanding of computers and their application in education,
3. To acquire sufficient knowledge of handling computers with a view to impart computers independently at school level,
4. To use computer based learning packages and organize effective classroom instructions,
5. To acquire necessary skills in using of modern word processing software,
6. To develop skills of creating and managing simple databases and handling of computers

SYLLABUS

UNIT – I

- Importance of information technology
- Classification of computers by technology, type and size.
- Uses and scope of computers
- Fundamentals of computers.
- Input/output devices,
- Central processing unit storage devices,
- Operating systems
- Application software.
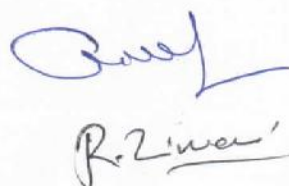
UNIT – II

Over view of Modern Operating Systems:

- Files and folders
- Use of pointing devices
- Cut and paste
- Shortcuts to applications
- Use and exploring the contents of storage devices- flippy disk, drives, hard discs,CD ROM etc.
- Running applications and exiting applications.

UNIT – III

Modern word processing applications:

- Importance of word processing in education
- Charecteristics of modern word processing applications
- Toolbars and menu
- Text and objects
- Text entry-Running text and paragraphs
- Formatting text- Bold, Italics, Centre and right, justification, changing font and font size, bullets and numbering.
- Editing text- select text, find and replace, cut, copy and paste.
- Editing duocumentt- Applying styles, spell check, hearders and footers, footnotes, pagination, subscript and superscript.
- Insertion of objects, pictures, symbols, fields, page break and section,
- Page setup – Margins, paper size, and layout, printing and saving documents.

UNIT – IV
Modern data base management applications:

- Importance of data base management in education,
- Charecteristics of modern data base management applications,
- Concept of relational data base management system,
- Fields name, Type , Width
- Databases,
- Forms,
- Reports.

UNIT – V
Computers for joyful learning:

- Need for joyful learning,
- Computers as an aid for joyful learning,
- Computer games,
- Multimedia capabilities of modern desk top computers,
- Internet-importance and need,
- Use of interactive and educational software.

Assignments:

1. Write an essay on any topic using word-processing software. Document must include at least three of the following characteristics.
- Pagination
- Header
- Two different paragraph styles
- Two different fonts,
- A picture object
- Bullets and numbering
- Subscript and super script
- Symbols or special characters.
2. Use relational database management software for any one of the following activities:
- Developing question bank

- Developing a data base for either students or staff including various fields like name, date of birth, date of joining, admission, salary/grade obtained etc.
- Automated printing of salary statement/ GPF deduction statement or any other administrative activity.

References :
1. Admas, D.M; Computer and Teachewr Training.
2. Bhatnagar, S.C. & Ramani,K.V; Computers and Information management.
3. CO-ROM-Titles available at cyber media 35 (4 bays) Echelon Institutional area, sector 32, Gurgaon 122002.
4. Desai, B; Database Management system.
5. Rajaram, V; Fundamentals of computers, Prentice Hall of India, new delhi.
6. SAM's Teach Yourself Office 97 in 24 hrs., Prentice Hall of India, new delhi.
7. Shelly, John and Hunt Roger; Computer studies-first course (second edition), A.H.Wheeler & Co., Delhi.
8. Windows 96: simplified. Complex publishing, New Delhi.
9. Windows 98; No experience required, BPB Publications, New Delhi.

XII (E)   INCLUSIVE EDUCATION

Total Marks: 100

Aims of the Course:
The students will be able to
- Demonstrate knowledge of different perspectives in the area of education of children with disabilities;
- Reformulate attitudes towards children with special needs;
- Identify needs of children with diversities;
- Plan need-based programmes for all children with varied abilities in the classroom;
- Use human and material resources in the classroom;
- Use specific strategies involving skills in teaching special needs children in inclusive classrooms;
- Modify appropriate learner-friendly evaluation procedures;
- Incorporate innovative practices to respond to education of children with special needs;
- Contribute to the formulation of policy; and
- Implement laws pertaining to education of children with special needs.

Course Outline
UNIT 1: PARADIGMS IN EDUCATION OF CHILDREN WITH SPECIAL NEEDS
- ❖ Historical perspectives and contemporary trends
- ❖ Approaches of viewing disabilities: The charity model, the bio centric model, the functional
- ❖ model and the human rights model
- ❖ Concept of special education, integrated education and inclusive education; Philosophy of inclusive education.

UNIT 2: LEGAL AND POLICY PERSPECTIVES

➢ Important International Declarations/Conventions/Proclamations – Biwako Millennium Framework (BMF, 1993-2012); Recommendations of the Salamanca Statement and Framework of Action, 1994; Educational Provisions in the UN Convention on the Rights of Persons with Disabilities (UNCRPD), 2006;

➢ Constitutional Provisions; The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995 (PWD Act); The Rehabilitation Council of India Act, 1992 (RCI Act); and The National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act, 1999; RTE Act, 2009.

➢ National Policy – Education of Students with Disabilities in the National Policy on Education, 1968, 1986, POA(1992); Education in the National Policy on Disability, 2006.

➢ Programmes and Schemes of Education of Children with Disabilities: Centrally- Sponsored Scheme for Integrated Education for the Disabled Children (IEDC), 1974; PIED (1986) and District Primary Education Programme (DPEP); Scheme for Inclusive Education for the Disabled Children (IEDC, 2000), Education of Special Focus Groups under the *Sarva Shiksha Abhiyan* (SSA, 2000); Goals and Strategies in the Comprehensive Action Plan for Including Children and Youth with Disabilities in Education, MHRD, 2005, Scheme of Inclusive Education for the Disabled at Secondary School (IEDSS, 2009).

➢ Special Role of Institutions for the Education of Children with DisabilitiesRehabilitation Council of India, National Institutes of Different Disabilities, Composite Regional Centres (CRCs), District Disability Rehabilitation Centres (DDRCs); Structures like BRCs, CRCs under SSA, National Trust and NGOs.
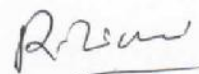
UNIT 3: DEFINING SPECIAL NEEDS

Understanding diversities–concepts, characteristics, classification of children with diversities (Visual Impairment, Hearing Impairment, Specific Learning Difficulties, Locomotor and Neuromuscular Disorders, Mental Retardation, Autism, Leprosy Cured Persons, Mental Illness and Multiple Disabilities)

• Special needs in terms of the curriculum in the context of different disabilities and their learning styles

• Concept of an inclusive school – infrastructure and accessibility, human resources, attitudes to disability, whole school approach

• Community-based education.

UNIT 4: INCLUSIVE PRACTICES IN CLASSROOMS FOR ALL

• School's readiness for addressing learning difficulties

• Assessment of children to know their profile

• Technological advancement and its application – ICT, adaptive and assistive devices, equipments and other technologies for different disabilities

• Classroom management and organisation

• Making learning more meaningful—Responding to special needs by developing strategies for differentiating content, curricular adaptations, lesson planning and TLM

- Pedagogical strategies to respond to individual needs of students: Cooperative learning strategies in the classroom, peer tutoring, social learning, buddy system, reflective teaching, multisensory teaching, etc.
- Supportive services required for meeting special needs in the classroom — special teacher, speech therapist, physiotherapist, occupational therapist, and counsellor
- Development and application of learner-friendly evaluation procedures; Different provisions for examination by CBSE and the board in their State
- Documentation, record keeping and maintenance.

UNIT 5: DEVELOPING SUPPORT NETWORKS

- Addressing social climate of the classroom
- Child-to-child programme
- Developing partnerships in teaching: Teacher and special teacher; Teacher and co-teaching personnel; Parents as partners – developing positive relationships between school and home
- Involving community resources as source of support to teachers
- Involving external agencies for networking – setting up appropriate forms of communication with professionals and para professionals
- Liaising for reciprocal support of pre-school programmes, pre-vocational training programmes, social security, different provisions, concessions, etc.

Books Recommended:

1. Bender, W.N. Learning Disability, Allyn & Bacon, Simon and Schuster, 1995, Boston London

2. Berdine, W.H & Blackhurst A.E.(eds). An Introduction to Special Education, Harpers Collins Publishers, Boston 1980.

3. Dunn., L & Bay, D.M (ed.): Exceptional Children in the Schools, New York : Holt, Rinehart, Winston.

4. Hallahar, D.P & Kauffman, J.M., Exceptional Children: Introduction to Special Education, Allyn & Bacon, Massachusetts, 1991

5. Hewett, Frank M. & Foreness Steven R., Education of Exceptional Learners, Allyn & Bacon, Masachusetts, 1984.

6. Jorden, Thomes E. The Exceptional Child, Ohio: Merrill.

7. Kirk, S.A & Gallagher J.J., Education of Exceptional Children ; Houghton Mifflin Co., Boston, 1989

8. Magnifico, L.X: Education of the Exceptional Child, New York, Longman.

9. Shanker, Udey: Exceptional Children, Jullundur: Sterling Publications.

10. Singh, N.N and Beale, I.L. (eds.) Learning Disabilities – Nature, Theory and Treatment

Spring-Verlag, New York, Inc:1992.

11. Smith, C.R, Learning Disabilities – the interaction of Learner, Task and Setting. Allyn and Bacon, Massachusetts, 1991.

12. Strange, Ruth : Exceptional Children & Youth J.J. : Prentice Hall.

XII (F) TEACHING OF VALUES

Course Objectives:

1. To understand the nature and sources of nature, and disvalues.
2. To understand the classification of values under different types.
3. 1:0 appreciate educational values like democratic, secular, and socialist.

Unit – I

- Nature and sources of values, biological, psychological, social and ecological determinants of values – their bearing on education in varying degrees.

Unit – II

- Classification 01 values into various types, material, social, moral and spiritual values; status of values, how can these be realized through education.

Unit – III

- Corresponding to values there are evils or dis-values- material, social, economic, moral and religious evils leading to faithlessness and irreverence; how can education overcome these negative values.

Unit – IV

- Levels of values realization, how to resolve the conflicts among values, how to work for the intergration of values of values that are embedded in education.
- Development of values as a personal and life-long process-teaching of values as an integral part of education.

Unit – V

- Evaluating that teachers and other school personnel are value laden, students and parents are value laden, curriculum is value laden Evaluate.
- Value of self-sacrifice vs value of selg centredness.
- Values of excellence vs values of eco-centralism.
- Values of work vs values of selfishness.
- Every teacher or all teacher need to teach values.

Reference:

1. Hassh, I R.H. Miller. J.R & fieding, G.D,: Models of moral Education, An Appraisal, Lorigman Inc New York.
2. Passi, B.K. & Singh, p.: Value Education, National Psychological Corporation. Agra.
3. Laths, L.E., Menu Harmins & Sydney. S.: value and Teaching, Menhill, Ohio.
4. Roclceach, M.: The Nature of human Values. Coiler McMilon Publisher, London.
5. Frank &. JR. : How to teach Value: Art. Analytical Approach Prentice Hall, New Jersey.

Pt. RaviShankar Shukla University , Raipur Bachelor of Education

Internship Guide

Description of Roles

Interns are students who are a graduate in their subject major, and are spending a four month working with experienced mentor teachers on their teaching practice while taking graduate courses in the Teacher Education department.

Mentor Teachers are experienced school teachers who mentor interns. They provide guidance, insight and opportunities for supported practice.

Supervisors work with school administrators/ Mentors to determine school experience for interns, mediate in difficult situations, and oversee interns' progress in schools and with respect to program requirements. They are faculty who organize campus based lectures and seminars in each subject area. They provide supervision and guidance for the interns in and out of the campus.

Intern Responsibilities

Interns are students of teaching. In contrast to traditional student teaching programs, interns are not expected to begin the year ready to teach on their own. Instead, they are expected to engage in observations, co-planning and co-teaching with their mentor teachers and to build their capacity toward assuming responsibility for extended lead teaching during the semester.

Interns are in a period of transition from students to professional teachers. During this transition, they must retain the perspective of a learner as they take on the new and unfamiliar role of a teacher. Interns are expected to take an active role in their own learning and to contribute to the learning of fellow interns.

Planning and Communication

- Keep supervisor informed about classroom schedules and events
- Direct questions or concerns to supervisors or mentor
- Schedule observations and conferences with the mentor and inform supervisor of changes promptly
- Meet regularly with the mentor to discuss planning for instruction
- Prepare written lesson and unit plans according to both mentor teacher and supervisor's expectations
- Arrange to share all plans and materials with the mentor in a timely way, to allow for feedback before using them
- Keep the focus class binder up to date with plans and materials and ensure that it is accessible to the mentor and supervisor at all times

- Engage in reflective diary writing or other communication forums required by mentors and/or supervisors
- Provide mentor/supervisor with copies of plans and materials
- Confer regularly with the mentor teacher and supervisor about progress and concerns

Professional Activities

- Prepare for and participate in seminars
- Participate in orientation activities, faculty meetings and other school events
- Initiate introductions to school faculty, staff and administrators
- Maintain accurate contact information for mentor teacher(s) and supervisor
- In case of absence, inform everyone affected promptly, i.e. prior to the absence
- Comply with the school absence policies and have substitute teacher plans available if scheduled to teach lessons during the absence
- Comply with the internship attendance policy
- Dress professionally
- Comply with the Professional Conduct policy
- Consult mentor teacher and supervisor about the work schedule for any part time job and arrange a mutually acceptable schedule
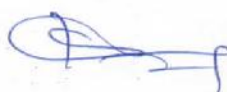
Personal Learning

- Take initiative in asking questions, searching out resources, inviting feedback and creating opportunities to learn.
- Reflect on teaching and learning through discussions and assignments
- Prepare a professional portfolio (reflective diary)
- Observe teachers and students carefully, taking notes and asking questions
- Study and participate in the formation and maintenance of a classroom learning community
- Begin the year co-planning and co-teaching lessons and activities, moving toward independent planning and teaching as the year progresses

Mentor Teacher Responsibilities

Planning and Communication

- Negotiate with intern and supervisor a sequence of intern responsibilities in accordance with the program standards
- Provide intern with an outline or list of topics intern will be responsible for teaching,

allowing extra time for intern to locate resources, plan, receive feedback from mentor teacher and supervisor, and revise

- Establish regular times to confer with the intern about unit planning and provide support for identifying big ideas and appropriate curriculum materials

- Help identify places in the curriculum where the intern can try out ideas learned in seminars

- Confer regularly with the supervisor about progress and concerns

- Participate in all school activities from morning assembly to evening assembly

Supporting Intern Learning

- Facilitate and monitor intern's progress from observation to co-planning and co- teaching to lead teaching

- Guide the intern through daily school-based experiences such as working with other teachers, dealing with classes on an assembly day, etc.

- Provide appropriate, classroom-based learning opportunities throughout the year.

- Work with intern as a co-teacher as soon as possible, sharing decisions and observations

- Observe intern's teaching and help the intern think about student understanding, alternative approaches, grouping, management, etc.

- Provide interns with oral and written feedback about their teaching, including written feedback

- Reflect with the intern about teaching, student learning and ideas and strategies studied in seminars.

Assessment

- Participate in assessment conferences

- Write and submit an Exit Performance Description at the end of the internship programme

- Help interns think about their careers as educators and assist with reviewing portfolios, videotaping, writing letters of recommendation, etc.

Supervisor Responsibilities

Meetings, Observation Visits, and Assessments

- Provide copies of written assessments to interns and mentor teachers

- Conduct five feedback sessions with the intern and mentor teacher, at the appropriate point of time

- Prepare participants for sessions by explaining what to bring and topics to discuss

- Make at least five observation visits during a week

- Prepare written assessments prior to feedback sessions, using the appropriate forms for your intern's subject area, and provide copies for the intern and mentor teacher at the conference
- Write and submit an Exit Performance Description at the end of the internship programme

Communication

- Facilitate communication among interns, mentor teachers and others involved with the internship
- Communicate regularly with each intern, at least every other day
- Communicate regularly with each mentor teacher
- Communicate regularly, as scheduled, with subject area leaders about interns' progress and problems
- Provide the intern and mentor teacher with detailed notes and written feedback about observation visits
- Make sure intern and mentor clearly understand expectations and program standards
- Keep informed about program developments and pass this information on to interns and mentors promptly
- Know where to direct questions and relay answers as soon as possible

Support of Intern Learning by the supervisor

- Observe the intern's teaching and confer about the planning and teaching of each observed lesson
- Provide constructive written and oral feedback for each observed lesson
- Identify the intern's specific needs and work on them with the intern and mentor teacher
- Inform subject area leader about problems promptly
- Help interns to develop their portfolios by giving feedback on materials, assisting with videotaping, etc. Records
- Keep notes of all observation visits including date, progress observed, suggestions made and actions taken
- Keep notes of all communication with interns and mentor teachers
- Keep examples of intern work indicative of progress or problems
- Keep copies of all written assessments and professional development plans
- Submit evaluation reports and professional development plans to the department head
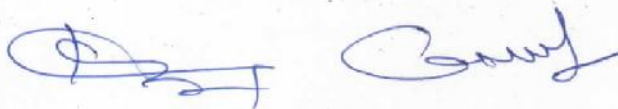
This highlights the intern's field experience that contribute to the overall design of the internship year experience. In schools with other configurations of class time, interns and mentors should discuss with their field instructors how the intern's lead teaching time will be distributed

throughout the year. Key aspects of any intern's lead teaching schedule include:

- After the initial week or two of school, the intern should have lead teaching responsibility (but not sole teaching responsibility) for at least one class period in a week.

- Interns are novice teachers for whom out-of-class preparation and reflection takes longer than it does for more experienced teachers. Having regular time during the school day to plan well for their teaching and reflect carefully on it is vital for the growth of the intern's practice and for the quality of the instruction they can provide to the students they share with their mentor. Interns may spend some of this time outside the classroom, and they may spend some of it in observation and analysis of the mentor's teaching.

- In the initial internship programme, short periods of increased lead(sole) teaching responsibilities should be preceded and followed by periods during which interns return to teaching only the focus class. From each period of increased lead teaching responsibility to the next, the demands on the intern's planning, teaching, and/or assessing should increase.

- Interns' on-campus classes do not meet every week of the internship. During certain weeks, the classes do not meet so that interns can be in their placement schools all five days of the week. Interns' obligations to their courses during this time focus more on at- school or in-class activities and less on lengthy reading or writing assignments.

SCORE SHEET FOR REFLECTION LOG ON FOCUS LESSON

(To be filled by the trainee, based on student reflection)

Name of the Trainee:

Duration: **Class:**   **Section:**

Unit of Teaching:

S.N.	CRITERION ON STUDENT RESPONSE	0	1	2	3	4
1	Ability to identify specific and/or varied instructional strategies.					
2	Examples to support the strategy					
3	Connectivity across disciplines					
4	Ability to identify learning styles					
5	Examples to reflect according to learning styles					
6	Ability to display personal reflections					
7	Examples reflected in support of personal reflection					
8	Group conformity					
9	Contribution to activity/ strategy					
10	Acceptance in group / solo activity or strategy					

Any other remarks by the trainee: Mentors' remarks:

Mentor's Signature   Trainee's Signature

MENTOR'S EVALUATION REPORT OF TRAINEE

Name of the Trainee: ....

Period of Evaluation: From: .... to: ....

Focus Lesson No.: ....

Subject: ....

S.N.	CRITERION	0	1	2	3	4
I	*INSRUCTINAL STRATEGIES USED -*					
1.	Are appropriate for the topic/topics					
2.	Has scope for learner engagement					
3.	Has suitability of learning materials					
4.	Assess learner's understanding throughout the lesson					
5.	Has effective displays					
6.	Are consistant with the objectives					
II	*LEARNER'S(LEARNING STYLES) IN CLASS*					
7.	Identification of personalities and talents of learners					
8.	Identification of learning styles of learners					
9.	Ensuring learner participation					
10.	Identification of learner's pace					
III	*LEARNING ENVIRONMENT*					
11.	Learners are motivated, appreciated and involved.					
12.	Learners are relaxed and confident					
13.	Management of classroom					
14.	Teacher – Student relationship					
15.	Class Control					
	Overall Performance					

Strengths of the trainee:
(May use separate papers for detailed report)

Areas of Improvement:
(May use separate papers for detailed report)

Sign. of Mentor with Name

Weekly Reflective Diary Format
We learn by doing and reflecting on what we do. (John Dewey)

Use this template to record your observations weekly. This document will be turned in every Monday following each week in the field. The weeks you teach will have a different format to follow. Please note that your document will be longer than one page.

Name:

Date:

Analyze your observations to identify specific teaching and learning strategies you observed involving the classroom teachers and their students. You may include your behavior if you are involved in the teaching process. Include more than one strategy.

Instructional Strategies (Include more than one strategy)	Specific example describing how the strategy was implemented

Learning Styles observed	Specific examples how the learner was supported through instructional delivery

1. What have you learned about teaching this week?

2. What have you observed/learned about students and their learning this week?

Theory base observed	Specific example from classroom to apply/support theory

Personal Reflection: Reflect specifically on something you observed and connect to personal opinions.

TEACHING REFLECTIVE LOG FORMAT

(This is to be completed daily during the week you teach.)

Objectives for day:

Materials for day:

Instructional Strategies used (Explain how the strategies were implemented):

What I did well:

What my students did well:

What I didn't do so well:
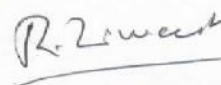
What my students didn't do so well:

What I would keep the same:

What I would Change:

What did I learn about teaching today?
(If you had to modify your lesson to help students, briefly explain here).

PT. RAVISHANKAR SHUKLA UNIVERSITY RAIPUR (C.G.)
M.ED. SYLLABUS 2018-19

S.NO.	PAPER	EXTERNAL	INTERNAL THEORY/PRATICUM
SEMESTER I	**THEORY**		
Paper I	Philosophical Perspectives of	80	
Paper 2	Sociological Perspectives of	80	20
Paper 3	Education Technology/ Teacher Education	80	20
Paper 4	Strengthening Language	100	20
	PRACTICUM		
	Exploring Library Resources		50
SEMESTER II	**THEORY**		
Paper 5	Introduction of Research Methodology in Education	80	20
Paper 6	Psychological Perspectives of	80	20
Paper 7	Specialization part I	80	20
	PRACTICUM		
	Proposal of Dissertation	100	
	Internship , School based		50
SEMESTER III	**THEORY**		
Paper 8	History and Development of Education in India	80	20
Paper 9	Economic and Political perspectives of Education	80	20
Paper 10	Advanced Education Statistics/Education	80	20
Paper 11	Gender Perspectives in Education	80	20
	PRACTICUM		
	Psycho-metric assessment		50
SEMESTER IV	**THEORY**		
Paper 12	Curriculum Development	80	20
Paper 13	Specialization Part II	80	20
	PRACTICUM		
	Academic Writing		
	Dissertation	100	50
	Viva Voce on Dissertation	100	
	TOTAL	1360	
	GRAND TOTAL		240 + 200 = 440
			1800

PSYCHOLOGY-PRACTICUM

1. Intelligence Test
2. Achievement test
3. Mental fatigue
4. Physical fatigue by Ergo graph
5. Learning by Substitution
6. Personality Testing
7. Span of attention by Tachistoscope
8. Transfer of Learning by mirror drawing

   (Any 5 practical are to be conducted)

CURRICULUM FRAMEWORK

M.ED. TWO YEARS COURSE 2018-2020

Curriculum Organization based on NCTE framework

Semester I			Semester II		Semester III		Semester IV		
(C)	PEC		(C)	P	P	(C)	P	(C)	PEC
Philosophical Perspectives of Education (4 Credits)	Strengthening Language Proficiency (4 Credits)		Introduction to Research Methodology in Education (4 Credits)	Proposal Presentation on Dissertation (2 Credits)	Internship School based Activities (4 Credits)	History and Development of Education in India (4 Credits)	Psycho-Metric Testing (4 Credits)	Curriculum Development (4 Credits)	Academic Writing (2 Credits)
(C)			(C)			(C)		(S)	
Sociological Perspectives of Education (4 Credits)	Exploring Library Resources (4 Credits)		Psychological Perspectives of Education (4 Credits)			Economic & Political Perspectives of Education (4 Credits)		Educational Guidance & Counseling / Education for Differently Abled (4 Credits)	
(E)			(S)			(E)			
Education Technology / Teacher Education (4 Credits)			Educational Guidance & Counseling (4 Credits) / Education for Differently Abled (4 Credits)			Advanced Education Statistics / Educational Administration and Management (4 Credits)		Dissertation & Viva-Voce (8 Credits)	
						(C)			
						Gender Perspectives in Education (4 Credits)			
12	8		12	6		16	4	16 / 18	2
20			18			20			

C = Core paper, E = Elective Paper, S = Specialization, PEC = Professional Enhancement Course, P = Practicum

M.ED. TWO YEARS COURSE (2018-2020)

CORE STUDY (SEMESTER I)

PAPER I- PHILOSOPHICAL PERSPECTIVES OF EDUCATION

Objectives of the course:

(i) To develop understanding of the interrelationship between Philosophy and Education

(ii) To develop appreciation of the basic tenets, principles and developments of the major Indian Schools of Philosophy and Educational thoughts of Indian Philosophers.

(iii) To develop the appreciation of the basic tenets principles and development of the major Western Schools of Philosophy.

(iv) To acquire knowledge of human values and role of education.

(v) To develop the understanding of interrelationship between Sociology and Education.

(vi) To develop appreciation of education as a means of social reconstruction

(vii) To understand the bearing of various Political & religious ideologies on Education.

UNIT-1: Philosophical Foundation of Education

1.1 Philosophy of Education.

1.2 Nature and Functions of Philosophy of Education.

1.3 Interrelationship between philosophy & Education.

1.4 Modern Concept of Philosophy: Analysis – Logical empiricism & positive relativism.

1.5 Scope- Functions of Educational Philosophy.

UNIT-2: Indian Schools of Philosophy

2.1 Sankhya, Nyaya, Vedic, Buddhist, Jainism, Islamic Traditions.

2.2 Education Implications of these schools with special reference to the concept of Knowledge, reality & values, methodology, public- Teacher. Relationship, freedom & descipline, Basic Tenets, aims, & objectives, curriculum.

2.3 Contributions of Vivekanand, Tagore, Gandhiji, Dr. Ambedkar & J.P.Naik, J.Krishnamurthi, Dr. Radhakrishnan, Arbindo to educational thinking.

UNIT-3: Western Schools of Philosophy

3.1 Idealism, Naturalism, pragmatism, realism, Existentialism, Marxism with.

3.2 Educational implications of these schools with special reference to basic tenets, Aims, & objectives curriculum methodology, Teacher. Pupil relationship, freedom & discipline.

3.3   Contribution of Plato, Rousseau, Dewey.

UNIT-4: Axiology & Education

4.1   Meaning of values

4.2   Types of various- spiritual, moral, social, aesthetic values

4.3   Values as mentioned in different schools of philosophy and their educational implications

4.4   Professional ethics of teachers.

UNIT-5: Critical Analysis of educational thoughts: With reference to-

5.1   Concept of man and the process of development
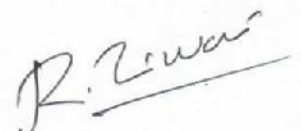
5.2   Epistemological perspectives of different thoughts.

5.3   Schools of Indian and western thought.

Reference Books:

1.   The Philosophical and Sociological foundations of Education (Doaba House, Book-sellers and Publishers, Delhi-110006) by Kamla Bhatia and Baldev Bhatia

2.   Groundwork of Theory of Education – by Ross

3.   Modern Philosophy of Education – by Brubacher

4.   Foundations of Education – V.P. Bokil

5.   Anand C.L. et.al. : Teacher and Education in Emerging India, NCERT, New Delhi.

6.   Anant Padmnabhan : Population Education in Classrooms, NCERT, New Delhi.

7.   Bhatnagar, S. : Adhunik Bhartiya Shiksha Aur Uski Samasyayen, Lyall Book Depot, Meerut.

8.   Chakravorty M. : Gandhian Dimension in Education Daya Publishing House New Delhi.

9.   Mani R.S. : Educational ideas and ideals of Gandhi and Tagore, New Book Society, New Delhi.

10. Ministry of Human Resource Development: National Policy on Education, 1896, New Delhi.

11. Mohanty Jagannath: Indian Education in Emerging Society, Sterling Publication, New Delhi.

12. Pandey, Shyam Swaroop: Shiksha ki Darshanik evam Samajik Shastriya Pursht Bcomi Vinod Pustak Mandir, Agra.

13. Pathak and Tyagi : Shiksha ke Samnya Siddhant, Vinod Pustak Mandir, Agra.

14. Pathak, RD. and Tyagi, I.S.D. Shiksha ke Samariya Siddhant. Vinod Pust8tk Mandir, Agra.

15. Saxena, N:R. Swaroop Shksha Re Samanya Siddhant, Lyall Book Depot, Meerut.

16. Singh B.P. : Alms of Education in India, Ajanta Publication New, Delhi.

17. Agrawal, J.C..: Nai Shiksha Niti. Prabhat Prakashan, Delhi.

18. Bhatnagar, R.P. Technology of Teaching, International Publishing House, Meerut.

19. Bhatnagar. R.R & Agarwal, Vidya Shaikshlk Prashasan, Eagle Books.

20. Bhatnagar, Suresh Shiksha Ki Samasyaen, Lyall Book Depot, Meerut.

21. Bhooshan, Shailendra & Anil Kumar : Shikshan Taknik. Vinod Pustak Mandir, Agra.

22. Manav Sansadhan Vikas mantralaya: Rashtriy Shiksha Niti 1986. New Delhi.

23. Safaya. Raghunath,. School Sangathan, Dhanpat Ram & Sons, Delhi.

24. Sampath, K. : Introduction to Educational Technology, Sterling Publishers, New Delhi.

25. Saxena, N.R. Swaroop, Shikshan Kala Ewam Paddatiyan. Lyall Book Depot, Meerut.

26. Sharma & Sharma Secondary Education and teacher Functions, Radha Publisher Mandir, Agra.

27. Higher Education in India ; Albach

CORE STUDY (SEMESTER I)

PAPER II : SOCIOLOGICAL PERSPECTIVES OF EDUCATION.

UNIT-1: Sociology & Education

1.1 Meaning & Nature of Educational Sociology

1.2 Interrelationship between Education and Social Variables

  (i) Sociology of Education

  (ii) Political Education – Process of Socialization

  (iii) Education and Family

  (iv) Education and Schooling

  (v) Education and culture in general

  (vi) Education and religion, Caste, Gender, Class

  (vii) Education for Weaker Sections

  (viii) Education and Development

  (ix) Sex Education

  (x) Economics of Education

  (xi) Education and Constitution

UNIT-2: Education and Socialization

2.1 Process of Socialization

2.2 Social Stratification and education

2.3 Social Mobility and Education

UNIT- 3 Education as a means of social changes

3.1 Education for emotional AND SOCIAL INTEGRATION

3.2 Education for Nationalism and International understanding

3.3 Meaning and need of Equality of Education opportunity and Social Justice with special reference to caste, class, race and religion.

3.4 Education of Socially, Economically under-developed society.

UNIT-4: Social forces and education

4.1 Education for maintaining the peace in diverse religious beliefs.

4.2 World problems and terrorism – its causes, its impact on Society and remedies through Education.

4.3 Concept of Secularism in India and World prospect and building of Secularism through Education

UNIT-5: Political Ideologies and Education

5.1 Totalitarian: Meaning, Main features, aims of Education, curriculum, Methods of teaching and School administration.
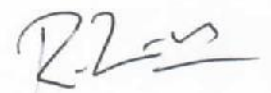
5.2 Democracy: Meaning, Values, Main features of democratic Education, aims, curriculum methods of teaching and School administration.

Practical Work (any one)

(i) Study of the comparison between one western school with one Indian school of philosophy.

(ii) Case Study of economically under developed student.

(iii) Study of the impact of modern Technology in one secondary school.

Reference books:

1. A Sociological Approach to Indian Education (Vinod Pustak mandir, Agra 2, by S.S. Mathur)

2. The Philosophical and Sociological foundations of Education (Doaba House, Book-sellers and Publishers, Delhi-110006) by Kamla Bhatia and Baldev Bhatia

3. Groundwork of Theory of Education – by Ross

4. Modern Philosophy of Education – by Brubacher

5. Foundations of Education – V.P. Bokil

6. Educational Sociology – Brown

7. De Schooling Society- Evan Illich.

ELECTIVE COURSE (SEMESTER I)

PAPER III (A) - EDUCATIONAL TECHNOLOGY

OBJECTIVES :

1) To enable the learner to become effective user of technology in Education

2) To acquaint the learner with the challenges and opportunities emerging in integrating new technology in Educational process.

3) To make the student familiar with new trends, techniques in education along with e learning.

4) To enable the student to become good practioner of Educational technology and e-learning.

UNIT – 1: Meaning & Scope of Educational Technology

1.1 Educational Technology as system approach to educator.

1.2 System approach in educational technology and its characteristics.

1.3 Components of Educational technology software and hardware.

1.4 Modalities of Teaching

1.5 Difference between teaching and Instruction, conditioning & training

1.6 Stages of teaching pre – active, interactive and post – active.

1.7 Teaching at different levels one way, understanding and reflective.

1.8 Modification of teaching behavior microteaching, Flander;s interaction analysis simulation.

UNIT – 2: Communication Modes in education

2.1 Concepts and process of communication

2.2 Principals of communications

2.3 Communication and learning

2.4 Modes of communication:

- Speaking and listing < --- > Writing and reading < ---- > visualizing and observing

2.5 SMCR model of communication, Sharon's model of communication

2.6 Task analysis

UNIT – 3: Integrating Multimedia in education

3.1 Multimedia concept and meaning text, graphics, animation, audio, video

3.2 Multimedia applications

- Computer based training

- Electronic books and references

- Multimedia application for educationist

- Information kiosks

- Multimedia www and web based training

UNIT – 4: Educational software applications

- Computer assisted instruction

- Drill & practice software

- Educational simulations

- Integrated learning system

- Curriculum specific Educational software

UNIT - 5: e-learning

5.1 E-learning definitions, scope, trends, attributes & opportunities.

5.2 Pedagogical designs & e-learning

5.3 Assessments, feedback and e-moderation

5.4 e-learning on line learning management

5.5 On line learning management system

5.6 Digital learning objects

5.7 Online learning course development models

5.8 Management and implementation of e-learning

Reference Books:

1. Integrating Technology in the classroom shelly, cashman, gunter and gunter, publication by Thomson course technology

2. Essentials of Educational Technology, Madan Lal, Anmol Publications

3. Online Teaching Tools and Methods, Mahesh Varma, Murari Lal & Sons

4. Education and Communication for development, O. P. Dahama, O. P. Bhatnagar, Oxford IBH Publishing company, New Delhi

5. Information and Communication Technology, N. Sareen, Anmol Publication

6. Communication and Education, D. N. Dasgupta, Pointer Publishers

7. e-learning a Guidebook of principals, Procedures and practices, Son Naidu, Commwealth of Learning, Commonwealth Educational Media Centre for Asis

8. Education and Communication, O. P. Dham

ELECTIVE COURSE (SEMESTER I)

PAPER III (B): TEACHER EDUCATION

Objectives:

To enable the students

(1) To understand the concept of teacher Education

(2) To develop necessary skills

(3) To develop insight into the problems of teacher Education at different levels.

(4) To develop experimental attitude in teacher Education

(5) To understand new trends, and techniques in teacher Education.

SECTION – 1

UNIT - 1: Historical development of teacher Education in India

1.1 Historical development of Teacher Education

1.2 Teacher education as distinguished from teacher training.

1.3 The need and importance of Teacher Education

1.4 Concept and structure of teacher Education

1.5 Meaning, Nature, Scope of Teacher education

1.6 Aims and Objectives of teacher Education at different level

1.7 Need for pre-service and in service professional education of teachers at different levels in the present Indian situations.

1.8 Qualifications of teachers-pre-primary, primary, Secondary, Higher Secondary, Higher Education.

1.9 Training of special teacher-Arts, Crafts, Physical Education, Home Science, Vocational Technical and work experience.

UNIT – 2: Content of Teacher Education

2.1 (i) Theory of teacher education and its duration.

(ii) Practical activities to be conducted during the training Course

(iii) Relationship and weightage given to theory and practical work.

(iv) Evaluation – Internal and external

2.2 Instructional Methods in Teacher Education

i. Lecture and discussion

ii. Seminars
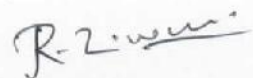
iii. Work shops

iv. Symposium

v. Group Discussion

vi. Supervised study

vii. New Methods- Microteaching, Macro-teaching, programme learning, Models of teaching, Content-cum methodology approach.

viii. Virtual and e-mode

2.3 Practice teaching in Teacher Education.

i. Demonstrations

ii. Experimentation

iii. Practice teaching and observations

iv Significance and Supervision of Practice teaching

v Internship

vi Relationship of College of Education with Co-operating Schools

UNIT-3: Evaluation procedures in Teacher Education

3.1 Assessment

(I) Aspect of Internal & External Assessment

(II) New techniques of Evaluation

3.2 Teaching as a profession:

3.3 Recommendations of various commissions on Teacher Education: Kothari Commission, National policy on Education, NCTE policy.

3.4 Professional organizations for various levels of teacher-types and their role & functions

3.5 Performance appraisal of teacher

3.6 Code of conduct and ethics of teaching profession.

3.7 Faculty improvement programme for teacher Education.

UNIT-4: Research and Teacher Education

4.1 Need of Research in Teacher Education

4.2 Action Research for quality improvement in T.E.

4.3 Area of Research in T.E.-Teaching Effectiveness, Criteria of admission, Modification of Teacher behavior, School effectiveness.

4.4 Current problems of Teacher Education

4.5 Teacher Education and practicing schools

4.6 Teacher Education and UGC, NCTE, University.

4.7 Preparing teacher for special school

4.8 Preparing teacher for Inclusive classroom.

4.9 Integrating Technology in Teacher Education.

UNIT- 5: Types of Teacher Education Programmes and Agencies:

5.1 In-service T.E. - Concept, Meaning, Need and nature

5.2 Preserves T.E. - Concept, Meaning, Need and nature

5.3 Orientation and Refresher courses

5.4 Agencies of T.E.-UGC, NCTERT, SCERT, Colleges of T. E., Open University. Academic Staff colleges, University Department of Education and Teacher Organization.

Reference Books:

1. Sualemeyarl indsey – working with student, Teachers, Eurasla Publishing House (Pvt.) Ltd., New Delhi-55.

2. William Taylor – Society and the Education of Teachers, Faber 7 Faber

3. Dr. G. Chaurasia- New Era in Teacher Education, Sterling Publishing Pvt.,Ltd.

4. Edited by S.N. Mukarji – Education of Teachers in India, Valun 1 e I& II – S Chand & Co., Delhi

5. K.L. Shrimali-Better Teacher Education. Ministry of education, Government of India

6. Dr. S. S. Dikshit- Teacher education in modern Democracies- Sterling Publishers Pvt., Ltd., Delhi-G

7. Report of the study Group on the Education of Secondary Teachers in India Association of Training College.

PROFESSIONAL ENHANCEMENT COURSE (SEMESTER I)

PAPER IV: STRENGTHENING LANGUAGE PROFICIENCY

एम.एड. सेमेस्टर I

विषय– हिन्दी प्रावीण्यता   अंक–50

यूनिट – 1 भाषा विज्ञान   (Weightage – 2questions 5 marks each)
❖ अर्थ, क्षेत्र एवं अवधारणा
❖ भाषायी सृजनात्मकता – अलंकार, रस
❖ संवाद लेखन
❖ विवरणात्मक लेखन– चित्र वर्णन, यात्रा वर्णन, त्योहार, आत्मकथा, इत्यादि

यूनिट – 2 शब्द भण्डार   (Weightage 5 Questions 3 marks)
❖ शब्द निर्माण – उपसर्ग, प्रत्यय
❖ शब्दकोष का विकास, उपयोग
❖ क्रिया भेद
❖ विशेषण व क्रिया विशेषण
❖ चिन्ह विन्यास, महत्व व उपयोग

यूनिट – 3 व्यवहारिक व्याकरण   (Weightage 25 Questions 1 marks each)
❖ सन्धि – प्रकार व नियम
❖ वाक्यभेद– रचना के आधार पर
❖ अनेकार्थी शब्द
❖ मुहावरे और लोकोक्तियाँ
❖ स्वर विज्ञान (ध्वनि पर आधारित)

Semester – I [M.Ed.]

Language Proficiency [English Language]   [50 Marks]

Unit –I [Linguistics]   (Weightage – 2questions 5 marks each)

- ❖ Linguistics : Meaning Scope and Concept

- ❖ Creativity in language : Beautification of language use of simile and metaphor, Rhyme and Rhythm

- ❖ Descriptive writing: Picture Scene, Park, Festival, Journey, College Function, Biography etc.

Unit –II [Vocabulary]   (Weightage 5 Questions 3 marks)
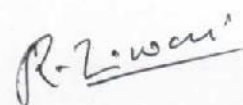
- ❖ Development of vocabulary

- ❖ Dictionary : Use of Dictionary, Difference between dictionary and thesaurus

- ❖ Use of vocabulary in noun verb, adjective, etc.

- ❖ Use and importance of punctuation in text

- ❖ Paragraph writing

Unit –III [Grammar]   (Weightage 25 Questions 1 marks each)

- ❖ Use of Vowels : Vowel blends usage of C-V-C (Consonant-Vowel-Consonant) in words

- ❖ Grammar rules : R rule , W rule

- ❖ Phonetics : S sound, G sound

- ❖ Diphthong and Digraph

- ❖ Parts of sentences

PROFESSIONAL ENHANCEMENT COURSE - SEMESTER I

EXPLORING LIBRARY AND OTHER LEARNING RESOURCES (PRACTICUM)

Objectives:

Student-teachers are expected to take some initiative in pursuing interests outside the formal course work from a range of available resources. Some of these resources are as follows:

- The institute library
- Websites on the internet
- Local events and facilities, as well as local issues (in the neighbourhood or town)
- Members of local community
- Visiting resource persons.

This component is aimed at developing a sense of initiative, imagination and discernment of learning potential of the resources available in their surroundings.

Course Outline

UNIT 1

      Knowing your library, Layout of the Library

      Library Policies

      Library Procedures – cataloguing, locating a book/material in the library.

      Library Management

UNIT 2

      Library as a resource of learning, pleasure and concentration.

      School library as an intellectual space for students and teachers.

UNIT 3
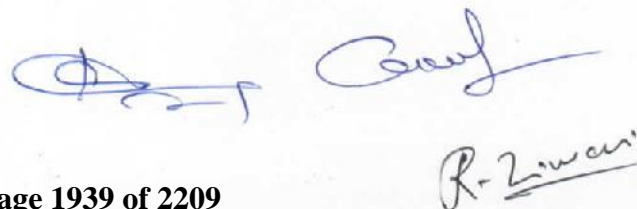
      Types of books and other material used by different readers.

      Techniques of keeping these books and materials

      Dimensions of setting up of a school library.

UNIT 4

Locating information and using it for one's own career development. Resources helpful in providing information for career development: newspaper, magazines, websites, learning guides, members of local community, resource persons.

CORE PAPER (SEMESTER II)

PAPER V: INTRODUCTION TO RESEARCH METHODOLOGY IN EDUCATION.

OBJECTIVES:

To enable the students to
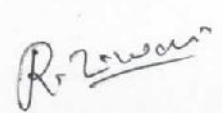
(1) To understand the concept of research and educational research.

(2) To understand the types and methods of educational research,

(3) To understand the steps involved in educational research,

(4) To understand the use of different tools and techniques in educational research

(5) To use the library, Internet services and other sources of knowledge for educational research Purposes.

(6) To understand the procedure to conduct the research in the educational field.

(7) To understand the nature of issues and problems faced by the State System of education and to find out the remedies to solve them.

(8) To understand the role and use of statistics in educational research.

(9) To select the appropriate statistical methods in educational research.

(10) To review the educational research articles.

(11) Use computers for data analysis.

UNIT–I: Concept of Educational Research

1.1 Meaning and nature, need and importance and scope of educational research.

1.2 Scientific Inquiry and Theory Development- some emerging trends in research.

1.3 Areas of educational research and different source of generating knowledge

1.4 Research Proposal

UNIT–2: Types and Methods of Educational research

2.1 Types of educational research – Fundamental, Applied, Action research

2.2 Methods of Educational Research:

(i) Qualitative Research- Ethono-methodical

(ii) Quantitative Research

(iii)Research problems, Variables and Hypothesis

(iv)Population and Sampling

UNIT–3 Review of related literature-

3.1   Purpose and need at different stages of research, sources of literature

3.2   Tools and Techniques of Educational Research- meaning and types of tools

3.3   Qualities of a good measuring tool and standardization procedure.

3.4   Collection of Data, Methods of collection of data.

UNIT–4 : Analysis and Interpretation of Data

4.1 NPC- Properties and uses, Skewness and Kurtosis

4.2 Descriptive Statistics – Significance and uses of:

(i)   Measures of Central tendency – Mean, Median, Mode.

(ii)   Measures of variability – Range, Q.D. , S.D.

(iii)   Measures of relative positions: Quartile, Deciles, Percentile and percentile rank, standard scores and T scores.

(i)   Correlation – Concepts, types and uses; assumption and uses of rank difference ,computation of rank difference correlation and Product Moment Method,

(ii)   Concepts- Bi-serial, point bi-serial- partial and multiple correlation and phi-coefficient.

(iii)   Regression equation and predictions

UNIT–5: Inferential Methods.

5.1   Concept of parameter, statistic, sampling distribution, sampling error, and standard error.

5.2   Levels of significance, confidence, limits and intervals, degrees of freedom, types of error- Types I, Type II; Tests of significance of mean and of difference between means (both large and small samples) one and two tailed tests.

5.3   Parametric and non-parametric Statistics: uses and computation of Chi-square test and Contingency coefficient.

5.4   Educational Research Report Writing (i) Format, Style, content and chapterisation (ii) Bibliography, Appendices (iii) Characteristics of a good research report.

PRACTICAL WORK: (any one)

(i) Review of Educational research report/article.

(ii) Data analysis using computer

Reference Books:

1. Best, J.W. and Kahn research in Education (9th Ed. Prentice of India, Pvt, Ltd, New Delhi,1982)

2. Tuckman Bruce W: Conducting educational Research (Harcourt Brace Javanovich, Inc. New York, 1978)

3. Garrett H.E. Statistics in Education and Psychology (Yakills Fitter & Simsons Pvt. Ltd., Bombay, 1973)

4. Kuriz Albert J. and Samuel T. Mayo, Stastitics in Education and Psychology (Narousa Publishing House, New Delhi, 1981)

5. Buch M.B., A survey of Research in Education (Centre of advanced Studies in Education, M.S.University Baroda, 1974)

6. Buch m.B. et al' second Survey of research in Education.

7. Donald Ary, Lucy Cheser Jacobs, Asghar Razavich "Introduction in research in Education" (Holt Rinehrt and Winston, New York, 19790.

8. Kreppendorff Kians contents analysis: An Introduction to its Methodology, Sage Publications. Beverly Hills, London, 1985.

9. Action research – Corery.

10. Fox David J : Techniques for the Analysis of Quantitative Data, Holt, Rinehart, & Winson, Inc.1969.

11. George Aegyrous , Statistics for research II edition Sage Publication, 2006.

12. Bieger and Gerlach ,Educational Research :A Practical Approach, Thomson Wadsworth Pup.

CORE STUDY (SEMESTER II)

PAPER VI : PSYCHOLOGICAL PERSPECTIVES OF EDUCATION

Objectives:

To enable students:

(1) To develop understanding of the Psychological basis of Education

(2) To understand the Cognitive, Affective and Psychomotor development of adolescents and youth.

(3) To develop the understanding of the theories of Personality and their use in the development of learner's Personality, measurement of personality.

(4) To understand the Changing Concept of Intelligence and it's application.

(5) To understand the theories of Learning and their Utility in the Teaching Learning Process.

(6) To understand the Concept and Process of teaching.

UNIT-1 Introduction to Psychological Basis of Education

1.1 Psychology as scientific study, its concerns-mind, consciousness, behavior, and experience: methods of study in psychology- introspection/self-reporting- observation, survey, case/study, interview, testing, Experimental.

1.2 Major schools of psychology-Structuralism, associationism behaviorism, Gestalt, Psycho-analytic, Humanistic and Cognitive.

1.3 Contribution of these Schools to Education.

UNIT-2 Development

2.1 Development – Concept, stages, dimensions.

2.2 Factors influencing development – genetic, biological environmental and physical.

2.3 Theories of development

- Piaget's Cognitive development

- Freud's Psycho-sexual development

- Erikson's psycho-social development

- Kohlberg's moral development

2.3 Language development with reference to syntax and structure

2.4 Social development – Erisco's Psycho-socio test.

2.5 Moral Development- Theories of Piaget and Kolhers.

UNIT – 3 Personality, Intelligence and Creativity

3.1   Theories of personality

3.2   Measurement of Personality

3.3   Intelligence

3.4   Nature and Theories of Intelligence

3.5   Measurement of Intelligence – Verbal, Non-Verbal Performance, Individual and Group Test of intelligence developed in India

3.6   Creativity

3.7   Creativity Concept, Factors and process, techniques for development of Creativity. Brain-Storming, Synectics, Attribute – listing.

UNIT- 4 Learning

4.1   Theories of Learning

   (i)   Operant conditioning (Skinner)

   (ii)   Conditions of Learning (Gagne)

   (iii) Information processing (Donald Norman)

   (iv)   Mastery learning (Bloom)

   (v)   Hull's reinforcement theory

   (vi)   Toleman's theory of learning

   (vii) Levin's field theory

4.2 (i) Constructivism & learning.   (ii) Brain base learning.

4.3 (i) Educational implications of theories of learning   (ii) Factors influencing learning

UNIT-5 Teaching

5.1   Models of teaching –concept and 4 families of models

5.2   Educational implications of researcher in the following areas in teaching :

   (i)   Teacher's thought processes

   (ii)   Student's thought processes

   (iii) Teaching of learning strategies

   (iv)   Teacher behavior and student achievement

   (v)   Teaching functions

   (vi)   Classroom organization and Management

Reference Books:

1. Ausubel D.P. and Robison F.G. : School learning An introduction to Educational Psychology New York Holt, Rinehart & Winston Inc 1969.

2. Bernard H.W. : Psychology of learning & Teaching, New York Macgraw Hill B

3. Gage and Berlinger : Educational Psychology, Boston Houghton Miffins Company 1984.

4. Hays J.R. : Cognitive Psychology, Thinking and Creating. Homewood Illinoins. The Dorsey press 1978

5. Joyce Bruce and well Marsha. Models of Teaching prentice Hall of India Ltd. 1985.

6. Mangal S.K. : advanced Educational Psychology; New Delhi, Prentice Hall of India Pvt,Ltd;193

7. Moully George J : Psychology of teaching botton Allyn & Decan Inc.

8. Wordsworth B.J. piaget's : Theory og cognitive and affective Development, New York, Longman incorporated, 1989.

9. Bower G.H. and Hilgard E.R. : theories of Learning New Delhi Prentice Hall india Pvt. Ltd.

10. Michael Green : Theories of Human Development prentice Hall, englewood cliffs, New Jersy,1989

11. S. Owen, H. Parker Blount, Heny Moscow : Educational Psychology – An Introduction Little, Brown and Company Boston, Toronto, 1978.

12. C.L. Kundu : Personality Development, Sterling publishers Pvt. Ltd., New Delhi, 1989

13. Charles N. Newmark : Major Psychological assessment Instruments : Allyn And Becan Inc. Boston, London, Sydney, Totonto, 1985.

14. Jayaswal, R.L. : Foundation of Educational Psychology : Allied Publishers, Bombay.

15. Bigge M.L. : Learning Theories for Teachers, Harper and Tow publishers, 1971.

16. Hilgard and Atkinson : Introduction to Psychology, Oxford and IBH Publisher, Bombay.

17. Bower G.H. and Hilgard E.R. : Theories of Learning Prentice Hall of India, New Delhi. 1980

18. Anastasi Anne: Psychological Testing, McMillan Co. New York.

19. Passi B.K. : Creativity ineducation NPC Agra 1982.

20. Daniel Goleman : Emotional Intelligence, Bantam books 1995.

21. Daniel Goleman 'Working with Emotional Intelligence 1998.'

22. Bichler R.F. and Jack Snowman : psychology Applied to Teaching Houghton Miffin Company, Boston 1986

SPECIALIZATION COURSE (SEMESTER II)

ANY ONE COURSE IS TO BE CHOOSEN FROM THE BELOW GIVEN:

A) Educational Guidance and Counseling.

B) Education for differently abled.

PAPER VII (A) - EDUCATIONAL GUIDANCE AND COUNSELLING

COURSE OBJECTIVES:

1. To acquire the students with the concepts, needs and viewpoints about Guidance and Counselling and the underlying principles in reference to normal children as well as in reference to children with special needs.

2. To acquire the students with the organizational framework and procedures of Guidance-Services in educational institutions.

3. To acquire the students with the tools and techniques required for providing guidance and counselling services to students.

COURSE CONTENT

UNIT I

Guidance and Counselling : Concept, nature, need, scope and purpose; relationship with education; issues and problems; role of teacher

- Basic types of Guidance and the underlying principles, their nature, scope and purposes.
- Basic approaches of counselling and their underlying assumptions.

UNIT II

1. Educational Guidance: basic assumptions and principles
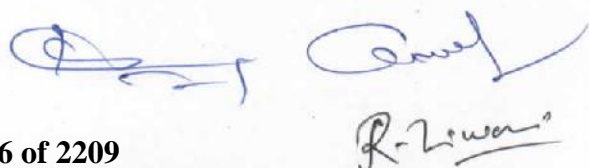
- Curricular choice and its implications for Career guidance; Guidance and Curriculum and the class room learning.

2. Vocational Guidance: basic principles.

- Vocational choice as a development process
- Nature of work and Job analysis, dissemination of occupational information: vocationalisation of secondary education and career development

UNIT III

1. Personal Guidance: basic assumptions; types of behavioural problems of school stage students. Methods and strategies of Personal Guidance

2. Group Guidance: basic assumptions. Group Guidance and Individual guidance. Techniques of Group Guidance
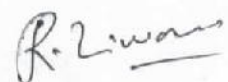
UNIT IV

1. Counselling: Meaning, need, characteristics, principles of Counselling

2. Process and types of Counselling

3. Counselling theories

UNIT V

1. Guidance and Counselling in Groups: Nature, aim, Principles and procedure; Group Counselling Vs Individual counselling; counselling for adjustment. Types of group activities- their merits and demerits

2. Current Trends, Concerns and Demands in Guidance.

(SUGGESTED READINGS ARE GIVEN AT THE END OF SECOND PART OF THE PAPER IN SEMESTER-III)

SPECIALIZATION COURSE (SEMESTER II)

PAPER VII (B) - EDUCATION FOR THE DIFFERENTLY ABLED

OBJECTIVES:

1) To enable the learner to understand the concept of Inclusive, Integrated and special education, need of special education and its practices.

2) To understand the various suggestions of recent commissions of education for the differently abled for realizing the concept of universalisation of education.

3) To enable the learner with the new trends in education for the differently abled with respect to the curriculum.

4) To enable the learner to identify the specific needs characteristics and modalities of identification of various types of differently abled.

5) To enable the learner with the educational programmes, equipments and aids for the differently abled.

PART - I

COURSE CONTENTS

UNIT I

Inclusive, Integrated and Special education-concept, meaning and difference.Concept of mainstreaming from segregated, integrated to inclusive. Introduction to education for the disabled, its objectives, assumptions and scope. Key terms – Handicap, Impairment and disability. Historical perspectives of special education.

Special education in India: Constitutional provisions , government policies and legislations. Recommendations of various Committees and Commissions – NPE (1986), POA (1992) , PWD (Person's with Disability) Act (1995). National Institutes for the handicapped and the role of rehabilitation Council of India.

UNIT II

Current issues in education for the differently abled. Cross Disability Approach. Meaning of educational intervention: Nature and objectives of schools and support services for differently abled . Role of family, counselor, peer members and the community in educating the child.

UNIT III

Types of special children : children with exceptional abilities- creative and gifted ; with deficiency and handicaps - mentally retarded , sensory and physically disabled ; with learning disability – slow learners ,under achievers ,and other types of learning disabled ; with social and emotional problems – truant ,delinquents ,drug addicts .Easy identification and educational programmes and their placement.

UNIT IV

Children with exceptional abilities: Types – Gifted and creative ;Meaning, characteristics and identification of each type. Measurement of creativity and fostering activities and programmes for creativity. Psychology of teaching and learning in respect to the gifted and the creative.
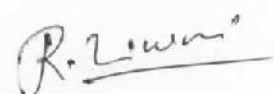
Curriculum, Pedagogy , evaluation and placement for each type.

UNIT V

Problem children : concept , meaning of truants , delinquents , drug addicts and other types of problem children. Etiology and prevention. Preventive measures and educational programmes ; placement of delinquents , drug addicts and other types.

PRACTICUM

Visit to integrated school : identification of creative child – measurement of creativity (SUGGESTED READINGS ARE GIVEN AT THE END OF PART II)

CORE COURSE (SEMESTER III)

PAPER VIII - HISTORY AND DEVELOPMENT OF EDUCATION IN INDIA

Course Objectives-

1. To be acquainted with the salient features of education in India in Ancient & Medieval times.

2. To be acquainted with the development of education in British India.

3. To be acquainted with the development of education in Independent India, including significant points of selected Education.

4. To be acquainted with current issues and trends in Education.

UNIT– I

1. Synoptic study of Brahmanic, Buddhist and Islamic Education in Ancient and Medieval India with respect to (a) Aims and Objectives (b) Subject of study (c) Methods of teaching including teacher – Pupil relationship. (d) Evaluation (e) Centre of Learning (f) Education of woman (g) Education in Ancient and Medieval India, characteristics of Gurukul, Matha/Vihar, Madarasah of and Maktabs.

2. Brief outline of events relating education from 1757 to 1947 - Missionaries activities (Srirampur Trio) (3) Charter Act of 1813 Bengal Renaissance – Contribution of Rammohan Ray H.L.V. Derozio. And Vidyasagar. Adams Report. Anglicist–Orientalist controversy– Macaulay's Minute & Bentinck's resolution. Wood dispatch (Recommendations only)

UNIT–II

Brief outline of Hunter Commission 1882-83 (Primary and Secondary Education), Curzon Policy (Quantitative development of Primary education, Quantitative and Qualitative development of Secondary education, Qualitative development of Higher education). National Education Movement (cause and effect) Calcutta University Commission (1917-1919), Basic Education (concept & development), Sargent Plan, Gokhle-bill, Sadler commission, Wardha Scheme.

UNIT-III: (1). Constitutional provision for Education in India **(2).** Brief outline of the recommendations made by different Education Commission: **(3).** University Education Commission (1948-49) **(4).** (Aims of Higher education & Rural University) Secondary Education Commission (1952-53) **(5).** Aims, Structure & Curriculum of Secondary education) Indian Education Commission (1964-66), National knowledge commission.

UNIT-IV (1) National Policy on Education (1986). (2) Current issues in education: Equalization of Education Opportunities. (3) Programmes on Universal Elementary Education (DPEP &SSA) (4) Non-formal education and alternative schooling, Education of women.
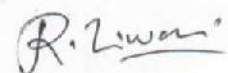
UNIT-V- : (1) Problems in Indian Education ; Secondary & Higher Secondary Education, Environmental Education, Vocational Education. (2) Experiments in Indian Education; About Eminent Vishwa Vidhyalaya in India like- Shanti Niketan, Nalanda University, Vanasthali University etc.

References:

1. Atlekar, A.S. -Education in Ancient India.

2. Basu, A.N. -Education in modern India.

3. Basu, A.N. -Adam's Report.

4. Banerjee.J.P. -Education in India-past, Present and future.

5. Dhar, Niranjan. -Fundamentals of Social Education.

6. Keay, E.E. -India Education in Ancient times.

7. Law, N.N. -Promotion of Learning in India.

8. Mukherjee, S.N. -Education in India, Today & Tomorrow.

9. Mukherjee, S.N. -History of Education (Modern Period).

10. Nurulla, S., Naik, J.P. -History of Education in India.

11. Purkait, B.R. -History of Indian Education.

12. Rawat, P.L. -History of Indian Education.

13. Sreemali, K.L. -The Wardha Scheme.

14. Indian Education Act. -1904

15. Govt. of India report of University Education Commission (1948-49).

16. Govt. of India report of Secondary Education Commission (1952-530).

17. Report of education Commission (1966) education and National development, Ministry of Education, New Delhi.

18. Govt. of India, Ministry of Human Resource – Development, National Policy on Education, 1986. New Delhi.

19. Govt. of India, Ministry of Human Resources Development, National Policy on

Education, 1986, Programme of Action, New Delhi.

20. Govt. of India, Ministry of Human Resource Development, Policy of Action, 1992, New Delhi.

21. Dayal Bhagwan – Development of Modern Indian education.

22. Education of Women key to progress, Ministry of education, New Delhi.

23. Kundu, C.L.-Adult Education.

24. Shah. A. & Ban, S.-National Education.

25. Singh, R.K.-Open University.

26. Shrivastava, K.N.-Education in Free India.
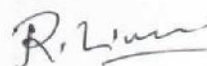
CORE STUDY (SEMESTER III)

PAPER IX - ECONOMIC & POLITICAL PERSPECTIVES OF EDUCATION

UNIT – I Economic Approach to Education

- Economics of Education
- Financing of Education
- Financing Higher Education in India
- Finance Commission and Allocation of Resources to the states for Education
- Economic problems of Education – related to quality and quantity. UNIT – II Educational Economy & Planning
- Meaning and nature of Economic Planning with special reference to Education
- National Budget of Education
- Principles of Educational Finance
- Methods of Financing Education
- Cost of Education
- Sources of income in Education – Govt., Private & Cooperative patterns of investment in Education
- Grants-in-Aide – Types, principles, practices & procedure UNIT- III Educational Finance
- Educational Finance – Need, Significance & Principles
- Concept of Educational Finance
- Demand for Education
- Supply of Education
- Educational Financing in India – a historical perspective UNIT – IV: Political perspective of Education
- Needs of education of Free India
- World New Trends of Education
- Five Year plans in India – Its historical background
- Main features of Five Year Plans with special reference to Education
- Impact of Five Year Plans on Education

- Perspective Plan for education in the 11th Five Year Plan

UNIT – V Educational Policy

- Indian Constitution & Its provisions for Education, Various articles related to Education, RTE
- Need and importance of Education Policy
- Types of Educational Policy – National, State Level & Institutional Level
- Role, Function & Impact of following organizations in upliftment of Education
  - NCERT
  - UGC
  - NCTE
  - SCERT
  - NUEPA
- Recent Initiatives in Education
  - At National level
  - At Chhattisgarh State Level
  - At District Level
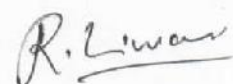
Reference Books:

1. History & Problems of Education – Volume I & Volume II Yogendra K. Sharma
2. UNESCO – Economic & Social aspects of Educational Planning – 1963
3. N.C.E.R.T – NCERT – The First Year Book of Education – 1961
4. Bell & Bell (2006) Education Policy & Social Class, Routledge
5. Naik J.P. (1965) Educational Planning in India, New Delhi: Allied
6. Mathur S.P. (2001) : Financial Administration & Management – The Indian Publications, India
7. Ramcharan Padma & R.Vasantha (2005) : Education in India, New Delhi, National Book Trust
8. Blaug, Mark (1972) An Introduction to Economics of Education – Allen Lane, The Penguin, London
9. Tilak, J.B.G (1988) Cost of Education in India – International Journal of Educational Development

10. Educational Planning & Management – Premila Chandran Sekaran, Sterling Publication Pvt. Ltd.

11. Perspectives of education – Mahesh Bhargava & Rajshree Bhargava, H.P. Bhargava Book House, Agre

12. Educational Planning, Budgeting & Financing in India, J.C.Aggarwal, Arya Book Depot, New Delhi.

(E) ELECTIVE II (SEMESTER III)

PAPER X (A) - ADVANCED EDUCATIONAL STATISTICS

OBJECTIVES:

To enable the students

(1) To understand the role and use of advanced Statistics in educational research.

(2) Select appropriate statistical methods in educational research

(3) To understand various Statistical measures for interpretation of data.

(4) To interpret the Statistical data.

UNIT- 1: The Normal distribution & Statistical measures.

1.1 Properties of normal probability distribution

1.2 Defects in normality-1 Skewness, 2. Kurtosis

1.3 Applications of normal probability curve

1.4 Statistical Measures

1.5 Difference between Statistical Measures

1.6 The significance of mean, median, standard deviation, quartile deviation, percentage and correlation.

1.7 The significance of difference, coefficient of correlation

1.8 Meaning of partial and multiple correlation

1.9 Simple applications of partial and multiple correlation

1.10 Biserial Correlation – Point biserial correlation

1.11 Phi-correlation-contingency coefficient

UNIT- 2: The scaling of tests

2.1 Sigma scaling and standard scores

2.2 T scaling

2.3 Stanine scaling

2.4 Percentile scaling

2.5 The reliability of test scores and methods of determining it.

2.6 Validity of test scores and determining validity

2.7 Item analysis

UNIT 3: Analysis of Variance

   3.1   Meaning of variance

   3.2   Method of analyzing variance

   3.3   Meaning of Covariance

   3.4   Analysis of Co-variance

UNIT 4: Testing of Experimental hypothesis by, non parametric tests

   4.1   Chi-square test

   4.2   Sign test

   4.3   Median test

   4.4   Man Whitney U test

UNIT-5: Regression and prediction.

   5.1   Nature of Scatter- diagram

   5.2   Meaning of regression

   5.3   Regression equations

   5.4   Application of regression equations in prediction

Reference Books:

1. H.E. garett- Ststistics on Psychology & edn, Longman Green & co., London

2. B. fruchter-Introd 1.1ction to factor analysis – D Van Hostrand & co., N.Y.

3. G Thompson – Frctoranalysis of human Ability, University of London Press

4. Albert Kurtz Semual Mayo –Statistical Methods in education and Psychological springer International student edition.

ELECTIVE COURSE II (SEMESTER III)

PAPER X (B)- EDUCATIONAL ADMINISTRATION AND MANAGEMENT

OBJECTIVES:

(1) To enable the learner to become effective manager of teaching /Administration of Education.

(2) To enable learner to become & agents of change in various aspects of education i.e. classroom management, curriculum construction, examination systems, Educational policies.

(3) To acquaint the learner with the challenges and opportunities emerging in the management and administration in education.

(4) To acquaint the learner with the Central and State machinery for educational administration and management.

(5) To make the students understand about the finance, management of Education.

(6) To make the student familiar with the new trends and techniques of education.

(7) To enable the students to get some insight into supervision, inspection and know trends of development

(8) To development an understanding of the planning of education in India and its Socio-economic context.

UNIT- 1: Management concept and process

1.1 Management – concept, Need of Management, Characteristics of good Management.

1.2 Management at different levels-Elementary Higher, secondary Higher Education, Time Management, Functions of Management

1.3 Leadership –Meaning and nature of Leadership, Theories of Leadership, Styles of Leadership and Measurement of Leadership.

1.4 Role of Management/Principal characteristics of effective Educational leadership, Time management techniques, manager as a good leader, group dynamics and motivation.

UNIT 2: Application of Management concept in Academic areas of the educational systems-

2.1 Curriculum development /Evaluation

2.2 Teaching Learning Processes

2.3 Evaluation Assessment (Management, Manager, Teacher, student, Parents)- Self Appraisal.

2.4 Professional Growth- In service Training

2.5 Planning in Education – Approaches to Educational Planning

2.6 Communication,

2.7 Communication skills. (Verbal, non-verbal-written),

2.8 Barriers and distortions in communication.

2.9 Information Systems- Modern Information Technology.

UNIT – 3 Machinery for educational Administration

3.1 Central Machinery (CABE,NCTE,UGC,) / State Machinery for educational Administration,.

3.2 Organization and functions of directorate of Education.

3.3 Roll of Central Govt., State Govt., and local bodies in education at all levels.

3.4 Trends in Educational Management

3.5 Decision Making – Nature, division of work, Centralization action and Decentralization of decision making, their merits and limitations.

3.6 Organizational compliance.

3.7 Organizational Development.

UNIT 4 Finance Management-

4.1 National budget of Education

4.2 Principles of Educational finance

4.3 Methods of Financing Education

4.4 Source of Income: Govt, Private and co-operative patterns of investment in education- past, present and future.,

4.5 Grant – in-aid principles, practices, types and procedure in- respect of University level.

4.6 Cost of Education.

UNIT- 5 Quality Management in Education

5.1 Meaning and importance of Quality

5.2 Quality in Higher Education

5.3 Accreditation Concept- Meaning, parameters, Role of NAAC

5.4 Educational Supervision and inspection –

5.5 Meaning and Nature of Educational Supervision

5.6 Functions of a supervisor, Defects in existing system of supervision, Remedies.
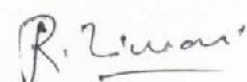
Practical – Any one

(1) Educational Survey of any state educational Institution.

(2) Report on an Institutional Planning of any one Educational Institute.

(3) Report on an Educational Institute on Quality Management.

Reference Books:

1. School Organisation and Administration- M.S. Sachdeva

2. Management in Education- Namita Roy chaudhary A. P.H. Publishing corporation, New Delhi.

3. Educational Planning and Management Premila Chandrasekaran, sterling Publication Pvt. Ltd.

4. Educational Administration and Management – S.S. Mathur

5. Theory of Educational Administration- S.R. Vashost

6. Efficient School Management and Role of Principals- Alka Karla

7. Administrative Strategy and Decision making- Hardwick Landuyt

8. Administration and management of Education- dr. S.R. Pandya, Himalaya Publishing House

9. Educational Administration Planning and Supervision- T.P. Lambal, V.R. Saxena, V.Murthy, Delhi Daoba house

10. School Organisation and Administration- U.S. Sidhu

11. Administration of Education in India- S.N. Mukharji

12. Educational Administration Principles and Practices- S.S. Mathur

CORE COURSE (SEMESTER III)

PAPER XI - GENDER PERSPECTIVES AND EDUCATION

Aims of the Course:

This course will enable the students to

• Develop basic understanding and familiarity with key concepts–gender, gender bias, gender stereotype, empowerment, gender parity, equity and equality, patriarchy and feminism;

• Understand the gradual paradigm shift from women's studies to gender studies and some important landmarks in connection with gender and education in the historical and contemporary period;

• Learn about gender issues in school, curriculum, textual materials across disciplines, pedagogical processes and its intersection with class, caste, religion and region; and

• Understand how gender, power and sexuality relate to education (in terms of access, curriculum and pedagogy).

UNIT 1: GENDER ISSUES: KEY CONCEPTS

In this Unit the students will develop an understanding of some key concepts and terms and relate them with their context in understanding the power relations

1.1 Gender, sex, sexuality, patriarchy, masculinity and feminism

1.2 Gender bias, gender stereotyping, and empowerment

1.3 Equity and equality in relation with caste, class, religion, ethnicity, disability and region. Suggested Practicum

  • Preparation of project on key concepts and relating it with the social context of the pupil teacher

  • Analysis of textual materials from the perspective of gender bias and stereotype

  • Organising debates on equity and equality cutting across gender, class, caste, religion, ethnicity disability, and region.

UNIT 2: GENDER STUDIES: PARADIGM SHIFTS

In this Unit, the students will develop an understanding of the paradigm shift from women studies to gender studies, based on the historical backdrop. They would be able to construct critically the impact of policies, programmes and scheme for promotion of gender equality and empowerment.

2.1 Paradigm shift from women's studies to gender studies

2.2 Historical backdrop: Some landmarks from social reform movements of the nineteenth and twentieth centuries with focus on women's experiences of education

2.3 Contemporary period: Recommendations of policy initiatives commissions and committees, schemes, programmes and plans.

Suggested Practicum

- Preparation of project on critical analysis of recommendations of commissions and policies on capacity building and empowerment of girls and women, how these initiatives have generated in the formation of women collectives and have helped in encouraging grassroots mobilisation of women, such as the Mahila Samakhya programmes

- Project on women role models in various fields with emphasis on women in unconventional roles.

UNIT 3: GENDER, POWER AND EDUCATION

In this Unit, the students will develop an understanding of different theories on gender and education and relate it to power relations. The institutions involved in socialisation processes would be analysed to see how socialisation practices impact power relations and identity formation.

3.1 Theories on Gender and Education: Application in the Indian Context

- Socialization theory

- Gender difference

- Structural theory

- Deconstructive theory

3.2 Gender Identities and Socialisation Practices in:
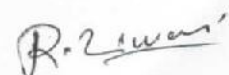
- Family

- Schools

- Other formal and informal organisation.

3.3 Schooling of Girls:

Inequalities and resistances (issues of access, retention and exclusion)

Suggested Practicum

- Discussion on theories of gender and education with its application in the Indian context

- Project on analyzing the institution of the family

(i) Marriage, reproduction

(ii) Sexual division of labour and resources

- Debates and discussions on violation of rights of girls and women
- Analysis of video clipping on portrayal of women
- Collection of folklores reflecting socialisation processes.

UNIT 4: GENDER ISSUES IN CURRICULUM

Students will build on the previous two Units to understand how gender relates to education and schooling. In this Unit, the students will be able to understand on how school as an institution addresses gender concerns in curriculum, textual materials and pedagogy. It will enable the student to draw linkages between life skills and sexuality.

4.1 Gender, culture and institution: Intersection of class, caste, religion and region

4.2 Curriculum and the gender question

4.3 Construction of gender in curriculum framework since Independence: An analysis

4.4 Gender and the hidden curriculum

4.5 Gender in text and context (textbooks' inter-sectionality with other disciplines, classroom processes, including pedagogy)

4.6 Teacher as an agent of change

4.7 Life skills and sexuality. Suggested Practicum

- Preparation of indicators on participation of boys and girls in heterogeneous schools–public and private-aided and managed by religious denominations
- Preparation of tools to analyse reflection of gender in curriculum
- Preparation of checklist to map classroom processes in all types of schools
- Field visits to schools, to observe the schooling processes from a gender perspective.

UNIT 5: GENDER, SEXUALITY, SEXUAL HARASSMENT AND ABUSE

The Unit will enable students to apply the conceptual tools learnt regarding gender and sexuality to understand issues related to Sexual Harassment at the workplace and Child Sexual Abuse.

5.1 Linkages and differences between reproductive rights and sexual rights

5.2 Development of sexuality, including primary influences in the lives of children (such as gender, body image, role models)

5.3 Sites of conflict: Social and emotional

5.4 Understanding the importance of addressing sexual harassment in family, neighbourhood

and other formal and informal institutions

5.5 Agencies perpetuating violence: Family, school, work place and media (print and electronic)

5.6 Institutions redressing sexual harassment and abuse. Suggested Practicum

- Project on how students perceive sexuality and their own body images. It would also focus on how gender identities are formed

- Debate on how they perceive role models in their own lives

- Preparing analytical report on portrayal of women in print and electronic media.

Suggested Readings:

1. Gender Analysis of State Policies: A case study of Chhattisgarh, Dr. Sen Ilina

2. Towards Gender Equality in Education: Progress and challenges in Asia-Pacific Region, R. Govinda, National University of Educational Planning and Administration, New Delhi.

3. Bhattacharjee, Nandini (1999) Through the looking-glass: Gender Socialisation in a Primary School in T. S. Saraswathi (ed.) Culture, Socialization and Human Development: Theory, Research and Applications in India. Sage: New Delhi.

4. Geetha, V. (2007) Gender. Stree: Calcutta.

5. Ghai, Anita (2008) Gender and Inclusive education at all levels In Ved Prakash & K.Biswal (ed.) Perspectives on education and development: Revising Education commission and after, National University of Educational Planning and Administration: New Delhi

6. Jeffery, P. and R. Jefferey (1994) Killing My Heart's Desire: Education and Female Autonomy in Rural India. in Nita Kumar (ed.) Women as Subjects: South Asian Histories. New Delhi.

7. Learning, Livelihoods, and Social Mobility: Valuing Girls' Education in Central India, Peggy Froerer, Brunnel University, Anthropolgy and Education.

CORE STUDY (SEMESTER IV)

PAPER XII CURRICULUM DEVELOPMENT

OBJECTIVES:

(1) To understand the concept and principles of curriculum development.

(2) To understand and appreciate curriculum as a means of development of the individual.

(3) To gain insight in to the development of new curriculum.

(4) To understand the Foundations of curriculum development.

(5) To appreciate the need for continuous Curriculum reconstruction.

(6) To help the student to develop skills in framing curriculum for subjects of teaching, analyzing curriculum for teaching-learning process and developing course contents in the subjects of teaching.

UNIT – 1 Principles of Curriculum Development

(a) Meaning and Concept of Curriculum

(b) Concept of Curriculum development

(c) Stages in the Process of Curriculum development

(d) Curriculum Syllabus and Units

UNIT- 2 Philosophical, Sociological and Psychological foundation of curriculum.

(a) Philosophical theories and their implications to Curriculum.

(b) Sociological needs and their implications for curriculum development.

(c) Psychological needs their implications for curriculum development.

(d) Curriculum development and teaching-learning process.

UNIT-3 Curriculum Development

(a) Need and Scope for Curriculum development, Criteria for Future Curriculum development and Characteristics of a good Curriculum.

(b) Strategies of Curriculum development.

(c) Guiding Principles for Curriculum development.

(d) Organization of Curriculum

UNIT-4 Procedure of organizing Content

(a) Formation of general objectives at School stage and their specification.

(b) Formation of instructional objectives and their specifications

(c) Terms of expected behavior changes in the students.

(d) Suggesting appropriate content to fulfill the objectives.

4.1 Factors responsible for innovations in curriculum development.

(a) Problems of curriculum reform.

(b) Periodic revisions of curriculum in view of the knowledge.

(c) Evaluation as an integral part of curriculum development.

(d) Need for permanent curriculum research unit.

UNIT-5 Evaluating the Curriculum

(a) A frame work for evaluation

(b) Planning for evaluation

(c) Conducting the Programme evaluation

(d) Evaluating the curriculum materials

(e) Conducting the Curriculum material evaluation

PRACTICAL WORK

1. Seminar on one of the topic assigned.

2. Critical analysis of the existing curriculum at various levels- primary/Secondary/Higher Secondary.

3. A report on the recent research on curriculum development

4. A Comparative study of two syllabi-state Government/ ICSE.

Reference Books:

1. "व्ांपछां डैंवफांदं रू उनस्व ,द्रंव

2. "व्ांपछां डैंवफांदंबं +चतवझं रू वं पअंण तंण पठंडजंक्व

3. "व्ांपछां अलंअुंचदं अं चैंदं रूवं कनदंझव वं चंतंदंप्

4. Curriculum Organization and Design- Jack Walton, Great Briton

5. Curriculum and lifelong Education- Studies for UNESCO

6. School Curriculum- Mohmmad Sharif Khan- ASHISH Publishing House, New Delhi.

7. The Improvement of Curriculum in Indian Schools H.E. Harmay, Ministry of Education.

8. Curriculum reform – B.D. Bhatt, Kanishka Publishers, New Delhi

9. Developing the Core Curriculum 3/ 4 roland C. Faunce, Nelson L. Bossing, Prentice Hall ofIndia, New Delhi

10. Evaluation and Research in Curriculum Construction- M.I. Khan I B.K. Nigam- Kanishka, Publisher, New York

11. Curriculum Development & Educational Technology Mamidj, S. Ravishankar- Sterling Publishers.

SPECIALIZATION COURSE (SEMESTER IV)

PAPER XIII (A) – EDUCATIONAL GUIDANCE AND COUNSELING (PART II)

UNIT I

1. Bases of guidance: Philosophical, Sociological, Pedagogical, Psychological

2. Concept of guidance: Meaning, Basic assumptions Need of guidance, Influence of family and Community on guidance. Functions and purposes of Guidance.

3. Types of guidance: Major guidance areas- Personal, educational, Career, Social, Health, Marital, Moral.

4. Adjustive guidance: Identification of maladjusted children and the principles of dealing with them.

UNIT II

1. Guidance of children with problems and special needs: gifted and creative; Role of the teacher in helping such children.

2. Group guidance: concept and techniques of group guidance.

3. Principles of mental hygiene and their implications of effective adjustment; mental health and development of integrated personality.

UNIT III

1. Guidance services: Individual Inventory and Information counselling Group Guidance services, Placement services and Follow-up services.

   • Guidance of children with special needs, role of teacher.

2. Organization of a Guidance programme and its principles-at elementary, secondary, college and university levels.

   • Evaluation of Guidance programmes **UNIT IV**

1. Guidance and Appraisal of the Individual: meaning, need, purpose and place of appraisal in Guidance.

2. Techniques of Appraisal: Testing techniques - tests (viz. Intelligence, Aptitude, Knowledge and Achievement), Interest tests and Personality measures.

   • Non-Testing Techniques–Rating scales, Questionnaires, Inventories, records and sociometric tools.

UNIT V

1. Job Analysis: Meaning and objectives of job analysis

2. Outline for job study

3. Job profiles

4. Job satisfaction

Practical Work (any one)

1. Job analysis of any one occupation

2. Prepare an interview schedule for an effective Counselling

3. Visit a guidance Centre and Write a report about its organization and functions.

Reference Books:

❖ Blocher, D.H. et al., (Eds. 1971): Guidance systems, New York: The Ronald Press Co.

❖ Bhatnagar, A. & Gupta, N. (Eds. 1999): Guidance and Counselling: A Theoretical Perspective, New Delhi: Vikas Publishing House.

❖ Lakshmi, K.S. (Eds. 2000) : Encyclopaedia of Guidance and Counselling, New Delhi: Mittal Publications.

❖ Shaw, M.C. (1973): School Guidance Systems. Boston: Houghton Mifflin Co. Anastasi, A. (1982). Psychological testing. London: Collier Macmillan Publishers.

❖ Bernard, H.W. & Fullmer, D.W. (1972). Principles of Guidance- a basic text. Bombay: Allied Publishers.

❖ Dink Mayer, D.C. & Caldwed, C.I. (1970). Development Counselling and Guidance- A Comprehensive School Approach. New York: Mac Graw Hill.

❖ Donald, H.B. Richard, D.C. & Willier, E.D. (1971). Guidance Systems- An introduction to student personal work. New York: The Ronald Press Company.

❖ Fullmer, D.W. & Bernard, H.W. (1972). Counselling: Content and Process. New Delhi: Thompson Press.

❖ Hackney, H. & Nye, S. (1973). Counseling Strategies and Objectives. New Jersey: Prentice Hall Inc.

❖ Indu Dane (1983). The basic essentials of counselling. New Delhi: Sterling Publishers Pvt.

❖ Jones, Stafflire & Stewart (1978). Principles of Guidance Sixth Edition. New Delhi: Mac Graw Hill.

❖ Mortensen, D.U. & Schumuller, A.M. (1976). Guidance in todays schools. New York: John Willy & Sins. Inc.

❖ Moser & Moser (1963). Counselling and Guidance an Exploration. New York: Prentice Hall Inc. Patterson, C.H. (1980). Theories of Counselling and Psycho Therapy. New York, Harper and Roul.

❖ Richard, C.N. (1972). Guidance and Counselling in the Elementary School. New York: Hlot Rineheart and Winston Inc.

❖ Robert Basell (1971). Interviewing and Counselling. London: H.T. Batsford, Ltd. Stefflee & Grant (1972). Theories of Counselling. New York: McGraw Hill.

❖ Traxler & North (1966). Techniques of Guidance. New York: Harper & Row Publishers. Super, D.E. & Crites, J.O. (1966). Appraising Vocational Fitness, Harper & Row.

❖ Raj Singh (1994). Educational and Vocational Guidance. New York: Commonwealth Publishers.

SPECIALIZATION COURSE (SEMESTER IV)

PAPER XIII (B) – EDUCATION FOR THE DIFFERENTLY ABLED(PART II)

COURSE CONTENTS

UNIT I

1. Children with physical disabilities: Basis of classification (Physical, physiological, social, psychological and mental), characteristics and etiology of each type and difference between them.

2. Education of visually impaired: Concept , Characteristics, Types (degree of impairment). Etiology and prevention.

3. Psychology of teaching and learning in relation to the disability and their specific needs. Curriculum, pedagogy, evaluation and placement . Role of National Institute for the visually impaired.

UNIT II
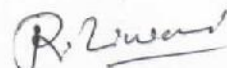
1. Education for the hearing impaired: Concept, Characteristics, Types (degree of impairment). Etiology and prevention.

2. Psychology of teaching and learning in relation to the disability and their specific needs. Curriculum, pedagogy, evaluation and placement. Role of National Institute for the hearing impaired.

UNIT III

1. Education for the Orthopaedically handicapped : Concept , Characteristics , Types (degree of impairment). Etiology and prevention.

2. Psychology of teaching and learning in relation to the disability and their specific needs. Curriculum, pedagogy, evaluation and placement. Role of National Institute for the orthopedically handicapped.

UNIT IV

1. Education for the mentally retarded: Mentally retarded, slow learners, backward and learning disabled children. Concept, Characteristics, Etiology and prevention.

2. Psychology of teaching and learning in relation to the disability and their specific needs. Curriculum, pedagogy, evaluation and placement. Role of National Institute for the Mentally retarded.
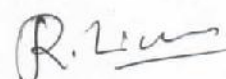
UNIT V

1. Socially deprived and emotionally disturbed children: Concept, characteristics and types (Dyslexic and delicate). Etiology and prevention.

2. Psychology of teaching and learning in relation to the disability and their specific needs. Curriculum, pedagogy, evaluation and placement .

3. Practicum

Books Recommended:

1. Bender, W.N. Learning Disability, Allyn & Bacon, Simon and Schuster, 1995, Boston London

2. Berdine, W.H & Blackhurst A.E.(eds). An Introduction to Special Education, Harpers Collins Publishers, Boston 1980.

3. Dunn., L & Bay, D.M (ed.): Exceptional Children in the Schools, New York : Holt, Rinehart, Winston.

4. Hallahar, D.P & Kauffman, J.M., Exceptional Children: Introduction to Special Education, Allyn & Bacon, Massachusetts, 1991

5. Hewett, Frank M. & Foreness Steven R., Education of Exceptional Learners, Allyn & Bacon, Masachusetts, 1984.

6. Jorden, Thomes E. The Exceptional Child, Ohio: Merrill.

7. Kirk, S.A & Gallagher J.J., Education of Exceptional Children ; Houghton Mifflin Co., Boston, 1989

8. Magnifico, L.X: Education of the Exceptional Child, New York, Longman.

9. Shanker, Udey: Exceptional Children, Jullundur: Sterling Publications.

10. Singh, N.N and Beale, I.L. (eds.) Learning Disabilities – Nature, Theory and Treatment Spring-Verlag, New York, Inc:1992.

11. Smith, C.R, Learning Disabilities – the interaction of Learner, Task and Setting. Allyn and Bacon, Massachusetts, 1991.

12. Strange, Ruth : Exceptional Children & Youth J.J. : Prentice Hall.

Syllabus

Women Law & Gender Justice

Part – I

Theory

Maximum Marks : 100

Unit - I

Basic concept **:** What is Law & Justice, Sex, Gender, Femininity, Masculinity, Androgyny, Sexually, Discrimination and Women Empowerment.

Feminism **:** Concept and Meaning, Feminism in India, Development and Feminist Development theory.

Constitution of India and the Gender question : Fundamentals rights, Directive Principles of state policy and Fundamental duties.

Unit II

Women Human Right : Historical background, UN Conference and Convention on women Need and Principles of Women's Rights. Natural rights of a girl child.

Law : Concept and Importance. Judicial System RTI, PIL, Legal Aid for women in India Family Court.

Unit III

Law for women in India : Marriage laws : Special marriage Act, 1954, Muslim Personal Law (shart) application Act., 1937, Prohibition of Child Marriage act, 2006.

Divorce Law : Judicial Separation, Divorce Restitution of Conjugal Rights and Maintenance (Hindu and Muslim) section 125. Criminal procedure code 1973.

Unit IV

Property Right and Women : Right to succession and inheritance (Hindu and Muslim Law).

Medical Termination of Pregnancy Act.1971, PCPNDT Act, 2000, Prevention of Sexual Harassment of Women in Work place. The indecent – representation of women (Prohibition) Act, 1986, Domestic Violence Act, 2005.

Anti Rap Law (latest criminal amendment act 2012)

Adoption laws in India.

Surrogacy laws in India.

Status of single female parent at the time of adoption.

Succession Act. etc

Unit – V

1. National and State Commission of Women : Role & Responsibilities.
2. Women's contribution in Policy Making and Leadership in Women.
3. Understanding women's issues in Panchyati Raj
4. Gender budgeting.

Part II

Maximum Marks : 100

Project work :

Minutes of Board of Studies

The meeting of Board of Studies in Regional Studies and Research was held on July 10, 2018 in School of Regional Studies and Research at 12:00 noon.
Following members were present:

1. Prof. Mitashree Mitra, Chairman, BoS
   School of Regional Studies & Research, Pt. RSU, Raipur

2. Prof. Promila Singh – Member
   SoS in Psychology, Pt. RSU, Raipur

3. Prof. A.K. Pandey – Member
   SoS in Economics, Pt. RSU, Raipur

Business transacted:

: Approval of the Minutes of the last BoS Meeting.

: Minutes of the last BoS meeting held on July 07, 2018 approved.

Agenda 1: Approval of PG course in Rural Development (2018-19)

: The existing syllabus of M.A. in Rural Development was thoroughly checked and approved.

Agenda 2: Approval of Ph.D. Entrance (Rural Development) & Ph.D. Course Work, M.Phil, P.G. Diploma in Regional Planning and Development, PG Diploma in Theory and Practice in Panchayat Monitoring and Evaluation and Three months Certificate Course on Rural Secretary (2018-19)

: Ongoing syllabi of P.G. Rural Development, Ph.D. Entrance Test (Regional Studies & Rural Development) & Ph.D. Course Work (Regional Studies & Rural Development) were approved with minor modification.

Syllabus for entrance test of PG Diploma in Regional Planning and Development was prepared and approved by the committee. Certificate course as mentioned above is approved

Approved syllabus is enclosed.

Agenda 3: Approval of Certificate Course in Community based Participatory Research (CBPR) (To be run by Centre for Women's Studies)

: As per MoU (signed on 05.02.2018) between PRSU, State Planning Commission and Society for Participatory Research in Asia (PRIA) under Knowledge for Change (K4C): An Global Consortium for Training in Community Based Research, the Certificate Course in Community Based Participatory Research (CBPR) is approved.

Committee approved the proposal and syllabus.
The meeting ended with vote of thanks to the Chair.

SYLLABUS

Certificate Course In Community Based Participatory Research

Centre for Women's Studies
Pt. Ravishankar Shukla University,
Raipur (C.G)

2018-2019

Certificate Course In: Community Based Participatory Research

Module	Content
Module 1	• History and Development of Community Based Participatory Research
Module 2	• Ethics and Values
Module 3	• Steps in CBPR • Modes of Inquiry
Module 4	• Knowledge Mobilization: Representation of Knowledge • Building & sustaining research partnerships • Reflections from face-to-face component
Module 5	• Balancing Theory & Practice
Module 5	• Balancing Theory & Practice • Field study • Reflections on Process of CBPR from Field Study
Module 6	• MTP - Evaluation

MODULE 1

➤ History and Development of Community Based Participatory Research

Learning Objectives

- Become familiar with the history and theoretical development of participatory research and CBPR
- Discuss the principles of CBPR
- Describe your field project using CBPR vocabulary

MODULE 2

➤ Ethics and Values

Learning Objectives

- Understand research and the concept of neutrality.

- Explore principles of Indigenous Research ethics.

- Analyze approaches to ethics in other forms of CBPR.

Discussion Questions

○ Ethics as a topic covers matters of harm, benefits, rights, responsibilities and relationships. What do you think are the distinctive ethical issues in CBPR and are they really that different from those that arise in 'traditional' research?

○ 'Institutional ethical review boards are not really concerned about 'ethics' in the sense of promoting good human relationships and social justice, they are concerned about reducing risk and maintaining institutional reputations'. Is this an unfair characterisation? What is the value of institutional review boards/research ethics committees and what role can community-based ethical review play?

○ If large institutions like universities, colleges, hospitals, or international NGOs are involved in CBPR, what steps can community-based organisations take to ensure more genuine power-sharing in the design and management of the research process and outcomes?

the role of ethical Review Boards-institutional and community level.

MODULE 3

➤ Steps in CBPR

Learning Objectives and Questions for the week

- Become familiar with co-construction of knowledge

- Understand special features of each research step in CBPR

- Learn the considerations in reaching agreement between community and researcher on the research question

- Define research question of your field study and its various steps
- There are spaces in the course space design to respond to three questions: 1) Are there examples of CBPR done only by groups or citizens outside the academy? When is co-constructed knowledge most useful? 2)What are the challenges in coming to a collective agreement with your community partner in the determination of the research question(s)? 3) Share your thinking at this stage of the steps that you will have in the CBPR work that you are planning?

➤ Modes of Inquiry

Learning Objectives

- Understand the significance of using multiple modes of research in CBPR.

- Develop an appreciation of diverse set of methods used in these different modes.

- Become familiar with methods of PAR, arts-based methods, and action-based methods.

- Begin to think about how you would teach these approaches with a CBPR framework

MODULE 4

➤ Knowledge Mobilization: Representation of Knowledge

- After successfully completing this week, you will be able to:

Know how knowledge and research findings can be represented and communicated in powerful and engaging ways to diverse audiences-social media, exhibitions, demonstrations, petitions to the powerful, etc.

Knowledge mobilization, representing knowledge and sharing our results

As we have learned over the past weeks, how we communicate our results in CBPR is a critical part, perhaps the most important part of the CBPR process. The term 'knowledge mobilization' is used sometimes to describe the process of making sure that the results of our work have the impact that our communities want. Another way to think of knowledge mobilization is 'sharing the stories'.

The way that we share the results will vary according to our own cultural and political contexts, according to who needs to hear the stories and according to the issues that we are working on in our CBPR projects.

We want to hear from you about <u>your</u> ways of sharing knowledge from the research or about other ways of sharing knowledge that you have heard about in your parts of the world.

We want to build our own K4C Knowledge Mobilization Tool kit over time and we are starting with you as the first contributors. OK?

If you wish to read or see more about KM, there are some additional resources listed below, but the main thing is to contribute <u>your own experience and ideas.</u>

Activity

- Online Discussion | Knowledge Mobilization Guide

➢ Building & sustaining research partnerships

Learning Objectives

- Understand the benefits and challenges of building research partnerships.

- Analyze different knowledge cultures that need accommodation in nurturing strong research partnerships.

- Identify roles of key intermediaries and interface mechanisms in ensuring sustainability of such partnerships between universities and communities.

- Explore the use of formal MOUs and agreements as tools in partnership management.

➢ Reflections from face-to-face component

Learning Objectives

- Systematize your agenda for personal and professional development of competencies in CBPR.

- Prepare tips for use of various new methods practiced during past two weeks.

MODULE 5

➤ Balancing Theory & Practice

Learning Objectives

- Understand the link between theory and practice.

- Understand issues of reliability and validity in research.

- Develop use of praxis in your field study.

Activity

- Online Discussion | Balancing Theory & Practice 1
- Online Discussion | Balancing Theory & Practice 2

➤ Field study Impact Assessment

Learning Objectives

- Analyze approaches to the assessment of impact in CBPR: institutional, political, personal, organizational

- Demonstrate commitment and responsibility to local community/civil society / social movements/partners.

- Reflections on Process of CBPR from Field Study

Learning Objectives

After successfully completing this week, you will be able to understand and apply:

- What has worked?

- What has not worked as you had hoped?

- What has surprised you in your work?

➤ Reflections on Process of CBPR from Field Study

Learning Objectives

- What has worked?

- What has not worked as you had hoped?

- What has surprised you in your work?

Activity and Assignment

MODULE 6

MTP - Evaluation

Post MTP - Evaluation

This is your opportunity to provide any final ideas you have about the MTP course. We also would like your ideas about how best to strengthen the K4C network so as to provide support for each of you and your colleagues going forward

Activity

• We will provide an individual evaluation form and welcome open ended reflections- all thoughts/ideas welcome

Reference

Module 1

History and Development of Community Based Participatory Research

Required Resources

- Hall, B., and Tandon, R. (2017) 'Participatory research: Where have we been, where are we going? – A dialogue'. Research for All, 1 (2): 365–74. https://dspace.library.uvic.ca//handle/1828/8562

- PRIA-logue 3rd Edition (2015). Participatory Research in Action: Where is the Future? A dialogue between Dr. Budd Hall and Dr. Rajesh Tandon.
  - Part 1
  - Part 2

- Etmanski et al. (2014), Introduction. In Etmanski et al. (eds), Learning and Teaching Community Based Research: Linking Pedagogy to Practice. Toronto: U of Toronto Press, pp 3-24. http://ezproxy.library.uvic.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=704528

- Fals Borda, O. (1980), Science and The Common People. In F. Dubell et al. (eds.), Research for the people – Research by the people. Selected papers from the International Forum on Participatory Research in Ljubljana, Yugoslavia. Linkoping University and SVE, The Netherlands Study and Development Centre for Adult Education, pp. 13-40. https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M4%20-%20Fals%20Borda_1980%20-%20Science%20and%20the%20common%20people.pdf

- Tandon, R.; Hall, B. (2014). Majority-World Foundations of Community Based Research. In Munck, McIllrath, Hall and Tandon (Eds.), Higher Education and Community Based Research: Creating a Global Vision. London: Palgrave McMillan, pp. 53-68. https://link-springer-com.ezproxy.library.uvic.ca/book/10.1057%2F9781137385284

Additional suggested resources:

- Gutberlet, J., Tremblay, C., Moraes, C. (2014). The Community-based Research Tradition in Latin America. In Munck, R., McIlarth, L., Hall, B., & Tandon, R. (eds.), Higher Education and Community-based Research: Creating a Global Vision. Palgrave Macmillan. pp. 167-180. https://link-springer-com.ezproxy.library.uvic.ca/book/10.1057%2F9781137385284

- Loiselle et al. (2014), When Girls Talk Back: Learning through Doing Critical, Girl-Centred Participatory Action Research. In Etmansky et al. (Eds.), Learning and Teaching CBR, Ch. 2, pp. 45-69. http://ezproxy.library.uvic.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=704528

- Flipp, C. (2014). Video on CBPR. Language: English. Length: 8:55. https://www.youtube.com/watch?v=AePC97aKOJA

MODULE 2

Ethics and Values

Required Resources

- Interview Sarah Banks - **https://www.youtube.com/watch?v=nePd3oTz_CU**

- Ethical Challenges in CBPR (Durham Conference, Feb 2013) -
  https://www.dur.ac.uk/socialjustice/ethics_consultation/films/ (Navigate to the bottom of the page)

- Centre for Social Justice and Community Action and National Coordinating Centre for Public Engagement (2012) Community-based participatory research: A guide to ethical principles and practice, Bristol, NCCPE, **https://www.dur.ac.uk/socialjustice/ethics_consultation/ethics.guide/**

- Banks, S et al (2013), Everyday ethics in community-based participatory research. Contemporary Social Science: Journal of the Academy of Social Sciences 8(3): 263-277, **http://www.tandfonline.com/doi/abs/10.1080/21582041.2013.769618#.VMDNaE-hTlU**

- Ethics in community-based participatory research, materials on Centre for Social Justice and Community Action website. **https://www.dur.ac.uk/socialjustice/ethics_consultation/**

Optional Resources

- Flicker, S. et al (2007), Ethical Dilemmas in Community-Based Participatory Research: Recommendations for Institutional Review Boards. Journal of Urban Health, 84(4), pp. 478-93.
  http://web.b.ebscohost.com.ezproxy.library.uvic.ca/ehost/results?vid=0&sid=443f8b11-7acb-43eb-8a18-170474b78a3d%40sessionmgr103&bquery=PM+17436114&bdata=JmRiPW1uaCZ0eXBlPTEmc2l0ZT1laG9zdC1saXZlJnNjb3BlPXNpdGU%3d

- Smith, L. (2006), Articulating an Indigenous Research Agenda. In Decolonizing Methodologies, Ch. 7, pp. 123-141. UVic call number: GN380 S65. Online readable version **https://ebookcentral.proquest.com/lib/uvic/reader.action?docID=1426837&ppg=212**

- Gov. of Canada (2015), Ethical Guidelines for Research Involving the First Nations, Innuit and Metis Peoples of Canada. **http://www.pre.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/chapter9-chapitre9/**

MODULE 3

Steps in CBPR
Required Resources

- PRIA (1982), Participatory Research: An Introduction. **https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M6%20-%20PRIA_1982%20-%20Participatory%20Research%20An%20Introduction.pdf**

- PRIA (2000), Doing Research with People: Approaches to Participatory research- An Introduction.**https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M6%20-%20PRIA_2000%20-%20Approaches%20to%20PR.pdf**

- UNESCO Chair CBR-SR (2017). Guidelines for Field Study. Mentor Training Program 2018.

Modes of Inquiry
Required Resources

- Finley, S. (2008) Arts-Based Research in Knowles, Gary and Ardra Cole (eds.) Handbook of the Arts in Qualitative Research. Sage: Thousand Oaks, CA pp 71-82. **https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M7%20-%20Finley_2008%20-%20Arts-Based-Research.pdf**

- Clover, D. (2017) Arts-Based Research (Power Point presentation). **https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M7%20-%20Clover_2017%20-%20Arts%20based%20research.ppt**

- PRIA (1992), Participatory Rural Appraisal: Old wines… **https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M7%20-%20PRIA%20-%20PRA.pdf**

- Corbett, J., and Lydon, M. (2014), Community-Based Mapping: A Tool for Transformation. In C. Etmanski et al. (eds.), Learning and Teaching Community Based Research. U of T Press: Toronto, pp. 113-134 **http://ezproxy.library.uvic.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=704528**

- Tremblay, C., & Jayme, B. (2015), Co-creating community knowledge through Participatory Video. Journal of Action Research: Special edition on Knowledge Democracy, 13(3), pp. 298-314. **http://journals.sagepub.com.ezproxy.library.uvic.ca/doi/full/10.1177/1476750315572158**

- Sitter, K. (2017), Taking a Closer Look at Photovoice as a Participatory Action Research Method. Journal of Progressive Human Services, 28 (1), pp. 36-48. **http://www-tandfonline-com.ezproxy.library.uvic.ca/doi/full/10.1080/10428232.2017.1249243**

Additional resources to be taken up in the face to face workshop as well:

- Kindon, S., Pain, R. and Kesby, M. (2007). Participatory action research approaches and methods: connecting people, participation and place. London: Routledge. Available at: **http://ezproxy.library.uvic.ca/login?url=http://www.tandfebooks.com/isbn/97802039336 71**

You will find these and other resources in the Module 7 section

- Tuhiwai, Smith, Linda (2013) Research Through Imperial Eyes in Decolonizing Methodologies London: Zed Books 2013
- Tuhiwai, Smith, Linda (2013) Colonizing Methodologies in Decolonizing Methodologies London: Zed Boods |

MODULE 4

Knowledge Mobilization: Representation of Knowledge
Resources

The following resources contain examples of different ways that have been used in CBPR to represent co-created knowledge. Use these readings when responding to the **discussion questions**:

- Cole Nussbaumer Knaflic (2015), Storytelling with data, Wiley, Hoboken, NJ. **http://www.storytellingwithdata.com/**

- Patel, S. (2007), Reflections on Innovation, Assessment and Social Change Processes: A SPARC case study, India. **https://www.ids.ac.uk/files/dmfile/CasestudySPARC.pdf**

- Research dissemination videos:
- **https://www.youtube.com/watch?v=AlFO42fO-_8**

https://www.youtube.com/watch?v=6zgSgLTs2hl

Building & sustaining research partnerships

Required Resources

- Rethinking Research Partnerships collaboration (2017). Rethinking Research Partnerships: Discussion Guide and Tool Kit. From Christian Aid's centre of excellence for research, evidence and learning. **https://www.christianaid.org.uk/resources/about-us/rethinking-research-partnerships**

- Wilson, S. (2008), 'Relational Accountability'. In Research is Ceremony: Indigenous Research Methods. Halifax: Fernwood Publishing. UVic call number GN380 W554 2008 **https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M 12%20-%20Wilson_2008_Research%20is%20Ceremony.pdf**

- Brown, D. L. et al. (2001). Practice-Research Engagement Principles for Civil Society. In D. Brown (ed.), Practice-Research Engagement and Civil Society: In a Globalizing World, Harvard University & CIVICUS, pp 31-48. http://siteresources.worldbank.org/INTPCENG/1220158-1118058516777/20526704/D87D671E-CDE9-11D5-857B0002A56B5CBF.pdf

Reflections from face-to-face component

Required Resources

- Small, D. (2005). Reflections of a Feminist Political Scientist on Attempting Participatory Research in Aotearoa. In R. Tandon, R. (ed.), Participatory Research: Revisiting the Roots. New Delhi: Mosaic Books, pp. 74-89. https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M10%20-%20Small_2005%20-%20Feminist%20Participatory%20Research%20in%20Aotearoa.pdf

- Tandon, R. (2005). Dialogue. In R. Tandon, R. (ed.), Participatory Research: Revisiting the Roots. New Delhi: Mosaic Books, pp. 275-294. https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M10%20-%20Tandon_2005%20-%20Dialogue.pdf Guhathakurta, M. (2008). Theatre in Participatory Action Research: Experiences from Bangladesh. In P. Reason

MODULE 5

Balancing Theory & Practice

Required Reading

- Bell, B., Gaventa, J., & Peters, J. (eds.) (1987), We Make the Road by Walking: Conversation on Education and Social Change by Myles Horton and Paulo Freire. Temple University Press, Philadelphia, pp 97-101. https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M15%20-%20Bell%20et%20al_1987_We%20Make%20the%20Road.pdf

Additional suggested resource

- Houh, E., and Kalsem, K. (2015), Theorizing Legal Participatory Action Research: Critical Race/Feminism and Participatory Action Research. Qualitative Inquiry, 03/2015, 21(3), pp. 262-276. http://journals.sagepub.com.ezproxy.library.uvic.ca/doi/full/10.1177/1077800414562897

- Blencowe C. et al. (2015), Theorising participatory practice and alienation in health research: A materialist approach. Social Theory & Health, August 2015, 13(3-4), pp 397-417. https://link-springer-com.ezproxy.library.uvic.ca/article/10.1057%2Fsth.2015.23

- Wallerstein, N., and Duran, B. (2010), Community-based participatory research contributions to intervention research: the intersection of science and practice to improve health equity. American Journal of Public Health, 04/2010, 100(S1), pp. S40-

S46. http://web.b.ebscohost.com.ezproxy.library.uvic.ca/ehost/results?vid=0&sid=3aeda
394-bceb-4407-bbaf-
4d98919d1b2e%40sessionmgr103&bquery=PM+20147663&bdata=JmRiPW1uaCZ0eX
BlPTEmc2l0ZT1laG9zdC1saXZlJnNjb3BlPXNpdGU%3d

Field study Impact Assessment

Required Resources

- Singh, W. (2017), Gauging the Impact of Community University Engagement Initiatives in India. ASEAN Journal of Community Engagement, Vol. I (1), pp. 1-16. https://dspace.library.uvic.ca//handle/1828/8320

- Lecture (video recorded): Dr. Crystal Tremblay, Special Advisor on **Engaged Scholarship to the Provost at the University of Victoria.**

  If you are having trouble viewing this video, please use the following links (note: please watch all three parts): **Part 1, Part 2** and **Part 3.**

- Bowman, S. (2016). Maximising impact through engaged research. Campus Engage. http://www.columbusproject.eu/SarahBowman.pdf

- Piggot-Irvine, E., & Zornes, D. (2016). Developing a Framework for Research Evaluation in Complex Contexts Such as Action Research. Sage Open, 1-15. http://journals.sagepub.com/doi/pdf/10.1177/2158244016663800

- Tremblay, C., & Jayme, B. (2015). Co-creating community knowledge through Participatory Video. Journal of Action Research: Special edition on Knowledge Democracy, 13(3): 298-314.
  http://journals.sagepub.com/doi/abs/10.1177/1476750315572158

- Tremblay, C. (2017). Impact Assessment of Community-engaged Research at the University of Victoria. Prepared for the Office of the Vice President Research.
  https://www.uvic.ca/ocue/assets/docs/CER.UVic.Report.pdf

- Bagelman, C. & Tremblay, C. (2017). Where pedagogy and social innovation meet: assessing the impact of experiential education in the third sector. In: Osman & Hornsby "Transforming Higher Education:
  Towards a Socially Just Pedagogy". Palgrave Macmillan.
  https://link.springer.com/chapter/10.1007/978-3-319-46176-2_11

- A Toolkit for Monitoring and Evaluating Children's Participation.
  Plan International. Source:
  https://plan-international.org/publications/monitoring-and-evaluating-childrens-participation

- Janzen, R., Ochocka, J., Stobbe, A. (2016). Towards a Theory of Change for Community-based Research Projects. Engaged Scholar Journal, 2(2): 44-64. Avaialble at: http://esj.usask.ca/index.php/esj/article/view/165/37

- Chong, J., Gero, A., & Treichel, P. (2015). What indicates improved resilience to climate change? A learning and evaluative process developed from a child-centered, community-based project in the Philippines. In D. Bours, C. McGinn, & P. Pringle (Eds.), Monitoring and evaluation of climate change adaptation: A review of the landscape. New Directions for

Evaluation, 147, 105–116.
https://onlinelibrary.wiley.com/doi/pdf/10.1002/ev.20134

Additional suggested resources

- UNDP (2013). Discussion Paper Innovations in Monitoring & Evaluating Results. http://www.undp.org/content/dam/undp/library/capacity-development/English/Discussion%20Paper-%20Innovations%20in%20Monitoring%20&%20Evaluating%20Results%20%20(5).pdf

- PRIA (2001), Participatory Planning, Monitoring & Evaluation. http://122.160.240.198/gsdl/collect/1partici/index/assoc/HASH7b31.dir/doc.pdf

- Tremblay C. (2017), Impact Assessment. Community-engaged Research (CER) at the University of Victoria, 2009-2015. At http://hdl.handle.net/1828/8166

Reflections on Process of CBPR from Field Study

Required Resources

- Kolb, D. A (1984). Experiential learning: experience as the source of learning and development (Chapters 8), First edition. https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M18%20-%20Kolb_1984_Ch.8.pdf

- Kolb, D. A (2015). Experiential learning: experience as the source of learning and development (Chapters 2), Second edition. https://distance.moodle.uvcs.uvic.ca/pluginfile.php/165141/mod_folder/content/0/M18%20-%20Kolb_2015_Ch.2.pdf

- Online Discussion | Knowledge Mobilization Guide

PT. RAVISHANKAR SHUKLA UNIVERSITY

RAIPUR -492010

DEGREE OF

BACHELOR OF VOCATION (B.Voc.)

IN

Renewable Energy Technology & Management

SCHEME AND SYLLABUS

UNDER THE

FACULTY OF SCIENCE

SYLLABUS

(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2015 – 16 ONWARDS)

Pt. Ravishankar Shukla University
Raipur - 492010 (C.G.), INDIA

(www.prsu.ac.in)

AUGUST, 2015

Approved on 07th November, 2015 by Board of Studies in Electronics

BACHELOR OF VOCATION (Renewable Energy Technology & Management)

PROGRAMME STRUCTURE

Module Code	Name	L	T	P	Credit	Marks
Year-1 Semester- I						
GENERAL EDUCATION COMPONENT						
RETM-101	Applied Physics	2	1	0	3	100
RETM-102	Environmental Studies	2	1	0	3	100
RETM-103	Fundamentals of Electronics	2	1	0	3	100
RETM-104	Business Communication - I	1	1	1	3	100
SKILL COMPONENT						
RETM-105	Energy Sources and Energy Scenario	2	1	0	3	100
RETM-106	Renewable Energy Sources and Technologies-I	1	1	1	3	100
RETM-107	Solar Photovoltaic Technologies-I	2	1	0	3	100
RETM-108	Waste to Energy Conversion Systems	2	1	0	3	100
RETM-109	Laboratory I (Electronics Lab & Photovoltaic Lab)	0	0	12	6	200
	TOTAL				30	1000
Year-1 Semester-II						
GENERAL EDUCATION COMPONENT						
RETM-201	Business Communication - II	2	1	0	3	100
RETM-202	Power Electronics	2	1	0	3	100
RETM-203	Biochemistry	2	1	0	3	100
RETM-204	IT FOR BUSINESS	1	1	1	3	100
SKILL COMPONENT						
RETM-205	Solar Thermal Engineering and Applications	2	1	0	3	100
RETM-206	Concentrating Solar Thermal Power Plants	2	1	0	3	100
RETM-207	Renewable Energy Sources and Technologies-II	2	1	0	3	100
RETM-208	Renewable Energy Resources and improved Energy Utilization	1	1	1	3	100
RETM-209	Laboratory II (Computer lab & RE lab)	0	0	12	6	200
	TOTAL				60	2000

7/11/15

Year-2 Semester- III							
Module Code	**Name**	**L**	**T**	**P**	**Credit**	**Marks**	
GENERAL EDUCATION COMPONENT							
RETM-301	Innovations In Science	2	1	0	3	100	
RETM-302	Material Science for Energy Applications	2	1	0	3	100	
RETM-303	Electronics and Instrumentation	2	1	0	3	100	
RETM-304	Digital Electronics & Fundamentals Of Microprocessor.	1	1	1	3	100	
SKILL COMPONENT							
RETM-305	Solar Cell and Photovoltaic Technologies	2	1	0	3	100	
RETM-306	Programming C++/Java	1	1	1	3	100	
RETM-307	Smart and Micro-grid	1	1	1	3	100	
RETM-308	Energy Storage Systems	2	1	0	3	100	
RETM-309	Laboratory III(Digital Electronics & RE lab)	0	0	12	6	200	
Year-2 Semester-IV							
GENERAL EDUCATION COMPONENT							
RETM-401	Life Coping Skills	1	1	1	3	100	
RETM-402	Applied Mathematics I	2	1	0	3	100	
RETM-403	Basic Electrical Engineering Systems	2	1	0	3	100	
RETM-404	Project Writing I	1	1	1	3	100	
SKILL COMPONENT							
RETM-405	Energy Management and Auditing	1	1	1	3	100	
RETM-406	Solar Photovoltaic Power Plants	2	1	0	3	100	
RETM-407	Engineering Drawing	2	1	0	3	100	
RETM-408	Wind Energy Conversion Systems	2	1	0	3	100	
RETM-409	Workshop Practices I/Minor Project	0	0	12	6	200	
	TOTAL				60	2000	

Year-3 Semester-V							
Module Code	**Name**	**L**	**T**	**P**	**Credit**	**Marks**	
GENERAL EDUCATION COMPONENT							
RETM-501	Project Writing II	1	1	1	3	100	

2 Page   B.Voc. in RETM | Pt.Ravishankar Shukla University, Raipur (C.G.)

Page 1992 of 2209

	SKILL COMPONENT					
RETM-502	Energy in Buildings	2	1	0	3	100
RETM-503	Energy Efficiency in Electrical Utilities	2	1	0	3	100
RETM-504	Other Renewable Energy Systems	2	1	0	3	100
RETM-505	Hydrogen Energy and Fuel Cells	2	1	0	3	100
RETM-506	Energy Modelling and Project Management	2	1	0	3	100
RETM-507	Energy Economics and Planning	2	1	0	3	100
RETM-508	Energy Efficiency in Thermal Utilities	2	1	0	3	100
RETM-509	Workshop Practices II	0	0	12	6	200
Year-3 Semester-VI						
GENERAL EDUCATION COMPONENT						
RETM-601	Industrial Training	0	0	20	10	350
RETM-602	Major Project	0	0	40	20	650
	TOTAL				**60**	**2000**

SEMESTER I (Certificate Course)

This course is designed to give you an insight in to the world of renewable energy technologies. You will get a chance to investigate all aspects of renewable energy. In this programme you will explore:

* Solar energy and its thermal and photovoltaic application
* Details of passive solar architecture
* Wind technologies
* Various biomass to energy routes
* Small hydro technologies
* Geothermal, tidal, wave ocean energy technologies
* Hydrogen and fuel cell

RETM-101 Applied Physics

Unit -1

Electric Current and Ohm's Law: Electron Drift Velocity-Charge Velocity and Velocity of Field Propagation- Electric Potential - Conductance and Conductivity- Ohm's Law Resistance in Series- in Parallel-Types of Resistors-Nonlinear - Varistor-Short and Open Circuits- Series Circuit-Equivalent Resistance-Relative Potential-Voltage Divider Circuits

Unit – 2

Electrostatics: Static electricity-Absolute and Relative Permittivity of a Medium-Laws of Electrostatics-Electric Field-Electrostatic Induction-Electric Flux and Faraday Tubes-Electric Flux Density - Electric Displacement D-Gauss Law- Poisson and Laplace-Electric Potential and Energy-Potential and Potential Difference-Potential at a Point-Potential of a charged sphere-Equi potential Surfaces-Voltage and Dielectric Strength-Boundary Conditions

Unit – 3

Electromagnetic Induction: Relation between Magnetism and Electricity-Production of

Induced E.M.F. and Current-Faraday's Laws of Electromagnetic Induction- Lenz's Law
Induced E.M.F.-Dynamically-Statically-induced E.M.F.-Self-Inductance-Coefficient of Self
Inductance (L)-Mutual Inductance-Coefficient of Mutual Inductance (M)-Coefficient of
Coupling-Inductances in Series and Parallel

Unit – 4
Magnetic Hysteresis- Area of Hysteresis Loop Properties and applications of Ferromagnetic
Materials-Permanent magnet materials-Steinmetz Hysteresis Law-Energy Stored in
Magnetic Field-Rate of Change of Stored Energy- - Lifting Power of Magnet-Rise and Decay
of Current in Inductive Circuit- Transient Current Rise and decay R-L Circuit -Automobile
Ignition System

References
1. Electrical Technology, Naidu-Kamakshaiah, Tata McGraw-Hill Education, 2006
2. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI Learning Pvt. Ltd.,2005
3. A Text Book of Electrical Technology, B.L. Theraja, S. Chand Limited, 2008
4. Photovoltaics: Design and Installation Manual, Solar Energy International, 2012

Module RETM – 102   ENVIRONMENTAL STUDIES
Unit I
Learning Objectives:
1. To familiarize students to the basic concepts of Environmental studies.
2. To help students develop their own perspectives around environmental issues.
3. To enable students to take practical steps to conserve the environment.

Number of lectures: 45

UNIT 1
Environment [12 lectures]
     a. Definition and Composition – Lithosphere, Hydrosphere, Atmosphere, Biosphere,
       Hydrological Cycle
     b. Historical Development and Approaches
     c. Man and Nature relation and interaction with respect to Food, Clothing, Shelter
       and Occupation: Concept of Ecology and Ecosystem.

UNIT 2
Resources and Wealth [12 lectures]
     a. Meaning, Types of Resources, Exploitation of Resources, use of Technology and its
       Impact on Natural Environment
     b. Wealth – meaning, Distinction between wealth and resources, Optimum
       Conversion of Resources into wealth
     c. Anthropogenic Waste – its effects, Man-made Industrial waste.

UNIT 3
Environmental Degradation [12 lectures]
     a. Meaning, causes : Degradation of Urban Land, Forest and Agricultural Land due to
       natural causes and human interference.

4 | Page   B.Voc. in RETM | Pt.Ravishankar Shukla University, Raipur (C.G.)

Page 1994 of 2209

b. Global Warming : Problems of non-degradable Waste – Electronic Devices, Plastic and Man- made fibres.

c. Environmental Assessment – Environmental Impact Assessment (EIA), Environmental Auditing, Environmental Legislation in India, Carbon Bank.

UNIT 4
Environmental Management [9 lectures]

a. Meaning, development and environmental linkages.

b. Environmental concerns in India. The need for sustainable development.

c. Actions for environmental Protection: national and international initiatives, emerging environment management strategies, Indian initiatives.

d. Environmental Protection Movements and NGOs in India.

Continuous Internal Assessment: Projects / Presentations / Tests
List of Recommended Reference Books:
R. Rajagopalan, R. (2005) *Environmental Studies – From Crisis to Cure.* Delhi: OUP

Additional reading:
- Guha Ramachandra Environmentalism: A global history (OUP) (2000)
- Movies:
- An Inconvenient Truth, Al Gore
- The 11th Hour, Leonardo DiCaprio
- The Age of Stupid. Franny Armstrong.
- Baraka, Ron Fricke.
- Climate change: An Untold Story [Climate's First Orphans; The Weeping Apple Tree; A Degree of Concern; A Green Agony], Discovery Channel.
- Liquid city--Mathew Gandy.
- Story of Stuff --Free Range Studios Tides Foundation.
- Story of bottled water---Free Range Studios Tides Foundation

RETM-103: Fundamentals of Electronics

Unit – 1
Electronics – Introduction- Applications-Current and Voltage Source-Physics of Semiconductor Materials –Structure of Atom-Energy band gap diagram of Conductors, Semiconductors and Insulators

Unit – 2
Semiconductor Diode: Types of semiconductors – P & N Types – charge carriers –P &N junction theory-VI characteristics –ideal diode-Rectifiers-types of rectifiers- Filters-C, LC and π – Regulators – Zener diode -voltage Regulator, Series voltage Regulator Different types of Filters- clipping and clamping circuits –LED-7-segment –Photo diode-LDR

Unit – 3

Transistor-amplifying action-transistor configuration:-CB, CE, CC Configurations-comparison-thermal runway-heat sink- Transistor ratings -Transistor biasing and stabilization –selection of operating point-different biasing circuits

FET – introduction, Types, construction, operation, characteristics – FET Parameters– Comparison between FET and BJT– JFET, MOSFET – UJT Characteristics, features and Applications

Unit – 4
Storage Batteries

Introduction, Types of Batteries primary and Secondary Batteries-Classification of Secondary Batteries base on their Use-Classification of Lead Storage Batteries Battery life and DOD, Battery Charging, State of Charge, Effect of temperature, Battery for Photovoltaic applications, Battery aging, important guidelines

References
1. Basic Electronics and Linear Circuits, Bhargava, Kulshreshtra & Gupta Tata McGraw-Hill Publishing Ltd. 2007
2. Applied Electronics, R S Sedha, S. Chand and Company Ltd. 2008
3. Principles of Electronics, V.K. Mehta, S.Chand and Company Ltd.2005
4. Electronics Service Technology Vol-1. Saji A.G,Shyam Mohan , Ayodhya publications, 2007
5. Integrated Electronics, Jacob Millman and C. Halkias Mill, Tata McGraw-Hill Publishing Ltd. 2008
6. Science & Technology of Photovoltaics P Jayrama Reddy, BS Publications ,CRC Press 2010
7.Solar Electricity Handbook - 2012 Edition: A Simple Practical Guide to Solar Energy - Designing and Installing Photovoltaic Solar Electric Systems, Michael Boxwell, Greenstream Publishers, 2012
8. Photovoltaics: Design and Installation Manual, Solar Energy International, 2012
9. Solar Electric Handbook: Photovoltaic Fundamentals and Applications, Solar Energy International, 2012

RETM-104   AECC: BUSINESS COMMUNICATION - I
LEARNING OBJECTIVE:

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions
- To enable students to have firm grounding in English to be able to use it effectively in professional as well as social contexts.
- To work towards strengthening the learning process of English language so that our graduates can find their feet in the fiercely competitive job market.

Unit-1 Introducing Professional English Total Lectures: 09
1. Theory of Communication, Types and modes of Communication
2. Oral communication in English

6 | Page
B.Voc. in RETM | Pt.Ravishankar Shukla University, Raipur (C.G.)

Page 1996 of 2209

3. Monologue, Dialogue, Group Discussion, Effective Communication/ Mis-Communication
4. English phonology
5. Intonation patterns in English
6. Intra-personal, Inter-personal and Group communication

Unit-2 Current Usage of English Grammar Total Lectures: 18
1. auxiliaries
2. tense and aspect
3. interrogative and negative sentences
4. the positive
5. conditionals
6. Concord

Unit-3 Vocabulary Total Lectures: 09
1. Verbal and Non-verbal (Spoken and Written)Personal, Social and Business
2 Phrasal Verbs
3. Idioms
4. Collocations

Unit-4 Written Business Communication Total Lectures: 09
1. Email Etiquette
2. Professional Presentations
3. Writing Skills: Documenting, Report Writing, Making notes, Letter writing
   Writing a Resume, Writing- Memo, Cover Letter

Continuous Internal Assessment
Classroom Practice:
- Greeting and introducing.
- Practicing Short Dialogues.
- Group Discussions, Seminars/Paper-Presentations.
- Listening News/Conversations/Telephonic Conversation.

Recommended Readings:
1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas
5. Department of Humanities and Social Sciences, Anna University, 'English for Engineers and Technologists', Vols. I & II (Combined Edition), Orient Longman Pvt. Ltd., 2006.
6. LALA, PUSHP and Sanjay Kumar. 'Communicate or collapse: a handbook of effective public speaking, group discussions and interviews'. PHI Learning Pvt. Ltd., 2007.
7. ILM Prasad, 'How to prepare for Group Discussion and Interview'. Tata McGrawHill, 2001.
8. Career Press Editors, '101 Great Resumes', Jaico Publishing House,2003.

7 | Page

B.Voc. in RETM | Pt.Ravishankar Shukla University, Raipur (C.G.)

Page 1997 of 2209

9. R.S. Aggarwal, 'A Modern Approach to Verbal & Non-Verbal Reasoning',S. Chand & Co, 2004.
10. Mishra Sunita and Muralikrishna, 'Communication Skills for Engineers', 1stEdition. Pearson Education, 2004.

Module RETM – 105: Energy Sources and Energy Scenario

Unit I

Introduction to Energy
Definition and units of energy and power, Conversion, Energy terms, calorific value, Forms of energy, Classification of energy sources Quality and concentration of energy sources,Energy and Thermodynamics, Energy parameters, Conservation of energy, Energy flow diagram to the earth. Origin of fossil fuels, Time scale of fossil fuels, Role of energy in economic development and social transformation, Energy security.

Unit II

Energy and Growing Economy

Commercial energy production, Final energy consumption, Energy needs of growing economy,Long term energy scenario, Energy pricing, Energy sector reforms, Energy conservation and its importance, Energy strategy for the future, Energy Conservation Act-2001 and its features.

Unit III

Global Energy Scene

Energy consumption in various sectors, projected energy consumption for the next century, exponential increase in energy consumption, energy resources, coal, oil, natural gas, nuclear power and hydroelectricity, impact of exponential rise in energy consumption on global economy, future energy options.

Unit IV

Indian Energy Scene

Commercial and non-commercial forms of energy, energy consumption pattern and its variation as a function of time, India's Power Scene, Gas-Based Generating Plants, Nuclear Power Programme, urban and rural energy consumption, energy as a factor limiting growth, need for use of new and renewable energy sources, Socio-economic impacts, Rural development, Poverty alleviation, Employment; Security of supply and use, Environmental and ethical concerns, Economical aspects of renewable energy systems vs large hydro and thermal power projects.

Text Books

1. Bani P. Banerjee, Energy and the Environment in India, Oxford University Press, New Delhi.
2. G. D. Rai, Non- conventional Sources of Energy, Khanna Publishers, Delhi.
3. Gopal kumar, Energy Independence Vision of a Hybrid, Unbound Future, Deep and Deep Publications Pvt. Ltd., New Delhi.
4. D. K. Asthana, Meera Asthana, Environment Problems and Solutions, S. Chand and Company Ltd., New Delhi.
5. Abdul Mubeen, M. Emran Khan, M. Muzaffarul Hasan, Energy and Environment, Anamaya Publishers, New Delhi.
6. Upender Pandel, M. P. Poonia, Energy Technologies for Sustainable Development, Prime Publishing, Ghaziabad (UP).
7. Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Singal K. C, New Arrivals - PHI; 2 edition (2011)

Module RETM – 106:   Renewable Energy Sources and Technologies

Unit I

Introduction to Non-conventional energy sources, Solar energy, Wind energy/power, Energy from biomass and biogas, Ocean energy ,Wave energy, Tidal energy/power, Geothermal energy, Hydrogen energy, Thermo-electric power, Fuel cell, Magneto-Hydro-dynamic (MHD) generator

Unit II

Renewable and Non-renewable energy sources: Renewable (Non-conventional) energy sources, Non-renewable energy sources, Alternative energy sources, Energy Scenario in India context, Electricity Generation from Non-conventional energy sources, Impact on environment, Fuels, Classification of fuels, Solid fuels ,Liquid fuels, Gaseous fuels

Unit III

SOLAR THERMAL TECHNOLOGIES: Solar Thermal Energy Systems: Absorption and Radiation, Heat Gain and Loss, Solar Cooking Systems ,Principle of Cooking, Cooking by Boiling, Speed of Cooking, Energy Required for Cooking, Types of Solar Cooker, Solar Distillation System , Distillation: Natural Process for Purifying Water

Unit IV

WIND ENERGY: Wind Flow, Motion of Wind , Vertical Wind Speed Variation,Distribution of Wind Speeds, Power in the Wind, Conversion of Wind Power: Wind Turbine, Efficiency of Wind Power Conversion: Cp, Types of Wind Turbines, Components of a Wind Turbine, Worldwide Wind installations
Wind Turbine Sizing and systems Design , Energy Derived from a Wind Turbine

Text Books:

B.Voc. in RETM | Pt.Ravishankar Shukla University, Raipur (C.G.)

Page 1999 of 2209

1. Renewable Energy Technologies: A Practical Guide for Beginners, <u>Chetan Singh Solanki,</u> PHI|School Books (2008)
2. Fundamentals of Renewable Energy Systems Paperback – D. Mukherjee, New Age International Publisher; First edition (2011)
3. Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Singal K. C, New Arrivals - PHI; 2 edition (2011)
4. G. D. Rai, Non- conventional Sources of Energy, Khanna Publishers, Delhi.

Module RET – 107: Solar Photovoltaic Technologies

Unit-1

SOLAR RADIATION: Solar Spectrum, Extraterrestrial Radiation, Radiation on the Earth Surface, Global, Direct and Diffuse Solar Radiation, Solar Radiation at a Given Location, Annual Variation in Solar Radiation, Optimal Tilt for Solar Equipment, Monthly Averaged Global Radiation at Optimal Tilt

Unit-2 Fundamentals of Solar Cells : Characteristics of semiconductors, Differences between semiconductors, insulators and conductors Theory of p n junction, Principle of operation of p-n junction Solar Cell, I-V Characteristics Solar Cell parameters ,Voc, Isc, FF ,conversion efficiency and power output of solar cell ,Status of Photovoltaic Technologies.

Unit-3

SOLAR PHOTOVOLTAIC TECHNOLOGIES: Solar PV Technology: Advantages and Limitations, Brief History of the Technology, Basics of Technology, the Amount of Power Generated, the Rated Power and Actual Power from a Module, Generating More Power Using Solar PV, Protection of Solar Cells

Unit 4

Solar PV Systems and their applications : Solar PV Module Ratings and Cost, Battery Ratings and Cost, Inverter Ratings and Cost, Maximum Power Point Tracking (MPPT), Solar PV Lantern, Design and Costing, Stand-alone PV System: Home Lighting and Other Usage, Solar PV System Designing , Case Study, Cost Estimation of a PV System

References

1. Renewable Energy Technologies: A Practical Guide for Beginners, <u>Chetan Singh Solanki,</u> PHI|School Books (2008)
2. Solar Photovoltaics: Fundamentals, Technologies and Applications, Chetan Singh Solanki PHI; 3 edition 2015
3. Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Singal K. C, New Arrivals - PHI; 2 edition (2011)
4. Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, Chetan Singh Solanki PHI (1 January 2013)
5. Fundamentals of Renewable Energy Systems Paperback – D. Mukherjee, New Age Internatioanal Publisher; First edition (2011)
6. Science & Technology of Photovoltaics P Jayrama Reddy, BS Publications ,CRC Press 2010

10 | Page

B.Voc. in RETM | Pt.Ravishankar Shukla University, Raipur (C.G.)

Page 2000 of 2209

7. From Sunlight to Electricity: A Practical Handbook on Solar Photovoltaic Applications, Suneel Deambi, The Energy and Resources Institute, TERI (30 January 2009)

RETM-108 Waste to Energy Conversion Systems

Unit I

Introduction

Introduction to waste and waste processing, Definitions, sources, types and composition of various types of wastes; Characterization of Municipal Solid Waste (MSW) , Industrial waste and Biomedical Waste (BMW), Waste collection and transportation; Waste processing-size reduction, Separation; Waste management hierarchy, Waste minimization and recycling of MSW; Life Cycle Analysis (LCA), Material Recovery Facilities (MRF), Recycling processes of solid waste.

Unit II

Waste Treatment and Disposal

Aerobic composting, Incineration, different type of incineration; medical and pharmaceutical waste incinerations, Landfill classification, types, methods and sitting consideration, layout and preliminary design of landfills: composition, characteristics, generation, movement and control of landfill leachate and gases, environmental monitoring system for land fill gases, Rules related to the handling, treatment and disposal of MSW and BMW in India.

Unit III

Waste to Energy Conversion Technologies

Sources of energy generation, incineration, gasification of waste using gasifiers, briquetting, utilization and advantages of briquetting. Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, industrial waste, agro residues, land fill gas generation and utilization.

Unit IV

Environmental and Commercial Aspects of Waste to Energy

Present status of technologies for conversion of waste into energy, design of waste to energy plants for cities, small townships and villages, Environmental and health impacts of incineration and other waste to energy conversion systems, case studies of commercial waste to energy plants, Strategies for reducing environmental impacts.

Text Books:

11 | Page   B.Voc. in RETM | Pt.Ravishankar Shukla University, Raipur (C.G.)

Page 2001 of 2209

1. Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, ISBN: 9780470539675, John Wiley and Sons.

2. Velma I. Grover and Vaneeta Grover, Recovering Energy from Waste Various Aspects, ISBN 978-1-57808-200-1.

3. Shah, Kanti L., Basics of Solid and Hazardous Waste Management Technology, Prentice Hall.

4. Rich, Gerald et.al., Hazardous Waste Management Technology, Podvan Publishers.

5. Marc J. Rogoff, Waste-to-Energy, Elsiever.

6. Parker, Colin and Roberts, Energy from Waste - An Evaluation of Conversion Technologies, Elsevier Applied Science, London.

7. Manoj Datta, Waste Disposal in Engineered Landfills, Narosa Publishing House.

8. Bhide A. D., Sundaresan B. B., Solid Waste Management in Developing Countries, INSDOC, New Delhi.

Semester-I

RETM-109 LABORATORY –I (6 credits)

LAB A : Electronics Lab

PRACTICALS (*ELECTRONICS*)

1. Study of forward and reversed biased characteristics of PN Junction Diode
2. Study of breakdown characteristics and voltage regulation action of Zener diode.
3. Study of half wave & full wave rectifier
4. To study and observe waveform at the output of half wave rectifier with and without filter capacitor. To measure DC voltage, DC current, ripple factor with and without filter capacitor.
5. Study of Capacitor input, L section and π section filter
6. Study of output characteristics of Bipolar Junction Transistor in CE mode.
7. Study of output and transfer characteristics JFET/ MOSFET.
8. Study of I-V characteristics of UJT and UJT based relaxation oscillator.
9. Study of I-V characteristics of SCR.
10. Design, build and test Low pass and High pass RC filters.
11. Study of Low voltage Half – wave, Full – wave and Bridge rectifier circuits.
12. Study of switching and amplification actions of BJT and JFET/ MOSFET
13. Study of potential divider biasing of BJT and its use in DC motor driving.

LAB B: Photovoltaic Laboratory

1. Identifying and Measuring the Parameters of Solar PV Module in the Field
2. Series and Parallel Connection of PV Modules
3. Estimating the Effect of sun Tracking on Energy Generation by Solar PV Modules
4. Efficiency Measurement of Standalone Solar PV System
5. Dark and Illumination Current-Voltage Characteristics of Solar Cell
6. Solar Cells Connected in series and in Parallel
7. Dependence of Solar Cell I-V Characteristics on Light Intensity and Temperature
8. Carrier Lifetime Measurements for a Solar Cell
9. Spectral Response Measurement
10. Solar Cell Simulation Using PC1D Simulator
11. SEQUEL: Using the GUI
12. Find the MPP manually by varying the resistive load across PV panel
13. Find the MPP by varying the duty cycle of the DC-DC converter
14. Observe the Vm, Im, Pm and duty cycle at which MPP occurs, with MPP algorithm Observe the response of Pm in the Plotter and compare with the Pm observed in the experiment

13 Page

B.Voc. in RETM | Pt.Ravishankar Shukla University, Raipur (C.G.)

Page 2003 of 2209

PT. RAVISHANKAR SHUKLA UNIVERSITY

Centre for Basic Sciences

Syllabus of

Integrated M. Sc. : Biology Stream

[Choice and Credit Based System]

Semester Examination

SESSION 2015-2020

Integrated M. Sc. : Biology Stream
[Choice and Credit Based System]
Scheme of Examination: Session 2015-20

(P: Physics, M: Mathematics, C: Chemistry, B: Biology, G: General, H: Humanities CB: Chemistry Biology,
PCB: Physics Chemistry Biology, MB: Maths for Biology)

FIRST YEAR [July 2015 to June 2016]

SEMESTER-I

Subject	Subject	Contact hrs/per week Theory + Tutorials	Credits
B 101	Biology I (Introductory Biology)	[2 +1]	3
C 101	Chemistry I (Structures & Bonding)	[2 +1]	3
P 101	Physics I (Classical Physics)	[2 +1]	3
MB101	Mathematics I	[2 +1]	3
G 101	Computer Basics	[2 +1]	3
H 101	Communication Skills	[2 +0]	2
		Contact hrs/per week Lab	Credits
BL101	Biology Laboratory	[4]	2
CL 101	Chemistry Laboratory	[4]	2
PL 101	Physics Laboratory	[4]	2
GL 101	Computer Laboratory	[4]	2
			25

SEMESTER-II

Subject	Subject	Contact hrs/per week Theory + Tutorials	Credits
B 201	Biology II (Introduction to Macromolecules)	[2 +1]	3
C 201	Chemistry II (Chemical thermodynamics)	[2 +1]	3
P 201	Physics II (Electricity, Magnetism & Optics)	[2 +1]	3
MB101	Mathematics II (Linear Algebra, Calculus of several variables)	[2 +1]	3
G 201	Electronics & Instrumentation	[2 +1]	3
G 202	Glimpses of Contemporary Science	[2]	2
		Contact hrs/per week Lab	Credits
BL 201	Biology Laboratory	[4]	2
CL 201	Chemistry Laboratory	[4]	2
PL 201	Physics Laboratory	[4]	2
GL 201	Electronics Laboratory	[4]	2
			25

SECOND YEAR [July 2016 to June 2017]

SEMESTER-III

Subject	Subject	Contact hrs/per week Theory + Tutorials	Credits
CB301	Essential Mathematics for Chemistry & Biology	[3 +1]	4
CB 302	Biochemistry – I	[3 +1]	4
B 301	Cell Biology – I	[3 +1]	4
CB 303	Organic Chemistry-I	[3 +1]	4
H 301	World Literature	[2 +0]	2
H302	History & Philosophy of Science	[2 +0]	2
		Contact hrs/per week Lab	Credits
BL 301	Biology Laboratory	6	3
GL 301	Applied electronics laboratory	4	2
			25

SEMESTER-IV

Subject	Subject	Contact hrs/per week Theory + Tutorials	Credits
B 401	Cell Biology – II	[3 +1]	4
B 402	Biochemistry – II	[3 +1]	4
CB 401	Introductory Spectroscopy (UV-vis, fluorescence, IR, Raman, NMR)	[3 +1]	4
PCB 401	Physical & Chemical kinetics	[3 +1]	4
G 401	Statistical techniques and Applications	[3 +1]	4
		Contact hrs/per week Lab	Credits
BL 401	Biology Laboratory	6	3
GL 401	Computational laboratory and Numerical Methods	4	2
			25

THIRD YEAR [July 2017 to June 2018]

SEMESTER-V

Subject	Subject	Contact hrs/per week Theory + Tutorials	Credits
B 501	Genetics	[3 +1]	4
B 502	Molecular Biology	[3 +1]	4
B 503	Biodiversity	[3 +1]	4
CB 501	Analytical Chemistry	[3 +1]	4
G 501	Earth Sciences and Energy & Environmental Sciences	[3 +1]	4
		Contact hrs/per week Lab	Credits
BL 501	Biology Laboratory	10	5
			25

SEMESTER-VI

Subject	Subject	Contact hrs/per week Theory + Tutorials	Credits
B 601	Immunology	[3 +1]	4
B 602	Animal Physiology	[3 +1]	4
B 603	Plant Physiology	[3 +1]	4
B 604	Microbiology	[3 +1]	4
CB 601	Biophysical Chemistry	[3 + 0]	3
H601	Ethics of Science and IPR	[2 + 0]	2
		Contact hrs/per week Lab	Credits
BL 601	Biology Laboratory	8	4
			25

FOURTH YEAR [July 2018 to June 2019]

SEMESTER-VII

Subject	Subject	Contact hrs/per week Theory + Tutorials	Credits
B 701	Neurobiology	[3 +1]	4
B 702	Immunology – II	[3 +1]	4
B 703	Developmental Biology	[3 +1]	4
B 704	Imaging technology in biological research	[3 +1]	4
BPr 701	Reading Project	-	4
		Contact hrs/per week Lab	Credits
BL 701	Advanced Biology Laboratory	[5 + 5]	5
			25

SEMESTER-VIII

Subject	Subject	Contact hrs/per week Theory + Tutorials	Credits
B 801	Virolog	[3 + 1]	4
B 802	Biotechnology – I	[3 + 1]	4
B 803	Bioinformatics	[3 + 1]	4
B 804	Biotechnology – II	[3 + 1]	4
		Contact hrs/per week Lab	Credits
BL 801	Advanced Biology Laboratory	[5 + 5]	5
BPr 800	Project	-	4
			25

FIFTH YEAR [July 2019 to June 2020]

SEMESTER-IX

Subject	Subject	Contact hrs/per week Lab	Credits
BPr 901	Project	-	20
			20

SEMESTER-X

Subject	Subject	Contact hrs/per week Lab	Credits
E 1001	Electives I	[3 + 2]	5
E 1002	Electives II	[3 + 2]	5
E 1003	Electives III	[3 + 2]	5
E 1004	Elective IV	[3 + 2]	5
			20

Total Credits: 240

Electives:

1. Toxicology and clinical research
2. Molecular modeling and drug design
3. Ethology
4. Parasitology
5. Reproductive biology
6. Occupational diseases (infectious incl)
7. Plant pathology
8. Plant communication
9. Animal migration
10. Commercial products from plants and animals
11. Biology of food industry
12. Transgenics
13. Ethical issues in biology and medicine
14. Physical biology
15. Astrobiology
16. Biology of traditional medicines
17. Translational biology
18. Science writing and communication
19. Forensic science
20. Epigenetics
21. On-line courses

FIRST YEAR

Semester – I [July- December 2015]

B 101: Biology I (Introductory to Biology)

Unit-I
Life: History and origin of life, Concepts of biological evolution, natural selection, speciation.
Classification of living things: Classification and domains of life, Prokaryotes and Eukaryotes,
Taxonomy of plants, animals and microorganisms.

Unit-II
Ecology & Ecosystem: Concept of ecology and ecosystem, ecological succession, ecosystem dynamics, flow of
ecology and matter, biogeochemical cycling, ecosystem changes, biotic and biotic factors and stresses, food
web, adaptation of individual organism to the environment through genetic
changes.

Unit-III
Cell Biology: Discovery of cell, cell theory, classification of cell types, cell membrane, cell-cellinteractions,
energy and metabolism, respiration, photosynthesis, sexual reproduction.

Unit-IV
Cell Division and System Development: cell cycle, mitosis, meiosis, mechanism of development (stem cells),
formation of tissues.

Unit-V
Physiology- Body Systems: Digestive system, circulatory system, Lymphatic system, nervous system,
respiratory system, sensory system, homeostasis.

Books Recommended:

S.No.	Author	Book
1	Neil A Campbell and JB Reece (2007)	Biology with Mastering Biology (8th Edition)
2	NA Campbell, JB Reece, MR Taylor and EJ Simon (2008)	Biology: Concepts & Connections with biology (6th Edition)
3	Charles Darwin (2008)	On the Origin of Species
4	B Alberts, D Bray, K Hopkin and AD Johnson (2009)	Essential Cell Biology
5	Rene Fester Kratz (2009)	Molecular and Cell Biology For Dummies
6	MJ Behe (2006)	Darwin's Black Box: The Biochemical Challenge to Evolution
7	SD Garber (2002)	Biology: A Self-Teaching Guide, (2nd Edition)

C 101: Chemistry –I [Structure & Bonding]

Unit-I
Atomic spectra, Bohr's theory of atomic structure, Sommerfeld's theory for complex electron spin and
magnetic quantum number, Pauli exclusion principle, Hund's rule, electron configuration of elements,
Sequence of energy levels and Periodic Table.

Size of atoms and ions, ionization energy, electron affinity, electronegativity – values by Pauling, Mulliken and Allred-Rochow, Metallic character, variable valence and oxidation states, horizontal, vertical and diagonal relationships in the periodic table.

Atomic Nucleus: Fundamental particles, classification of nuclides, nuclear stability, the neutron to proton ratio N/Z, nuclear potential, binding energy, exchange force. Radioactivity and radioactive elements, radioactive decay and decay kinetics.

Unit-II
The covalent bond - the Lewis theory, Octet rule and its limitations. Shapes of the molecules –Sidgwick – powel theory. Valence shell electron pair (VSEPR) theory, effect of lone pair and electronegativity, isoelectronic principle, examples to apply VSEPR theory. Valence bond theory. Hybridization. Bond length, bond angle & dihedral angle, d-orbital participation in molecular bonding, sigma and pi bonding. Molecular orbital method – Linear combination of atomic orbitals (LCAO), MO treatment for di- and tri-atomic molecules and involving delocalized pi-bonding. Conjugation & aromaticity.

Unit-III
Metallic and organometallic bonds – general properties. Coordinate bond- coordination complexes. Physical properties and molecular structures – polaizability and dipole moments, melting point, solubility and acid-base properties, Intermolecular forces (dipole-dipole interaction) Hydrogen bonding and vander Waals's forces.

Unit-IV
Inductive and field effects and bond dissociation energy. pπ-dπ bonding.
Delocalization –cross conjugation, resonance. Aromaticity and Huckel's rule – systems of 4n and 4n+2 electrons, antiaromaticity . Resonance and Hyperconjugation.
Reaction mechanism: Types of mechanisms, Arhenius theory, collision theory, types of reactions, redox reactions, displacement and addition reactions, thermodynamic and kinetic requirements.

Unit-V
Hammond postulate, Curtin-Hammett principle, transition states and intermediates, carbocations, carbanions, free radicals, methods of determining mechanisms, isotopic effects.
General concepts: Oxidation number and oxidation states, Oxidation – reduction reactions and the use of reduction potential, Bronsted acids and bases, gas phase vs. solution acidity, solvent levelling effects, hardness and softness, surface acidity.

Books Recommended:

S.No.	Author	Book
1	J.D.Lee	Concise Inorganic Chemistry, 4th Edition, ELBS, 1991
2	P.W.Atkins	Physical Chemistry, Oxford University Press, 7th Edition, 2006
3	G.M.Barrow	Physical Chemistry, 5th Edition, Tata McGraw-Hill, 1992
4	R. T. Morrison, R. N. Boyd, P. Sykes	Organic Chemistry, Prentice Hall of India
5	G.W. Castellan	Physical Chemistry, 3rd Ed. Addison - 1993

P 101 Physics- I (Classical Physics)

Unit-I
Concepts of energy and mass, Linear kinematics and dynamics. Concept of force: Conservative and non-conservative forces, Friction. Conservation of momentum, energy, and angular momentum. Work-energy theorem, Centre of mass, moment of inertia.

Unit-II
Rotational kinematics and dynamics, Rigid body motion. Impulse and collisions, Central forces, Kinetic theory of gases, Equipartition of energy.

Unit-III
Free oscillations in one, two, and many degrees of freedom. Linearity and superposition principle.
Normal modes; Transverse and longitudinal modes

Unit-IV
General notion of a continuous string; Resonance; Coupled pendula and oscillators, Normal coordinates.

Unit-V
Probability (chance, fluctuations, random walk, probability distribution, uncertainty principle);
Curvilinear Coordinates, Vector calculus (differentiation and integration, gradient, divergence, curl,
Green's theorem, Gauss' theorem, Stokes' theorem); Fourier series (an introduction).

Books Recommended:

S.No.	Author	Book
1	R. P. Feynman, R. B. Leighton, M. Sands	The Feynman lectures in Physics" Volume-1
2	D. Kleppner and R. Kolenkow	An introduction to mechanics
3	C. Kittel, W. D. Knight and M. A. Ruderman	Mechanics [Berkeley Physics CourseVol. 1]
4	F. S. Crawford	Waves [Berkeley Physics Course Volume 3]

MB 101: Mathematics – 1

Unit-I
The idea of derivative of a function, polynomials, slope and tangent line, derivatives of trigonometric functions, product and quotient rules. Notion of limits and continuous functions. Elementary results pertaining to limits of functions: product and quotient rules. Higher order derivatives, examples. Maxima and minima, curve tracing, Conic sections: circle, ellipse, hyperbola and parabola; equations, focus, directrix, latus rectum. Generalised conic section equation, exponential and logarithmic functions and their derivatives.

Unit-II
Application of derivatives to root finding: Newton's method (to be supplemented by an introduction to iterative processes). Mean value theorem of differential calculus, Rolle's theorem, applications. l'Hôpital's rule. The chain rule of differentiation, Implicit differentiation, Inverse functions and their derivatives, Inverse trigonometric functions, Applications.
Concept of infinite series, Geometric series, convergence tests; Taylor series, Maclaurin series for
elementary functions, power series, simple applications.

Unit-III
Notion of an integral, integral as limit of sums; anti-derivatives, area under a curve, definite integrals, indefinite integrals. Rules of integration: integration by parts, integration by substitution. Properties of definite integrals including mean value theorem for integral calculus. Fundamental theorem of integral calculus. Integrals involving polynomial, exponential, logarithmic, trigonometric, inverse trigonometric functions. Application of integrals to areas, length of a plane curve, volumes of solids of revolution.

Unit-IV
Complex numbers: real and imaginary parts, The complex plane, Complex algebra (complex conjugate, absolute value, complex equations, graphs, physical applications). Elementary functions of complex numbers, Euler's formula, Powers and roots of complex numbers. The exponential and trigonometric functions, Hyperbolic functions, Logarithms, Complex roots and powers, Inverse trigonometric and hyperbolic functions, Some applications.

Unit-V

Separable equations, Linear first order equations, Other methods for first order equations, Second order linear equations with constant coefficients and both zero and non-zero right hand side, Other second order equations.

Books Recommended:

S.No.	Author	Book
1	Gilbert Strang (MIT Courseware)	Calculus
2	M. Weir, J. Hass and F. R. Giordano (Pearson Education)	Calculus

H 101: Communication Skills

Unit-I

An interactive session (with examples) on what is communication, communication in the natural and civilized worlds, types of human communication: visual / non-verbal / verbal, written / spoken, etc

Unit-II

An overview of mass media; a brief discussion of their types (with examples). The concepts of facilitating factors, barriers, and filters in communication; the seven C's of effective communication.

Unit-III

Verbal communication: How to speak / listen effectively (in interpersonal communication), types of public speaking, tips for effective public speaking, how to make effective presentations. The role of written text in communication,

Unit-IV

Types of writing (academic/creative/general; formal/informal etc.) with examples of good/bad writing and their analysis.Introduction to letter writing, with stress on formal correspondence; email do's and don'ts.

Unit-V

Academic writing- an overview; explanation of various terms used in academic writing; parts of a paper/thesis; aspects such as formal language, grammatical accuracy, etc. Common grammatical/punctuation errors and how to avoid them (example-based instruction)

G101: Computer Basics

Unit-I

Introducing LINUX: getting started;

Unit-II

FORTRAN programming

Unit-III

LaTeX introduction (sufficient to make small documents); gnuplot - graph plotting and data fitting; xfig - simple drafting tool; MATHEMATICA - algebraic computations.

Unit-IV
Projects on:

Some of the projects done by the students are listed below; Predator-prey problem; Harmonic oscillator with friction Coupled pendulum

Unit-V

Projects on:

   Testing random number generator; Brownian motion as a random walk problem; Sorting function and its
   application to making ranked lists, SUDOKU solver

BL 101 Biology laboratory

1) Introduction to Biology laboratory
2) Taxonomy
3) Methods of Classification
   Dichotomous key;   Hierarchical Classification; Phylogenetic Classification
4) Natural Selection
5) Natural Selection using Daphnia
6) Concept of pH & Buffers:
   Hydrogen ion concentration in solution; Inorganic ion concentration in solutions
   Inorganic Buffers and Biological fluids; Henderson-Hesselbach equation
7) Media Preparation:
   Preparing and inoculating solid and liquid nutrient media for culturing microorganisms
   Pouring nutrient agar plates and streaking bacterial culture on solid media Inoculating nutrient
   broth with bacterial culture Preparing nutrient media
8) Introduction to Research Laboratory
   Different kinds of microbial plates, liquid growth media for microbes, Laminar air flow system,
   stem cells laboratory, Centrifuges, Spectrophotometer, Sonicator, PCR and Real-time PCR, Gel
   Documentation system, *Chlamydomonas* and *Drosophila* incubation systems,
   Stereomicroscope and various Incubators
9) Growth Curve:
   Generating a bacterial growth curve under various pH and environmental conditions (steady and
   shaking); Calculations of Growth rate constant (μ); Calculation of generation time
10) Enzyme Kinetics: To study an enzyme catalyzed reaction using hydroquinone as a substrate and
    peroxidase extracted from cabbage.
11) Introduction to Light Microscopy: Observing cells in a leaf peel using a compound microscope and
    to study the morphological characteristics of *Saccharomyces cerevesiae.*
12) Dye exclusion method of differentiating dead v/s live cells: To use a vital stain to distinguish dead
    and live yeast cells.
13) Staining and Observing human cheek cells: To carry out staining of epithelial cells from the mouth
    using acetocarmine and methylene blue stains.
14) Staining human blood cells: To observe human blood cell types by differential staining.
15) Plant anatomy: Relationship between plant anatomy and habitat.
16) Micrometry: Measuring size of a microscopic specimen.
17) Haemocytometer
18) Gram Staining: To differentiate bacteria cells by Gram staining.

CL 101: Chemistry Laboratory

Calibrations of pipette, burette, standard flasks etc., acid base titrations, recrystallization, thin
layer chromatography, identification of organic functional groups, complexometric titrations
based on EDTA complexation with metals, Synthesis of benzoic acid, diazotization etc.

Books Recommended:

S.No.	Author/Book
1	Vogel's Textbook of Quantitative Chemical Analysis (5th Edition; Longmann)
2	Vogel's Qualitative Inorganic Analysis (7th Edition)
3	ACS Journal of Chemical Education

Page 2013 of 2209

PL 101: Physics Laboratory -I

Introduction to experimental physics – conceptual and procedural understanding, planning of experiments; Plots (normal, semi-log, log-log); uncertainty / error in measurements and uncertainty / error analysis. Introduction to measuring instruments – concepts of standards and calibration; determination of time periods in simple pendulum and coupled strip oscillator system with emphasis on uncertainty in the measurements and accuracy requirements; study of projectile motion – understand the timing requirements; determination of surface tension of a liquid from the study of liquid drops formed under the surface of a glass surface; determination of Young's modulus of a strip of metal by double cantilever method (use of traveling microscope); study of combination of lenses and nodal points and correspondence to a thick lens; study of thermal expansion of metal – use of thermistor as a thermometer; measurement of small resistance of a wire using Carey-Fosterbridge and determine electrical resistivity of the wire; study of time dependence of charging and discharging of capacitor using digital multimeter –use of semi-log plot.

Books Recommended:

S.No.	Author	Book
1	Worsnop and Flint	Advanced Practical Physics for Students

GL 101 Computer Laboratory

History of computers; hardware basics. Concept of operating system; basic Unix/Linux commands; Office suite, including spreadsheets.
Flowcharts; computer arithmetic. Simple FORTRAN programming mathematical operators, input, output from keyboard, library functions.
Conditional statements - If-thenelse, Case, Go-to. Loops- Do loops, cycle, exit, nested loops. Arrays- 1 dimensional and multidimensional.
Formatting - input and output. Input and output from file.
Functions and Subroutines.; Creating HTML pages; Plotting utilities like GNU Plot.

Semester – II [January - June 2016]

B 201: Biology –II [Introduction to Macro Molecules]

Unit-I
Cell – Overview: Cellular organization, Biomembranes, Nucleus, Cytoplasmic organelles, Bacteriophages. Nucleic Acids, Genomes and Proteomics: Building blocks- nucleotides, DNA structure, RNA structure and function, chromatin structure, genome code, genes, repetitive DNA sequences.

Unit-II
Gene Transcription: Overview of gene expression, overview of transcription, gene's regulatory elements, transcription mechanisms in prokaryotes and eukaryotes (a comparison).

Unit-III
Protein Structure and Function: Building blocks- amino acids, peptides, secondary structure, three dimensional structure, membrane proteins, miscellaneous proteins, enzymes.

Unit-IV
Cell Signaling: Overview, signaling via hydrophobic molecules, signaling via ion channels, Signaling via G-protein coupled receptors, signaling via cell surface enzymes, intracellular signaling.

Unit-V
Biotechnology: DNA cloning, Uses of recombinant DNA technology, Polymerase chain reaction (PCR), Production of recombinant proteins and SDS-PAGE.

Books Recommended:

S.No.	Author	Book
1	B Alberts, A Johnson, J Lewis, and M Raff	Molecular Biology of the Cell
2	J D. Watson, T A. Baker, S P. Bell, & A Gann	Molecular Biology of the Gene (6th Edition)
3	John Wilson and Tim Hunt (2007)	Molecular Biology of the Cell: The Problems
4	Benjamin Lewin (2007)	Genes IX (Lewin, Genes XI)

C 201: Chemistry- II [Chemical Thermodynamics]

Unit-I
Classification of system, intensive and extensive properties, equilibrium and Heat, work and energy, irreversible and reversible expansion work of an ideal First law of thermodynamics, heat content or enthalpy of a system; Thermochemistry – Enthalpy of a reaction, exothermic and endothermic

Unit -II
Second law of thermodynamics, Carnot cycle, entropy, entropy change and Free energy functions and Maxwell's relations, Gibb's Helmholtz relations, nonequilibrium states, reversible and irreversible processes. gas, internal energy in a cyclic process. heat capacities, Joule- Thomson effect, Adiabatic expansion of an ideal gas and work done. reactions, thermochemical equation, Kirchoff's equation, heat of reaction and flame temperature, heat of combustion, heat of solution, heat of neutralization, heat of fusion, heat of vaporization, Bond energy and dissociation energy, Hess's law and its applications. irreversible processes and Clausius inequality, entropy and available work. criteria of spontaneity and conditions of equilibrium, Heat capacity relations (C_p/C_v and $C_p – C_v$), change of phase and Clapeyron equation, Trouton's rule.

Unit -III
Electrode potential and free energy, electrochemical series. Nernst heat Theorem and third law of thermodynamics, experimental Elements of statistical thermodynamics

Unit -IV
Chemical equilibrium and chemical potential (μ): chemical potential of an determination of entropy. ideal gas and gas mixture, Gibbs free energy and entropy of mixing, Chemical Phase equilibrium in simple systems: Equilibrium condition, stability of the Ideal solutions and colligative properties: ideal solutions, chemical potential equilibrium in a mixture of ideal gases and real gases, Equilibrium constants – K_x and K_c between ideal gases and pure condensed phase. Lechatelier principle and applications. phases of a pure substance, pressure dependence of μ vs. T curves, Clapeyron equatons.

Unit -V
Phase equilibrium: solid- liquid, liquid-gas, solid-gas, phase diagram – water, carbondioxide, sulphur, Effect of pressure on the vapour pressure, the phase rule. of a solute in a binary ideal solution – Gibbs-Duhem equation, Colligative properties – freezing pointing depression, solubility, elevation of boiling point, Osmotic pressure, Vant Hoff equation.

Books Recommended:

S.No.	Author	Book
1	P.W. Atkins	Physical Chemistry, Oxford University Press, 7th Edition, 2006
2	G.W. Castellan	Physical Chemistry, 3rd Ed. Addison - Wesley/Narosa Publishing House, 1993
3	G.N.Lewis and Randall	Thermodynamics, (Revised by K.S.Pitzer and L.Brewer), International Students Edition,
4	K. Denbigh	The principles of Chemical Equilibrium
5	B. G. Kyle	Chemical & Process Thermodynamics

P 201: Physics – II: [Electricity, Magnetism and Optics]

Unit-I
Electrostatics: Coulomb's law and Gauss' law; Electrostatic potential, uniqueness theorem, method
of images; Electrostatic fields in matter; Conductors and insulators; Capacitors and capacitance;
Electric current.

Unit-II
Magnetostatics: Biot – Savart law, Ampere's law; Electromagnetic induction; Mutual inductance and self
inductance; Magnetic fields in matter.

Unit-III
Displacement current; Maxwell's equations; Alternating current circuits; Electric and magnetic properties
of matter; Plane electromagnetic waves in vacuum; Polarisation;

Unit-IV
Energy and momentum in electromagnetic waves; electromagnetic radiation (qualitative); Dipole radiation
formula; Larmor's formula for radiation due to accelerated charge (without proof); Synchrotron radiation
(descriptive).

Unit-V
Optics Interference of two beams and involving multiple reflections; Young's experiment, Fresnel's biprism,
Lloyd's mirror, Optical instruments; Telescope and microscopes; Magnifying power and resolving
power.Sources of light and spectra; Dispersion, polarization, double refraction; Optical activity.

Books Recommended:

S.No.	Author	Book
1	Edward M. Purcell	Electricity and Magnetism Berkeley Vol. 2
2	Frank S. Crawford	Waves, Berkeley Vol. 3
3	Jenkins and White	Fundamentals of Optics
4	Feynman	Feynman Lectures Vol. 2

MB 201: Mathematics – II [Linear Algebra, Calculus of Several variables]

Unit I
Functions of several variables, partial derivatives, geometric interpretation, properties of partial derivatives,
chain rule, applications. Elementary discussion on scalars and vectors, norm of a vector, dot product,
projections. Linear equations and matrices, matrix operations. Concept of a determinant, its properties,
evaluation of a determinant, cross product as a determinant, lines and planes. Elementary ideas of tensors.

Unit II
Vector functions. Gradient of a function, geometric interpretation, properties and applications; divergence
and curl of a vector function, geometric interpretation, properties and applications; higher derivatives,
Laplacian. Line integrals. Double and triple integrals, their properties and applications to areas, volumes, etc.

Unit III
Gradient theorem, Green's theorem, Stokes' theorem, divergence theorem, applications. Proofs of Stokes' and
divergence theorems through physical examples (such as circulation in a 2 dimensional plane and
accumulation of fluid in a given volume).

Unit IV
Curvilinear coordinate systems, spherical and cylindrical coordinates, area and volume elements, illustrations.
Gradient, divergence and curl in curvilinear coordinate systems.

Unit V

Introduction to linear algebra. Vector spaces, linear dependence and independence, notion of basis, and dimension, subspaces. Examples. More on matrices: special kinds of matrices, their properties. Eignevalues and eigenvectors, secular determinant, characteristic polynomial. Eigenvalues and eigenvectors of a real symmetric matrix. Illustrative examples. Applications of linear algebra.

Books Recommended:

S.No.	Author	Book
1	Gilbert Strang (MIT Courseware)	Calculus
2	Thomas	Calculus
3	Howard Anton and Chris Rorres	Elementary Linear Algebra
4	Gilbert Strang (MIT Courseware)	Introduction to Linear Algebra
5	George B. Arfken and Hans J. Weber	Mathematical Methods for Scientists and Engineers

G201- Electronics & Instrumentation

Unit-1

Analog electronics: Introduction to passive electronic components -resistance, capacitance, inductance; Circuit theorems: Thevenin's theorem, Norton's theorem and Maximum power transfer theorem; basic concepts of semiconductor diode and transistor; application of Bipolar Junction Transistor (BJT) – biasing circuits: The CE configuration, fixed base bias, emitter bias, and potential-divider or voltage divider bias; CE amplifier, amplifier as a switch, concept of negative feedback.

Unit-2

Principle of DC power supply; half and full wave bridge rectifier, capacitor filter – ripple factor, concept of load and line regulation, concept of constant voltage source and constant current source; concept of short circuit protection and current limit protection; Zener regulator; concept of Switch Mode Power Supply (SMPS), power supply ICs, charge pump ICs for stepping up voltage and for bipolar supply.

Unit-3

Differential amplifier; Operational Amplifier (OPAMP): principle, basic characteristics and parameters relevant for general use; non-inverting and inverting amplifier, voltage follower, difference amplifier, summing amplifier, voltage controlled current source; OPAMP comparator, Schmidt trigger; Digital to Analog Converter (DAC) with weighted resistance and R-2R ladder network; Anlog to Digital Converter (ADC); filters: low pass, high pass; band pass; Butterworth filter.

Unit-4

 Digital electronics: Review of basic logic gates; DeMorgan's theorem, Use of NAND / NOR as universal building blocks; arithmetic circuits; binary addition, half adder, full adder, binary subtraction - 1s and 2s complement, controlled inverter, adder / subtracter, parity checker; Flip-Flops (FF): RS-FF, D-FF, JK-FF; counters and shift registers: binary counter, ripple counter.

Unit-5

Basic concepts of instrumentation, generalized instrumentation systems block diagram representation; Sensing elements: electrodes and transducers. Electrode-electrolyte interface, stability of electrode potentials, circuit models, external and internal electrodes, pH, pO2 and pCO2 electrodes. Transducer, definition, types, displacement, velocity, acceleration, pressure, temperature vibration, ultrasound etc., calibration, sensitivity and resolution.

Books Recommended:

S.No.	Author	Book
1	R. L. Boylestad, L. Nashelsky, K. L. Kishore, Pearson	Electronic Devices and Circuit Theory
2	Malvino and Bates	Electronic Principles
3	Donald A. Neamen, Tata McGraw Hill	Electronic Circuit Analysis and Design
4	David A. Bell	Electronic Devices and Circuits
5	Leach, Malvino and Saha	Digital Principles and Applications
6	R.P. Jain	Modern Digital Electronics, Tata McGraw-Hill (2003)
7	M. Morris Mano, Michael D. Ciletti	Digital Design, Pearson Education Asia, (2007)
8	Thomas L. Floyd	Digital Fundamentals, Pearson Education Asia (1994)
9	DVS Murthy	Measurement & Instrumentation
10	A.K. Sawhney	Electrical Measurements & Electronic Measurements

G202- Glimpses of Contemporary Science

Unit-I
Physics in life systems: size and scale, diffusion, cell locomotion, force generated by actin growth and flagellum rotatory motion, ion channels, resting potential across the membrane, nerve conduction velocity, action potential, macromoleculaes of life, random walk model of polymer, single molecular experiments, optical tweezers, magnetic tweezers.

Unit-II
Complex systems: dynamical chaos, logistic map, bifurcation, Universality, Feigenbaum constants, Mechanical demonstrations of chaos, Nanomechanical oscillators, Patterns, Reaction-diffusion systems, Nodal patterns, thermodynamics and human population, Falling leaves, Smoke ring physics.

Unit-III
At the turn of 1900: Silver threads, Discovery of the electron, Rutherford's nuclear atom Wien's law, Blackbody radiation and Max Planck's action.

Unit-IV
Astrophysics, Astrochemistry and Astrobiology

Unit-V
Quantum mechanics, atoms : Entanglement Light-atom interaction, Bringing atoms to rest, Laser tweezers, How bright is laser, Quantum computing.

Books Recommended:

S.No.	Author	Book
1	Darcy Wentworth Thompson	Growth and Forms
2	Rob Phillips	Physical biology of the cell
3	Harward Berg	Random walks in biology
4	L. Cooper	Physics: Structure and Meaning
5	R. P. Feynman, R. B. Leighton, and M. Sands	The Feynman Lectures on Physics vol. 3
6	S. Chandrasekhar	Introduction to the study of stellar structure

BL 201: Biology Practical

1. Observing instruments to be used in semester II, their use and maintenance: (a) micro-pipettes, (b) tissue homogenizer, (c) electrophoresis apparatus, (d) centrifuges, (e) ultraviolet and visible (uv-vis) absorption spectrophotometer
2. Centrifugation of the cell contents at varying speeds such that the subcellular fractions separate out based on their density differences
3. Photosynthesis - floating leaf disc experiment under various conditions (light, dark & light - dark)
4. Visit to TIFR
5. Nucleic acid extraction - from plant & animal tissue using ethanol precipitation
6. Agarose gel electrophoresis
7. Analysis of DNA under various conditions – pH and Temperature
8. Protein extraction & separation using polyacrylamide gel electrophoresis (PAGE)
9. Carbohydrate extraction & estimation - extraction of sugars from grapes & estimation of the same by DNSA method
10. Protein extraction & estimation determination of total protein content in microorganisms by folin-ciocaltaeu method
11. Lipid extraction & separation - Extraction of total lipids from liver tissue & separation by thin layer chromatography
12. Separation of biomolecules using:
    Adsorption chromatography; Partitioning of indicators in various solvent systems. ;
    Separation of a mixture of solutes by partitioning; Separation of leaf pigments by paper chromatograhy
    Separation of flower pigments by paper chromatography ; Reverse phase thin layer chromatography
    (PRTLC) - Separation of photosynthetic pigments

CL 201: Chemistry Laboratory

Colorimetric titrations, Beer Lambert law, Estimation of concentration by colorimetric methods, conductometric methods, estimation of concentraion of acid base bt pH meter, identification of inorganic anions and cations, finding of pka values, short project of 2 weeks based on the experiments available in Journal of Chemical Education.

Books Recommended:

S.No.	Suggested text and references:
1	Vogel's Textbook of Quantitative Chemical Analysis (5th Edition; Longmann)
2	Vogel's Qualitative Inorganic Analysis (7th Edition)
3	ACS Journal of Chemical Education

PL 201- Physics Laboratory

Review of uncertainty / error analysis; least squares fit method; introduction to sensors / transducers; determination of 'g' (acceleration due to gravity) by free fall method; study of physical pendulum using a PC interfaced apparatus – study variation of effective 'g ' with change of angle of plane of oscillation - investigation of effect of large angle of oscillation on the motion;

Study of Newton's laws of motion using a PC interfaced apparatus; study of conservation of linear and angular momentum using 'Maxwell's Wheel' apparatus; study of vibrations of soft massive spring; study of torsional oscillatory system; study of refraction in a prism - double refraction in calcite and quartz; study of equipotential surface using different electrode shapes in a minimal conducting liquid medium; determination of electrical inductance by vector method and study effect of ferromagnetic core and study the effect of non-linearity of inductance with current.

Books Recommended:

      Worsnop and Flint   Advanced Practical Physics for Students

GL 201 Electronics laboratory

1. To study the Half wave & Full wave rectifier and study the effect of C filter.
2. To design a Single Stage CE amplifier for a specific gain and bandwidth.
3. Study of Operational amplifier in inverting and non-inverting mode.
4. To verify and design AND, OR, NOT and XOR gates using NAND gates.
5. Measurement of pressure, strain and torque using strain gauge.

Second Year

Semester – III [July - December 2016]

CB 301- Essential Mathematics for Chemistry & Biology

Unit-I
Applications of Taylor series, Euler series

Unit-II
Review of first order ordinary differential equations, second order ODE's with constant coefficients, solutions by series expansion methods, introduction to partial differential equations,

Unit-III
Laplace's equation, separation of variables, Legendere differential equation and Legendere polynomials, important properties of Legendere poynomials, Hermite polynomials, Laguerre polynomials, Fourier series and simple applications, Laplace transforms and applications, convolution.

Unit-IV
The matrix Eigen value problems, Secular determinants, Characteristics polynomials, Eigen values and Eigen functions. Eigen values of real symmetric matrices; Eigen values and Eigen functions, important properties and examples.

Unit-V
Complex numbers, Analytic functions, Cauchy Riemann equations, Cauchy's integral formula, Residue theorem and simple applications.

Books Recommended:

S.No.	Author	Book
1	D.J.S. Robinson	A Course in Linear Algebra with Applications, World Scientific.
2	G. B. Thomas and R.L. Finney	Calculus and Analytic Geometry, 9th ed., Addison-Wesley/Narosa
3	J. Marsden, A. Tromba and A. Weinstein	Basic Multivariable Calculus, Springer
4	Inder K. Rana	Calculus@iitb, Concepts and Examples, Version 1.2

CB 302: Biochemistry-I

Unit-I
General biochemistry concepts: The concept of pH, dissociation and ionization of acids and bases, pKa, buffers and buffering mechanism, Henderson Hasselbalch equation, dissociation of amino acids and determination of pKa.

Unit-II
Chemical structure of Major: Carbohydrates, Lipids, Nucleic acids, Proteins: amino acid ; Chemical properties: molecular bond, covalent bond, ionic bond, hydrogen bond, ester, ; ethyl ; Molecular charge hydrophilic, hydrophobic, polar. pH : acid, alkaline, base. oxidation: reduction, hydrolysis Structural compounds:
       In cells: flagellin, peptidoglycan, myelin, actin, myosin
       In animals: chitin, keratin, collagen, silk
       In plants: cellulose, lignin, cell wall

Unit-III
Enzymes and enzyme activity: enzyme kinetics , enzyme inhibition, proteolysis; ubiquitin – proteasome, kinase -- dehydrogenase

Unit-IV
Membranes : fluid mosaic model; diffusion, osmosis. Phospholipids, glycolipid, glycocalyx, antigen, isoprene ion channel; proton pump, electron transport , ion gradient, antiporter, symporter, quinine, riboflavin Lipids, Vitamins, Hormones

Unit-V
Protein structure and function: folding, modification, enzymes, enzyme kinetics, enzyme regulation and inhibition

Books Recommended:

S.No.	Author	Book
1	D. L. Nelson & M. M. Cox	Lehninger Principles of Biochemistry,
2	Stryer L (1995	Biochemistry, 4 th edition,
3	Starzak, Michael E.	Energy and Entropy equilibrium to stationary states
4	J. McMurry (1999)	Fundamentals of General Organic & Biological Chemistry

B 301: Cell Biology -I

Unit-I
Cell biology - An Overview: Universal features of cells, Diversity of their genomes, Overview of cell chemistry (important atoms and their properties, pH, acids, bases, and buffers in cells, formation and functions of proteins, DNA, sugars, and fats in cells, Visualization of cell; Basic principles of light microscopy, Different microscopic techniques for imaging cells.

Unit-II
Membrane system: The cell membrane and its structure, Models of the biomembrane: Charles Overton's "Lipid Membrane", Lipid monolayer model of Irwing Langmuir, Lipid bilayer model by Gorter and Grendel, Protein-containing lipid bilayer model of Daveson and Danielly, David Roertson's direct observation of the membrane, Fluid Mosaic model of Singer and Nicholson, Constituents and fluidity of plasma membrane, Transport across membrane, Ion channels.

Page 2021 of 2209

Unit-III

Cellular organelles and their functions: Mitochondria: Structure of mitochondria, Different enzymes and their location, Electron transport complexes, ATP synthase, Mitochondrial DNA, Structure of chloroplast, Protein complexes and photosynthetic electron transport chain, DNA of the chloroplast, Bioenergetics, Structure and functions of the ribosomes, Endoplasmic reticulum, Golgi body, Lysosomes, and Nucleus. Protein sorting, Vesicular traffic inside the cells, targeting & degradation

Unit-IV

Cytoskeleton, cilia and flagella: Structure and functions of Microtubules, Actin, and Intermediate filaments. Interplay between different cytoskeletal components. Molecular motors. Cilia and flagella: structure and functions. Diseases associated with the cytoskeleton, cilia, and flagella.

Unit-V

Organization, Replication, and Maintenance of the genome: Complexity of eukaryotic genomes, Chromosomes and chromatin, DNA replication, DNA damage and repair, DNA rearrangements

Books Recommended:

S.No.	Author	Book
1	D. L. Nelson & M. M. Cox	Lehninger Principles of Biochemistry,
2	Stryer L (1995	Biochemistry,
3	Starzak, Michael E.	Energy and Entropy equilibrium to stationary states
4	J. McMurry (1999)	Fundamentals of General Organic and Biological Chemistry (Study Guide)

CB 303: Organic Chemistry –I

Unit-I

A. Basic concepts - Recapitulation

Hybridisation, formal charge, inductive and resonance effects and their effect on reactivity and acidity and basicity of organic compounds; polar & non polar covalent bonds; homolytic and heterolytic fission, types of reagents- electrophiles and nucleophiles; curly arrow notation; classification of organic reactions.

Unit -II

B. Chemistry of Aliphatic compounds

IUPAC nomenclature of aliphatic and substituted aliphatic compounds and alicyclic compounds Preparation, structure, properties and reactions of the following classes of compounds.

Hydrocarbons - a) alkanes, Methods of formation Kolbe reaction, Wurtz reaction, Corey House reaction, decarboxylation of carboxylic acids; Mechanism of halogenation of alkanes, orientation, selectivity & reactivity, product ratio.

Cycloalkanes - Methods of formation and reactivity ; Baeyer's strain theory and its limitation; theory of strainless rings

Alkenes - Elimination reactions ; Saytzeff & Hoffman elimination; Reactions – halogenation reactionsfree radical and polar mechanisms. Markownikoff's rule, the peroxide effect, allylic halogenations using NBS; Ozonides/Ozonolysis. epoxidation; hydroboration-oxidation; oxymercuration-demercuration; Oxidation using $KMnO_4$ & OsO_4.; polymerization.

Dienes - Structure of butadiene and allene ; 1,2 vs 1,4 addition ; Diels Alder reaction.

Unit -III

Alkynes - Methods of formation; acidity of alkynes; electrophilic addition to alkynes; hydroboration oxidation ; metal ammonia reductions; hydrogenation using Lindlar's catalyst.

Alkyl halides - Preparation, properties and synthetic applications of alkyl halides ; SN1 & SN2 reactions (mechanism), E1 and E2 reactions(mechanism); Grignard reagent and its applications.

Alcohols - Methods of formation ; acidity ; H-Bonding ; reactions of mono; di & trihydric alcohols; Diols as protecting groups

Unit -IV

Ethers and epoxides - Formation & reactions of ethers and epoxides ; ring opening reactions of epoxides under acidic and basic consitions; reaction epoxides with Grignard & organolithium reagents Aldehdyes & ketones - Methods of formation of aldehdyes and ketones; Nucleophilic addition reactions with cyanide, ammonia and derivatives of ammonia; acetal formation; oxidation reduction reactions. Meerwin-Pondroff-Verley reduction, Clemmensen reduction, Wolf-Kishner reduction, Aldol condensation reaction, Cannizzaro reaction, Tischenko reaction, haloform reaction, Baeyer-Villiger oxidation, Wittig reaction; Mannich reaction

Unit -V

Carboxylic acids - Methods of formation of mono and di carboxylic acids; acidity and factors affecting acidity; reactions of carboxylic acids :
Carboxylic acid derivatives - Methods of formation of acid chlorides, amides, anhydrides and esters and their interconversions; relative stabilities of acid derivatives; Rosenmund reaction; Hoffmann rearrangement; saponification.
Nitrogen and sulphur compounds - Nitro alkanes

Books Recommended:

S.No.	Author	Book
1	I. L. Finar	Organic Chemistry, Vol. 1 & 2, ELBS.
2	R. T. Morrison and R. N. Boyd	Organic Chemistry, Prentice Hall of India
3	L. G. Wade,	Organic Chemistry, Pearson Education
4	G. Solomons and C. Fryhle,	Organic Chemistry, John Wiley & Sons
5	W.G. Solomons	Fundamentals of Organic Chemistry,
6	J. March	Advanced Organic Chemistry, 3rd Edn.
7	F.J. Carey and R.J. Sundburg	Advanced Organic Chemistry, Part A & Part B
8	D. D. Ebbing	General Chemistry, Houghton Miffin Co
9	M. J. Sienko and R. A. Plane	Chemical Principles and Applications,

H 301: World Literature

Unit-I

What is Literature? - a discussion; Introduction to literary terms, genres, and forms of various periods, countries, languages, etc. Comprehensive idea about Sanskrit literature in relation to scientific writing: Vedic and Classical literature

Unit-II

The Novel: Class study of 'Brave New World' by Aldous Huxley; Group discussions and student presentations on other genres such as the graphic novel, detective fiction, children's literature, etc.

Unit-III

Plays: Introduction to the history of theatre, class study of (mainly) two plays: 'Pygmalion' by G. B. Shaw and 'Fire and Rain' by Girish Karnad, the setting up of play –reading group through which the students can be introduced to several other plays.

Unit-IV

Poetry: Brief introduction; Study of poetic genres, forms, topics, figures of speech, poetic language etc. by analysing various poems from around the world

Unit-V

Short stories, essays and other types of writing by various authors. Screening of films based on literary works, such as Pygmalion (My Fair Lady), Fire and Rain (Agnivarsha), Persepolis (a graphic novel) and a few others.

H302: History and Philosophy of Science

Unit-I
Brief overview of the contemporary cultural development elsewhere in the world; Indus Civilisation: progress of art, architecture, science and technology, role of geometry in art and architecture; Study of ancient Indian linguistic techniques and their relation with modern programming languages; Overview of Paninian style and techniques; Precision of Sanskrit in expressing technical terms; History of number naming and writing in India; Sulbasutra and Vedanga Jyotisha – geometrical constructions and astronomical calculations; Jain literature on mathematics and astronomy; Linguistic techniques used in Aryabhatiya; Works of Brahmagupta in opposition of Aryabhata; Contribution of Kerala school of mathematics to development of mathematical ideas.

Unit-II
Genesis of systematic ideas: Science in ancient Greece; against mythological explanations to natural phenomena; Early atomism, mathematical atomism, against atomism. Introduction to epistemology; Possible criteria of demarcation between science and folklore; Non–science and metaphysics; Introduction to logical positivism and the "standard view"; Criticism of "standard view".

Unit-III
Method of analysis and synthesis; Beginning of mathematical sciences; multicultural origins of science. Renaissance and scientific revolution:

Unit-IV
Galilean ideas; mechanisation of world picture; From alchemy to chemistry, from natural history to evolutionary history, from natural numbers to complex numbers, from physiology to cell biology.

Unit-V
Rise of experimental science: Discussion of some of the crucial experiments with an emphasis on the analysis of conceptual changes rather than the technical details.

Books Recommended:

S.No.	Author	Book
1	Colin Ronan	Cambridge Illustrated History of Science
2	Rom Harre	Great Scientific Experiments: 20 Experiments that Changed our View of the World
3	T. A. Saraswati Amma	Geometry in Ancient and Medieval India
4	Kim Plofker	Mathematics in India (Princeton Univ. Press)
5	Samir Okasha	Philosophy of Science – A Very Short Introduction
6	Henry Collins and Trevor Pinch	The Golem – What Everyone should Know about Science by (Cambridge Uni. Press, 1996)
7	Alan Chalmers	What is this thing called Science?

BL 301: Biology Laboratory (Biochemistry + Cell Biology)

1. Biochemical calculation
2. Amino acid titration:
    Determine the pka value of the provided amino acid solutions using titration curve.
    Identify the amino acids using the reference table on the basis of pka values obtained
3. Carbohydrate identification & estimation by anthrone method
    Extraction of carbohydrates from various sources.
    Identification by dichotomous key & estimation by anthrone method
4. Estimation of total free amino acids
    Extraction of total free amino acids from plant sample estimation by ninhydrin reagent
5. Acid value - Acid number is a measure of the amount of carboxylic acid groups a fatty acid
6. Iodine number

Iodine numbers are often used to determine the amount of unsaturation in fatty acids

7. Saponification value

   Measure of the average molecular weight (or chain length) of all the fatty acids present

8. Peroxide value - Gives the evidence of rancidity in unsaturated fats and oils

9. Potato starch - isolation of starch

10. Enzyme kinetics

    Enzymatic reaction using potato starch and salivary amylase.

    Determine Vmax and Km for individuals salivary amylase.

11. pH and temperature effect on enzyme kinetics

    Effect of pH and temperature on salivary amylase action on starch

12. Effect of inhibitors on enzyme kinetics

13. Carbohydrate identification by thin layer chromatography

    Extraction of carbohydrates from various fruit sample and identification by separating using tlc

14. Chromatography:

    Paper chromatography, dimensional chromatography of a mixture of amino acids

    Circular chromatography, Separation utilizing gel filtration and ion-exchange chromatography, S. Russo and A. Radcliffe, *J.Chem. Educ.* **68**, 168-171 (1991).

    Isolation of lactoferrin by immobilized metal ion affinity chromatography (IMAC), A. Calvo and F. Batista-Viere, *Biochem. Educ.* **22**, 50-52 (1994).

    Rapid microscale isolation and purification of yeast alcohol dehydrogenase using Cibacron blue affinity chromatography, C. Morgan and N. Moir, *J.Chem. Educ.* **73**, 1040-1041 (1996).

    Chromatographic separation of two proteins, J. Szeberenyi, *Biochem. Mol. Biol. Educ.* **35**, 71-72 (2007).

15.Electrophoresis

    SDS-agarose gel electrophoresis in a simple procedure for determining high molecular weight protein oligomerization, M. Brownleader et al., *Biochem.Educ.* **22**, 155-158 (1994).

    Capillary electrophoresis: a fast and simple method for the determination of the amino acid composition of proteins, P. Weber and D. Buck, *J. Chem. Educ.* **71**, 609-611 (1994).

    Determination of the subunit molecular mass and composition of alcohol dehydrogenase by SDSPAGE, B. Nash, *J. Chem. Educ.* **84**, 1508-1511 (2007).

    Metal-catalyzed cleavage of tRNA-Phe, S. Kirk et al., *J. Chem. Educ.* **85**, 676-678 (2008).

    Introducing proteomics in the undergraduate curriculum: A simple 2D gel electrophoresis exercise with serum proteins, T. Kim and P. Craig, *Biochem. Mol. Biol. Educ.* **38**, 29-34 (2010).

16. Isolation and Characterization of Enzymes

    Testing the á-amylase inhibitor of the common bean, J. Moreno et al., *J. Chem. Educ.* 71, 350-352 (1994). A rapid and inexpensive procedure for the determination of amylase activity, V. Mulimani and J. Lalitha, *Biochem. Educ.* 24, 234-235 (1996).

    A rapid and inexpensive procedure for the determination of proteolytic activity, S. Castro and A. Cantera, *Biochem. Educ.* 23, 41-43 (1995).

    Zymography of extracellular matrix proteases, A. Quesada et al., *Biochem. Educ.* 24, 170-171 (1996).

    The thermodynamic stability and catalytic activity of yeast alcohol dehydrogenase at different pH values, R. Tabor and J. Ladwig, *Biochem. Educ.* 25, 169-170 (1997).

    The competitive inhibition of yeast alcohol dehydrogenase by 2,2,2-trifluoroethanol, R. Tabor, *Biochem. Educ.* 26, 239-242 (1998).

    From egg to crystal: a practical on purification, characterization, and crystallization of lysozyme for bachelor students, V. Olieric et al. *Biochem. Mol. Biol. Educ.* **35**, 280-286 (2007).

    Lactate dehydrogenase kinetics and inhibition using a microplate reader, J. Powers et al. *Biochem. Mol. Biol. Educ.* **35**, 287-292 (2007).

17. Cell biology

    Cell staining – i (capsule, cell wall, lipid granules)

    Cell staining – ii (metachromatic granules, endospores)

    Cell motility

    Subcellular fractionation of mouse liver tissue, page & wester blotting

    Immunoflourescence of cytoskeleton & nuclear proteins

    Meiosis using lily anthers

GL 301- Applied Electronics Lab

Experiments based on:
1- Norton's theorem and Maximum power transfer theorem; basic concepts of semiconductor diode and transistor;
2-Principle of DC power supply; half and full wave bridge rectifier, capacitor filter – ripple factor,
3-Zener regulator; concept of Switch Mode Power Supply (SMPS), power supply ICs,
4- Bipolar Junction Transistor (BJT) – biasing circuits:
5- Anlog to Digital Converter (ADC); filters: low pass, high pass; band pass; Butterworth filter
6- controlled inverter, adder / subtracter, parity checker; Flip-Flops (FF):
7- RS-FF, D-FF, JK-FF; counters and shift registers: binary counter, ripple counter.

Semester – IV [January - June 2017]

B401: Cell Biology - II

Unit-I
Cell Junctions, Cell Adhesion, and the Extracellular Matrix: Introduction, Cell Junctions, Cell-Cell Adhesion, The Extracellular Matrix of Animals, Extracellular Matrix Receptors on Animal Cells. Integrins, Selectins, and other proteins involved in intercellular contacts. The Plant Cell Wall

Unit-II
Cell signaling: 1. Introduction: Components involved in signaling, Types of signaling, Three Major Classes of Signaling Receptors: Ion Channel-linked, G protein-coupled receptors (GPRs), Enzyme-linked receptors: Tyrosine-Kinase Receptors, other enzyme-linked receptors, Second Messengers: cAMP, cGMP, IP3 and DAG, Ca+2, PIP3. Signaling Cascades. Cell signaling and cancer.

Unit-III
Cell cycle and Cell division: Mechanisms and regulations of cell division, Mitosis, Meiosis, and Germ cells, Cell renewal, Uncontrolled cell division and cancer.

Unit-IV
Types of cell death: Apoptosis, Necrosis, Anoikis, Oncosis

Unit-V
Techniques in Cell biology: Cell fractionation, DNA libraries, DNA transfer into eukaryotic cells and Mammalian embryos, Nucleic acid hybridization, Purification of nucleic acid, Isolation and fractionation of proteins.

Books Recommended:

S.No.	Author	Book
1	Alberts *et al*.	Molecular biology of the Cell
2	Alberts, Bray *et al*	Essential Cell Biology Garland, Publication New York 1997
3	James E. Darnell, Harvey F. Lodish, and David Baltimore	Molecular Cell Biology
4	Geoffrey M Cooper	The Cell, 2nd edition, A Molecular Approach
5	http://publications.nigms.nih.gov/insidethecell/index.html.	Inside the Cell, an internet-based study of cells (National Institute of General Medical Sciences)

B 402: Biochemistry-II

Unit-I

Metabolism and metabolic pathways: Glycolysis, TCA cycle, Oxidative Phosphorylation, Photophosphorylation

Unit-II

Biosynthesis of macromolecules: Carbohydrate biosynthesis (Pentose phosphate pathway), Fatty acid synthesis, Cholesterol of steroid biogenesis, Amino acid biosynthesis & degradation, Nucleotide biosynthesis & degradation, Fatty acid degradation

Unit-III

Pigments : chlorophyll , carotenoids, xanthophyll , cytochrome, phycobilin, Bacteriorhodopsin, hemoglobin, myoglobin, absorption spectrum, action spectrum, fluorescence

Unit-IV

Photosynthesis : light reaction -- dark reaction. Fermentation : Acetyl-CoA -- lactic acid
Cellular respiration : Adenosine triphosphate (ATP) - NADH - pyruvate - oxalate – citrate Chemosynthesis

Unit-V

Regulation hormones : auxin signal transduction -- growth factor -- transcription factor -- protein kinase -- SH3 domain Malfunctions : tumor -- oncogene -- tumor suppressor gene Receptors : Integrin -- transmembrane receptor -- ion channel

Books Recommended:

S.No.	Author	Book
1	D. L. Nelson , M. Cox	Lehninger Principles of Biochemistry,
2	Stryer L	Biochemistry.
3	Starzak Michael E.	Energy and Entropy equilibrium to stationary states
4	J McMurry	Fundamentals of General Organic and Biological Chemistry (Study Guide)

CB 401: Introductory Spectroscopy [UV-Vis, Florescence, IR, Raman, NMR]

Unit-I

The electromagnetic spectrum: Nature of electromagnetic radiation. The electromagnetic spectrum and its regions. Frequency, waveno and wavelength: units and conversions. Absorption of electromagnetic radiation. Molecular energy states and quantisation of internal energy. Boltzmann distribution. Spectroscopic Processes: Absorption, emission, and scattering of light. Beer-Lambert Law - Quantitative absorption measurements, Jablonski diagram Fourier transformation: A mathematical tool to our advantage, basic principle and its relevance in spectroscopy.

Unit -II

UV-VIS Absorption Spectroscopy: Principles and instrumentation of spectrophotometers. UV-vis spectroscopy to determine conjugation. UV-visible spectroscopy and electronic transitions. Electronic ground states and excited states in organic molecules: pi-star and pi to pi-star transitions. band position and band intensities. Fluorescence Spectroscopy: Principles and instrumentation of fluorimeters. Advantage of fluorimetry compared to absorption spectrophotometry. Luminescence and the fate of excited states: timescale of fluorescence and phosphorescence.Qualitative and Quantitative Fluorimetry.

Unit -III

IR - Principles and instrumentation of Infrared spectroscopy. nfrared spectroscopy and molecular vibrational transitions. Simple dispersive IR spectrometer and ovewrview of modern instrumentation. Transmittance and absorbance. Vibrational modes and selection rules. Factors governing the position and intensity of IR bands: effects of variation in reduced mass and force constant. Group frequency and fingerprint regions: use of IR for identification by presence/absence of absorptions characteristic of specific bonds/bond groupings.

Interpretation of IR spectra.
Raman Spectroscopy: Raman Effect and molecular polarizability. Technique and instrumentation. Pure rotational Raman spectra, vibrational Rama spectra. Structure determination from Raman and IR.

Unit -IV
Nuclear Magnetic Resonance (NMR): Introduction to Nuclear Magnetic Resonance (NMR) spectroscopy. number of signals, integration, chemical shift, splitting of signals. Principles and instrumentation of NMR spectroscopy. Nuclear spin and nuclear magnetism. Energies of nuclear spin states in a magnetic field. Boltzmann population of nuclear spin states and the origin of NMR signals.. Information from: chemical shifts and delta values, peak areas and integration, splitting patterns and spin-spin coupling constants. (n+1) rule and Pascal's triangle. Interpretation of NMR spectra using

Unit -V
Examples of organic compounds. Short introduction about application of NMR for proteins.
Mass spectrometry: Introduction to mass spectroscopy (molecular mass, accurate mass and isotopes)
Principles, ionisation methods (including EI, MALDI, ESI). Molecular ions and fragmentation processes under EI. Mass spectrometry for determining the molecular weight/formula of organic compounds and identify the presence of isotopes. Introduction of MS application in protein analysis.

Books Recommended:

S.No.	Author	Book
1	K Wilson and John Walker	Practical Biochemistry: Principles & Techniques
2	GR Chatwal and SK Anand	Instrumental methods of Chemical Analysis
3	S. K. Sawhney	Introductory Practical Biochemistry
4	RF Boyer	Biochemistry Laboratory: Modern Theory & Techniques
5	S Carson, H Miller and D Scott	Molecular Biology Techniques: A Classroom Laboratory Manual
6	T C Ford and J M Graham	An Introduction to Centrifugation
7	TS Work and E Work	Density Gradient Centrifugation, Vol. 6
8	David Rickwood	Centrifugation Techniques
9	A Braithwaite and FG Smith	Chromatographic Methods
10	LR Snyder, JJ Kirkland & JW Dolan	Introduction to Modern Liquid Chromatography
11	S J Pennycook and PD Nellist	Scanning Transmission Electron Microscopy
12	DJ Rawlins	Light microscopy
13	M Hoppert	Microscopic Techniques in Biotechnology
14	M Hoppert and A Holzenburg	Electron microscopy in microbiology
15	T Peng, D L Horrocks and E L Alpen	Liquid Scintillation Counting: Recent Applications and Development, Volume I
16	R Baserga and D Malamud	Autoradiography: techniques and application
17	T Chard	An Introduction to Radioimmunoassay and Related Techniques , Volume 6
18	MD Bruch	NMR Spectroscopy Techniques
19	B A Wallace and R. William	Modern Techniques for Circular Dichroism and Synchrotron Radiation ..., Volume 1

PCB 401: Physical & Chemical Kinetics

Unit -I
Basic Concepts: Rate, order and molecularity of a reaction, First, second and third order reactions – effect of concentration on reaction rate, rate expressions and integrated form, pseudo-unimolecular and second order autocatalytic reactions, nth order reaction of a single component, effect of temperature on reaction rate – Arrhenius equation and activation energy.
Complex Reactions: parallel first order reactions, series first order reactions – determination of rate constants by graphical method and the time ratio method. The stationary state, radioactive decay, general first order series and parallel reactions. Competitive, consecutive second order reactions, reversible reactions, equilibrium from the kinetic view point, complex mechanisms involving equilibria.

Unit -II
Kinetic Measurements: Experimental determination of reaction rates and order of reactions –correlation of physical properties with concentrations, reactions in the phase, reactions at constant pressure, fractional-life period method, initial rate as a function of initial concentrations.
Reactions in Solutions: General Properties, Phenomenological theory of reaction rates, Diffusion limited rate constant, Slow reactions, Effect of ionic strength on reactions between ions, Linear free energy relationships, Relaxation methods for fast reactions.

Unit -III
Catalysis: Homogeneous catalysis in gas phase, in solution, basis of catalytic action, catalysis and the equilibrium constant, acid base catalysis, The Bronsted catalysis law, linear free energy changes, general and specific catalysis. Heterogeneous catalysis. Negative catalysis and inhibition, Surface reactions – effect of temperature and nature of surface. Industrial catalysis.
Chain reactions: general treatment, activation energy, chain length, chain transfer reactions, inhibition.

Unit -4
Bond dissociation energies, branching chain reactions.
The collision theory: Dynamics of bimolecular collisions and rate and rate constant of bimolecular reaction, factors determining effectiveness of collisions, Termolecular reactions, unimolecular reactions. Relation between cross section and rate coefficients.
Potential Energy Surfaces: Long range, empirical intermolecular and molecular binding potentials, Internal coordinates and normal modes of vibration, Potential energy surfaces, ab-initio calculation of potential energy surface, experimental determination of potential energy surfaces, Details of the reactionpath, potential energy surface for electronically excited molecule. Molecular beam scattering, Stateresolved spectroscopic technique, molecular dynamics of $H_2 + H$ reaction, state-to-state kinetics of $F + H_2$ reaction.

Unit -V
Transition State Theory (TST): Motion on the potential energy surface, Basic postulates and derivation of TST, dynamical derivation of TST, Quantum mechanical effects on TST, Thermodynamic formulation of TST, Application of TST, Microcannonical TST, Variational TST, Experimental observation of TST.

Books Recommended:

S.No.	Author	Book
1	K.A. Connors	Chemical Kinetics: A Study of Reaction Rates in Solution,
2	J.I. Steinfeld, J.S. Francisco & W.L. Hase	Chemical Kinetics and Dynamics,
3	K. J. Laidler	Chemical Kinetics,
4	R. D. Levine and R. B. Bernstein	Molecular Reaction Dynamics & Chemical Reactivity
5	J.W. Moore and R.G. Pearson	Pearson, Kinetics and Mechanisms,
6	Sanjay K. Upadhay	Chemical kinetics and Reaction Dynamics,

G 401: Statistical Techniques and Applications

Unit-I
Purpose of Statistics, Events and Probabilities, Assignments of probabilities to events, Random events and variables, Probability Axioms and Theorems. Probability distributions and properties: Discrete, Continuous and Empirical distributions.

Unit-II
Expected values: Mean, Variance, Skewness, Kurtosis, Moments and Characteristics Functions. Types of probability distributions: Binomial, Poisson, Normal, Gamma, Exponential, Chi-squared, Log-Normal, Student's t, F distributions, Central Limit Theorem

Unit-III
Monte Carlo techniques: Methods of generating statistical distributions: Pseudorandom numbers from computers and from probability distributions, Applications. Parameter inference: Given prior discrete hypotheses and continuous parameters, Maximum likelihood method for parameter inference.

Unit-IV
Error Analysis: Statistical and Systematic Errors, Reporting and using uncertainties, Propagation of errors, Statistical analysis of random uncertainties, Averaging Correlated/ Uncorrelated Measurements. Deconvolution methods, Deconvolution of histograms, binning-free methods. Least-squares fitting: Linear, Polynomial, arbitrary functions: with descriptions of specific methods; Fitting composite curves.

Unit-V
Hypothesis tests: Single and composite hypothesis, Goodness of fit tests, P-values, Chi-squared test, Likelihood Ratio, Kolmogorov-Smirnov test, Confidence Interval. Covariance and Correlation, Analysis of Variance and Covariance. Illustration of statistical techniques through hands-on use of computer programs.

Books Recommended:

S.No.	Author	Book
1	R.J. Barlow	Statistics: A Guide to the Use of Statistical Methods in the Physical Sciences
2	John Mandel, Dover	The Statistical Analysis of Experimental Data
3	Philip Bevington and Keith Robinson	Data Reduction and Error Analysis for the Physical Sciences, 3rd Edition

BL401: Biology Laboratory (Biochemistry + Cell Biology)

1. Ligand Binding
 a) The binding of coomassie brilliant blue to bovine serum albumin, J. Sohl and A. Splittgerber, *J. Chem. Educ.* **68**, 262-264 (1991).
 b) Evaluation of the Hill coefficient from Scatchard and Klotz plots, A. Sabouri and A. Moosavi-Movahedi, *Biochem. Educ.* **22**, 48-49 (1994).
 c) The shapes of Scatchard plots for systems with two sets of binding sites, A. Bordbar et al.,*Biochem. Educ.* **24**, 172-175 (1996).
2. Spectroscopy
 d) Fluorescence quenching of albumin. A spectrofluorimetric experiment, M. Montero et al, *Biochem Educ.* **18**, 99-101 (1990).
e) Lactate dehydrogenase kinetics and inhibition using a microplate reader, J. Powers et al., *Biochem. Mol. Biol. Educ.* **35**, 287-292 (2007).
3. Isolation and Analysis of Biomolecules - Amino acids/peptides/proteins/antibodies
 f) Application of gel filtration for fractionation and molecular weight determination of proteins, O. Malhotra and A. Kumar, *Biochem. Educ.* 17, 148-150 (1989).

g) Protein structure and chromatographic behavior: The separation and characterization of four proteins using gel filtration and ion-exchange chromatography and gel electrophoresis, M. Chakravarthy, L. Snyder, T. Vanyo, J. Holbrook, and H. Jakubowski, *J. Chem. Educ.* 73, 268-272 (1996).

4. Isolation and Analysis of Biomolecules - Carbohydrates

h) Changes in carbohydrate content during fruit ripening-a new approach of teaching carbohydrate chemistry in biochemistry course, P. Chaimanee and O. Suntornwat, *Biochem. Educ.* 22, 101-102 (1994).

i) Carbohydrate Analysis: Can we control the ripening of bananas?, S. Deal, C. Farmer, and P. Cerpovicz, *J. Chem. Educ.* **79**, 479-480 (2002).

5. Isolation and Analysis of Biomolecules - Lipids

j) Isolation and spectrophotometric characterization of photosynthetic pigments, R. Boyer, *Biochem. Educ.* **18**, 203-206 (1990), and *Modern Experimental Biochemistry,* 3rd ed., p. 333-344, (2000) Benjamin Cummings. (San Francisco).

k) An improved method for the extraction and thin-layer chromatography of chlorophyll a and b from spinach. H. Quach, R. Steeper, and G. Griffin, *J. Chem. Educ.* **81**, 385-387 (2004).

6. Metabolism/Regulation/Transport

l) The energetics of aerobic versus anaerobic respiration, T. Champion and R. Schwenz, *J. Chem. Educ.* 67, 528-530 (1990).

m) Use of DCPIP in a colorimetric method to investigate electron transport in crude heart mitochondrial extracts, A. Myers, *Journal of Biol. Educ.* 24, 123-126 (1990).

n) Mitochondria from rat liver: method for rapid preparation and study, C. Heisler, *Biochem. Educ.* 19, 35-38 (1991).

o) An experiment on glycogen biosynthesis in *E. coli,* A. Lodeiro et al, *Biochem. Educ.* 22, 213-214 (1994).

p) An experiment illustrating catabolite repression in yeast, W. Baker, *Biochem Educ.* 23, 216-217 (1995).

q) A simple experiment demonstrating the allosteric regulation of yeast pyruvate kinase, R. Taber, A. Campbell, and S. Spencer, *Biochem. Educ.* **26**, 73-76 (1998).

r) A simple laboratory exercise illustrating active transport in yeast cells, B. Stambuk, *Biochem. Mol. Biol. Educ.* **28**, 313-317 (2000).

s) The pentose phosphate pathway in the yeasts *Saccharomyces cerevisiae* and *Kloeckera apiculata,* an exercise in comparative metabolism for food and wine science students, C. Steel, P. Grbin, and A. Nichol, *Biochem. Mol. Biol. Educ.* **29**, 245-249 (2001).

t) Kinetic analysis of glucose-6-phosphatase: an investigative approach to carbohydrate metabolism, M. Wallert, J. Foster, D. Scholnick, A. Olmschenk, B. Kuehn, and J. Provost, *Biochem. Mol. Biol. Educ.* **29**, 199-203 (2001).

u) Nitrate reductase: A model system for the investigation of enzyme induction in eukaryotes, C. Pike, W. Cohen, and J. Monroe, *Biochem. Mol. Biol. Educ.* **30**, 111-116 (2002).

CELL BIOLOGY

v) Programmed Cell Death DNA Laddering and Cell death assay (quantification by Evans Blue)

w) Post-translational modification of proteins

x) Introducing undergraduate students to real-time PCR, D. Hancock et al., *Biochem. Mol. Biol. Educ.* **38**, 309-316 (2010).

y) Caenorhabditis elegans as an undergraduate educational tool for teaching RNAi, J. Andersen et al., *Biochem. Mol. Biol. Educ.* **36**, 417-427 (2008).

GL 401: Computational Laboratory and Numerical Methods

This course is primarily a lab course introducing computational techniques used for solving mathematics problems numerically. Vast amount of software for solving these problems exists and has been put together in general purpose packages such as MATHEMATICA, MAXIMA, MAPLE and so on.

Computing special functions (using recurrence relations, Attn: loss of accuracy and its effects), making subroutines/functions for these. Computing derivatives numerically (accuracy issues). Zeros (roots) of functions (single variable, multivariable, complex functions poles as zeros of inverse function). Solving differential equations (single variable, any order), Euler and Runge-Kutta, initial and boundary value problems. Eigenvalue problems as boundary value problems.

Numerical integration: trapizoidal and Simpson rules, Gaussian quadrature rules. Linear equations, inverse of a matrix, determinant using Gauss elimination. Matrix eigenvalue problems, Euler rotations, relaxation methods. Data fitting, χ methods, some simulations minimization. Random number generators, Monte-Carlo methods, some simulations.

Third Year

Semester – V [July - December 2017]

B501: Genetics

Unit-I
Introduction and overview of genetics: Information transfer DNA-RNA-Protein/genotype & phenotype, Eukaryotic & Prokaryotic genes, Pseudogenes. Gene regulation: λ phage, Bacterial gene regulation, Eukaryotic gene regulation, Epigenesis, Reverse genetics, genomes and genomics.

Unit-II
Mendelian inheritance (in details): *basics would have been taught*, Cell division- mitosis & meiosis *(revise: would have been taught)*, Deviation from mendelian inheritance, Linkage & Sex-linked inheritance Model genetic systems.

Unit-III
Human genome and genetics: Elements of human genetics & genetic disorders, Examples from *Drosophila*, yeast, maize and mouse, Immunogenetics.

Unit-IV
Genes and Evolution: The law of DNA constancy and C-value paradox: Numerical and structural changes in chromosomes; Molecular basis of spontaneous and induced mutations and their role in evolution; Environmental mutagenesis and toxicity testing; Population genetics.

Unit-V
Biostatistics: Principles and practice of statistical methods in biological research; samples and populations; Basic statistics – average, statistics of dispersion, coefficient of variation; Standard error; Confidence limits; Probability distributions binomial, Poisson and normal; Tests of statistical significance; Simple correlation of regression; Analysis of variance, Population genetics.

Books Recommended:

S.No.	Author	Book
1	E. J. Gardner, D.P Snustad and M. J. Simmons	Principles of Genetics
2	Leland Hartwell, Leroy Hood, Michael Goldberg, Ann Reynolds, Lee Silver, Ruth Veres.	Genetics: From genes to genomes
3	Anthony J. F. Griffiths. 2010	Introduction to genetic analysis
4	Harvey Motulsky, 2010	Intuitive Biostatistics: A Nonmathematical Guide to Statistical Thinking
5	Marcello Pagano, 2000	Principles of Biostatistics
6	Genetics for Dummies, 2005	T. R. Robinson

B 502: Molecular Biology

Unit-I
Molecular biology an overview: Concept and definition of the gene, complexity of the eukaryotic gene. Structural organization of the DNA in the nuclear material- General properties of histones, nucleosomes and solenoid structure, RNAs and their structure & function.

Unit-II
DNA synthesis: The enzymes of DNA replication in prokaryotes and eukaryotes, mechanism of replication in bacteria and viruses, reverse transcriptase, salient features of eukaryotic nuclear and mitochondrial DNA replication.
RNA synthesis: The enzymes of transcription in prokaryotes and eukaryotes, mechanism of transcription in bacteria, heteronuclear RNA, post transcriptional processing of RNA, role of ribozymes.

Unit-III
Protein synthesis: Concept of the genetic code, structure of t-RNA and t-RNA, enzymes of translation in prokaryotes and eukaryotes, mechanism of protein synthesis, post translational processing of proteins.

Unit-IV
Gene expression and its characterization: Regulation of gene expression in prokaryotes and eukaryotes, structure and mechanism of different operons, Gene regulation during development, Gene function and phenotype loss of function & gain of function, Gene interaction, suppressors & enhancers redundancy & epistasis.

Unit-V
Mutations and their consequences: Definition of mutation, mutagenesis & mutant selection, Alleles, Complementation, Recombination, recombination mapping and mechanism of recombination, Repair of DNA, Transposons & retroposons, Genomic & evolution of diversity.

Books Recommended:

S.No.	Author	Book
1	Stryer L	Biochemistry, 4 th edition,
2	Watson J. D., Hopkins, N. H., Roberts, J. W., Steitz, J. A. and Weiner, A. M.	Molecular biology of the gene, 4th edition, The Benjamin/Cummings publishing companies,
3	Benjamin Lewin	Genes VII, oxford University Press, Oxford
4	Weaver R. F.	Molecular biology,
5	Brown T A	Essential molecular biology, vol. I, A practical approach, IRL press, Oxford.28
6	Cox Lynne S	Molecular Themes in DNA Replication
7	Cantor, C. R., and Schimmel, P. R.	Biophysical Chemistry.

B 503: Biodiversity of plants/animals/microbes

Unit-I
Principles of taxonomy: Concept of species and hierarchical taxa, Biological nomenclature, Taxonomical structure**,** Outline classification of animals**,** important criteria used for classification in each Taxon.**,** Classification of animals Levels of Structural organizations: Larval forms and their evolutionary significance, Unicellular, colonial, and multicellular forms**,** Levels of organization of tissues, organs, and systems**,** Comparative anatomy

Unit-II
Classical and quantitative methods in taxonomy: Biosystematics, Interrelationship among major invertebrate phyla and minor invertebrate phyla; Evolutionary relationship among taxa, Natural History of

Indian subcontinent: Major habitat types, Geographical origin and migration of species , Common Indian mammals and birds, Seasonality and Phenology of Indian subcontinent

Deriving Solutions: Examine the concepts, benefits, and limitations of the different strategies for conserving biodiversity. a. Conservation Strategies, b. Laws and Legal Actions, c. Grassroots Action Program

Unit-III

Taxonomy of plants: Plant identification, nomenclature, collecting and documentation, plant phylogeny and systematics.

Comparative anatomy and morphology of angiosperms and gymnosperms. Angiosperms: Characteristic features, outline classification, vascular anatomy, leaves, flower, fruits and seeds. Gymnosperms: Characteristic features, outline classification, morphology and anatomy of ovules and female gametophyte, microspore and male gametophyte, seeds, stem and leaves.

Unit-IV

Concepts and characteristics of biodiversity: The concepts of biodiversity, Comparison of historical and current rate of species extinction, How genetic diversity may change between generations and within population of species, Complexity and functions of ecosystems; predictable and non-predictable features of ecosystem, Importance of preserving biodiversity, Genetic diversity

Unit-V

Causes and consequences of biodiversity loss: Address the major threats to biodiversity. The biggest threat is from habitat loss and alteration followed by the introduction of exotic species that become invasive. Chemical alteration of the environment also has a major impact on both natural and managed ecosystems.

    a. Habitat Loss & Alteration b. Exotic Species c. Chemical Pollutants d. Loss of Genetic Diversity in Crops

Books Recommended:

S.No.	Author	Book
1	Cecie Starr, Ralph Taggart, Christine Evers, and Lisa Starr	Biology: The Unity and Diversity of Life
2	Hawksworth, D. L. & Bull Alan T.	Plant Conservation and Biodiversity. Series: Topics in Biodiversity and Conservation, Vol. 6 (Eds.) Reprinted from Biodiversity and Conservation, 16:6, 2007, VIII, 424 p.
3	M P Singh	Plant Biodiversity & Taxonomy
4	E.O.Wilson, *Editor.* Frances M. Peter	Biodiversity
5	Peter H. Raven, Ray F. Evert, and Susan E. Eichhorn	Biology of Plants

CB 501- Analytical Chemistry

Unit-I

Statistics in chemical analysis: Methods of sampling and associated errors, Classification of errors, Propagation of errors, treatment of errors, Normal distribution, Tests of Significance and Confidence Limits.

Unit -II

Separation techniques:

    a. Solvent Extraction Technique: Conventional, Liquid Membranes – Bulk, Supported and Emulsified, Solid Phase Extraction (SPE).

    b. Ion Exchange: Conventional, Membranes.

    c. Chromatography: Gas chromatography (GC), High Performance Liquid Chromatography (HPLC), Ion chromatography (IC).

Unit -III

Mass Spectrometry: Mass Analysers – Magnetic, Quadrupole, Time of Flight (TOF), Ion Cyclotron Resonance, Features – Resolution, Dispersion, Abundance, Sensitivity , Detectors – Faraday Cup, Channeltron, Daly, Ion Sources –Thermal Ionisation (TI), Electron Impact, ICP, GD, Laser Ablation (LAICP), Secondary Ionisation (SI), Resonance Ionisation (RI), Matrix Assisted Laser Desorption and Ionisation (MALDI), Hyphenated Technique – IC-MS, HPLC-MS, GC-MS.

Unit -IV

Thermal Methods: Thermogravimetric Analysis (TGA), Derivative Thermogravimetric Analysis (DTG), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), Evolved Gas Analysis (EGA).

Unit -V

Electrochemical Methods: Introduction, Potentiometry , Ion Selective Electrodes (ISE), Voltammetry & Polarography , Cyclic, Pulse and Stripping Voltammetry, Coulometry and Amperometry, AC Electrochemical Techniques, Scanning Electrochemical Microscopy.

Books Recommended:

S.No.	Author	Book
1	RA Meyers	Encyclopaedia of Analytical Chemistry: Applications, Theory and Instrumentation
2	DA Skoog, DM West, FJ Holler and SR Crouch	Fundamentals of Analytical Chemistry, 8th Edition
3	DA Skoog, FJ Holler and TA Niemann	Principles of Instrumental Analysis, 5th Edition, Saunders College Publishing (1998)
4	GH Jeffery, J Bassett, Mendham and RC Denney	A text book of Quantitative Analysis, 5th Edition Revised
5	AK De and SM Khopkar	Chalmers, Solvent Extraction of Metals, Van Nostrand, Reinhold
6	F Helfferich	Ion Exchangers, McGraw Hill
7	LR Snyder and JJ Kirkland	Introduction to Modern Liquid Chromatography, 2nd Edition, Wiley
8	Editors JA Marinsky, Y Marcus, Marcel Dekker	Ion Exchange and Solvent Extraction: A Series of Advances
9	ED Katz Chichester	High Performance Liquid Chromatography : Principles and Methods in Biotechnology;
10	A Metcalfe	Atomic Absorption and Emission Spectroscopy,
11	K Jose and AC Broekaert	Analytical Atomic Spectrometry with flames and Plasmas, Wiley-VCH
12	IJ Sneddon	Advances in Atomic Spectroscopy, Jai Press
13	M John Roboz	Introduction to Mass Spectrometry: Instrumentation and Techniques, Interscience
14	Steve J Hill	Inductively Coupled Plasma Spectrometry and its Application, Sheffield Academic Press
15	WW Wendlandt	Thermal Methods of Analysis, 2nd Edition, Wiley
16	T Daniels, Kogan Page	Thermal Analysis
17	AJ Bard and LR Faulkner	Electrochemical Methods, 2nd Edition, Wiley
18	SP Kruger	Principles of Activation Analysis, Wiley Interscience
19	LC Feldman and JW Meyer	Fundamentals of Surface and Thin Film Analysis, North Holland
20	JC Miller and JN Miller	Statistics for Analytical Chemistry, 2nd Edition, Wiley

G 501: Earth Science and Energy & Environmental Sciences

Unit –I
Origin of the earth, type of rocks in different layers, their physical and chemical properties.
Mechanism of their formation and destruction. Radioactivity and its role in geochronology, Plate tectonics and geodynamics and the role of mantle plumes in sustaining these processes.
Gravity, electrical, seismic and magnetic properties of the different layers in the earth.
Their variations in different geological terrains. Instrumentation, field procedures used in these studies.
Response of the earth to the elastic (Seismic) and electromagnetic waves, use of this phenomena to study the earth's interior.

Unit-II
Geodynamo and the internal magnetic field of the earth.
Paleomagnetic studies, Polar wandering and reversal, possible theoretical arguments for understanding the phenomena.
Seismology and its use in understanding of the different layers in the earth's interior.
Utility of the different geophysical techniques (discussed above) in exploration for academic as well as for harnessing resources.

Unit-III
Introduction to Environmental Science. Natural Environments: Ecosystems and ecology, biodiversity.
Socio-cultural environments: demography, population density, human organizations.
Land use and its planning.
Global climate change and effects on environment.
Carbon cycle from human activity, calculation of carbon budgets.

Unit-IV
Water harvesting, storage and treatment.
Natural calamities, hazards, and effects of human activity: Chemical and other technological hazards.
Introduction to energy Sources - evolution of energy sources with time. Power production, per capita consumption in the world, and relation to development index. Energy scenario in India:
Various issues related to consumption and demands -energy crisis issues in India.
Renewable and non-renewable energy sources - technology and commercialization of energy sources, local (decentralized) versus centralized energy production, constraints and opportunities of renewable energy (hydrocarbon and coal based energy sources).

Unit-V
Energy conservation – calculation of energy requirements for typical and home and industrial applications.
Alternative to fossil fuels - solar, wind, tidal, geothermal.
Bio-based fuels. Hydrogen as a fuel.
Energy transport and storages, comparison of energy sources - passage from source to delivery (source, production, transport, delivery) - efficiencies, losses and wastes.
Nuclear energy: Power production: Components of a reactor and its working, types of reactors and comparison. India's three stage nuclear program. Nuclear fuel cycle. Thorium based reactors. Regulations on nuclear energy.

Books Recommended:

S.No.	Author	Book
1	Merill RT, McElhinny MW and McFadden PL	The magnetic field of the Earth: International Geophysical Series
2	Edward J, Tarbuck EJ and Lutgens FK	Earth Science
3	HR Sheehan *et al.,*	Introduction to Applied Geophysics: Exploring the Shallow Subsurface Burger
4	Condie KC	Mantle Plumes and Their Record in Earth History; Cambridge University Press, Cambridge, UK

5	WM Telford, Robert E Sheriff and LP Geldart	Applied Geophysics (Paperback)
6	JB Marion	Energy in Perspective, University of Maryland, Academic Press
7	Robert A Ristinen and Jack J Kraushaar	Energy and Environment, , 2nd Edn., John Wiley and Sons, Inc.
8	Boyle Godfrey	Renewable Energy, Oxford University Press
9	D.K.Asthana and Meera Asthana	Environment, Problems and Solutions, S. Chand and Company
10	Balaram Pani IK	Text Book on Environmental Chemistry, International Publishing House

BL 501: Biology Laboratory (Molecular Biology + Biodiversity + Genetics)

1. BACTERIAL GENETICS
   a) *E. coli* Transformation
   b) *E. coli* Conjugation
   c) *E. coli* Transduction
   d) Phage Titration
   e) Transposition
   f) α- Complementation
2. EUKARYOTIC GENETICS
   g) To Study the model organism, *Drosophila Melanogaster*
   h) Concept of Crossing: - Monohybrid and Dihybrid crosses using *Drosophila Melanogaster*
   i) Drosophila Genetics:
   To Observe & Study the Mutants of *Drosophila Melanogaster*
   Concept of Mutation - Lethal Mutations
   j) Karyotyping
3. BIODIVERSITY
   k) Setting up biodiversity niches in the lab & Hospital :fish-tank & Winogradsky column
   l) Biodiversity in soil, air & Winogradsky's Column – Plating , Colony Characterization & Gram Staining
   m) Field Trips - SEWRI MUD FLATS – ½ DAY, COLABA WOODS - ½ DAY, THANE BUTTERFLY PARK - ½ DAY, KARNALA BIRD SANCTUARY - ½ DAY, MAHIM NATURE PARK - ½ DAY
4. MOLECULAR BIOLOGY
   n) General Laboratory Procedures
      Pouring Nutrient Agar Plates; Preparation of Solutions;
      Bacterial Culturing Techniqueso) Designing of Primers for PCR procedure
   p) Extraction and Isolation of genomic DNA Using Kit method
   By conventional Ethanol Precipitation method
      q) Detection of Nucleic acids (AGE)
      r) Polymerase Chain Reaction (PCR) & Detection of the PCR product and its purification
      s) Blunt-end cloning (after Ligation)
      t) Preparation of competent cells & Transformation of E. coli cells with plasmid
      u) Plasmid Purification, RE Digestion & Detection of the RE-digested product
      v) Overexpression & Detection by PAGE
      w) Using restriction mapping to teach basic skills in the molecular biology lab, L. Walsh et al., *Biochem. Mol. Biol. Educ.* **35**, 199-205 (2007).
      x) Western blot analysis to illustrate relative control levels of the *lac* and *ara* promoters in *E. coli*, B. Nielsen et al., *Biochem. Mol. Biol. Educ.* **35**, 133- 137 (2007).

B601: Immunology

Unit-I
Overview of the Immune system: Types of immunity, innate, acquired, passive and active, self vs nonself discrimination, Adaptive immune response, Autoimmunity

Unit-II
Cells and organs of the immune system: T cell receptors, T cell receptor genes & gene rearrangements, T cell maturation, activation & differentiation, B cell generation, activation & development

Unit-III
Antigens and Antibodies: Immunoglobulins- structure and function, Immunoglobulin genes- Organization and rearrangement, Antibody diversity, Antigen antibody reactions, MHC (antigens and genes), Antigen processing & presentation

Unit-IV
Immune response: Self Non-self discrimination (mechanism), Clonal selection theory & idiotypic network hypothesis, Cytokines, The complement system, Cell mediated effector response, Leukocyte migration and inflammation, Hypersensitive reactions, Immune regulation, Immune response to infectious organisms, Vaccines, Immunodeficiency diseases (AIDS)

Unit-V
Immunology & applications: Transplantation immunology, Tumour immunology, Immunotechnology, Animal models. Plant immunity

Books Recommended:

S.No.	Author	Book
1	Goldsby, Kindt, and Osborne	Immunology
2	Janice Kuby	Immunology
3	Ivan Roitt	Essential Immunology, 8th Edition
4	Cellular and Molecular Immunology	Kathyrn Austyn
5	David	Biology of Immunological Diseases
6	Richard Burry	Immunocytochemistry: A practical guide for Biomedical Research

B 602: Animal Physiology

Unit-I
Cell Structure & Metabolism: Homeostasis, Mechanisms of Cellular Control, Membrane Transport, Membrane Potentials (a review). Body Control: Hypothalamic/Pituitary Axis, Mystic Rhythms

Unit-II
Neurons and the Nervous system: Synapses, Sense Perception, Special Senses, CNS Design: Autonomic Nervous System, Action Potential, - Basic structures of neurons and glia, Neurotransmission: Ion channels, Membrane potentials, Resting potential – Depolarization, repolarization and hyperpolarization. Electrotonic and Action potential, Mechanism of neurotransmission. Membrane channels –voltage gated, ligand gated, mechanically gated. Basics of a synapse (electrical and chemical). Introduction to central nervous system design: Structural and functional outline of the brain and the spinal cord, Hypothalamus: Osmoregulation, temperature control, and role in neuroendocrine system: Hypothalamo-hypophyseal portal system, Autonomic Nervous System (sympathetic and parasympathetic pathways). Reflex action.

Unit-III
Muscular system: Skeletal Muscle, Muscle Characteristics, Muscle Control, Muscle Exercise, Smooth Muscle. Cardiovascular Systems: Cardiac Muscle, Heartbeat , Cardiac Control, Blood: Hemostasis, Temperature Control, Vessels, Tissue Exchange, EKGs and Blood Pressure. Digestion: Absorption

Unit-IV
Respiratory Systems: Respiration, Respiratory Control. Energy Balance and Metabolism: Fuel Metabolism (both plants and Animals)

Unit-V
Processes: Excretion Control Salt & Water Balance, An example of a process going wrong. Diabetes. Comparative Physiology

Books Recommended:

S.No.	Author	Book
1	Linda S. Costanzo	Physiology: Board Review Series
2	William Ganong	Review of Medical Physiology (Lange Basic Science)
3	Guyton and Hall	Physiology Review
4	Appleton and Lange	Review of Physiology
5	Linardakis	Illustrated review of Physiology
6	C Guyton	Textbook of Medical Physiology

B 603: Plant Physiology

Unit-I
Plant Cells - Model Organisms, The Plant Kingdom, Flower Structure and the Angiosperm Life Cycle,
Plant Tissue Systems: Dermal, Ground, and Vascular
The Structures of Chloroplast Glycosylglycerides
A Model for the Structure of Nuclear Pores
The Proteins Involved in Nuclear Import and Export
Protein Signals Used to Sort Proteins to their Destinations
SNAREs, Rabs, and Coat Proteins Mediate Vesicle Formation, Fission, and Fusion
ER Exit Sites (ERES) and Golgi Bodies Are Interconnected
Specialized Vacuoles in Plant Cells
Actin-Binding Proteins Regulate Microfilament Growth
Kinesins Are Associated with Other Microtubules and Chromatin
Water and Plant Cells
Calculating Capillary Rise, Calculating Half-Times of Diffusion
Alternative Conventions for Components of Water Potential
Temperature and Water Potential, Can Negative Turgor Pressures Exist in Living Cells?
Measuring Water Potential, The Matric Potential, Wilting and Plasmolysis
Understanding Hydraulic Conductivity
Water Balance of Plants
Irrigation, Physical Properties of Soils, Leaf Transpiration and Water Vapor Gradients
Calculating Velocities of Water Movement in the Xylem and in Living Cells
Mineral Nutrition
Symptoms of Deficiency in Essential Minerals - Wade Berry, UCLA
Observing Roots below Ground
Solute Transport
Relating the Membrane Potential to the Distribution of Several Ions across the Membrane: The Goldman Equation, Patch Clamp Studies in Plant Cells, Chemiosmosis in Action
Kinetic Analysis of Multiple Transporter Systems, ABC Transporters in Plants
Transport Studies with Isolated Vacuoles and Membrane Vesicles

Page 2039 of 2209

Unit-II
Photosynthesis: The Light Reactions
Principles of Spectrophotometry, Quantum Yield
The Distribution of Chlorophylls and Other Photosynthetic Pigments
Antagonistic Effects of Light on Cytochrome Oxidation
Structures of Two Bacterial Reaction Centers
Midpoint Potentials and Redox Reactions
Oxygen Evolution, Photosystem I, ATP Synthase
Mode of Action of Some Herbicides, Chlorophyll Biosynthesis
Photosynthesis: The Carbon Reactions
Inorganic Carbon-Concentrating Mechanisms: CO_2 and HCO_3 – Pumps
How the Calvin–Benson Cycle Was Elucidated
Rubisco: A Model Enzyme for Studying Structure and Function
Energy Demands for Photosynthesis in Land Plants
Rubisco Activase, Thioredoxins, Operation of the C2 Oxidative Photosynthetic Carbon Cycle
Carbon Dioxide: Some Important Physicochemical Properties
Three Variations of C4 Metabolism
Single-Cell C4 Photosynthesis, Photorespiration in CAM plants
Glossary of Carbohydrate Biochemistry, Starch Architecture
Fructans, Chloroplast Phosphate Translocators

Photosynthesis: Physiological and Ecological Considerations
Working with Light, Heat Dissipation from Leaves: The Bowen Ratio
The Geographic Distributions of C3 and C4 Plants
Calculating Important Parameters in Leaf Gas Exchange
Prehistoric Changes in Atmospheric CO_2
Projected Future Increases in Atmospheric CO_2
Using Carbon Isotopes to Detect Adulteration in Foods
Reconstruction of the Expansion of C4 Taxa

Translocation in the Phloem
Sieve Elements as the Transport Cells between Sources and Sinks
An Additional Mechanism for Blocking Wounded Sieve Elements in the Legume Family
Sampling Phloem Sap, Nitrogen Transport in the Phloem
Monitoring Traffic on the Sugar Freeway: Sugar Transport Rates in the Phloem
Alternative Views of Pressure Gradient in Sieve Elements: Large or Small Gradients?
Experiments on Phloem Loading, Experiments on Phloem Unloading
Allocation in Source Leaves: The Balance between Starch and Sucrose Synthesis
Partitioning: The Role of Sucrose-Metabolizing Enzymes in Sinks
Possible Mechanisms Linking Sink Demand and Photosynthetic Rate in Starch Storers
Proteins and RNAs: Signal Molecules in the Phloem

Unit-III
Respiration and Lipid Metabolism
The Q-Cycle Explains How Complex III Pumps Protons across the Inner Mitochondrial
Membrane, Multiple Energy Conservation Bypasses in Oxidative Phosphorylation of Plant
Mitochondria, FoF1-ATP Synthases: The World's Smallest Rotary Motors
Transport Into and Out of Plant Mitochondria, The Genetic System in Plant Mitochondria Has
Several Special Features, Does Respiration Reduce Crop Yields?
The Lipid Composition of Membranes Affects the Cell Biology and Physiology of Plants
Utilization of Oil Reserves in Cotyledons

Assimilation of Mineral Nutrients
Development of a Root Nodule, Measurement of Nitrogen Fixation
The Synthesis of Methionine, Oxygenases

Secondary Metabolites and Plant Defense

Cutin, Waxes, and Suberin, Structure of Various Triterpenes
The Shikimic Acid Pathway, Detailed Chemical Structure of a Portion of a Lignin Molecules

Cell Walls: Structure, Biogenesis, and Expansion
Plant Cell Walls Play a Major Role in Carbon Flow through Ecosystems
Terminology for Polysaccharide Chemistry
Molecular Model for the Synthesis of Cellulose and Other Wall Polysaccharides That Consist of a
Disaccharide Repeat, Matrix Components of the Cell Wall
The Mechanical Properties of Cell Walls: Studies With *Nitella*
Wall Degradation and Plant Defense, Structure of Biologically Active Oligosaccharins
Glucanases and Other Hydrolytic Enzymes May Modify the Matrix

Unit-IV
Growth and Development
Embryonic Dormancy, Rice Embryogenesis
Polarity of *Fucus* Zygotes, *Azolla* Root Development
Class III HD-Zip Transcription Factors Promote Adaxial Development through a micro RNASensitive Mechanism
During Senescence Photoactive Chlorophyllide Is Converted into a Colorless Chlorophyll Catabolite
Phytochrome and Light Control of Plant Development
Mougeotia: A Chloroplast with a Twist, Phytochrome and High-Irradiance Responses
The Origins of Phytochrome as a Bacterial Two-Component Receptor
Profiling Gene Expression in Plants, Two-Hybrid Screens and Co-immunoprecipitation
Phytochrome Effects on Ion Fluxes, Microarray Analysis of Shade Avoidance
Blue-Light Responses: Morphogenesis and Stomatal Movements
Blue-Light Sensing and Light Gradients, Guard Cell Osmoregulation and a Blue Light-Activated
Metabolic Switch
The Coleoptile Chloroplast, Phytochrome-Mediated Responses in Stomata
Gibberellins: Regulators of Plant Height and Seed Germination
Structures of Some Important Gibberellins and Their Precursors, Derivatives, and Inhibitors of
Gibberellin Biosynthesis
Commercial Uses of Gibberellins, Gibberellin Biosynthesis
Environmental Control of Gibberellin Biosynthesis, Auxin Can Regulate Gibberellin
Biosynthesis
Negative Regulators of GA Response, Effects of GAs on Flowering
DELLA Proteins as Integrators of Multiple Signals
Cytokinins: Regulators of Cell Division
Cultured Cells Can Acquire the Ability to Synthesize Cytokinins
Structures of Some Naturally Occurring Cytokinins
Various Methods Are Used to Detect and Identify Cytokinins
The Biologically Active Form of Cytokinin Is the Free Base
Cytokinins Are Also Present in Some tRNAs in Animal and Plant Cells
The Structures of Opines, The Ti Plasmid and Plant Genetic Engineering
Phylogenetic Tree of *IPT* genes
A Root-Derived Hormone, Strigolactone, Is Involved in the Suppression of Branching in Shoots
Cytokinin Can Promote Light-Mediated Development
Cytokinins Promote Cell Expansion and Greening in Cotyledons
Cytokinins Interact with Elements of the Circadian Clock
Ethylene: The Gaseous Hormone
Ethylene in the Environment Arises Biotically and Abiotically
Ethylene Readily Undergoes Oxidation
Ethylene Can Be Measured by Gas Chromatography
Cloning of the Gene That Encodes ACC Synthase
Cloning of the Gene That Encodes ACC Oxidase
Ethylene Binding to ETR1 and Seedling Response to Ethylene
Conservation of Ethylene Signaling Components in Other Plant Species
ACC Synthase Gene Expression and Biotechnology
The *hookless* Mutation Alters the Pattern of Auxin Gene Expression
Ethylene Inhibits the Formation of Nitrogen-Fixing Root Nodules in Legumes

Ethylene Biosynthesis Can Be Blocked with Anti-Sense DNA
Abscission and the Dawn of Agriculture
Specific Inhibitors of Ethylene Biosynthesis Are Used Commercially to Preserve Cut Flowers
Abscisic Acid: A Seed Maturation and Stress-Response Hormone
The Structure of Lunularic Acid from Liverworts
ABA May Be an Ancient Stress Signal
Structural Requirements for Biological Activity of Abscisic Acid, The Bioassay of ABA
Evidence for Both Extracellular and Intracellular ABA Receptors
The Existence of G Protein-Coupled ABA Receptors Is Still Unresolved
The Yeast Two-Hybrid System
Yellow Cameleon: A Noninvasive Tool for Measuring Intracellular Calcium
Phosphatidic Acid May Stimulate Sphingosine-1-Phosphate Production
The ABA Signal Transduction Pathway Includes Several Protein Kinases
The *ERA*1 and *ABH* Genes Code for Negative Regulators of the The ABA Response
Promoter Elements That Regulate ABA Induction of Gene Expression
Regulatory Proteins Implicated in ABA-Stimulated Gene Transcription
ABA Gene Expression Can Also Be Regulated by mRNA Processing and Stability
ABA May Play a Role in Plant Pathogen Responses
Proteins Required for Desiccation Tolerance, The Types of Coat-Imposed Seed Dormancy
Types of Seed Dormancy and the Roles of Environmental Factors
The Longevity of Seeds, Genetic Mapping Of Dormancy: Quantitative Trait Locus (QTL)
Scoring of Vegetative Dormancy Combined with a Candidate Gene Approach
ABA-Induced Senescence and Ethylene

Unit-V
The Control of Flowering
Contrasting the Characteristics of Juvenile and Adult Phases of English Ivy (*Hedera helix*) and
Maize (*Zea mays*), Regulation of Juvenility by the *TEOPOD* (*TP*) Genes in Maize
Flowering of Juvenile Meristems Grafted to Adult Plants
Characteristics of the Phase-Shifting Response in Circadian Rhythms
Support for the Role of Blue-Light Regulation of Circadian Rhythms
Genes That Control Flowering Time, Regulation of Flowering in Canterbury Bells by Both
Photoperiod and Vernalization, The Self-Propagating Nature of the Floral Stimulus
Examples of Floral Induction by Gibberellins in Plants with Different Environmental
Requirements for Flowering, The Effects of Two Different Gibberellins on Flowering (Spike
Length) and Elongation (Stem Length), The Contrasting Effects of Phytochromes A and B on Flowering
A Gene That Regulates the Floral Stimulus in Maize
Responses and Adaptations to Abiotic Stress
Stomatal Conductance and Yields of Irrigated Crops, Membrane Lipids and Low Temperatures
Ice Formation in Higher-Plant Cells, Water-Deficit-Regulated ABA Signaling and Stomatal
Closure, Genetic and Physiological Adaptations Required for Zinc Hyperaccumulation
Cellular and Whole Plant Responses to Salinity Stress
Signaling during Cold Acclimation Regulates Genes That Are Expressed in Response to Low
Temperature and Enhances Freezing Tolerance

Books Recommended:

S.No.	Author	Book
1	Hans Mohr, Peter Schopfer	Plant Physiology; Springer, 629 pages
2	Taiz and Zeiger	Plant Physiology; 4th Edition. Sinauer
3	Hopkins WG	Introduction to Plant Physiology. 2nd or 3rd Edition
4	Stern KR	Introductory Plant Biology. 7th Ed. Wm C Brown Publishers
5	Fosket	Plant Growth and Development: A molecular approach. Acad. Press. More details on how plants grow and develop.
6	Buchanan R, Gruissem W and	Biochemistry and Molecular Biology of

	Jones R	Plants
7	Chrispeels MJ and DE Sadava	Plants, Genes and Crop Biotechnology. 2nd Ed. Jones and
8	Bartlett	Understanding plant biology and the potential of agricultural biotechnology

B 604: Microbiology

Unit-I
General Microbiology - Introduction to Microscopy, Prokaryotic Structure & Function, Microbial Nutrition, Microbial Growth, Control of Microbes, From Taxonomy through the *Archaea*: Gram Negative Bacteria, Gram Positive Bacteria, metabolism, microbial genetics, and the role of microorganisms in disease, immunity, and other selected applied areas.
Fundamentals of General Microbiology - Isolation of a broad range of nonpathogenic bacteria from natural sources, using selective and enrichment techniques, with microscopic, biochemical, and molecular identification. Related exercises include genetics, physiology, quantitation, and growth energetics. Survey of the microbial world, metabolism, biosynthesis, regulation, growth, structure, and function.

Unit-II
Microbes and Society Focuses on activities of bacteria, viruses, and other microorganisms, and their influence on humans. Microbe-related topics include disease, bioterrorism, food, biotechnology, and ecology. Examine the nature of scientific inquiry, along with major biological concepts.
Bacterial Genetics - Molecular genetics: description of fundamental genetic processes such as mutation, repair, genetic exchange, recombination, and gene expression. Use of genetic strategies to analyze complex biological processes. Focuses on prokaryotic organisms. Signal transduction in bacteria

Unit-III
Evolution of Prokaryotic Diversity - Evolution, diversity, and genomics of prokaryotic microorganisms, Enrichment, isolation, and molecular phylogenetic characterization of selected prokaryotic organisms. Prokaryotic Diversity - Structure, biochemical properties, and genetics of the major groups of prokaryotes.
Microbial Ecology - Consideration of the various roles that microorganisms, particularly bacteria and cyanobacteria, play in environmental processes. The interrelationships among microorganisms and the effects of the physical, chemical, and biological properties of their environment are discussed and assessed. Microbial ecology; food, industrial and medical microbiology Symbiosis Aquatic Ecology, Terrestrial Ecology, Industrial Microbiology, Food Microbiology

Unit-IV
Medical Bacteriology - Medically important bacterial pathogens in terms of the clinical, therapeutic, and epidemiological aspects of diseases caused by them, molecular mechanisms of pathogenesis and their identification in the clinical laboratory, procedures for isolation and identification of pathogenic bacteria, testing their susceptibility to antibiotics. Bacterial Pathogenesis: Introduction, Genetic tools used for bacterial pathogenesis study; Bacterial cell-cell communications and biofilm formation, Bacterial genomics, lateral transfer, phage, Vertebrate microbial communities in health and disease, Strategies for bacterial adhesion and invasion
Medical Mycology and Parasitology - Consideration of medically important fungi and parasites, with emphasis on their biology in relation to disease and its laboratory diagnosis.

Unit-V
Molecular Mechanisms of Bacterial Pathogenesis Mechanisms of bacterial pathogenesis explored at the molecular, genetic, and cellular levels through selected models as presented in the current scientific literature. Molecular and Medical Microbiology recent advances in molecular biology of microbial pathogenesis or the current research of the participants is presented and discussed critically.

Protozoan infections: Introduction to protozoa, A survey of the major protozoan infections of humans including a brief description of the parasite life cycles and a brief discussion of the clinical diseases seen during these infections.

Biology and pathogenesis of Plasmodium. life cycle Plasmodium parasites and pathology of human malaria, biochemical and cell biological similarities and differences with other apicomplexa (Babesia, Cryptosporidium, Toxoplasma, etc.), and implications for therapeutic development. Biology and pathogenesis of Toxoplasma, Leishmania, Trypanosoma.

Books Recommended:

S.No.	Author	Book
1	Thomas D Brock	Brock's Biology of Microorganisms
2	Patrick R Murray	Medical Microbiology: with STUDENT CONSULT Access
3	John M Barry	The Great Influenza: The Story of the Deadliest Pandemic in History
4	Alfred E Brown	Benson's Microbiological Applications: Laboratory Manual in General Microbiology (Spiral-bound)
5	Ananthanarayan and Paniker Orient Blackswan	Textbook of Microbiology: Medical microbiology

CB601: Biophysical Chemistry

Unit-I
Physical properties of water: Structure, water as solvent, The hydrophobic effect, osmosis and Diffusion. Introduction to Biomolecules: Nucleic Acid, Protein - Polymer Description of Macromolecular Structure, Intermolecular and Intramolecular forces, Non Covalent Interaction

Unit -II
Hydrodynamic properties: Diffusion and sedimentation, determination of molecular weight from sedimentation and diffusion; Introduction of Ultra Centrifugation, Dynamic Light Scattering and Electrophoresis.
Spectroscopic properties of proteins and nucleic acid: UV/Vis, Intrinsic fluorescence, Circular Dichroism

Unit -III
The concept and application of Chemical and Physical equilibria in Biological system, The equilibrium constant and Standard Gibbs Free energies of reactants and products, Temperature dependence of the equilibrium constant, Double Strand formation in nucleic acid, Ligand-protein binding, Protein denaturation and stability, Introduction of DSC and ITC

Unit -IV
Protein folding kinetics and Biophysical methods, Misfolding and aggregation ; Physical basis of conformation diseases, Therapeutic approaches to protein misfolding diseases**.**

Unit -V
Introduction to basic principles of protein X-ray crystallography, protein NMR, Small Angle X-ray scattering (SAXS), and Electron microscopy (EM).

Books Recommended:

S.No.	Author	Book
1	Tinoco, Sauer, Wang & Puglisi	Physical Chemistry: Principles and Applications in the Biological Sciences
2	Peter Atkins and Julio de Paula	Physical Chemistry for the Life Sciences

H 601 Ethics of Science and IPR

Unit-I
Introduction – causes of unethical acts, ignorance of laws, codes, policies and Procedures, recognition, friendship, personal gains; Bioethics: Definition – moral, values, ethics; Role and importance of ethics in biology; Professional ethics – professional conduct
Ethical decision making, ethical dilemmas; Teaching ethical values to scientists, good laboratory practices, good manufacturing practices, laboratory
Basic Approaches to Ethics; Posthumanism and Anti-Posthumanism;
Bioethics: legal and regulatory issues;

Unit-II
Bioethics in healthcare, agriculture, modern biology, biotechnology, animal welfare & right / animals in research, wildlife conservation and management, commercialism in scientific research
Bioethics and cross-cultural bioethics – Autonomy, Rights, Beneficience, Do No Harm, Justice, Confidentiality, Animal Rights, Environmental ethics, Decision-Making Perceptions of Ethical Biotechnology 'Moral' is not the same as Ethical, Mixed Perception of Benefit & Risk, Reasoning behind Acceptance or Rejection of Genetic Manipulation, Concerns about Consuming products of GMOs.
Past and Present 'Bioethical Conflicts' in Biotechnology- Interference with Nature , Fear of Unknown, Regulatory Concerns, Human Misuse Future 'Bioethical Conflicts' in Biotechnology - Changing perception of Nature, Human Genetic Engineering

Unit-III
Ethical issues related to Synthetic bilogy:
Engineering DNA-based biological circuits, including but not limited to standardized biological parts;
Defining a minimal genome/minimal life (top-down); Constructing protocells, i.e. living cells, from scratch (bottom-up), Creating orthogonal biological systems based on a biochemistry, e.g. non-ATGC DNA bases or non-DNA non-RNA nucleic acids, so called XNA

Unit-IV
Introduction to IPR; Types of Intellectual property – Patents, Trademarks
Copyrights and related rights; Traditional vs. Novelty; Importance of intellectual property rights in the modern global economic environment, Importance of intellectual property rights in India; IPR and its relevance in biology and environmental sciences;
Case studies and agreements - Evolution of GATT and WTO and IPR provisions under TRIPS;
Madrid agreement; Hague agreement; WIPO treaties; Budapest treaty; Indian Patent Act (1970)

Unit-V
Patents: Definition, patentable and non patentable inventions; types of patent application – Ordinary, Conventional, PCT, Divisional, and Patent of addition; Concept of Prior Art; Precautions while patenting disclosure / nondisclosure; Time frame and cost; Patent databases, Searching International databases; Patent licensing and agreement; Patent infringement – meaning, scope, litigation, case studies. Patenting rules – European Scenario, US Scenario, Australia Scenario, Indian Scenario, Non Patentable IP and Patentable IP in Indian Patent Act
Rights of patents – Infringement of patent rights Remedies for infringement of patent rights; Patentability and emerging issues

Books Recommended:

S.No.	Author	Book
1	Lesk	Introduction to Bio Informatics, OUP
2	Cynthia Gibas and Per Jambeck,	Developing Bioinformatics Computer Skills
3	Atwood, Pearson Education	Introduction to Bioinformatics
4	Tisdall, SPD	Beginning Perl for Bio-informatics
5	Smith, D.W., 1994	Biocomputing: Informatics and Genome Project
6	Baxevanis, A.D., Quellette, B.F.F.,	Bioinformatics: A practical Guide to the Analysis of Genes and Proteins

BL 601: Biology Laboratory
(Animal Physiology + Plant Physiology +Immunology + Microbiology+ Bioinformatics)

1. ANIMAL PHYSIOLOGY
    a) Animal cell culture and microscopy
    b) Gross anatomy of the animal brain & Staining of mouse brain sections
    c) Wound Healing Assay

2. IMMUNOLOGY
    d) Isolations of monocytes/macrophages- properties; Isolation of Lymphocytes- T and B cell identification & Lymphocyte Activity.
    e) Separation of WBC & RBC; counting by Haemocytometer
    f) Serum Electrophoresis
    g) ELISA - direct & indirect
    h) Ag detection & Ab detection
    i) Widal – Tube & Slide
    j) VDRL
    k) Blood typing & Pregnancy hCG Ag
    l) Double diffusion
    m) Immunoelectrophoresis
    n) Radial Immunodiffusion

3. PLANT PHYSIOLOGY
    p) *Arabidopsis thaliana* - model organism and its development
    q) *Funaria hygrometrica* - differentiation from chloronema to caulonema to bud formation
    r) Callus formation from carrot cells

4. Bioinformatics:
    DNA sequence analysis using BLAST; sequence pattern, motifs and profiles.
    Prediction of secondary structure of proteins
    Prediction of tertiary structure of (fold recognition, homology search)
    Molecular modeling and dynamics: using small oligonucleofides and small protein with known crystal structure (available from data bank)
    Drug designing – using available data Applications of bio informatics – open ended / small project.

FOURTH YEAR

Semester – VII [July – December 2018]

B 701: Neurobiology

Unit-I
The glial system: Generation of Astrocytes, Oligodendrocytes, and Schwan cells. Function of glia in normal brain and in neuroprotection.
Chemical composition of the brain: metabolism (utilization and uptake of glucose and amino acids). Blood-Brain barrier.

Unit-II
Neurotransmitters: Synthesis, storage, release, uptake, degradation and action of neurotransmitters, Acetyl choline, GABA, Serotonin, Dopamine, Glutamate, Nitrous oxide, etc. Receptors: different subtypes (cholinergic, dopaminergic, adrenergic, and glutamatergic), mechanism of action, Agonists and Antagonists – their mode of action and effects. Exocytosis of neurotransmitter – Role of synapsins, synaptogamins, SNAP, SNARE and other proteins in docking, exocyotosis and recycling of vesicles.

Unit-III
Sleep and Learning and memory: Mechanism of short-term memory and Long-term memory (longterm potentiation). Role of sleep in memory consolidation. Electroencephalogram. Role of second messenger pathways in learning and memory process. Role of synaptic plasticity.

Unit-IV
Sensory organs:
Vision: Biochemistry of vision: Rod and cone cells, mechanism and regulation of vision, color vision, visual field, visual acuity. Visual pathway and topographic mapping.
Audition: functional anatomy of the middle and inner ear. Amplification of sound. Functional anatomy and mechanism of detection of specific sound frequency in the inner ear. Mechanism of action of the mechanosensory receptors in the inner ear.

Unit-V
Chemical senses:
Olfaction: The olfactory pathway, mechanism and the combinatorial code of detecting a smell.
Taste: Mechanism of taste perception.
Touch/pain: The touch/pain/temperature pathway (ascending and descending). Higher order integration in the brain.
Pathologies of the nervous system: Molecular basis of Parkinson's disease, Alzheimer's disease, Schizophrenia, Myasthenia gravis and Multiple sclerosis, stress and antidepressants.

Books Recommended:

S.No.	Author	Book
1	Ferdinand Hucho	Neurochemistry
2	MP Spiegel	Basic Neurochemistry
3	Koenig and Edward	Cell Biology of the Axon, Series: Results & Problems in Cell Differentiation, Vol. 48
4	Eric Kendel, JH Schwartz, T Jessel	Principles of neural Sciences
5	A Guyton and J Hall	Textbook of medical Medical physiology

B 702: Immunology-II (Immunity and Disease)

Unit-I
Host-Pathogen relationship
Diseases caused by Viruses and the immune response to them- HIV and AIDS-immune responses

Unit-II
Bacterial diseases – and the immune response to bacteria
Vaccines- mechanisms, types of vaccines

Unit-III
Parasites – protozoan parasites, parasitic worms and the immune response to them- eg malaria, leishmaniasis, worm infestations

Unit-IV
Immediate Hypersensitivity and allergy, anaphylaxis
Hypersensitivity and chronic inflammatory diseases- tuberculosis and leprosy
Cancer immunology

Unit-V
Autoimmune diseases- generalized- SLE, Rheumatoid arthritis; localized- multiple sclerosis
Diseases due to immune cross reactivity- Rh incompatibility, transfusion, transplantation
Inherited immune diseases

Books Recommended:

S.No.	Author	Book
1	Charles A Janeway, JP Travers, Mark Walport and Mark J Shlomchik	Immunobiology, 5th edition; The Immune System in Health and Disease
2	Baron S, Galveston	Medical Microbiology; 4th Edition; University of Texas Medical Branch at Galveston
3	RA Goldsby *et al.*	Kuby's Immunology
4	E Benjamini, R Coico and G Sunshine	Immunology- A short Course
5	Roitt, Brostoff and Male	Immunology
6	William Paul	Fundamentals of Immunology
7	Tizard	Immunology
8	Abbas *et al*.	Immunology

B 703: Developmental Biology

Unit-I

Basic concepts of molecular regulation of development: Transcription factors in differential gene expression; morphogens and axis formation; autocrine and paracrine regulation. How cell proliferation, apoptosis, and fate specification determine developmental processes.
Fertilization: Structure of oocytes and spermatocytes. The process of fertilization.

Unit-II

Comparative study of early embryonic development: (*Caenorhabditis elegans*, amphibians, birds, and mammals), Cleavage formation, Gastrulation
Axis formation: Signaling cascades and molecular understanding of anteroposterior, mediolateral, and dorsoventral axes development.

Unit-III

Organogenesis in vertebrates: Germ layer formation. Regulation of formation of the somites, heart, kidney, blood vessels, and limb. Changes in circulation pattern between fetus and newborn.
Metamorphosis and regeneration process: Hormonal control of metamorphosis in amphibians and insects; wing imaginal disc formation in *drosophila*. Regeneration in planeria and that of vertebrate limb.

Unit-IV

Stem cells: Concepts of totipotent, pluripotent, and multipotent cells. Factors regulating "stemness" of a cell. Embryonic vs. adult stem cells. Sources of stem cells in vertebrates and their applications.
Developmental disorders and aging: Regulatory role of genetic and environmental factors. Role of carcinogens and teratogens.

Unit-V

Development processes in plants: How are the mechanisms different from that of animal development? Gametogenesis, pollination, and fertilization processes in angiosperms. Hormonal regulation of seed dormancy and the process of germination. Root and shoot development mechanisms. Reproductive phase: photoperiod sensitivity and molecular regulation of flowering process.
Epigenetic and environmental control of development: Sexual dimorphism, sex determination, X inactivation. Environ-elicited phenotypic changes. Defense mechanism-related changes.

Books Recommended:

S. No.	Author	Book
1	Alberts *et al*.	Molecular Biology of the Cell
2	SF Gilbert	Developmental Biology
3	Lewin Benjamin	Gene VIII

4	PO Moody	Introduction to Evolution, 1970,
5	Dobzhansky et al.	Evolution, W. H. Freeman. New York
6	SW Fox and K Dose	Molecular Evolution and the Origin of Life,
7	FJ Ayala and JW Valentine	Evolving: The theory and processes of Organic evolution
8	EO Dodson	Evolution: Process and Product
9	MW Strickberger	Evolution, 1979, James and Barlett International

B 704: Imaging Technology in Biological Research

Unit-I

The power of ten (understanding how small cells and the sub-cellular contents are)
An introduction to light and optics, exploring with lenses (what are lenses, looking through them, understanding the concept of magnification, mirrors, angles of reflection, refraction, prisms and colors)

Unit-II

Fundamentals of illumination (ray diagrams, types of light sources, LEDs, power levels, coherence of light, elliptical reflectors)
Exploring microscopes (short history, magnifying glass, simple and compound microscopes, electron Microscopes, stereomicroscope)

Unit-III

Fluorescence microscopy (Understanding fluorescence, Fluorescence protein technology, GFP, YFP)
two-photon fluorescence microscopy, matrix-assisted laser desorption/ionization mass spectrometry (MALDI-MS) imaging

Unit-IV

Live cell imaging (confocal microscopes), Differential interference contrast (DIC) images
Comparing Confocal and Widefield Fluorescence Micro scopy
Atomic force microscopy and optical tweezers force spectroscopy

Unit-V
NMR Imaging

Spatially nonresolved NMR spectroscopy; low-field NMR instruments; ^{1}H-nuclear magnetic resonance (NMR) microimaging ; ^{1}H-magic angle spinning NMR spectroscopy; MAS-^{13}C NMR spectroscopy
Spectral-resolution enhancement using magic angle spinning

Books Recommended:

S.No.	Author	Book
1	Ulf Grenander, Y Chow and Daniel M Keenan	Hands: A Pattern Theoretic Study of Biological Shapes (Research Notes in Neural Computing) (Volume-2)
2	Valery V Tuchin, Lihong Wang and Dmitry A Zimnyakov	Optical Polarization in Biomedical Applications (Biological and Medical Physics, Biomedical Engineering)
3	RM Lambrecht	Biological Models in Radiopharmaceutical Development (Developments in Nuclear Medicine)
4	Michael D Powers and Janet Poland	Asperger Syndrome and Your Child: A Parent's Guide
5	Philippe Sansonetti	Bacterial Virulence: Basic Principles, Models and Global Approaches (Infection Biology (VCH)
6	Richard Nuccitelli, Leslie Wilson and Paul T Matsudaira	A Practical Guide to the Study of Calcium in Living Cells, Volume 40 (Methods in Cell Biology)
7	Warren CW Chan	Bio-Applications of Nanoparticles (Advances in Experimental Medicine and Biology)
8	Bertram Manz, Kerstin Mü ller,	Water Uptake and Distribution in Germinating

	Birgit Kucera, Frank Volke, and Gerhard Leubner-Metzger	Tobacco Seeds Investigated in Vivo by Nuclear Magnetic Resonance Imaging. Plant Physiology, July 2005, Vol. 138, pp. 1538–1551

Semester – VIII [January – June 2019]

B 801: Virology

Unit-I
Introduction to Virology: definition, properties and origin of viruses
Virus architecture and nomenclature
Virus replication cycle
Basic virological methods
Basics of virus entry, spread and transmission

Unit-II
Host resistance to viral infection: immune responses
Vaccines and antiviral chemotherapy: the prevention and treatment of viral diseases
Epidemiology
Exploiting viruses as gene therapy and vaccine vectors

Unit-III
Viruses and cancer: oncoviruses and oncolytic viruses
Polioviruses and other single-stranded positive-strand RNA viruses
Rabies and other single-stranded nonsegmented negative-strand
Influenza viruse and ther single-stranded segmented negative-strand RNA viruses.

Unit-IV
Evolution of viruses: new and reemerging viruses
Herpesviruses (nuclear large double-stranded DNA viruses)
Poxviruses (cytoplasmic large double-stranded DNA viruses)
HIV and other retroviruses

Unit-V
Hepatitis B virus (reverse-transcribing DNA virus) and other viruses causing hepatitis
Prion diseases
Plant viruses
Bacteriophages

Books Recommended:

S.No.	Author	Book
1	L Collier, J Oxford and Paul Kellam	Human Virology (4th edition),
2	SJ Flint, LW Enquist, VR Racaniello and AM Skalka	Principles of Virology (3rd edition) 2009
3	AJ Cann	Principles of Molecular Virology,
4	Teri Shors, Jones and Bartlett	Understanding Viruses
5	NJ Dimmock, A Easton, K Leppard	Introduction to Modern Virology 6th edition,
6	David M Knipe, Peter M Howley, MD Diane E Griffin, Robert A Lamb, Malcolm A Martin, Bernard Roizman, Stephen E Straus	Field's Virology. 6th edition

7	AJ Zuckerman, JE Banatvala, P Griffiths, B Schoub and P Mortimer	Principles and Practice of Clinical Virology (6th edition)
8	G Kudesia and T Wreghitt: Cambridge Clinical Guide	Clinical and Diagnostic Virology
9	L. Sompayrac	How Pathogenic Viruses Work;

B 802: Biotechnology-I

Unit-I
Basic principles of genetic engineering:
Methods of creating recombinant DNA molecule, splicing, properties of restriction endonucleases and their mode of action. Cloning vectors (lambda phage plasmid, M-13 phage, cosmid, shuttle vectors, yeast and viral vectors, expression vectors), construction of DNA library, Subtraction cDNA cloning, genomic vs cDNA library - Expression libraries and vectors for protein synthesis, protein purification, protein solubilization, protein export, RNA probes, BACs, PACs and cosmid vectors, Yeast vectors and YACs

Unit-II
Transgenic animals [Selectable markers for animal cells eg HAT, methotrexate Reporter genes for promoter analysis (Lac Z, GFP) vectors (Baculoviruses) microinjection, retroviruses, Embryonic stem cells), Transgenic mouse / Super mouse – (MT promoter fused to human growth hormone) (isolation of cloned proteins from goat milk). Viruses as gene-transfer Methods for production of transgenic mice (Pronuclear Transgenic Goats Whole animal cloning eg Dolly, Knock-out, knock-down, knock-in technology, Site-specific recombination using Cre-recombinase LOX system, Gene therapy eg SCID]

Unit-III
Transgenic plants [Agrobacterium mediated transformation, Ti plamid, Transgenic tobacco expressing luciferase gene, Bt Cotton, Herbicide-resistant plants, Plant viruses as vectors (eg CaMV virus)]. Application of genetic engineering in medicine and agriculture, vaccine production.

Unit-IV
Chemical synthesis of gene and engineering artificial life . Selection/screening: Analysis of genomic DNA by Southern hybridization, Northern and Western blotting techniques, Restriction mapping: Restriction fragment length polymorphism (RFLP). DNA sequencing and analyses techniques: plus and minus, dideoxynucleotide, Maxam and Gilbert, deep sequencing and next gen sequencing, microarray technology and hybridisations.

Unit-V
DNA manipulation techniques:
Preparation of radiolabelled and synthetic probes, Amplification of DNA by polymerase chain reaction (PCR), Site directed mutagenesis, Gene transfer methods for animals and plants; Agrobacterium mediated gene transfer, electroporation and particle gun. Cell and tissue culture in plants and animals: Primary culture; Cell line; Cell clones; Callus cultures; Somaclonal variation; Micropropagation; Somatic embryogenesis; Haploidy; Protoplast fusion and somatic hydridization; Cybrides; Gene transfer methods in plants and in animals; Transgenic biology; Allopheny; Artificial seeds; Hybridoma technology.

B 804: Biotechnology-II

Unit-I
Principles of plant breeding: Important conventional methods of breeding self and cross pollinated and vegetatively propagated crops; Non-conventional methods; Polyploidy: Genetic variability; Plant diseases and defensive mechanisms. Ethics of GM crops and animal cloning . Model organisms - S. cereviceae, Dictostylium, Caenorhabditis elegans, Arabidopsis, Zebra Fish, Mouse, Drosophila

Unit-II

Industrial Biotechnology-I

Bioprocess Technology [basics of bioreactor kinetics and mathematical equations regarding bioreactors, scale-up and aeration of bioreactors in detail, Kinetics of microbial growth, substrate utilization and product formation: Batch, Fed- Batch and continuous processes, Scale up concepts with respect to fermenter design and product formation, Gas exchange and mass transfer: O2 transfer, critical oxygen concentration, determining the oxygen uptake rate, Solid state fermentation. Common examples: Biopolymers: Xanthan , melanin , adhesive proteins , rubber, poly hydroxyl alkaloids

Unit-III

Industrial Biotechnology-II

Downstream Processing - Flocculation and floatation, Filtration, Centrifugation, Cell disruption, Liquid extraction, Precipitation, Adsorption, Dialysis, Reverse osmosis, Chromatography, Crystallization and drying, Biodegradation of xenobiotic compounds:Remediation and Biotechnology - Priority pollutants and their health effects, Microbial basis of biodegradation, Bioremediation (phyto and metal), Environmental and industrial pollution control, Biopesticides, Microbial plastics, Solid waste management

Unit-IV

Medical Biotechnology -

a. Small Biological Molecules: - ascorbic acid, indigo, amino acids, lycopene, succinic acid production, Antibiotics, Tissue Engineering - Growth Factors and morphogens: signals for tissue engineering and whole organ development, extracellular Matrix: structure, function and applications to tissue engineering, Cell adhesion and migration, Inflammatory and Immune responses to tissue engineered devices
b. Biomaterials - Polymeric scaffolds, Calcium Phosphate Ceramics for bone tissue engineering, Bio mimetic materials, Nanocomposite scaffolds

Unit-V

Nanotechnology-

a. Introduction to nanotechnology and nano-biotechnology, Nanomaterials and their uses.
b. Nanoparticles derived from biological molecules, Synthesis of nanoparticles: strategies, biological methods, general properties and characterization methods
c. Applications of nanotechnology: Nanosensors, Carbon nanotubes and their applications in biology
d. Environmental and safety issues with nanoparticles.

Books Recommended:

S.No.	Author	Book
1	Benjamin Lewin	Gene VII, Oxford Publishers
2	T A Brown	Genome, Second edition,
3	Old and Primrose	Principles of Gene Manipulation;
4	Simmons and Gardner	Principles of genetics;
5	Donald Voet and Judith Voet	Biochemistry 3rd Edition,
6	T D.Watson and others	Molecular Biology of the Gene , 6th Edition
7	GM Cooper	The Cell: A molecular approach: Library of Congress cataloging in publication data.
8	Griffiths A and Miller J	An introduction to genetic analysis; Freeman
9	Lodish H and Berk	A Molecular cell biology;
10	Sambrook J, Russell	Molecular cloning:- Vol I, II , III; CSHL Press
11	TA Brown	Gene cloning and DNA analysis;
12	B Glick, J Pasternak & C Patten	Molecular Biotechnology- principles and applications of Recombinant DNA, 4th
13	K. Deb and Satish Totey	Stem Cells Basics and Applications;
14	Gary Stein and Maria B et al.	Human Stem Cell Technology and Biology;

15	R. Ian Freshney, Glyn N. Stacey, Jonathan M. Auerbach	Culture of Human Stem Cells. John Wiley & Sons
16	Bernard R Glick, Jack J Pasternak, Cheryl L Patten	Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press
17	Robert Lanza, Robert Langer, Joseph P Vacanti	Principles of Tissue Engineering
18	Inderbir Singh and GP Pal	Human Embryology; MacMillan Publishers
19	Thomas W Sadler	Langman's Medical Embryology;
20	F Gilbert	Developmental Biology; 6th Edition;
21	Gordana Vunjak-Novakovic, R Ian Freshney	Culture of Cells for Tissue Engineering;
22	SB Primrose and Twyman	Principles of gene manipulation
23	RW Old and SB Primrose	Principles of gene manipulation
24	Watson	Recombinant DNA
25	TA Brown	Gene cloning and DNA analysis
26	SC Rastogi *et al.,*	Bioinformatics-Methods and Applications
27	A Caldwell et al.,	Integrated Genomics; Wiley Publishers
29	D Clark, N Pazdernik	Bioprocess Technology- Biotechnology- Applying the genetics to revolution
30	Wulf Crueger and Anneliese Crueger	Biotechnology: A Textbook of Industrial Microbiology; Panima Publishers, New Delhi
31	Michael L Shuler, Fikret Kargi	Bioprocess Engineering: Basic concepts
32	Stanbury PF, Whitaker A, Hall SJ	Principles of Fermentation Technology; Butterworth-Heinemann
33	Glazer AN and Nikaido H	Microbial Biotechnology: Fundamentals of Applied Microbiology
34	Sulabha Kulkarni	Nanotechnology principles and practices;
35	David S Goodsell	Bionanotechnology: Lessons from Nature;
36	James A Schwarz, Cristian I Contescu and Karol Putyera	Dekker Encyclopaedia of Nanoscience and nanotechnology;

B 803: Bioinformatics

Unit-I
Computer related introductory topics: History of development of computers, Basic components of computers, Hardware; CPU, input, output, storage devices. Software; operating systems, Programming languages (Machine, Assembly and Higher level)
Application software: Introduction to MSEXCEL-Use of worksheet to enter data, edit data, copy data, move data. Use of in-built statistical functions for computations of Mean, S.D., Correlation, regression coefficients etc. Use of bar diagram, histogram, scatter plots, etc. graphical tools in EXCEL for presentation of data. Introduction to MSWORD word process or editing, copying, moving, formatting, Table insertion, drawing flow charts etc.

Unit-II
Bioinformatics core topics: Introduction to Internet and use of the same for communication, searching of database, literature, references etc. Introduction to Bioinformatics, Databank search- Data mining, Data management and interpretation, BLAST, Multiple sequence alignment, Protein Modeling, Protein structure Analysis, Docking, Ligplot interactions, Genes, Primer designing, Phylogenetic Analysis, Genomics and Proteomics.

Unit-III
Biological databases**:** Introduction to variety of data sources. Population, sample, Classification and modeling of Data. Quality of data, Private and public data sources.

Example Databases:
(a) Nucleic acid databases (NCBI, DDBJ, and EMBL). (b) Protein databases (Primary, Composite, and Secondary)
(c) Specialized Genome databases: (SGD, TIGR, and ACeDB) (d) Structure databases (CATH, SCOP, & PDBsum)

Unit-IV

Alignment: Basics and techniques, Local alignment and Global alignment Pairwise sequence alignment: NEEDLEMAN and Wunsch algorithm, Smith and Waterman algorithm, The Dot Plot, Dynamic Programming Algorithm. Multiple Sequence Alignment (MSA): Definition, Objective, Consensus, Methods for MSA: Heuristic approach, Dynamic programming approach and their combinations. Complexity analysis. Phylogenetic Analysis: Molecular-Phylogenetics, Phylogenetic-trees, Terminology of tree-reconstruction, rooted and un-rooted trees, gene vs species trees and their properties. Algorithms /methods of phylogenetic analysis: UPGMA, Neighbor-Joining Method.

Unit-V

Protein structure analysis and prediction: Identification/assignment of secondary structural elements from the knowledge of 3-D structure of macromolecule using DSSP and STRIDE methods , Prediction of secondary structure: PHD and PSI-PRED method Tertiary (3-D) Structure prediction: Fundamentals of the methods for 3D structure prediction (sequence similarity/identity of target proteins of known structure, fundamental principles of protein folding etc.) Homology Modeling, fold recognition, threading approaches, and ab-initio structure prediction methods. Genomics: Basic concepts on identification of disease genes, role of bioinformatics-OMIM database, reference genome sequence, integrated genomic maps, gene expression profiling; identification of SNPs, SNP
database (DbSNP). Role of SNP in Pharmacogenomics, SNP arrays
Drug discovery and Development : - Introduction to Drug Design and Development, Drug targets, Lead Identification and Modification, Computer-Aided Drug Design, Drug Delivery, Pre-clinical and Clinical Testing Applications of Bioinformatics: Pharmaceutical industries, immunology, agriculture, forestry; Legal, ethical and commercial ramifications of bioinformatics; Bio-sensing

Books Recommended:

S.No.	Author	Book
1	E Wayne W Daniel	Biostatistics: A foundation for Analysis in the Health Sciences
2	Prem S Mann	Introductory Statistics. 5th Edition;
3	Olive Jean Dunn	Basic Statistics: A primer for Biomedical Sciences
4	Auram Gold Stein	Biostatistics: An introductory text
5	Taro Yamane	Statistics: An Introductory Analysis;
6	C Stan Tsai	Computational Biochemistry;

FIFTH YEAR

Semester – IX [July – December 2019]

BPr 901 Research Project*

*Note: Project Work****

  The project has to be carried out in recognized national laboratories or UGC-recognized universities. No student will be allowed to carry out project work in private laboratories/ college/ institutions, excluding the colleges recognized as research centers by the RDC of Pt. Ravishankar Shukla University, Raipur.

Semester – X [January – June 2020]

E 1001	**Elective I**
E 1002	**Elective II**
E 1003	**Elective III**
E 1004	**Elective IV**

Electives:
1. Toxicology and clinical research
2. Molecular modeling and drug design
3. Ethology
4. Parasitology
5. Reproductive biology
6. Occupational diseases (infectious incl)
7. Plant pathology
8. Plant communication
9. Animal migration
10. Commercial products from plants and animals
11. Biology of food industry
12. Transgenics
13. Ethical issues in biology and medicine
14. Physical biology
15. Astrobiology
16. Biology of traditional medicines
17. Translational biology
18. Science writing and communication
19. Forensic science
20. Epigenetics
21. On-line courses

Center for Basic Sciences
(CBS)
SCHEME OF EXAMINATION
&
COURSE STRUCTURE
Of
SEMESTER IX and X
M.Sc. Integrated (Biology Stream)
UNDER
FACULTY OF LIFE SCIENCE
EFFECTIVE FROM JANUARY 2020

Center of Basic Science
Pt. Ravishankar Shukla University
Raipur (C.G.) 492010
PH: - 0771-2262864
WEBSITE: -www.prsu.ac.in

Approved by Board of Studies in Bio Science
Pt. Ravishankar Shukla University, Raipur (C.G.)

CENTER FOR BASIC SCIENCES
Pt. Ravishankar Shukla University, Raipur

5-Year Integrated M.Sc. Biology
Under
Faculty of Life Science

SEMESTER-IX (Biology Stream)

Project (BPr901) Evaluation Scheme

20 Credits

		Marks
1.	Project Report/Dissertation (Certified by the Supervisor of the Institute)	150
2.	Seminar based on Project	150
3.	Viva-Voce based on Project report and Seminar	100
	Total Marks	400

CENTER FOR BASIC SCIENCES
Pt. Ravishankar Shukla University, Raipur

5-Year Integrated M.Sc. Biology
Under
Faculty of Life Science

SEMESTER-X (Biology Stream)

Subject		Subject Contact hrs/per week Theory+Tutorial	Credits
BE 1001	Electives I	[4 + 1]	5
BE 1002	Electives II	[4 + 1]	5
BE 1003	Electives III	[4 + 1]	5
BE 1004	Elective IV	[4 + 1]	5
		Total	20

Min. 20
(Total 240 credits)

*Any four papers out of the available seven papers (as mentioned in the next pages) shall be in operation on availability of the instructors with more than 50% of students opting for them.

Electives for X Semester-Biology Stream

1. Proteomics and Genomics

Unit-I

Introduction and scope of proteomics; Protein separation techniques: ion exchange, size-exclusion and affinity chromatography techniques; Polyacrylamide gel electrophoresis; Isoelectric focusing (IEF); Two dimensional PAGE for proteome analysis; Image analysis of 2D gels.

Unit-II

Introduction to mass spectrometry; Strategies for protein identification; Protein sequencing; Protein modifications and proteomics; Applications of proteome analysis to drug.

Unit-III

Protein-protein interaction (Two hybrid interaction screening); Protein engineering; Protein chips and functional proteomics; Clinical and biomedical application of proteomics; Proteome database; Proteomics industry.

Unit-IV

Introduction and Classification of genomics; Methods of preparing genomic DNA; Genome sequencing methods (next-generation sequencing); Databases of genomes; Genetic mapping; Mapping of human genome; Human genome project; HapMap Project, The 1000 genome project, and The ENCODE Project.

Unit-V

Gene variation and Single Nucleotide Polymorphisms (SNPs); Expressed sequenced tags (ESTs); Gene disease association; DNA fingerprinting; Microarray based techniques for RNA analysis; metagenomics.

Suggested readings:

1. Cantor and Smith, Genomics. John Wiley & Sons, 1999.
2. Introduction to Genomics - Arthur M Lesk, Oxford University Press, 2007.
3. R.M.Twyman, Principles of Proteomics, BIOS Scientific Publishers, 2004.
4. P.Michael Conn, Handbook of Proteomic Method. Humana Press, Totowa, New Jersay, USA, 2003.
5. L.Stryer, Biochemistry, W. H. Freeman and Co., New York, 2007.

2. Nanobiotechnology

Unit-I

The nanoscale dimension and paradigm, Various definitions and Concept of Nano-biotechnology, Historical background, Development. Fundamental sciences and broad areas of Nanobiotechnology.

Unit-II

Nanomaterial in biotechnology - nanoparticles, quantum dots, nanotubes and nanowires etc. Cell – Nanostructure interactions. Protein-based Nanostructures, Cell as Nanobio-machine,

DNA-Protein Nanostructures-Overview and introduction, DNA-Protein conjugates in microarray technology.

Unit-III

Biosensors; molecular recognition elements, transducing elements. Applications of molecular recognition elements in nanosensing of different analytes, Application of various transducing elements as part of nanobiosensors.

Unit-IV

Miniaturized devices in nanobiotechnology - types and applications, lab on a chip concept. Biological nanoparticles production - plants and microbial, methods, Properties, Characterization and applications.

Unit-V

Nanobiotechnological applications in health and disease - infectious and chronic. Nanobiotechnological applications in Environment and food - detection and mitigation.

Suggested readings:
1. Nanobiotechnology: Concepts,Applications and Perspectives (2004), Christof M.Niemeyer (Editor), Chad A. Mirkin (Editor), Wiley VCH.
2. Nanobiotechnology - II more concepts and applications. (2007) - Chad A Mirkin and Christof M. Niemeyer (Eds), Wiley VCH.
3. Nanotechnology in Biology and Medicine: Methods, Devices, and Applications.

3. Plants for Human Welfare

Unit-I

A general overview of economically important plants and their role in human welfare as food, oil, drugs, nutraceuticals, fuel. Food crops: Cereals; Spices and condiments; Alcoholic and non-alcoholic beverages.

Unit-II

Medicinal: Traditional plants as source of drugs against several diseases such as cancer, diabetes, malaria, dengue, psoriasis,etc. Plant secondary metabolites; classification, knowledge of extraction, isolation, characterization and elicitation of bioactive metabolites.

Unit-III

Nutraceuticals and functional foods; Important plants such as Aloe vera, Piper, Withania, Ginseng, Amaranthus etc. yielding antioxidants and nutraceutical compounds. Edible and non-edible oils: Oil yielding plants, transgenic approaches and constraints for improvement in different oils. Essential oils.

Unit-IV

Plant-based biofuels e.g., Difference between first and 2nd generation biofuels, Jatropha, Pongamia, Zea mays, Madhuca, etc. Extraction and economic viability; application as alternate source of diesels, Bioelectricity.

Unit-V

Plants as a source of timber: e.g., Tectona grandis, Salix sp., Dalbergia sisso, Fibre yielding plants: Cotton (Gossypium sp.), Jute (Corchorus sp.) with special reference to their improvement through breeding and genetic transformation e.g., Bt cotton.

Suggested readings:

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R. New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Acharya, Deepak; Anshu, Shrivastava (2008). Indigenous Herbal Medicines: Tribal Formulations and Traditional Herbal Practices. Jaipur, India: Aavishkar Publishers
5. Raven, Peter H.; Evert, Ray F.; Eichhorn, Susan E. (2005). Biology of Plants (7th ed.). New York: W. H. Freeman and Company

4. Plant Genetic Engineering

Unit-I

Plant transformation vectors and methods: T-DNA and viral vectors; Selectable marker and reporter genes, Plant transformation by Agrobacterium sp., Molecular mechanism of T-DNA transfer; in planta transformation; Direct gene transfer methods in plants.

Unit-II

Genetic engineering for increasing crop productivity by manipulation of Photosynthesis, Nitrogen fixation, Nutrient uptake efficiency. Genetic engineering for biotic stress tolerance (Insects, fungi, bacteria, viruses, weeds). Genetic engineering for abiotic stress (drought, flooding, salt, metal and temperature)

Unit-III

Genetic engineering for quality improvement of Protein, lipids, carbohydrates, vitamins & mineral nutrients, Plants as bioreactor, Marker-assisted selection of qualitative and quantitative traits. Concept of gene synteny, Concept of map-based cloning and their use in transgenics.

Unit-IV

Chloroplast transformation; Transgene analysis, silencing and targeting; Marker-free and novel selection strategies; Multigene engineering; Gene knock-down by ribozymes, antisense RNA and RNA interference.

Unit-V

Plant Metabolic Engineering. The concept of secondary metabolites, Historical and current views. Importance of secondary metabolites in medicine and agriculture, Introduction to various pathways, Flavanoid pathway, Terpenoid pathway, Polyketoid pathway, Plant vaccine.

Suggested readings:
1. Plant Tissue Culture: Theory and Practice Bhojwani S. S. & Razdan M. K. Elsevier
2. Plant Biotechnology: The Genetic Manipulation of Plants Slater A. Scott N. & Fowler M. Oxford University Press Inc.

3. Plants, Genes and Crop Biotechnology Chrispeels M. J. & Sadava D. E. Jones and Barlett Publishers

4 Principles of Gene Manipulation and Genomics Primrose S. B. & Twyman R. M. Blackwell Publishing.

5. Plant Cell, Tissue and Organ Culture: Fundamental Methods. (Eds). Gamborg O. L & Phillips G. C. Springer-Verlag.

5. Evolutionary Biology

Unit- I

Origin of life: Historical theories and background information, Experimental approaches. Chemogeny, Biogeny, RNA and DNA world, evolution of proteins, origin of photosynthesis, evolution of eukaryotes. Lamarckism, Darwinism, pre-Darwinian and post-Darwinian period, Neo-Darwinism. Theories of organic evolution. Evidences of Evolution.

Unit- II

Sources of variations: Heritable variations and their role in evolution. Natural selection; types of natural selection (Directional, stabilizing and disruptive) and examples (Industrial melanism, Australian rabbits, resistant to pestiscides, heavy metal resistance in plants), Sexual selection, group and kin selection.

Unit- III

Polpulation genetics and evolution: Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium. Genetic Drift (mechanism, founder's effect, bottleneck phenomenon); Role of Migration and Mutation in changing allele frequencies.

Unit-IV

Evolution above species level: Adaptation, adaptive radiation, microevolution, macroevolution, megaevolution, punctured equilibria and related phenomenon. Isolation: Introduction and types of isolation. Speciation: species concept, modes of speciation: allopatric, sympatric

Unit-V

Origin and evolution of man, Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens, Phylogenetic trees, Multiple sequence alignment, construction of phylogenetic trees.

Suggested readings:

1. S. Freeman and J. C. Herron, *Evolutionary Analysis*, 4th Edn., Benjamin-Cummings (2007).

2. D. J. Futuyma, *Evolution*, 2nd Edn., Sinauer Associates Inc. (2009)

6. Plant-Microbe Interaction

Unit-I

History of Plant pathology and recent developments: Significance of plant diseases, and pathology, types of plant-microbe associations (pathogenic— bacteria, virus, fungi, and symbiotic).

Unit-II

Beneficial Plant - Microbe interactions (molecular aspects): a. Nitrogen fixing bacteria and blue green algae b. Mycorrhizal association c. Phytohormones and Biocontrol antibiotics

Unit-III

Parasitism and disease development: Pathogenecity, host range of pathogens, disease cycle and epidemics.

Unit-IV

Molecular biology of pathogenicity: Mechanisms of variability in pathogens, pathogenicity genes and mechanisms in pathogenic bacteria, biotrophic and necrotrophic fungi, Virus and Viroid genes involved in pathogenicity, Agrobacterium and plant interaction-a model system.

Unit-V

Molecular genetics of plant disease susceptibility and resistance: Types of plant resistance to pathogens (R gene resistance, quantitative and monogenic), basal and induced defense mechanisms, pre-formed inhibitors of pathogens, gene for gene interaction in plant defense, Systemic Acquired Resistance (SAR) and Induced Systemic Resistance (ISR), Recognition mechanism and signal transduction during plant - pathogen interaction.

Suggested readings:
1. Plant Pathology Agrios G. N. Academic Press
2. Molecular Plant pathology Dickinson M. BIOS Scientific Press
3. Plant Pathogenesis and Resistance: Biochemistry and Physiology of Plant-Microbe Interactions Jeng-Sheng H. T Kluwer Academic Pubs.T Gen 904(ii)- MEDICA

7. Animal Tissue Culture

Unit-I

Introduction and significance of Animal cell culture, historical background of cell culture. Types of cell culture: Primary and secondary cell culture.
Laboratory requirements for animal cell culture: Sterile handling area. Sterilization of different materials used in animal cell culture, Aseptic concepts. Instrumentation and equipments for animal cell culture.

Unit-II

Culture requirements and reagents: Culture media, properties of media, Types of cell culture media, Ingredients of media, Physiochemical properties, Antibiotics, growth supplements, Foetal bovine serum; Serum free media, Trypsin solution, Selection of medium and serum, Conditioned media, Other cell culture reagents, Preparation and sterilization of cell culture media, different types of serum and other reagents.

Unit-III

Types of cell culture: Different types of cell cultures, Trypsinization, Cell separation, Continuous cell lines, Suspension culture, Organ culture.
Cell lines: Introduction, development of cell lines, Characterization and maintenance of cell lines, stem cells, Cryopreservation, Common cell culture contaminants.

Unit-IV

PT. RAVISHANKAR SHUKLA UNIVERSITY

Centre for Basic Sciences

Syllabus of

Integrated M. Sc.: Chemistry Stream

[Choice and Credit Based System]

Semester Examination
SESSION 2015-2020

Center for Basic Sciences
Pt. Ravishankar Shukla University, Raipur

Course structure for the M. Sc. (Integrated) Chemistry stream
1st July, 2015

(B: **B**iology, C: **C**hemistry, M: **M**athematics, P: **P**hysics, G: **G**eneral, H: **H**umanities,
BL: **B**iology **L**aboratory, CL: **C**hemistry **L**aboratory, PL: **P**hysics **L**aboratory,
GL: **G**eneral **L**aboratory, PE: **P**hysics **E**lective, PPr: **P**hysics **Pr**oject)

FIRST YEAR
SEMESTER –I

Subject Code	Subject	Contact Hours / Week Theory +Tutorials	Credits
B101	Biology – I	[2 + 1]	3
C101	Chemistry – I	[2 + 1]	3
M100/101	Mathematics – I	[2 + 1]	3
P101	Physics – I	[2 + 1]	3
G101	Computer Basics	[2 + 1]	3
H101	Communication Skills	[2 + 1]	3
		Contact Hours / Week Laboratory	
PL101	Physics Laboratory – I	[4]	2
CL101	Chemistry Laboratory – I	[4]	2
BL101	Biology Laboratory – I	[4]	2
GL101	Computer Laboratory	[4]	2

26
(26 of 240 credits)

C 101: Chemistry-I
UNIT-I $\qquad$ **(30 + 15 = 45 hrs.)**

Structure and Properties of atoms: Revisited $\qquad$ **(4 + 2 = 6 hrs.)**
(i) Atomic spectra, Bohr's theory of atomic structure, Sommerfield's theory for complex electron spin and magnetic quantum number, Pauli exclusion principle, Hund's rule, electron configuration of elements, Sequence of energy levels and Periodic Table.
(ii) Size of atoms and ions, ionization energy, electron affinity, electronegativity – values by Pauling, Mulliken and Allred-Rochow, Metallic character, variable valency and oxidation states, horizontal, vertical and diagonal relationships in the periodic table.

(iii) Atomic Nucleus: Fundamental particles, classification of nuclides, nuclear stability, the neutron to proton ratio N/Z, nuclear potential, binding energy, exchange force. Radioactivity and radioactive elements, radioactive decay and decay kinetics.

UNIT-II
Types of Chemical Bonds   **(14+ 7 = 18 hrs.)**
(i) The covalent bond - the Lewis theory, Octet rule and its limitations. Shapes of the molecules – Sidgwick – powel theory. Valence shell electron pair (VSEPR) theory, effect of lone pair and electronegativity, isoelectronic principle, examples to apply VSEPR theory. Valence bond theory. Hybridization. Bond length, bond angle & dihedral angle, d-orbital participation in molecular bonding, sigma and pi bonding. Molecular orbital method – Linear combination of atomic orbitals (LCAO), MO treatment for di- and tri-atomic molecules and involving delocalized pi-bonding. Conjugation & aromaticity.

UNIT-III
(ii) Metallic and organometallic bonds – general properties.
(iii) Coordinate bond- coordination complexes.
(iv) Physical properties and molecular structures – polaizability and dipole moments, melting point, solubility and acid-base properties, Intermolecular forces (dipole-dipole interaction) Hydrogen bonding and vander Waals's forces.

UNIT-IV
Reactivity & Mechanism: **(12 + 6= 18 hrs)**
(i) Inductive and field effects and bond dissociation energy. p$\square$-d$\square$ bonding. Delocalization – cross conjugation, resonance. Aromaticity and Huckel's rule – systems of 4n and 4n+2 electrons, antiaromaticity . Resonance and Hyperconjugation.

(ii) Reaction mechanism: Types of mechanisms, Arhenius theory, collision theory, types of reactions, redox reactions, displacement and addition reactions, thermodynamic and kinetic requirements.

UNIT-V
Hammond postulate, Curtin-Hammett principle, transition states and intermediates, carbocations, carbanions, free radicals, methods of determining mechanisms, isotopic effects.
(iii) General concepts: Oxidation number and oxidation states, Oxidation – reduction reactions and the use of reduction potential, Bronsted acids and bases, gas phase vs. solution acidity, solvent levelling effects, hardness and softness, surface acidity.

Suggested texts and References:

(1) J.D.Lee, Concise Inorganic Chemistry, 4th Edition, ELBS, 1991.
(2) P.W.Atkins, Physical Chemistry, Oxford University Press, 7th Edition, 2006.
(3) G.M.Barrow, Physical Chemistry, 5th Edition, Tata McGraw-Hill, New Delhi, 1992.
(4)R. T. Morrison and R. N. Boyd, Organic Chemistry, Prentice Hall of India.
(5)G.W. Castellan, Physical Chemistry, 3rd Ed. Addison - Wesley/Narosa Publishing House, 1993.

CL 101: Chemistry Laboratory

Calibrations of pipette, burette, standard flasks etc., acid base titrations, recystallization, thin layer chromatography, identification of organic functional groups, complexometric titrations based on EDTA complexation with metals, Synthesis of benzoic acid, diazotization etc.

 Suggested text and references:
(1) Vogel's Textbook of Quantitative Chemical Analysis (5th Edition; Longmann)
(2) Vogel's Qualitative Inorganic Analysis (7th Edition)
(3) ACS Journal of Chemical Education

SEMESTER –II

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
B201	Biology – II	[2 + 1]	3
C201	Chemistry – II	[2 + 1]	3
M200/201	Mathematics – II	[2 + 1]	3
P201	Physics – II	[2 + 1]	3
G201	Electronics and Instrumentation	[2 + 1]	3
G202	Glimpses of Contemporary Science	[2 + 1]	3
		Contact Hours / Week Laboratory	
PL201	Physics Laboratory – II	[4]	2
CL201	Chemistry Laboratory – II	[4]	2
BL201	Physics Laboratory – II	[4]	2
GL201	Electronics Laboratory	[4]	2

26
(52 of 240 credits)

C 201: Chemistry II   **(30 + 15 = 45 hrs.)**
UNIT-I
(1) Thermochemistry: Enthalpy, heat of fusion and heat of vapourisation, enthalpy of a chemical reaction (heat of combustion, heat of solution, heat of neutralization), enthalpy of formation, standard reaction enthalpy, Hess's law, Kirchhoff's law, bond energy, dissociation energy. Entropy formulation of Second law, entropy change in a phase transition, Trouton's Rule, calculation of absolute (Third law) entropy, entropy change in a chemical reaction.

UNIT-II
(2) Free energy functions, criteria for spontaneity and equilibrium of closed systems, variation of Gibbs free energy with pressure and temperature, Gibbs Helmholtz equation, the concept of chemical potential, partial molar quantity, Gibbs Duhem relation.

UNIT-III

(3) Phase equilibrium in simple systems: Solid – liquid, liquid – vapour, vapour – solid, phase diagrams – water, carbon dioxide, sulphur, phase equilibrium condition, Gibbs phase rule, Clapeyron equations, Clausius – Clapeyron equation.

UNIT-IV

(4) Ideal Solutions, chemical potential of a solute in a binary ideal solution, Raoult's Law, entropy and Gibbs energy of mixing, Colligative properties – freezing point depression, boiling point elevation, osmotic pressure, van't Hoff equation.

UNIT-V

(5) Chemical equilibrium: Gibbs energy change of a reaction, standard reaction Gibbs energy, the condition for chemical equilibrium, equilibrium constant, reactions involving gases and pure substances, the Principle of Le Chatelier and applications.

(6) Chemical potential of a charged species, electrochemical cell (galvanic and electrolytic), examples of electrochemical cells, half cell potential (electrode potential), Nernst equation.

Suggested texts and References:
(1) P.W.Atkins, Physical Chemistry, Oxford University Press, 7th Edition, 2006.
(2) G.W. Castellan, Physical Chemistry, 3rd Ed.Wesley/Narosa Publishing House, 1993.
(3) G.N.Lewis and Randall, Thermodynamics, (Revised by K.S.Pitzer and L.Brewer),
International Students Edition, McGraw Hill, 1961.
(4) K. Denbigh, The principles of Chemical Equilibrium.
(5) B. G. Kyle , Chemical & Process Thermodynamics.

CL 201: Chemistry Laboratory

Colorimetric titrations, Beer Lambert law, Estimation of concentration by colorimetric methods, conductometric methods, estimation of 5oncentration of acid base bt pH meter, identification of inorganic anions and cations, finding of pka values, short project of 2 weeks based on the experiments available in Journal of Chemical Education.

Suggested text and references:
(1) Vogel's Textbook of Quantitative Chemical Analysis (5th Edition; Longmann)
(2) Vogel's Qualitative Inorganic Analysis (7th Edition)
(3) ACS Journal of Chemical Education

SEMESTER –III

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
CB301	Essential mathematics for Chemistry and Biology	[3 + 1]	4
CB302	Biochemistry-I	[3+ 1]	4
CB303	Organic Chemistry-I	[3 + 1]	4
C301	Inorganic Chemistry-I	[3 + 1]	4
H301	World Literature	[2 + 0]	2
H302	History and Philosophy of Science	[2 + 0]	2
		Contact Hours / Week Laboratory	
CL301	Chemistry Laboratory	[6]	3
GL301	Applied Electronics Laboratory	[4]	2

25

(77 of 240 credits)

CB 303: Organic Chemistry –I **(45 +15 = 60 hrs.)**

UNIT-I
A. Basic concepts - Recapitulation
Hybridisation, formal charge, inductive and resonance effects and their effect on reactivity and acidity and basicity of organic compounds; polar & non polar covalent bonds; homolytic and heterolytic fission, types of reagents- electrophiles and nucleophiles; curly arrow notation; classification of organic reactions.

UNIT-II
B. Chemistry of Aliphatic compounds

IUPAC nomenclature of aliphatic and substituted aliphatic compounds and alicyclic compounds

Preparation, structure, properties and reactions of the following classes of compounds.
i) Hydrocarbons: a) alkanes, Methods of formation Kolbe reaction, Wurtz reaction, Corey House reaction, decarboxylation of carboxylic acids; Mechanism of halogenation of alkanes, orientation, selectivity & reactivity, product ratio. b) **Cycloalkanes** : Methods of formation and reactivity ; Baeyer's strain theory and its limitation; theory of strainless rings c) **Alkenes:**

Elimination reactions ; Saytzeff & Hoffman elimination; Reactions – halogenation reactions-free radical and polar mechanisms. Markownikoff's rule, the peroxide effect, allylic halogenations using NBS; Ozonides/Ozonolysis. epoxidation; hydroboration-oxidation; oxymercuration-demercuration; Oxidation using KMnO4 & OsO4.; polymerization. d) **Dienes:** Structure of butadiene and allene ; 1,2 vs 1,4 addition ; Diels Alder reaction.

UNIT-III
e) Alkynes: Methods of formation; acidity of alkynes; electrophilic addition to alkynes; hydroboration oxidation ; metal ammonia reductions; hydrogenation using Lindlar's catalyst.

ii) Alkyl halides Preparation, properties and synthetic applications of alkyl halides; S_N1 & S_N2 reactions (mechanism), E1 and E2 reactions(mechanism); Grignard reagent and its applications.

iii) Alcohols: Methods of formation; acidity; H-Bonding; reactions of mono; di & trihydric alcohols; Diols as protecting groups.

UNIT-IV

iv) Ethers and epoxides: Formation & reactions of ethers and epoxides ; ring opening reactions of epoxides under acidic and basic consitions; reaction epoxides with Grignard & organolithium reagents

v) Aldehdyes & ketones: Methods of formation of aldehdyes and ketones; Nucleophilic addition reactions with cyanide, ammonia and derivatives of ammonia; acetal formation; oxidation reduction reactions. Meerwin-Pondroff-Verley reduction, Clemmensen reduction, Wolf-Kishner reduction, Aldol condensation reaction, Cannizzaro reaction, Tischenko reaction, haloform reaction, Baeyer-Villiger oxidation, Wittig reaction; Mannich reaction

vi) Carboxylic acids : Methods of formation of mono and di carboxylic acids; acidity and factors affecting acidity; reactions of carboxylic acids :

vii) Carboxylic acid derivatives: Methods of formation of acid chlorides, amides, anhydrides and esters and their interconversions; relative stabilities of acid derivatives; Rosenmund reaction; Hoffmann rearrangement; saponification.

viii) Nitrogen and sulphur compounds. a) Nitro alkanes: methods of formation and reactions of aliphatic and aromatic nitro compounds b) Amines: methods of formation; basicity and factors affecting basicity ; reactions of aliphatic amines. c) Sulfonic acids : Methods of formation & reactions of aliphatic sulfonic acids.

ix) Applications of phosphorous and boron in organic synthesis :
Wittig reaction (with mechanism) ; hydroboration-oxidation (with mechanism); reduction using 9-BBN.

UNIT-V
C. Chemistry of aromatic compounds
IUPAC Nomenclature of benzene, naphthalene and anthracene derivatives
i) Aromaticity: Structure and stability of benzene, Huckel's rule, MO picture, polycyclic aromatic hydrocarbons.
ii) Aromatic electrophilic substitution: General mechanism. Effect of substituents on rate and orientation to aromatic electrophilic substitution in substituted benzenes, ortho-para ratio.
iii) Hydrocarbons: Alkylarenes, preparation via Friedel Crafts reaction. Reactions- oxidation, nuclear and side chain halogenation.

iv) Haloarenes: Preparation, aromatic nucleophilic substitution, elimination-addition and addition-elimination mechanisms, hydrolysis and amination of nitrohaloarenes.

v) Phenols: Preparation from sulfonic acids, haloarenes, alkylbenzenes, Acidity, O-alkylation, O-acylation, Fries rearrangement, Claisen rearrangement, Reimer- Tiemann reaction, Hauben Hoesch reaction, Lederer Manasse reaction.

vi) Aromatic aldehydes and ketones: Preparation via Gattermann, Gattermann-Koch, Vilsmeyer-Haack, Rosenmund and Friedel Crafts acylation reactions, Reactions: Claisen-Schmidt, Knovenagel, Perkin, Benzoin condensation and Cannizaro reactions,

vii) Aromatic carboxylic acids: Preparation, acidity, preparation and interconversion of acid derivatives.

viii) Aromatic sulfonic acids: Preparation, acidity, preparation and interconversion of sulfonic acid derivatives.

ix) Aromatic nitrogen compounds: Nitro and nitroso compounds - preparation and reduction, Amino compounds – preparation, basicity, Aromatic electrophilic substitution, N-alkylation, N-acylation, Diazotisation, Synthetic uses of diazonium salts, azo coupling

Suggested texts and References:

(1) I. L. Finar, Organic Chemistry, Vol. 1 & 2, ELBS.
(2) R. T. Morrison and R. N. Boyd, Organic Chemistry, Prentice Hall of India.
(3) J. McMurry, Organic Chemistry, Asian Books Pvt. Ptd.
(4) L. G. Wade, Organic Chemistry, Pearson Education
(5) G. Solomons and C. Fryhle, Organic Chemistry, John Wiley & Sons (Asia) Pte Ltd.
(6) J. March, Advanced Organic Chemistry, 3rd Edn. McGraw Hill,1991.
(7) S.H.Pine, Organic Chemistry, 5th Edn., McGraw Hill, 1987.

C 301: Inorganic Chemistry I

UNIT-I   **(45 + 15 = 60 hrs.)**
(i) Hydrogen: Preparation of hydrogen, Isotopes, ortho and para hydrogen, hydrides.
(ii) Rare gases: Occurrence and recovery of the elements, physical and chemical properties, Clathrate compounds, chemistry of Xenon and xenon fluoride complexes.

UNIT-II
(iii) Chemistry of s-block elements: a) alkali and alkaline earth metals: Extraction, general physical properties, flame colours ans spectra, Reaction with water, air and nitrogen, oxides, hydroxides, peroxides and superoxides, sulphides, oxysalts, halides and hydrides, oraganic and organometallic compounds. b) Group IIB elements: Zn, Cd, Hg.

UNIT-III
(iv) Chemistry of p-block elements: a) Group IIIA elements: Boron, aluminium, gallium indium and thalium – physical properties, oxidation states and type of bonds, Reactions with other elements, compounds of boron with oxygen and hydrogen. b) Group IVA elements: carbon, silicon, germanium, tin and lead – physical properties, allotropes of carbon, graphite compounds, carbaides, carbonates, carbon cycle, silicates, organosilicons, hydrides, halides and cyanides, cluster compounds.

UNIT-IV

c) Group VA elements: Nitrogen, phosphorous, Arsenic, antimony and bismuth – general properties, hydrides, azides, oxides and oxyacids, sulphides and organometallics, fertilizers. d) Group VIA elements: oxygen, sulphur, selenium, tellurium and polonium – general properties, structure and allotropy of the elements, chemistry of ozone, oxides, oxyacids, oxohalides, hydrides and halides, organo derivatives.

UNIT-V

e) Group VIIA elements: Fluorine, chlorine, bromine, iodine and Astatine- general properties, oxidizing power, hydrogen halides, ionic and molecular halides, bridging halides, halogen oxides, oxoacids, interhalogen compounds, polyhalides, pseudohalogens and pseudohalides.

Suggested texts and References:
(1) J. E. Huheey, 'Inorganic Chemistry - Principles of Structure and Reactivity' Harper & Row, 1988.
(2) F. A. Cotton and G. Wilkinson, 'Advanced Inorganic Chemistry', John Wiley, 1995.
(3) D. F. Shriver, P.W. Atkins and C.H. Langford, 'Inorganic Chemistry', OxfordUniversity Press, 1991.
(4) F. A.Cotton and G. Wilkinson, Basic Inorganic Chemistry, Wiley Easter, 1978.
(5) J. D. Lee, Concise Inorganic Chemistry, Van Nostrand Reinhold, 1977.
CL 301: Chemistry Laboratory
Experiments of inorganic chemistry: Synthesis of coordination complexes, gravimetric analysis etc

SEMESTER –IV

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
PCB401	Physical and Chemical kinetics	[3 + 1]	4
CB401	Introductory Spectroscopy (UV-vis, fluorescence, IR, Raman, NMR)	[3+ 1]	4
C401	Properties of Matter	[3 + 1]	4
C402	Group theory	[3 + 1]	4
G401	Statistical Techniques and Applications	[2 + 0]	2
		Lab hrs	**Credits**
CL401	Chemistry Laboratory	[6]	3
GL401	Computational Laboratory and Numerical Methods	[4]	2

25

(102 of 240 credits)

PCB 401: Physical and Chemical Kinetics: (45 + 15 = 60 hrs.)

UNIT-I
(i) Basic Concepts: Rate, order and molecularity of a reaction, First, second and third order reactions – effect of concentration on reaction rate, rate expressions and integrated form, pseudo-unimolecular and second order autocatalytic reactions, nth order reaction of a single component, effect of temperature on reaction rate – Arrhenius equation and activation energy.

UNIT-II
(ii) Complex Reactions: parallel first order reactions, series first order reactions – determination of rate constants by graphical method and the time ratio method. The stationary state, radioactive decay, general first order series and parallel reactions. Competitive, consecutive second order reactions, reversible reactions, equilibrium from the kinetic view point, complex mechanisms involving equilibria.

UNIT-III
(iii) Kinetic Measurements: Experimental determination of reaction rates and order of reactions – correlation of physical properties with concentrations, reactions in the phase, reactions at constant pressure, fractional-life period method, initial rate as a function of initial concentrations.

UNIT-IV
(iv) Reactions in Solutions: General Properties, Phenomenological theory of reaction rates, Diffusion limited rate constant, Slow reactions, Effect of ionic strength on reactions between ions, Linear free energy relationships, Relaxation methods for fast reactions.

UNIT-V

(v) Catalysis: Homogeneous catalysis in gas phase, in solution, basis of catalytic action, catalysis and the equilibrium constant, acid base catalysis, The Bronsted catalysis law, linear free energy changes, general and specific catalysis. Heterogeneous catalysis. Negative catalysis and inhibition, Surface reactions – effect of temperature and nature of surface. Industrial catalysis.

Suggested texts and References:
(i) K.A. Connors, Chemical Kinetics : A Study of Reaction Rates in Solution, V.C.H. Publications 1990. **(ii)**J.I. Steinfeld, J.S. Francisco and W.L. Hase, Chemical Kinetics and Dynamics, Prentice Hall 1989. **(iii)** Paul L. Houston, Chemical Kinetics and reaction dynamics.
(iv) K.J.Laidler, Chemical Kinetics, 3rd ed. Harper and Row, 1987.
(v) J.W. Moore and R.G. Pearson, Kinetics and Mechanisms, John Wiley and Sons, 1981.
(vi) A. A. Forst and R. G. Pearson, Kinetics and Mechanism, Wiley International Edition.
(vii) Sanjay K. Upadhay, Chemical kinetics and Reaction Dynamics, Springer, 2006

CB401: Introductory Spectroscopy (45 + 15 = 60 hrs)
UNIT-I
(i) The electromagnetic spectrum: Nature of electromagnetic radiation. The electromagnetic spectrum and its regions. Frequency, waveno and wavelength: units and conversions. Absorption of electromagnetic radiation. Molecular energy states and quantisation of internal energy. Boltzmann distribution.

(ii) Spectroscopic Processes: Absorption, emission, and scattering of light. Beer-Lambert Law - Quantitative absorption measurements, Jablonski diagram

(iii) Fourier transformation: A mathematical tool to our advantage, basic principle and its relevance in spectroscopy.

UNIT-II

(iv) UV-VIS Absorption Spectroscopy: Principles and instrumentation of spectrophotometers. UV-vis spectroscopy to determine conjugation. UV-visible spectroscopy and electronic transitions. Electronic ground states and excited states in organic molecules: n to pi-star and pi to pi-star transitions. band position and band intensities.

(v) Fluorescence Spectroscopy: Principles and instrumentation of fluorimeters. Advantage of fluorimetry compared to absorption spectrophotometry. Luminescence and the fate of excited states: timescale of fluorescence and phosphorescence.Qualitative and Quantitative Fluorimetry.

UNIT-III

(vi) IR - Principles and instrumentation of Infrared spectroscopy. nfrared spectroscopy and molecular vibrational transitions. Simple dispersive IR spectrometer and ovewrview of modern instrumentation. Transmittance and absorbance. Vibrational modes and selection rules. Factors governing the position and intensity of IR bands: effects of variation in reduced mass and force constant. Group frequency and fingerprint regions: use of IR for identification by presence/absence of absorptions characteristic of specific bonds/bond groupings. Interpretation of IR spectra.

(vii) Raman Spectroscopy: Raman Effect and molecular polarizability. Technique and instrumentation. Pure rotational Raman spectra, vibrational Rama spectra. Structure determination from Raman and IR.

UNIT-IV

(viii) Nuclear Magnetic Resonance (NMR): Introduction to Nuclear Magnetic Resonance (NMR) spectroscopy. 1H and 13C NMR, number of signals, integration, chemical shift, splitting of signals. Principles and instrumentation of NMR spectroscopy. Nuclear spin and nuclear magnetism. Energies of nuclear spin states in a magnetic field. Boltzmann population of nuclear spin states and the origin of NMR signals. Applications: Interpretation of simple 1H NMR spectra. Information from: chemical shifts and delta values, peak areas and integration, splitting patterns and spin-spin coupling constants. (n+1) rule and Pascal's triangle. 13C NMR spectra and sensitivity issues. Interpretation of NMR spectra using examples of organic compounds. Short introduction about application of NMR for proteins.

UNIT-V

(ix) Mass spectrometry: Introduction to mass spectroscopy (molecular mass, accurate mass and isotopes) Principles, ionisation methods (including EI, MALDI, ESI). Molecular ions and fragmentation processes under EI. Mass spectrometry for determining the molecular weight/formula of organic compounds and identify the presence of isotopes. Introduction of MS application in protein analysis.

C 401: Properties of Matter   **(45 + 15 = 60 hrs.)**

UNIT-I
(i) Gaseous State a). Perfect gases and gas laws, law of partial pressures and partial volumes, Graham's law of effusion, critical state and determination of the critical constants, continuity of state, coefficient of expansion and compressibility. b). The kinetic theory of gases, pressure and temperature of a gas, derivation of the gas laws from the kinetic theory, The Boltzmann constant, Maxwell's law of distribution of molecular velocities, experimental verification of Maxwell's law. c). Ideal and real gases, deviations of the real gases from the ideal gas laws, collision diameter, van der Waals equation, reduced equation of state, The Dieterici equation, The Berthelot's equation, The equation of Kammerling-Onnes, Virial Theorem and equation of state, compressibility factors, The heat capacity of gases, The principle of equipartition of energy, gas density and vapour density. d). Collision number and mean free path, transport properties: viscosity, thermal conductivity and diffusivity of gases.

UNIT-II
(ii) The Liquid State: a) Intermolecular forces – dipole-dipole London forces, hydrogen bonding. b) Vapour pressure, determination of vapour pressure, external and internal pressure, boiling point and vapour pressure. c) Surface tension, angle of contact and wetting of surface pressure on a curved surface, rise of liquid in a capillary tube, measurement of surface tension. Surface tension and vapour pressure, surface tension and temperature – Eootvos-Ramsay-Shields relation, Macleod's equation, parachor. d) Viscosity, measurement of relative and absolute viscosity, viscosity and temperature, molecular weight from viscosity. e) refractive index, specific rotation, molar refraction and chemical constitution, optical activity and specific rotation.

UNIT-III
(iii) The Solid State: Crystalline and amorphous solids, Crystals – Steno's law, Hauy's law, Laws of symmetry. Crystals systems and lattices, Crystals and X-rays, Bragg's method of crystal analysis. Different kinds of crystal structures, methods of crystal analysis, electron diffraction, Isomorphism, Heat capacity of solids, Debye's equation. Liquid crystals, magnetic properties - diamagnetic and paramagnetic materials. Ionic, covalent, metallic and coordinate bonds. (ii) Ionic Bond - characteristics of ionic compounds and crystal structures, radius ratio rules and coordination number, close packing. Classification of ionic structures – AX, AX2 and AX3 groups. Lattice Energy, Stoichiometric defects – Schottky and Frenkel. Non-stoichiometric defects – metal excess and metal deficiency. Semiconductors and transistors.

UNIT-IV
(iv) Colloids: The colloidal system, preparation of colloidal systems, classification. Lyophobic sols - optical and electrical properties, effect of addition of electrolytes and applied electric field. Determination of zeta potential by electrophoresis and electroosmotic methods. Origin of charge and the mechanism of flocculation – stability of sols. Properties of Lyophilic sols – viscosity and protective action.

UNIT-V
Kinetic properties of sols and Brownian motion. Determination of Avogadro's number from vertical distribution of sol particles and by diffusion method. Macromolecules – viscosity and

molecular weight of polymers, osmotic pressure, The Donnan equilibrium. Sedimentation and ultracentrifuge, scattering of light. Protein sols, association colloids and emulsions, Ideal solution and colligative properties.

Suggested texts and References:

(1) P.W.Atkins, Physical Chemistry, Oxford University Press, 7th Edition, 2006.
(2) G.M.Barrow, Physical Chemistry, 5th Edition, Tata McGraw-Hill, New Delhi, 1992.
(3) D.A.McQuarrie and J.D. Simon, Physical Chemistry - a molecular approach, Viva Books Pvt. Ltd. (1998).
(4) D.K.Chakrabarty, Adsorption and catalysis by solids, Wiley Eastern, 1990.
(5) F.P.Kane and G.B.Larrabee (Eds.),Characterisation of solid surfaces, Plenum, 1978.
(6) A.W.Adamson, Physical Chemistry of Surfaces, 3rd Edn.,Wiley Interscience, 1976.

C 402: Group theory   **(45 + 15 = 60 hrs)**

UNIT-I
(i) Symmetry Elements and Operations, Pure Rotations (C_nRotations), Improper Rotations, Rotation-Reflection (S_n) & Rotation-Inversion (n-bar) Axes.

UNIT-II

(ii) Point Groups: Low Symmetry Point Groups (C1 ,Ci , Cs), Simple Axial Point groups (c., S4n, Cnv' Cnh), Dihedral Groups (Dn, , Dnd, Dnh)

UNIT-III
Platonic Solids & the "Cubic" Groups (Td, 0h , Ih), Derived High Symmetry Groups (T, Th , 0, I), The "Infinite Groups" ($C\infty v$ and $D\infty h$), Points Groups & Chirality, Point Groups & Dipole Moment.

UNIT-IV
(iii) Multiplication Tables (i.e., operation 1 followed by operation 2) for point groups. Similarity Transforms, Classes of Symmetry Elements. Naming Representations (Mulliken Symbols), Subgroups and Supergroups., Non Commutative Operations.

UNIT-V
(iv) Representations of Groups., Irreducible Representations., Character Tables. Their derivations and use of their contents. Matrix Representation of Symmetry Operations. The "Full Form" of the Character Table.

Suggested texts and References:
1. F. A. Cotton, "Chemical Applications of Group Theory", 3rd Edition, John Wiley (1990).
G 401: statistical techniques and its applications

CL 401: Chemistry Laboratory

Acetylation of primary amine, synthesis of cyclohexanone oximes, nitration of phenols, bromination of acetanilide, photoreduction of benzophenone to benzopinacole, pinacole pinacolone rearrangements, benzil- benzilic acid rearrangement, aldol condensation, coenzyme catalysed benzoin condensation, separation of organic mixtures(solid-solid, solid -liquid and liquid-liquid), characterization of all the synthesized compounds using FTIR, UV-vis spectroscopy and 1H-NMR**.**

3rd Year
SEMESTER –V

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
CB501	Analytical Chemistry	[3 + 1]	4
C501	Quantum Chemistry	[3+ 1]	4
C502	Inorganic Chemistry II	[3 + 1]	4
C503	Organic Chemistry II	[3 + 1]	4
G501	Earth Science and Energy & Environmental Sciences	[3 + 1]	4
		Lab contact hrs	**Credits**
CL501	Chemistry Laboratory	[8]	4

24

(126 of 240 credits)

CB 501: Analytical Chemistry   **(45 + 15 = 60 hrs.)**

UNIT-I

(i) Error analysis: Methods of sampling and associated errors, Classification of errors, Propagation of errors, treatment of errors, Normal distribution, Tests of Significance and Confidence Limits.

UNIT-II

(ii) Separation techniques: Solvent Extraction Technique: Conventional, Liquid Membranes – Bulk, Supported and Emulsified, Solid Phase Extraction (SPE). Ion Exchange: Conventional, Membranes. Chromatography: Gas chromatography (GC), High Performance Liquid Chromatography (HPLC), Ion chromatography (IC).

UNIT-III

(iii) Mass Spectrometry: Mass Analysers – Magnetic, Quadrupole, Time of Flight (TOF), Features – Resolution, Dispersion, Abundance, Sensitivity, Detectors, Ion Sources –Thermal Ionisation (TI), Electron Impact, ICP, GD, Laser Ablation (LA-ICP), Secondary Ionisation (SI),

Matrix Assisted Laser Desorption and Ionisation (MALDI), Hyphenated Technique – IC-MS, HPLC-MS, GC-MS.

UNIT-IV

(iv) Thermal Methods: Thermogravimetric Analysis (TGA), Derivative Thermogravimetric Analysis (DTG), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), Evolved Gas Analysis (EGA).
(v) Electrochemical Methods: Introduction, Potentiometry , Ion Selective Electrodes (ISE), Voltammetry & Polarography , Cyclic, Pulse and Stripping Voltammetry, Coulometry and Amperometry, AC Electrochemical Techniques, Scanning Electrochemical Microscopy.
(vi) Detectors- Photomultiplier Tube (PMT), Charge Coupled Device (CCD), Charge Injection Device (CID), Spectrometers – Czerny Turner, Echelle, Sample Introduction Devices – Flame, Electrothermal, Laser Ablation, Direct Sample Insertion Devices, Interferences, detection limits, sensitivity.

UNIT-V

(vii) Conductance of solutions and electrochemistry: Faraday's laws of electrolysis, Electrolytic conduction- Arrhenius theory of electrolytic dissociation, strong and weak electrolytes. Migration of ions – transference numbers, Determination of transference number using Hittrof's rule and moving boundary method. Conductance of solutions – electrolytic conductance, determination of conductance, equivalent conductance and concentration, Kohlrausch's law of independent migration of ions, ionic mobilities, temperature dependence. Hydration of ions, the interionic attraction theory. Applications of conductance measurements– degree of dissociation of weak electrolytes, dissociation constants of weak acids, degree of dissociation of water, basicity of organic acids, determination of solubilities of sparingly soluble salts, conductometric titrations, activities of electrolytic solutions, ionic strength. The Debye-Huckel theory of dilute ionic solutions.

Suggested texts and References:

(1) D.A. Skoog, D. M. West, F. J. Holler, S.R. Crouch, Fundamentals of Analytical Chemistry, 8th Edition, Thomson (2004).
(2) A.I. Vogel, A text book of Quantitative Analysis, 5th Edition Revised by G. H. Jeffery, J. Bassett, J. Mendham and R. C. Denney, ELBS (1989).
(3) A. K. De, S. M. Khopkar and R. A. Chalmers, Solvent Extraction of Metals, Van Nostrand, Reinhold (1970).
(4) L. R. Snyder and J. J. Kirkland, Introduction to Modern Liquid Chromatography, 2nd Edition, Wiley (1979).
(5) Jose A. C. Broekaert, Analytical Atomic Spectrometry with flames and Plasmas, Wiley-VCH (2002).
(6) John Roboz, Introduction to Mass Spectrometry: Instrumentation and Techniques, Interscience (1968).

C 501: Quantum Chemistry (45 + 15 = 60 hrs.)
UNIT-I

(i) Foundations of quantum mechanics.
(ii) Wave function for a free particle, the Schrodinger equation, physical interpretation of the Scrodinger equation wave function, expectation of a dynamical quantity, Wavepackets and the uncertainty principle, WKB approximation.

UNIT-II

(iii) Operator concept in quantum chemistry.
(iv) Solution of Schrodinger's equation in some simple systems: one and three dimensional boxes, electron in a ring, rigid rotator, concept of tunnelling, one dimensional harmonic oscillator, hydrogen-like atoms, shapes of atomic orbitals.

UNIT-III

(v) Approximate methods of quantum chemistry: variational principle; Time-independent perturbation theory: Many electron sysytems: Orbital approximation, Slater determinant; Hartree-Fock self-consistent field theory; Slater type orbitals.

UNIT-IV

Concept of LCAO and introduction to ab-initio and semi-empirical molecular orbital calculations of molecules. Huckel Theory: Extended systems: From bonds to bands. Angular momentum of many-particle systems. Born-Oppenheimer approximation, MO and VB theories illustrated with H2-molecule, An elementary treatment of scattering theory.

UNIT-V

(vi)Spin orbital interaction; LS and JJ coupling. Spectroscopic term symbols for atoms. Molecules and Chemical bonding, Spectroscopic term symbols for diatomics; Directed valence & hybridization in simple polyatomic molecules.

Suggested texts and References:

(1) Ira N. Levine, Quantum ChemistryPrentice Hall India.
(2) John L. Powell and Bernd Crasemann, Quantum Mechanics, Oxford & IBH Publishing.
(3) A. K. Chandra, Introductory Quantum Chemistry, Tata McGraw-Hill Publishing Comp. Ltd.
(4) David B. Beard, Quantum Mechanics, Allyn & Bacon, Inc, Boston.

C 502: Inorganic Chemistry II: (45 + 15 = 60 hrs.)
UNIT-I

(i) Coordination compounds, Werners's theory, effective atomic number, coordination number, shapes of d-orbitals and bonding in transition metal complexes, stability of complexes, the chelates and macrocyclic effects, types of classification of ligands, second sphere of coordination, □-complexes, □-acid ligands, multiple bonds from ligands to metals.

UNIT-II

(ii) Crystal Field theory – crystal filed splitting and elementary treatment of the electronic spectra, Jahn-Teller distortion of octahedral complexes, square planar complexes, tetrahedral complexes, magnetic properties of 3*d* compounds.

UNIT-III

(iii) MO theory – Nomenclature of coordination compounds, d-orbital splitting in various fields - Spectroscopic states - Tanabe-Sugano and Orgel diagrams - Derivation of Ligand field parameters (Dq. B) from electronic spectra - Magnetic moments - Orbital contribution, spin-orbit coupling and covalency.

UNIT-IV

Molecular orbitals and energy level diagrams for common symmetries.
(iv) Bonding involving-donor ligands - Back-bonding - f-orbital splitting - Spectral and magnetic properties of f-block elements.

UNIT-V

(v) Reaction mechanisms: Substitution reactions - Dissociative and associative interchange - trans-effect - Linear free energy relations. Rearrangements - Berry pseudo rotation, Electron transfer reactions. Photo-dissociation, substitution and redox reactions, Fluxional molecules.

Suggested texts and References:

(1) F.A. Cotton, G. Wilkinson, C.A. Murillo and M. Bochmann, Advanced Inorganic Chemistry, Wiley Eastern, John Wiley, 6th Ed., 1999.
(2) J.E. Huheey, E. Keiter and R. Keiter, Inorganic Chemistry, 4th Ed., Harper Collins College Publisher, 1993.
(3) D.Banerjea, Inorganic Chemistry Principles, Books Syndicate Pvt. Ltd., 2000.
(4) N.N. Greenwood and E.A. Earnshaw, Chemistry of Elements, Pergamon Press, 1989.
(5) J.J. Kratz, G.T. Seaborg and L.R. Morss; *The Chemistry of Actinide Elements,* 2ₙd Edition, Vol. 1&2, Chapman & Hall, New York (1986).
(6) J.C. Bailar, H.J. Emelius, R. Nyholm and A.F. Trotman-Dickenson; *Comprehensive*

C 503: Organic Chemistry – II   **(45 + 15 = 60 Hrs.)**

UNIT-I
(A) Stereochemistry of Organic Compounds 25h **(i)** Isomerism – Concept and types **(ii)** Chirality: Configuration, stereogenic/chiral center, chirality and enantiomerism. Representation of configuration by flying wedge formulae and Fischer, Newman and Sawhorse projection formulae. **(iii)** Stereochemistry of carbon compounds with upto three similar and dissimilar asymmetric carbon atoms; enantiomers, diastereomers, and racemic mixtures and their properties, resolution (chemical and chromatographic). **(iv)** Diastereomerism: Threo, erythro, meso diastereomers. Geometrical isomerism in olefins, cycloalkanes and oximes. Absolute

configuration: Assigning of stereochemical descriptors - R/S to Fischer projection and flying wedge formulae of chiral molecules and E/Z to olefins.

UNIT-II

(v) Molecular chirality and elements of symmetry: Stereochemistry and stereochemical nomenclature of biphenyls, spirans, cummulenes, and alkylidene cycloalkanes (vi) Conformational concepts, conformations of acyclic molecules (ethane and butane), cyclohexane and mono, di-substituted cyclohexanes. Conformationally rigid and mobile diastereomers. (vii) Stereoselectivity and stereospecificity of organic reactions: Enantiomeric and diastereomeric selectivities.

UNIT-III

The mechanism and stereochemical outcome of the following reactions: (a) S_N1, S_N2 and S_Ni reactions (b) Catalytic hydrogenation of alkenes (c) Ionic trans addition of bromine to alkenes (d) Epoxidation of alkenes, acid catalysed ring opening of epoxides. (e) Reactions of OsO_4 and $KMnO_4$ with olefins (f) E2 reactions. (g)Topicity and prostereoisomerism - Enantiotopic and diastereotopic atoms, groups and faces.

UNIT-IV

(B) Chemistry of heterocyclic compounds   25h
Heterocycles containing one heteroatom (furan, thiophene, pyrrole, pyridine) and more than one heteroatom (pyrazole, imidazole, oxazole, thiazole, pyrimidine and pyrazines) their derivatives – preparation, properties and reactions. (C) Chemistry of Alicyclic compounds: Cycloalkanes and cycloalkenes. Factors affecting stability of conformations, conformation of cycloalkanes. Reaction mechanism in alicyclic compound.

UNIT-V

(i) Conformation of Cyclic System: Monocyclic compounds and Fused ring and Bridged ring Compound. Topicity and Prostereoisomerism & Racemisation and Methods of Resolution.
(ii) Dynamic stereochemistry: Conformationally rigid and mobile diastereomers, seteroselectivity.
(iii) Chemistry of Carbon radical (Single electron transfer mechanism): neighboring group participation; non-classical carbocataion; S_Ni mechanism. Rearrangements of Carbocataion, Free-radical: Allylic, Pinacol/ Pinacolone, 1,2 rearrangements etc and rearrangement to heteroatoms. Pericyclic reaction and FMO approach.

Suggested texts and References:

(1) I. L. Finar, Organic Chemistry, Vol. 1 & 2, ELBS.
(2) R. K. Bansal, Heterocyclic Chemistry, Synthesis, Reactions and Mechanisms, Wiley Eastern Ltd., 1990.
(3) J.A.J. Joule and G.F. Smith, Heterocyclic Chemistry, ELBS, 2nd Ed., 1982.F.G. Riddell, The Conformational Analyis of Heterocyclic Compounds, Academic Press, 1980.
(4) L.A. Paquette, Principles of Modern Heterocyclic Chemistry, W.B. Benjamin, Inc., 1978.
(5) B.M. Acheson, An Introduction to the Chemistry of Heterocyclic Compounds, Interscience, 2nd Ed., 1975.

G501: Earth Science and Energy & Environmental Sciences
Earth Science
Origin of the earth, type of rocks in different layers, their physical and chemical properties, mechanism of their formation and destruction. Radioactivity and its role in geochronology, Plate tectonics and geodynamics and the role of mantle plumes in sustaining these processes. Gravity, electrical and magnetic properties of the different layers in the earth. Their variations in different geological terrains. Instrumentation, field procedures used in these studies. Response of the earth to the elastic (Seismic) and electromagnetic waves, use of this phenomena to study the earth's interior. Geodynamo and the internal magnetic field of the earth. Paleomagnetic studies, Polar wandering and reversal, possible theoretical arguments for understanding the phenomena. Seismology and its use in understanding of the different layers in the earth's interior. Utility of the different geophysical techniques (discussed above) in exploration for academic as well as for harnessing resources.

Suggested Texts and references:
1. The magnetic field of the Earth, Merill, R.T. McElhinny, M.W. and McFadden, P.L. International Geophysical Series.
2. Earth Science by Edward J. Tarbuck, E.J. and Lutgens, F.K.
3. Introduction to Applied Geophysics: Exploring the Shallow Subsurface Burger, H.R., Sheehan, A.F., C.H.
4. Mantle Plumes and Their Record in Earth History, Condie, K.C., 2001, Cambridge University Press, Cambridge, UK
5. Applied Geophysics (Paperback) W M Telford, Robert E Sheriff and L P Geldart.

Energy and Environmental Sciences
Introduction to Environmental Science. Natural Environments: Ecosystems and ecology, biodiversity. Socio-cultural environments: demography, population density, human organizations. Land use and its planning. Global climate change and effects on environment. Carbon cycle from human activity, calculation of carbon budgets. Water harvesting, storage and treatment. Natural calamities, hazards, and effects of human activity: Chemical and other technological hazards. Various case studies of natural calamities and human-induced disasters. Causes, effects, forecasting, preparedness, planning measures, technological solutions, social interventions. Concept of sustainability, individual and social, and local and global actions for a sustainable future. Introduction to energy Sources - evolution of energy sources with time. Power production, per capita consumption in the world, and relation to development index. Energy scenario in India: Various issues related to consumption and demands -energy crisis issues in India. Renewable and non-renewable energy sources - technology and commercialization of energy sources, local (decentralized) versus centralized energy production, constraints and opportunities of renewable energy (hydrocarbon and coal based energy sources). Energy conservation – calculation of energy requirements for typical and home and industrial applications. Alternative to fossil fuels - solar, wind, tidal, geothermal. Bio-based fuels. Hydrogen as a fuel. Energy transport and storages, comparison of energy sources - passage from source to delivery (source, production, transport, delivery) - efficiencies, losses and wastes. Nuclear energy: Power production: Components of a reactor and its working, types of reactors and comparison. India's three stage nuclear program. Nuclear fuel cycle. Thorium based reactors. Regulations on nuclear energy.

Suggested texts and References:
1. Energy in Perspective, J.B.Marion, University of Maryland, Academic Press, (1974)
2. Energy and Environment, Robert A.Ristinen and Jack J. Kraushaar, 2nd Edn., John Wiley and
Sons, Inc. (2006).
3. Renewable Energy, Boyle Godfrey, Oxford University Press (2004)
4. Environment, Problems and Solutions, D.K.Asthana and Meera Asthana, S.Chand and
Co.(2006)
5.Text Book on Environmental Chemistry, Balaram Pani, I.K.International Publishing
House(2007).

CL 501 Chemistry Laboratory:

Isolation and purification of lysozyme protein from hen egg by different methods (ethanol, ammonium sulfate and TCA precipitation), Relative quantification of lysozyme obtained from different methods by using:Dialysis, Gel electrophoresis, UV-Vis spectroscopy, Purification of lysozyme obtained from different methods with fast performance liquid chromatography (FPLC), Qualitative analysis of the lysozyme obtained after FPLC by using spectroscopic techniques (UV-Vis and fluorescence spectroscopy), Calculation of Quantum yield using fluorescence Spectroscopy, Binding effect of ligand on fluorescence of protein fluorophore (Calculation of inner filter effect), Calculation of binding constant of a ligand with protein by Stern-Volmer plot using fluorescence spectroscopy, Study of solvent effects on the stability of proteins by drawing a denaturation profile in presence of denaturing agents using UV-Vis and fluorescence spectroscopy.

SEMESTER –VI

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
CB601	Biophysical Chemistry	[3 + 1]	4
C601	Atomic and molecular spectroscopy	[3+ 1]	4
C602	Inorganic Chemistry III	[3 + 1]	4
C603	Organic Chemistry III	[3 + 1]	4
C604	Nuclear Chemistry	[3 + 1]	4
H601	Ethics in Science and IPR	[2 + 0]	2
		Lab contact hrs	**Credits**
CL601	Chemistry Laboratory	[6]	3

25
(151 of 240 credits)

CB 601: Biophysical Chemistry

UNIT-I
(i) The Chemistry of Life: An introduction: Physical properties of water: Structure, water as solvent, The hydrophobic effect, osmosis and diffusion. Introduction to Biomolecules: Nucleic

Acid, Protein - Polymer Description of Macromolecular Structure, Intermolecular and Intramolecular forces, Non Covalent Interaction
.
 UNIT-II
 (ii) General principles of Biophysical chemistry I: Hydrodynamic properties: Diffusion and sedimentation, determination of molecular weight from sedimentation and diffusion; Introduction of Ultra Centrifugation, Dynamic Light Scattering and Electrophoresis. Spectroscopic properties of proteins and nucleic acid: UV/Vis, Intrinsic fluorescence, Circular dichroism.

UNIT-III
(iii) General principles of Biophysical chemistry II: The concept and application of Chemical and Physical equilibria in Biological system, The equilibrium constant and Standard Gibbs Free energies of reactants and products, Temperature dependence of the equilibrium constant, Double Strand formation in nucleic acid, Ligand-protein binding, Protein denaturation and stability, Introduction of DSC and ITC.

UNIT-IV
(iv) Molecular self-assembly and Molecular medicine: Protein folding kinetics and Biophysical methods, Misfolding and aggregation; Physical basis of conformation diseases, Therapeutic approaches to protein misfolding diseases**.**

UNIT-V
(v) Introduction to structure biology: Introduction to basic principles of protein X-ray crystallography, protein NMR, Small Angle X-ray scattering (SAXS), and Electron microscopy (EM).

Suggested texts and References:
(1) Tinoco, Sauer, Wang, and Puglisi. (2003) Physical Chemistry: Principles and Applications in the Biological Sciences. Prentice Hall, Inc.
 (**2**) Physical Chemistry for the Life Sciences: Peter Atkins and Julio de Paula
(**3**) General review papers Dobson CM. Principles of protein folding, misfolding and aggregation. Semin Cell Dev Biol. 2004 Feb;15(1):3-16.

C 601: Atomic and molecular Spectroscopy   **(45 + 15 = 60 hrs.)**

UNIT-I
 (i) Born-Oppenheimer approximation - rotational, vibrational and electronic energy levels of homonuclear and heteronuclear diatomic and polyatomic molecules.

UNIT-II
(ii) Microwave Spectroscopy: Rotational of molecules and rotational spectroscopy of rigid diatomic molecules, Effect of isotopic substitution, The non-rigid rotator and rotational spectra. Rotational spectra of polyatomic molecules – linear, symmetruic top and asymmetric top. Techniques and instrumentation.

UNIT-III

(iii) Infrared spectroscopy: energy levels of vibrating diatomic molecule, simple harmonic oscillator and anharmonic oscillator, diatomic vibrating rotator, vibration-rotation spectra of CO. Breakdown of B-O approximation – interaction of rotations and vibrations. Vibrations of polyatomic molecules – Fundamental vibrations and their symmetry, overtone and combination frequencies, influence of rotation on the spectra of polyatomic molecules – linear and symmetric top molecules. Influence of nuclear spin. Group frequencies and analysis of spectra, Techniques and instrumentation, FTIR spectroscopy.

UNIT-IV

(iv) Raman Spectroscopy: Classical and quantum theories of Raman effect and molecular polarizability. Pure rotational Raman spectra, Vibrational Raman spectra, Polarization of light and the Raman effect, Structure determination from Raman and infrared spectroscopy, Techniques and Instrumentation, Near IR FT Raman spectroscopy. Resonance Raman and electronic Raman transition and applications.

UNIT-V

(v) Electronic spectroscopy – Electronic structure and spectra of diatomic and polyatomic molecules. Techniques and instrumentation. Molecular photoelectron spectroscopy.
(vi) Electron spin resonance spectroscopy - spin and spectra - relaxation processes - origin of g-shifts and hyperfine coupling - Tensor quantities - Experimental determination of g, A and D tensors - their interpretation - several examples.

Suggested texts and References:
(1) G. M. Barrow, Molecular spectroscopy
(2) C.N. Banwell and E. M. McCash, Fundamentals of Molecular spectroscopy, Tata McGraw HillPub. Co.New delhi
(3) J. D. Graybeal, Molecular Spectroscopy, McGraw Hill International Book Co. N.Y.

C 602: Inorganic Chemistry III   **(45+15 = 60 hrs)**

UNIT-I
Chemistry of d-block elements
(i) General introduction to transition elements – Electronic structure, Metallic character, variable oxidation state, complexes, magnetic and catalytic properties.

UNIT-II
 (ii) Elements of the first transition series: Occurance, separation, extraction and chemistry of the scandium group (IIIB), titanium Group (IVB), vanadium group (VB), chromium group (VIB), Manganeese group (VIIB).

UNIT-III
Iron group (VIIIB(8)), Nickel group (VIII(9)) and Copper group (VIIIB(10)).
(iii) Chemistry of the elements of the second and third transition elements: fnium group (Group IVB), Niobium and Tantalum (Group VB), Molybdenum and tungsten (Group VIB); Technitium and Rhenium (Group VIIB),

UNIT-IV
The Platinum group Metals, Ruthenium and Osmium (Group VIII(8)); Rhodium and Irridium (Group VIII(9)), Palladium and Platinum (Group VIII(10), Silver and gold Group (1B(11)).

UNIT-V
(iv)Chemistry of f-block elements-The lanthanide and actinide elements.

Suggested texts and References:
(1) Advanced Inorganic Chemistry, F. Albert Cotton and G. Wilkinson@1988, John Wiley & Sons.

C 603: Organic chemistry III   **(45 + 15 = 60 Hrs.)**

UNIT-I
Chemistry of Natural Products:
(i) Terpenoids: Classification, structure, chemistry and biogenesis of some important mono; sesqui,di, and triter penes.

UNIT-II
(ii) Steroids: Sterols and bile acids, estrogens, androgens, gestogens and adrenocortical hormones. Hormone production. Cardiac glycosides. Steroidal triterpenes; biogenesis of steroids and correlation with terpenoids.

UNIT-III
(iii) Alkaloids: Characteristic reactions, general methods of degradation, structure and chemistry of some well-known alkaloids.

UNIT-IV
(iv) Natural Pigments: anthocyanines, Flavones, flavanones, isoflavones, xanthones, quinones, pterins, chlorophyll and haemin.

UNIT-V
(v) Carbohydrates: Stereochemistry, reaction and conformation of monosaccharides, deoxy and aminosugars, hexonic acid and vitamin C, disaccharides, polysaccharides, inositol; gangliosides and other glycosides. Chemistry of vitamins A, B, C and E.

Suggested texts and References:
(1) I. L. Finar, Organic Chemistry, Vol. 1 & 2, ELBS.

C 604: Nuclear Chemistry   **(45 + 15 = 60 hrs.)**

UNIT-I
(i) Nuclear Stability: Concept of nucleus and properties, nuclear mass and binding energy, elemental abundance, radioactive decay laws and equilibria. Nuclear Models: Liquid drop model, Shell model, Fermi gas model, collective model, optical model, concept of spin, parity electric and magnetic moments, isomerism.

UNIT-II

(ii) Modes of Decay: ☐ decay, ☐ decay, electron captures, ☐ de-excitation, internal conversion, artificial radioactivity.

(iii) Nuclear reactions: Energetics, cross-section, centre of mass system, angular momentum, compound nucleus, statistical model, nuclear fission and fusion, nuclear reactors, Heavy ion induced reactions, Accelerators.

UNIT-III

(iv) Applications of radioactivity: Probing by isotopes, preparation of radioisotopes, Szilard-Chamers' reaction, Concept of tracers, chemical yield, radiochemical purity, Application of radiotracers in Chemical Sciences, uses of nuclear radiations, radioisotopes as a source of electricity.

UNIT-IV

(v) Elements of Radiation Chemistry: Interaction of radiation with matter, radiation dosimetry, radiolysis of water and some aqueous solutions, other radiolytic events.

(vi) Nuclear Methods: Activation Analysis – Neutron Activation Analysis (NAA),

UNIT-V

Charged Particle Activation Analysis (CPAA), X-ray fluorescence (XRF) spectrometry, Ion Beam Analysis – Backscattering Spectrometry (BS), Particle Induced ☐-ray Emission (PIGE), Nuclear Reaction Analysis (NRA), Elastic Recoil Detection Analysis (ERDA), Particle Induced X-ray Emission (PIXE).

Suggested texts and References:
(1) G. Friedlander, J. Kennedy, Nuclear and Radiochemistry (1981) –J. M. Miller and J. W. Macias
(2) R. D. Evans, Atomic Nucleus (1955)
(3) S. Glasstone, Source book of Atomic Energy (1969)
(4) G. T. Seaborg, Man made elements (1963).
(5) H. J. Arnikar, Essentials of Nuclear Chemistry (1982).
(6) C. Keller, The Chemistry of Transuranium Elements (1971).
(7) J.C. Bailar, H.J. Emelius, R. Nyholm and A.F. Trotman-Dickenson; Comprehensive Inorganic Chemistry, Vol. 5, Pergamon Press, Oxford (1973).

H601: Ethics of Science and IPR

Introduction to a Collective, Participatory Teaching-learning Program: A Science of Our own. Science Stands the Test of Ethics … Some indicators. Levels of Moral Development - Does it mean anything?
Medical Ethics: Different themes pertaining to medical ethics including ethical issues in public health.
History, Philosophy and Psychology of Ethics: History of Political Economy and Modern Ethics Environmental Ethics
Intellectual Property Rights and Associated Issues: History of Patenting. Digitalizing Culture-I: Free Software and Free Culture. Digitalizing Culture-II: Concentration and appropriation of Power by the few as well as Possibility of Distributive Justice

Journals and Publishers: Monopolistic practices by Academic Publishers Quest for Determining what is Virtuous: Ethics in Practice. Collaborative Projects by the Class.
Teaching the Teachers and other Virtuous Inquiries.

CL 601: Chemistry laboratory:
Experiments based on analytical techniques such as cyclic voltammetry, pulse polarography, electrodeposition, gas chromatography, nuclear magnetic resonance, FTIR, thermal gravimetry methods, atmic absorption spectroscopy etc.

FOURTH YEAR
SEMESTER –VII

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
C701	Photochemistry	[3 + 1]	4
C702	Chemical biology	[3+ 1]	4
C703	Organometallics & Bio-inorganic Chemistry	[3 + 1]	4
C704	Physical Organic Chemistry	[3 + 1]	4
CPr701	Reading project	-	4
		Lab contact hrs	**Credits**
CL701	Advanced Chemistry Laboratory-I	[8]	4

24

(175 of 240 credits)

C701: Photochemistry   **(45 + 15 = 60 hrs.)**

UNIT-I
Basic Principles of photochemistry:
(i) Photophysical processes: Deexcitation processes for the excited molecules (fluorescence, phosphorescence, delayed emission, nonradiative relaxation, excimer and exciplex formation, heavy atom effect, etc.). Kinetics of excited state processes and quantum yields of different processes.
(ii) Properties of the excited state: Acid-base properties, redox potential, geometry, dipole moment, dynamic properties of the excited states.

UNIT-II
(iii) Photoinduced processes: Photo-dissociation, photo-ionization, intramolecular charge and proton transfer processes, intermolecular electron and proton transfer reactions, conformational relaxations, intra and intermolecular energy transfer processes and other important photochemical reactions. Kinetics and mechanism of photochemical reactions.

(iv) Applications of photochemistry: Photosynthesis, vision, solar energy conversion, atmospheric photochemistry, etc.

UNIT-III
(v) Studies on ultrafast processes: Nanosecond, picoseconds and femtosecond laser flash photolysis, fluorescence time domain spectroscopy with special emphasis on energy transfer and electron transfer reactions and studies on excited state properties.

UNIT-IV
(vi) Organic Photochemistry Distintive features of photochemical reactions, methods of preparative photochemistry, Photochemistry of alkenes, alkynes and related compounds – geometrical isomerism, electrocyclic processes, sigmatropic shifts, di-π methane reactions, addition, cycloaddition and oxidative reactions. Photochemistry of aromatic compounds – bond cleavage and hydrogen abstraction reactions, cycloaddition reactions, rearrangements of cyclo-hexenones and cyclo-hexadienones, thiocarbonyl compounds. Photochemistry of other organic compounds – imines, imminium salts, nitriles and nitro compounds, azo and diazo compounds, diazonium salts, sulphur and halogenated compounds, photohalogenation and photonitrosation reactions. Photooxidation of alkanes.

UNIT-V
(vii) Inorganic Photochemistry Introduction to inorganic photochemistry. Photophysical processes. The electronic absorption spectra of inorganic compounds. Characteristics of the electronically excited states of inorganic compounds. Photoelectochemistry of excicted state redox reactions. Photosensitization. Photochemical reactions; substitution, decomposition and fragmentation, rearrangement, and redox reactions. Selective inorganic photochemistry using laser beams. Inorganic photochemistry in biological processes and their model studies. Ligand field photochemistry of dn complexes, photochemistry of carbonyl compounds, energy conversion (solar) and photodecomposition of water.

Suggested texts and References:
(1) K.K.Rohatagi-Mukherjee, Fundamentals of Photochemistry, Wiley Eastern, 1978.
(2) M.S.Wrighton, Inorganic and Organometallic photochemistry, ACS Pub., 1978.
(3) V. Balzani and V. Carasiti, Photochemistry of Co-ordination compounds, Academic Press, 1970.
(4) J. D. Coyle, Introduction to Organic Photochemistry, ISBN

C 702: Chemical Biology   **(45 + 15 = 60 Hrs.)**

UNIT-I
(i) Structure and the Synthesis of Life: Central Dogma, Introduction to Biological Chemistry, Artificial gene synthesis: solid-phase DNA synthesis Versus molecular cloning and polymerase chain reaction (PCR). Synthia and *Mycoplasma laboratorium,*

UNIT-II
DNA digital data storage, Peptide and protein synthesis. Lipid synthesis,Carbohydrate and membrane synthesis.

What Chemists Can Do for Biology: Natural Versus non Natural amino acid, Nonnatural Amino Acids for Site-Specific Protein Conjugation, Bio-orthogonal chemistry, Chemical genetics, reverse chemical genetics.

UNIT-III
Biomimetic Chemistry: Compounds that mimics a biological material in its structure or function, Artificial Enzymes: Chemical transformation, Molecular recognition (Mimic binding), examples of mimics found in research and industry: Cyclodextrins Cryptands,

UNIT-IV
Catalytic antibodies. Nanozymes- next-generation artificial enzymes, A laboratory procedure designed to imitate a natural chemical process: Biomimetic synthesis, Natural product synthesis, Asymmetric catalysis, Reaction methodology.

UNIT-V
(iv) Metabolomics: Technologies in metabolomics. Nutrigenomics. Other omics. Nuclear Magnetic Resonance Spectroscopy and Mass Spectrometry in metabolomics. Metabolic pathways resources: KEGG, Biocarta. Nutrigenomics and metabolic health. Solved problems and future challenges.

C703: Organometalics and Bioinorganic Chemistry (45 + 15 = 60 hrs.)

UNIT-I
Organometallics: Overview, 18-electron rule, square planar complex. Carbonyl ligand – bonding, binary carbonyl complexes, oxygen-bonded carbonyls, other ligands similar to CO, IR spectrum, main group parallels with binary carbonyl. Pi-ligands – linear and cyclic pi systems, NMR spectra of organometallic complexes.

UNIT-II
Comparative survey of structure and bonding of metal alkyls and aryls, complexes with $\square$ acids, CO and related ligands, complexes with olefins, acetylenes and related unsaturated molecules, catalytic properties of mononuclear compounds, stereochemical non-rigidity in organometallic compounds, boranes, carboranes and metallocarboranes, bimetallic and cluster complexes, structure and applications in catalysis, applications of organometallic compounds in organic synthesis, enantioselective synthesis via organometallic compounds.

UNIT-III
importance of organometallic compounds in certain biological systems. Other important ligands – complexes containing M – C, M= C, M $\equiv$ C bonds, hydride and dihydrogen complexes, phosphines and related ligands.
(ii) Organometallic reactions occurring in metal – ligand substitution, oxidative, addition, reductive, elimination. Organometallic reactions involving modification of ligands – insertion and deinsertion, nucleophilic addition to ligands, nucleophilic abstraction, electrophilic reactions.

UNIT-IV
Homogeneous catalysis and heterogeneous catalysis – use of transition metal complexes, hydroformylation reaction, Walker-Smidt synthesis of acetaldehyde, hydrogenation, Monsanto

acetic acid process. Transition metal carbine complexes – structure, preparation and chemistry, metathesis and polymerization reactions. Applications of organometallics to organic sysnthesis and other applications. Metal cluster compounds - metal-metal bond, carbonyl and non-carbonyl clusters, structure and bonding low dimensional solids, clusters in catalysis.

UNIT-V

(iii) Bio-inorganic chemistry - biochemistry of iron - its storage, transport and function, copper and zinc proteins, biological activation of oxygen, bioinorganic chemistry of alkali and alkaline earth metal cations, photosynthesis, nitrogen fixation, toxicity of metals. Chemical make up and essential inorganic elements of organisms. Chemistry aspects of metal complexes. Spectral, biochemical and biological methods used in bioinorganic chemistry. Bioinorganic chemistry of Na_+, K_+, Mg_{2+} and Ca_{2+}. Role of metal ions in biology : Proteins and enzymes of V, Mn, Fe, Co, Ni, Cu, Zn and Mo. Structural and functional models. Transport and storage of metal ions. Carcinogenicity of chromium. Selenium in biology.

Suggested texts and References:
(1) G.O.Spessard, G.L.Miessler, Organometallic Chemistry, Prentice Hall, 1997.
(2) C.Elsehenbroich and A. Salzer, Organometallic Chemistry, 2nd Ed., Wiley VCH, 1992.
(3) F.A.Cotton, G. Wilkinson, C.A. Murillo and M. Bochmann, Advanced Inorganic Chemistry, 6th Edn., Wiley, 1999.
(4) N.N.Greenwood and A. Earnshaw, Chemistry of the Elements, lst Edn., Pergamon, 1985.
(5) S.J.Lippard & J.M.Berg, Principles of bioinorganic chemistry, University Science Books, Mill Valley, 1994.
(6) I. Bertini, H.B.Gray, S.J.Lippard and J.S.Valentime, Bioinorganic Chemistry, Univ. Sci. Books, Mill Valley, 1994.
(7) James A.Cowan, Inorganic Biochemistry, VCH Publishers, 1993.

C 704: Physical organic chemistry   **(45 + 15 = 60 hrs)**

UNIT-I
Structure and Models of Bonding: Basic Bonding Concepts, Bonding and Structure of Reactive Intermediates, Molecular Orbital Theory, electron in a box problem, energies and coefficients of linear pi-systems, Secular Determinant, Huckel MOT, HMOT in cyclic and acyclic pi-systems, Aromatic and antiaromatic systems.

UNIT-II
(ii) Strain and Stability: Thermochemistry of Stable Molecules, Thermochemistry of Reactive Intermediates, Relation Between Structure and Energetics-Basic Conformational Analysis, Conformations of Acyclic and Cyclic Systems, Electronic Effects.
Acid-Base Chemistry: Bronsted Acid-Base Chemistry, Aqueous and Non-Aqueous Systems, Predicting Acid Strength in Solution, Lewis Acids/Bases and Electrophiles/Nucleophiles.

UNIT-III
(iv) Thermal Pericyclic Reactions: Cycloadditions, Orbital correlation diagram, Frontier Molecular Orbital, Comments on forbidden and allowed reactions, Photochemical pericyclic reactions, D-A cycloadditions, regio- and stereoselectivity, endo-effect, [2+2] cycloaddition, ketene cycloaddition, 1,3-dipolar cycloaddition, ene-reaction, retrocycloaddition, electrocyclic

reactions, torquoselectivity, sigmatropic rearrangements, Claisen and Cope rearrangements, Cheletropic reactions.

UNIT-IV
(v) Reactivity, Kinetics and Mechanisms: Energy Surfaces and Related Concepts, Postulates and Principles Related to Kinetic Analysis, Kinetic Experiments and Deciphering Mechanisms.
(iv)Experiments Related to Thermodynamics and Kinetics: Isoptope Effects, Substituent Effects, Hammett Plots and Linear Free Energy Relationships, Other Linear Free Energy Relationship, Acid-Base Related Effects, Experiments for Studying Mechanism.

UNIT-V
(vii) Application of physical methods: Deciphering mechanisms of electrophilic and nucleophilic substitution/additions, eliminations, cyclizations, radical reactions and reactions involving reactive intermediates.

Suggested texts and References:
(1) E. V. Anslyn and D. A. Dougherty, Modern Organic Chemistry, University Science, 2005.
(2) I. Fleming, Molecular Orbitals and Organic Chemical Reactions, John Wiley, 2009.
(3) J. Clayden, S. Warren, N. Greeves, P. Wothers, Organic Chemistry, 1st Edition, Oxford University Press, 2000
(4) F. J. Carey and R. J. Sundburg, Advanced Organic Chemistry, Part A and Part B, 5th Ed., Springer, 2007
(5) J. March, Advanced Organic Chemistry, 3rd edition, McGraw Hill, 1991.
(6) S. H. Pine, Organic Chemistry, 5th edition, McGraw Hill, 1987.

SEMESTER –VIII

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
C801	Chemistry of Materials	[3 + 1]	4
C802	Macro and Supra-molecular chemistry	[3+ 1]	4
C803	Reaction Dynamics	[3 + 1]	4
C804	Computational Chemistry	[3 + 1]	4
		Lab contact hrs	**Credits**
CL801	Advanced Chemistry Laboratory-II	[10]	5
CPr801	Project	-	4

25

(200 of 240 credits)

C801: Chemistry of Materials (45 + 15 = 60 hrs.)

UNIT-I
Basic Aspects of the Solid State

(i) **S**olid State Structure: Primitive lattice vectors - reciprocal lattice - crystal systems and desymmetrization schemes. Bravais lattices; closed packed structures, octahedral and tetrahedral holes, crystallographic point groups and space groups - organic and in organic crystal structure motifs - polytypes and polymorphs. pervskites and related structures, normal and inverse spinels.

(ii) Defects and Non-stoichiometry: Intrinsic and extrinsic defects - point, line and plane defects; vacancies, Schottky defects, Frenkal defects - Charge compensation in defective solids - non-stoichiometry, thermodynamic aspects and structural aspects.

UNIT-II

(iii) Thermal Properties: Free electron theory, electrical conductivity, Hall effect - band theory, band gap, metals and semiconductors - intrinsic and extrinsic semiconductors, hopping semiconductors - semi-conductor/metal transition - p-n junctions - superconduction, Meissner effects, type I and II superconductors, isotope effect, basic concepts of BCS theory, manifestations of the energy gap, Josephson devices.

(iv) Ionic Conductors: Types of ionic conductors - Mechanism of ionic conduction; interstitial jumps (Frenkel), vacancy mechanism, diffusion - superionic conductors, phase transitions and mechanism of conduction in superionic conductors - examples and applications of ionic conductors.

UNIT-III

(v) High Tc Materials: Defect pervskites - high Tc superconductivity in cuprates – preparation and characterization of 1-2-3 and 2-1-4 materials - normal state properties, anisotropy, temperature dependence of electrical resistance, optical phonon modes – superconducting state, heat capacity, coherence length, elastic constants, positron lifetimes, microwave absorption - pairing and multigap structure in high Tc materials - applications of high Tc materials.

(vi) Magnetic Properties: Classification of magnetic materials - Langevin diamagnetism - Quantum theory of paramagnetism - cooperative phenomena - magnetic domains and hysteresis - magnetism and dimensionality.

(vii) Optical Properties: Optical reflectance - excitons - Raman scattering in crystals - photoconduction - color centers - lasers - photovoltaic effect.

UNIT-IV

(viii) Synthesis of Materials: Phase diagrams - preparation of pure materials, mass transport, nucleation and crystal growth - preparative techniques, zone refining, chemical transport, etc.

(ix) Multiphase materials: Ferrous alloys, Fe-C phase transformations in ferrous alloys, stainless steels - non-ferrous alloys - properties of ferrous and non-ferrous alloys and their applications.

(x) Nanocrystalline phase - preparation procedures – special properties - applications

(xi) Thin Films, Langmuir-Blodgett Films: Preparation techniques, evaporation/sputtering, chemical processes, MOCVD, sol-gel etc. - LB film growth techniques - photolithography - properties and applications of thin films, LB films.

UNIT-V

(xii) Liquids Crystals: Mesmorphic behavior - thermotropic and lyotropic phases – description of ordering in liquid crystals, the director field and order parameters - nematic and semectic

mesophases, smectic -nematic transition and clearing temperature - homeotropic, planar and twisted nematics - chiral nematics - smectic A and smectic C phases - cholesteric-nematic transition - optical properties of liquid crystals - effect of external field.

(xiii) Materials for Solid State Devices: Rectifiers, transistors, capacitors - IV-V compounds - low-dimensional quantum structures, optical properties.

(xiv) Organic Solids, Fullerenes, Molecular Devices: Conducting organics – organic superconductors - magnetism in organic materials.

(xv) Fullerenes - doped fullerenes as superconductors

(xvi) Nonlinear Optical Materials: Nonlinear optical effects, second and third order – molecular hyperpolarisability and second order electric susceptibility - materials for second and third harmonic generation.

Suggested texts and References:
(1) H.V. Keer, Principles of the Solid State, Wiley Eastern (1993).
(2) N.W. Ashcroft, N.W. Mermin, Solid State Physics, Saunders College, Philadelphia (1976).
(3) W.D. Callister, Material Science and Engineering. An Introduction, Wiley, New York (1985).
(4) Charles Kittle, Introduction to solid state physics, John Wiley & Sons, New York (1968). Anthony R.West, Solid State Chemistry and its Applications, John Wiley & Sons, New York (2005).
(5) Lesley E. Smart, Elaine A. Moore, Solid State Chemistry (3rd Ed), Taylor & Francis (2005).
(6) N.N. Greenwood, Ionic crystals, lattice defects and non-stoichiometry,

C 802: Macro and Supramolecular Chemistry   **(45 + 15 = 60 hrs.)**

UNIT-I
A. Polymer Chemistry
(i) Polymerization reactions, mechanism and kinetics – cationic, anionic and radical polymerization. Template, emulsion and electrochemical polymerization, Condensation, ring opening, step growth and radiation polymerization reactions. Coordination complex polymerization, Naturally occurring polymers, Biological polymers, inorganic polymers. Polymerization of cyclic organic compounds. Copolymerization and multicomponent polymerization,
(ii) Thermodynamics and kinetics. Polymerization and depolymerization equilibria - Kinetics of condensation (Step-Growth), Free radical and ionic polymerizations.

UNIT-II
(iii) Physical Characterization: Fabrication and Testing, Relationship between structure and properties - Thermal, flame and chemical resistance - Additives - Electroactive polymers - Biomedical applications. Molecular wieght (Mn, Mw) determination - Morphology -Glass transitions and crystallinity - Conformational analysis. Dynamics of dilute polymer solutions and effect of increasing concentration, NMR and neutron scattering studies.
(iv) Reactions and degradation of polymers, biodegradable polymers. Thermal and oxidative degradation, catalysis by macromolecules, computer applications.

UNIT-III

Supramolecular Chemistry

(i) Introduction to Supramolecular Chemistry.

(ii) Molecular and Chiral Recognition - Self-Organization, Self-Assembly and Preorganization, molecular and chiral recognition, self-Assembly and self-organization, role of preorganization in the synthesis of topological molecules, template reactions, one-pot' reactions.

(iii) Covalent self-assembly based on preorganization - inclusion complexes, host-guest chemistry, early development of host-guest chemistry. pedersen's works onc crown ethers, nomenclature, the structure of inclusion complexes, dynamic character of inclusion complexes, the complexes involving induced fit and without it, endo-hedral fullerene, hemicarcerand and soft rebek's tennis ball-like hosts.

(iv) Mesoscopic Structures as an Intermediate Stage Between Molecules (Micro Scale) on the One Hand and Biological Cells (Macro Scale) on the Other – introduction, medium sized molecular aggregates.

UNIT-IV

(v) Between Classical Organic Chemistry and Biology Understanding and Mimicking Nature- Introduction, the role of self-organization and self-association in the living nature, modeling processes in living organisms.

(vi) On the Border Between Chemistry and Technology - Nanotechnology and Other Industrial Applications of Supramolecular Systems – introduction, between chemistry and solid state physics - crystal engineering, obtaining crystals with desired properties, nanotechnology and other industrial applications of supramolecular systems, supramolecular catalysis.

(vii) The Most Interesting Macrocyclic Ligands which Are Hosts for Inclusion Complexes- . Crown ethers and coronands, cryptates and cryptands, calixarenes, hemispherands, and spherands, carcerands, hemicarcerands and novel `molecular flasks' enabling preparation and stabilization of short-lived species, cyclodextrins, and their Complexes, endohedral fullerene complexes, nanotubes and other fullerene-based supramolecular systems, dendrimers, cyclophanes and steroids forming inclusion complexes, anion binding receptors and receptors with multiple binding Sites.

UNIT-V

(viii) Other Exciting Supramolecular Systems- Making Use of the preorganization phenomenon, topological molecules, multiple hydrogen-bonded Ssstems, organic zeolite, metal directed self-assembly of comple, supramolecular architecture, chains, racks, ladders, grids, macrocycles, cages, nanotubes and self-Intertwining strans (helicates).

(ix) The Prospects of Future Development of Supramolecular Chemistry.

Suggested texts and References:

1. H.R. Allcock, F.W. Lampe and James Mark, Contemporary Polymer Chemistry, Prentice Hall, Inc. (1990).
2. M.P. Stevens, Polymer Chemistry: An Introduction (2nd Edition) Oxford University Press 91990).
3. F.W. Billmeyer, Jr., Textbook of Polymer Science (3rd Edition) Wiley-Inter Science (1984) paperback.
4. A. Ravve, Principles of Polymer Chemistry.
5. Recommended Review Articles in the field of supramolecular chemistry.

6. "Supramolecular Chemistry" by F. Vogtle, John Wiley, 1991.
7. "Crystal Engineering. The Design of Organic Solids" by G.R. Desiraju, Elsevier, 1989.
8. Introduction to Supramolecular Chemistry, Dodzuick Helena.

C 803: Reaction dynamics   (45 + 15 = 60 hrs.)

UNIT-I
Chain reactions: general treatment, activation energy, chain length, chain transfer reactions, inhibition, bond dissociation energies, branching chain reactions.

UNIT-II
The collision theory: Dynamics of bimolecular collisions and rate and rate constant of bimolecular reaction, factors determining effectiveness of collisions, Termolecular reactions, unimolecular reactions. Relation between cross section and rate coefficients.

UNIT-III
Potential Energy Surfaces:: Long range, empirical intermolecular and molecular binding potentials, Internal coordinates and normal modes of vibration, Potential energy surfaces, ab-initio calculation of potential energy surface, experimental determination of potential energy surfaces.

UNIT-IV
Details of the reaction path, potential energy surface for electronically excited molecule. Molecular beam scattering, State resolved spectroscopic technique, molecular dynamics of $H_2 + H$ reaction, state-to-state kinetics of $F + H_2$ reaction.

UNIT-V
(iv) *Transition State Theory (TST):* Motion on the potential energy surface, Basic postulates and derivation of TST, dynamical derivation of TST, Quantum mechanical effects on TST, Thermodynamic formulation of TST, Application of TST, Micro-cannonical TST, Variational TST, Experimental observation of TST.

Suggested texts and References:
(**1**) J.I. Steinfeld, J.S. Francisco and W.L. Hase, Chemical Kinetics and Dynamics, Prentice Hall 1989.
(**2**) Paul L. Houston, Chemical Kinetics and reaction dynamics.
(**3**) R.D.Levine and R.B.Bernstein, Molecular Reaction Dynamics and Chemical Reactivity, Oxford University Press, 1987.
(**4**) Sanjay K. Upadhay, Chemical kinetics and Reaction Dynamics, Springer, 2006

C 804 Computational chemistry   (45 + 15 = 60 hrs.)

A brief outline of molecular mechanics, semi-empirical approximations, ab initio methods, basis sets and Z-matrix; Application of these computational methods for prediction of structural and electronic properties of molecules by using standard programs; FMOs in organic chemistry, crystal and ligand field calculations, computation of potential energy surfaces. Conformational

analysis by molecular mechanics; Dynamical and structural studies of molecules using molecular dynamics simulations; Monte Carlo simulations of molecules.

Suggested texts and References:
(**1**) C. J. Cramer, Essentials of Computational Chemistry: Theories and Models, John Wiley & Sons, 2002.
(**2**) David Young, Computational Chemistry: A practical Guide for applying Techniques to Real World Problems, Wiley Interscience, 2001.
(**3**) A.R. Leach, Molecular Modelling: Principles and Applications, Pearson Education, 2001.
(**4**) J. B. Foresman, A. Frisch, Exploring Chemistry with Electronic Structure Methods. Gaussian Inc., 1996.
(**5**) M.P. Allen and D.J. Tildesley, Computer Simulations of Liquids, Oxford, 1987.

FIFTH YEAR
SEMESTER –IX

Subject Code	Subject	Contact Hours / Week	Credits
CPr901	Project	-	24

24
(224 of 240 Credits)

SEMESTER –X

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
CE1001	Elective I	[3 + 1]	4
CE1002	Elective II	[3+ 1]	4
CE1003	Elective III	[3 + 1]	4
CE1004	Elective IV	[3 + 1]	4

16
(240 of 240 credits)

(P: Physics, M: Mathematics, C: Chemistry, B: Biology, G: General, E: Elective, Pr: Project)

Elective subjects on Physical Chemistry:

Theoretical Organic Chemistry
Structure and Heats of Formation: Classical mechanical approach - Additivity schemes - Relationship between structure and strain - -electrons within the classical modelπConformational energies - Introduction of - Inter and intramolecular forces. Quantum mechanical approaches - Applications of semi-empirical and ab intio electronic structure methods - Analysis of computatioinal results - Computer experiments. Reactivity: Substituent effects in reactions - Predictions from theory - Steric and electronic effects - Transition states - A curve crossing model for organic reactions. Structure - Activity correlations. Computer Assisted Organic Synthesis.

Suggested Reading:
1. U. Burkert and N.L. Allinger, Molecular Mechanics, ACS Monograph 177, American Chemical Society, Washington DC, 1982.
2. L. Salem and W.L. Jorgensen, Organic Chemists- Book of Orbitals, Academic Press, 1973.
3. T.H. Lowry and K.C. Richardson, Mechanism and Theory in Organic Chemistry, 3rd Editiion, Harper and Row, New York, 1987.

Statistical Mechanics

Ensembles and Averages, equivalence of Ensembles, classical Limit. Monte Carlo and Molecular Dyamics simulations. Distribution functions at equilibrium. Integral equation methods. Perturbation theory. Density functional methods. Molecular fluids. Estimation of thermodynamic functions. Non-equilibrium methods. Linear response theory. Projection operator method. Stochastic processes and Brownian motion. Selected applications to problems in chemical dynamics, relaxation processes and neutron diffraction.

Texts/References
M.P.Allen and D.J.Tildesley, Computer Simulation in Liquids, Oxford University Press, 1987.
J.P.Hansen and I.R.McDonald, Second Ed., Theory of Liquids, Academic Press,1986.
D.Chandler, Statistical Mechanics, Oxford University Press,1985.
H.L.Friedman, A Course in Statistical Mechanics, Prentice Hall,1983.
L. D. Landau, E. M. Lifshitz and L.P. Pitaevskii, Statistical Physics Parts I and II, Pergamon Press, 1980

Chemical Applications of Group Theory.
1. The Great Orthogonality Theorem Explained.
2. Projections Operators and SALC's (Symmetry Adapted Linear Combinations).
3. Symmetry of Metal-Ligand o-Bonding in simple M(Xnn (n = 1-9) Species.
Rarity of the Symmetrical Cube as a Coordination Environment.
4. Infinite Groups -- Their treatment by Expansion of a Finite Group.
5. Molecular Vibrations Revisited. Force Constants and F and G Matrices.
6. Crystallographic Symmetry. Translational symmetry, screw axes, glide planes and the 230 Space Groups.

Environmental Chemistry

Biocycles: C, O2, N2, P, S, CO2, etc. Cycles, biodistribution of the elements, chemical - sepration-.Pollution and its Control a. Atmospheric pollution: gaseous air pollution, greenhouse effect and ozone shield, acid-rain particulate air pollutiion, radiation hazard. b. Aquatic pollution: agricultural and pesticidal inorganic and organic pollutants, marine pollution, oil spills and oil pollutiion. c. Industrial pollution: Thermal power, cement, fertilizer, sugar, distillery, drug, paper and pulp and nuclear industry pollution, mining and metallurgy, polymers, etc.

Environmental Analytical Chemistry
Techniques and quantification of pollutants, trace element and radionuclide analysis.
Environmental Toxicology and Detoxification Mechanism Chemical solutions to environmental problems, better biodegradability, kinetics of decomposition, clean technology, etc.

Suggested Reading
1. Handbook of Environmental Chemistry (Ed. O. Hutzinger) Springer-Verlag, Vol.1-3.
2. Environmental Inorganic Chemistry (Ed. J. Irgolic and A.E. Martell), VCH Publishers. 3. The importance of Chemical -speciation- in Environmental Processes (Ed. M.
Bernhard, F.E. Brinckman and P.J. Sadler) Springer-Verlag.
4. Environmental Chemistry, Vol. 1 and 2, Specialist Periodical Report, The Chemical Society (London).
5. Environmental Instrumentation (L.J. Fristschen and L.W. Gay) Springer-Verlag.
6. Comprehensive Analytical Chemistry (Ed. G. Svehla) Elsevier, Vol. I_XXVIII

Radioisotopes – Production and applications.
Production of Radioisotope, Basic principles of radioisotope production using nuclear reactors and charged particle accelerators. Szilard-Chalmers effect and its utility in radioisotope production. Concept of radionuclide generators; Growth and decay of activity in a generator; Different types of 99Mo-99mTc generators; Few other important generator systems such as 90Sr-90Y, 188W-188Re etc. Methods of production of some important radioisotopes (such as 32/33P, 41Ar, 60Co, 79Kr, 82Br, 90Sr-90Y, 99Mo-99mTc, 125I, 131I, 137Cs, 153Sm, 166Ho, 177Lu, 186/188Re, 192Ir, and 11C, 13N, 15O, 18F, 67Ga, 123/124I, 201Tl etc.). Calculations of production yields; Bateman's equation and its utility in production yield calculations. Applications of Radioisotopes in Medicine Concept of nuclear medicine and radiopharmaceuticals, Classification of radiopharmaceuticals, Characteristics of diagnostic (SPECT and PET) and therapeutic radiopharmaceuticals. Basis of designing radiopharmaceuticals, Methods of radiolabeling, New approaches in radiopharmaceuticals chemistry. Some important organ-specific diagnostic radiopharmaceuticals (myocardial imaging, brain imaging, renal imaging, tumor and inflammation imaging, receptor-specific imaging agents etc.). PET radiopharmaceuticals – Principle an applications. Therapeutic radiopharmaceuticals for some specific applications (bone pain palliation, radiation synovectomy, targeted radiotherapy etc.) Concepts of brachytherapy and teletherapy Quality control of radiopharmaceuticals. Basic principles of Radiometric assays for in-vitro estimation of hormones, tumour associated antigens etc. Industrial applications of radiation technology Fundamental aspects of radiation technology, Ionizing radiation: Sources and Effects,

Comparison of different radiation sources for different applications. Radiation dosimetry, Radiation polymerization, Radiation effects on Polymers, Radiation Modification of polymers for industrial applications, Radiation sterilization of Medical products Radiation processing of food, Radiation hygienization of sewage sludge, Radiation processing of flue gases, Application of radioisotopes as tracers in process optimization and trouble shooting in industries.

Isotope tracer applications in hydrology:
Environmental isotopes and artificial radioisotopes in hydrology. Application of environmental isotopes in studying ground water salinity, pollution, recharge etc.; Artificial radioisotopes in studying dam seepage, effluent dispersion, sediment transport etc.

Reference Books:
1. Manual for Reactor Produced Isotopes. IAEA-TECDOC-1340, IAEA, 1999.
2. Fundamentals of Radiochemistry. D.D. Sood, A.V.R. Reddy, N.Ramamoorthy. 3rd Edition, Indian Association of Nuclear Chemists and Allied Scientists, 2004.
3. Radiopharmaceuticals : Chemistry and Pharmacology Adrian D. Nunn. Marcel Dekker, 1992.
4. Fundamentals of Nuclear Pharmacy. G.B. Saha. 2nd Edition, Springer-Verlag, 1984.
5. Radionuclides in Therapy. R.P. Spencer, R.H. Sievers, A.M. Friedman. CRC Press, Boca Raton, 1987.
6. PET in Oncology : Basics and Clinical Applications, J. Ruhlmann, P. Oehr, H.J. Biersack. Springer-Verlag, 1998.

Advanced techniques in NMR spectroscopy

Nuclear magnetic resonance (NMR) phenomenon and the experimental aspects, Chemical shift, indirect spin-spin coupling, direct spin-spin coupling, Relaxation times, nuclear Overhauser effect, polarization transfer, Two-dimensional NMR, correlation spectroscopy (COSY), Nuclear Overhauser effect spectroscopy (NOESY). Hetero-nuclear correlation spectroscopy (HETCOR), Inverse experiments, hetero- nuclear multiple quantum spectroscopy (HMQC), NMR in higher dimensions, NMR of oriented molecules, Structure and dynamics of bio-molecules, NMR in the solid state, Magnetic resonance imaging.

Suggested Reading
1. Modern NMR Techniques for Chemistry Research, Ed. Andrew E. Derome.
2. Introduction to Mass Spectrometry, Ed. S.K. Aggarwal and H.C. Jain.

Advanced Topics in Inorganic Chemistry
Electron transfer properties of metal complexes. Molecular recognition. Asymmetric catalysis. Phosphorus compounds as ligands. Cluster chemistry. Bio-inorganic reaction mechanisms. Basic aspects of single crystal diffraction. Molecular metals. Inorganic rings. Transition metal chemistry of macrocycles. Metal ions in medicine. Fluxional molecules.

Text/References
1.W.L.Jolly, Modern Inorganic Chemistry, McGraw, Hill Co., 1984.
2.R.W. Hay, Bioinorganic Chemistry, Wiley, 1984.

3. M.Day and J.Selbin, Theoretical Inorganic Chemistry, Von. Nostrand, 2nd Ed. 1980.
4. H.J.Emeleus and J.J. Anderson, Modern Aspects of Inorganic Chemistry, Von. Nostrand, 1962.
5. J.E.Huheey, Inorganic Chemistry, 4th Ed., Harper Collins College Publisher, 1993.
6. G.H.Stout and L.H.Jensen, X-ray Structure Determination : A Practical guide, 2nd Ed., John Wiley, 1989.

Nano- Materials and Soft Condensed Matters

Nano-materials

Introduction: Definition of nano-materials, Difference between bulk and Nano-Materials, Quantum size effect, Evolution of electronic Structure from atoms, clusters, nano-materials to bulk solids, Calculation of surface to volume ratio for different structural arrangements, Different Class of Nano-Materials : Metal nano-particles, nano-crystals, Clusters and cluster assembled materials (example of C60 solid), Semiconductor nanoparticles, Quantum Well/ wire/Dot Core-Shell nanoparticles Polymers, Organic-inorganic nanocomposite, Nano-structured multilayers Self-Assembly, Bio-Materials (poly-peptide), Nanotubes, nanowires, Nano-rods, Synthesis: Chemical precipitation, Sol-Gel method, Ball milling, Physical vapor deposition,Thermal decomposition, Solid state precipitation, Co-sputtering, Silver ion exchange, Ion-implantation, Methods for obtaining monodisperse particles

Properties: Electronic Properties : (IP, EA, Reactivity, Electronic Structure, DOS etc. Optical Properties : Electron and hole confinement in Semiconductor quantum dots, Band-gap engineering, Optical absorption and photoluminescence, efficiency of optical process, application of nano-particles in non-linear optical devices, Magnetic Property, High density data storage.Thermo-Mechanical Properties. Applications: Nano-Catalysis : Electro catalysis, Fuel Cell Materials Bio-medical application, Electronic device application, Molecular Electronics, Spintronics, data storage etc. Carbon based Nano-Materials: Carbon Clusters, Fullerence, nano-tubes : Synthesize, Properties and applications.

Soft Condensed Matters:

2.1 Introduction to Soft Matter : Forces, energies, length and time scales in soft matter. Soft matter systems (colloids, surfactants and polymers). Interactions in soft matter (electrostatic, vander Walls, hydrophilic and hydrophobic interactions, depletion interaction). Soft matter in nature (proteins, polysaccharides, membrances).

2.2 Experimental techniques to investigate structure and dynamics in soft matter : Scattering techniques (Small-angle X-ray scattering (SAXS), Ultra-small-angle-X-ray scattering (USAXS), Small-angle (SANS) and inelastic neutron scattering, Static and Dynamic light scattering (SLS & DLS), NMR, Optical microscopy, digital video microscopy, confocal laser scanning microscopy, Atomic Force Microscopy (AFM), Electron microscopy (TEM &SEM). Optical Tweezers [2 lectures].

2.3 Computer simulations : Molecular dynamics (MD), Monte Carlo (MC), Calculation of pair-correlation function, structure factor.

2.4 Colloids : Sterically stabilized and Charge stabilized colloids, Colloidal interactions, Synthesis of monodisperse colloidal particles, characterization, Structural ordering, Dynamics, Phase Transitions and applications of colloids.

2.5 Surfactants: Classification, Micellization and critical micelle concentration. Surface tension. Gibbs adsorption equation and surface excess. Phase bahavior of surfactants. Cloud point and Kraft temperature. Liquid crystalline phases in surfactants and block copolymers. Langmuir-Blodgett films, Monolayer, Bilayers and Vesicles.

2.6 Polymer Solutions and Polyelectrolytes : A single ideal chain, mean-squared end to-end distance, radius of gyration. Gaussian chain, Freely jointed chain. Worm-like chain and persistence length. Excluded volume, solvent quality and theta-temperature. Size of a polymer in dilute solutions : osmotic pressure, light scattering and intrinsic viscosity, Polyelectrolytes : Debye-Huckle theory, Donnan equilibrium and manning condensation. Dynamics of polymeric liquids: Maxwell model. Scaling laws based on Rouse theory, Zimm theory and reptation theory. Polymer Gels: Classes of gels and theory of gelation.

Reference Books:
1. Nanoparticles and Nanostructured Films: Preparation, Characterization, and Applications, Ed. J.H. Fendler, (Willey-VCH, New York, 1998)
2. Fundamental properties of Nanostructured Materials, Eds. D. Fiorani (World Scientific, Singapore, 1994)
3. Advanced Catalysts and Nanostructured Materials: Modern Synthetic Mthods, Ed. W.R. Moser (Academic, San Diago, 1996)

Advanced Coordination Chemistry

A. Advanced Coordination Chemistry   **25 hrs.**

Chemistry of Sigma donor and pi-acceptor complexes. Ligand field and molecular orbital theories. Term diagrams in octahedral, tetrahedral and lower symmetries. Electronic dipole selection rules, band intensities, factors influencing band widths. Dichroism studies. Charge transfer spectra. Calculation of ligand field parameters. Magnetic properties of coordination compounds, basic equations of magnetic susceptibility, diamagnetism, paramagnetism, ferromagnetism and antiferromagnetism, temperature independent. paramagnetism and electron delocalisation, effect of zero field splitting. ESR and NMR studies of paramagnetic complexes.

Text/References
1. R.S.Drago, Physical Methods for Chemists, W.B. Saunders Co., 1992.
2. B.N.Figgis, Introduction to Ligand Fields, Wiley Eastern, 1976.
3. A.B.P. Lever, Inorganic Electronic Spectroscopy, Elesevier, 1968.

Molecular Bio-Organic Chemistry

1.New paradigm in synthesis: Rational synthetic design, convergent and divergent strategies, multi-component and Domino reactions, atom economy, high-throughput synthesis, substrate and reagent-controlled asymmetric synthesis.
2.New paradigm in synthetic approaches: Green strategies, biocatalysis and solvent engineering, microwave and soon-chemistry, non-conventional reaction media (room temperature ionic liquids, super critical fluids, florous phase, super-heated steam), template-driven synthesis.

3.New paradigm in functional targets : Design and synthesis of functional molecules/molecular assemblies, non-covalent interactions, electro-magnetic & photoactive organics, organic-inorganic hybrids, organic memory systems for medicinal and separation sciences.

Reference Books

1. Zhu, J. and Bienayme, H.(Eds.) Multi component Reactions. Wiley-VCH Verlag GmbH & Co. 2005.
2. Jung, G. Combinatorial Chemistry: Synthesis, Analysis, Screening, Wiley, 1999.
3. Bannworth, W. and Felder, E. Combinatorial Chemistry: A Practical Approach. Wiley, 2000.
4. Stephenson, G.R. Advanced Asymmetric Synthesis. Chapman & Hall, 1996.

■

Center for Basic Sciences (CBS)

SCHEME OF EXAMINATION
&
COURSE STRUCTURE

Of

SEMESTER IX and X

M.Sc. Integrated (Chemistry Stream)

UNDER

FACULTY OF SCIENCE

EFFECTIVE FROM JANUARY 2020

Center of Basic Science
Pt. Ravishankar Shukla University
Raipur (C.G.) 492010
PH: - 0771-2262864
WEBSITE: -www.prsu.ac.in

Approved by Board of Studies in Chemistry
Pt. Ravishankar Shukla University, Raipur (C.G.)

CENTER FOR BASIC SCIENCES
Pt. Ravishankar Shukla University, Raipur

## 5-Year Integrated M.Sc. Chemistry
Under the
Faculty of Sciences

SEMESTER-X (CHEMISTRY STREAM)

SEMESTER –X

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
CE1001	Elective I	[3 + 2]	5
CE1002	Elective II	[3 + 2]	5
CE1003	Elective III	[3 + 2]	5
CE1004	Elective IV	[3 + 2]	5
		Total	20

Note- Any four papers out of the available seven papers (mentioned in the syllabus) shall be in operation on availability of the instructors with more than 50% of students opting for them.
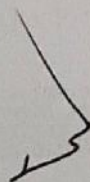
CE1- Environmental Chemistry

Unit-I

Scope: Environmental pollution, structure of atmosphere, biogeological cycles – oxygen, nitrogen, carbon, phosphorous, sulphur ; biodistribution of elements, air pollutions - reactions in atmosphere, primary pollutants, air quality standards, analysis of CO, nitrogen oxides, sulphur oxides, hydrocarbons and particulate matter, particulate pollution - control methods, vechicular pollution, green house effect and global warming, climatic changes, ozone, photochemical smog, acid rain, sampling, monitoring & control.

Unit-II

Hydrosphere: Water pollution, hydrological cycle, chemical composition, sea water composition, water quality criteria for domestic and industrial uses, BIS and WHO standards, ground water pollution, surface water pollution - lake and river water, eutrophication, marine pollution, water pollutants - biodgradeability of detergents – pestisides - endosulfan and related case studies.

Unit-III

Classification of industrial waste waters: Principles of water and waste water treatment - aerobic and anaerobic treatment, industrial waste water treatment, heavy metal pollution, hard water - softening - purification of water for drinking purposes, water treatment for industrial use, electrodialysis, reverse osmosis, other purification methods, chemical speciation of elements.

Unit-IV

Water analysis: Color, odor, conductivity, TDS, pH, acidity, alkalinity, chloride, residual chlorine, hardness, trace metal analysis, elemental analysis, ammonia, nitrite, nitrate, fluoride, sulphide, phosphate, phenols, surfactants, BOD, COD, DO, TOC, nondispersive IR spectroscopy, anode stripping, ICP, AES, Chromatography, ion selective electrodes, neutron activation analysis.

Unit-V

Soil pollution: Soil humus, soil fertility, inorganic and organic components in soil, acid, base and ion exchange reactions in soils, micro and macro nutrients, wastes and pollutants in soil, introduction to geochemistry, solid waste management, treatment and recycling soil analysis, radioactive pollution, disposal of radioactive waste.

References:

1. H. Kaur, Environmental Chemistry, 6th Edn, Pragathi Prakashan, Meerut, 2011.
2. K.H.Mancy and W,.J.Weber Jr. Wiley, Analysis of Industrial Waste Water, Interescience New York, 1971.
3. L.W. Moore and E. A. Moore, Environmental Chemistry, McGraw Hill Publication, New York, 2002.
4. S. M. Khopkar, Environmental Pollution Analysis, New Age International (P) Ltd, 1993.
5. Colid Baird. Environmental Chemistry, W. H. Freemand and Company, 1995.

⑥

CE2- Inorganic Rings, Cages and Clusters

Unit-I

Main group clusters: Geometric and electronic structure, three - four and higher connect clusters, the closo-, nido-, arachno- borane structural paradigm, Wade-Mingos and Jemmis electron counting rules, clusters with nuclearity 4-12 and beyond 12. Structure, synthesis and reactivity.

Unit-II

Transition metal clusters: Low nuclearity metal carbonyl clusters and $14n+2$ rule, high nuclearity metal carbonyl clusters with internal atoms, structure, synthesis and reactivity - capping rules.

Unit-III

Isobal analogy: Heteronuclear clusters - carboranes and heteroboranes, metal clusters - structural prediction of organometallic clusters, main group transition metal clusters: Isolobal analogs of p-block and d-block clusters - interstitial systems - cubanes and zintl clusters.

Unit-IV

Inorganic homo- & heterocycles: Synthesis, structure and reactivity - structural variety & properties of borazins and phosphazenes, borides, carbides, silicides, nitrides, phosphides, oxides and sulphides of transition elements, multiple bonds and cluster variety of transition metals.

Unit-V

Inorganic rings and polymers: Definition, variety and merits, P, Si, S, N, & O based polymers, poly-phosphazenes, poly-thiazenes, poly-siloxanes and poly-silanes.

References:
1. D. M. P. Mingos and D. J. Wales, Introduction to Cluster Chemistry, Prentice Hall, 1990.
2. N. N. Greenwood and E. A. Earnshaw, Chemistry of Elements, Pergaman Press, 1984.
3. I. Haiduc & D. B. Sowerby (Eds.), Inorganic Homo-and Heterocycles Vols. 1 & 2, Academic Press, 1987. 4. J. E. Mark, R. West & H. R. Allcock, Inorganic Polymers, Academic Press, 1992.
5. T. P. Fehlner, J. F. Halet and J-Y. Saillard, Molecular Clusters: A Bridge to Solid-State Chemistry, Cambridge University Press, 2007.
6. P. Braunstein, L. A. Oro, P. R. Raithby, Ed. Metal Clusters in Chemistry, John Wiley and sons, 1999.
7. T. Chivers, I. Manners, Inorganic Rings and Polymers of the p-Block Elements, from Fundamentals to Applications, RSC Publishing, 2009.

CE3- Medicinal Chemistry

Unit-I

Introduction: History of medicinal chemistry, general mechanism of drug action on lipids, carbohydrates, proteins and nucleic acids, drug metabolism and inactivation, receptor structure and sites, drug discovery development, design and delivery systems, gene therapy and drug resistance.

Unit-II

Classification: Drugs based on structure or pharmacological basis with examples, synthesis of important drugs such as α - methyl dopa, chloramphenicol griseofulvin, cephelosphorins and nystatin. Molecular modeling, conformational analysis, qualitative and quantitative structure activity relationships.

Unit-III

General introduction to antibiotics: Mechanism of action of lactam antibiotics and non lactam anti biotics, antiviral agents, chemistry, stereochemistry, biosynthesis and degradation of penicillins - An account of semisynthetic penicillins, acid resistant, penicillinase resistant and broad spectrum semisynthetic penicillins.

Unit-IV

Elucidation of enzyme structure: Mechanism, kinetic, spectroscopic, isotopic and stereochemical studies. Chemical models and mimics for enzymes, design, synthesis and evaluation of enzyme inhibitors.

Unit-V

Interactions: DNA-protein interaction and DNA-drug interaction. Introduction to rational approach to drug design, physical and chemical factors associated with biological activities, mechanism of drug action.

Recommended books:

1. I. Wilson, Giswald and F. Doerge, Text Book of Organic Medicinal and Pharmaceutical Chemistry, J.B. Lippincott Company, Philadelphia, 1971.
2. A. Burger, Medicinal Chemistry, Wiley Interscience, New York, Vol. I and II, 1970.
3. Bentley and Driver's Text Book of Pharmaceutical Chemistry revised by L.M. Artherden, Oxford University Press, London, 1977.
4. A. Gringauz, Introduction to Medicinal Chemistry, How Drugs Act and Why?, John Wiley and Sons, 1997.
5. G. L. Patrick, Introduction to Medicinal Chemistry, Oxford Univeristy Press, 2001.

CE4- Nanochemistry and Nanoscience

Unit-I

Introduction to nanoscience and nanotechnology: Underlying physical principles of nanotechnology, Nanostructured Materials, Size is Everything: Fundamental physicochemical principles, size dependence of the properties of nanostructured matter, quantum confinement, single electron charging, the central importance of nanoscale morphology, Societal aspects of nanotechnology: Health, environment, hype and reality.

Unit-II

The advent of the nanomaterial: Top down and bottom up approaches to building materials, Properties of nanomaterials such as nanoparticles, carbon nanotubes, Overview of selfassembly, Inert gas condensation, arc discharge, RF plasma, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, ball milling, molecular beam epitaxy, chemical vapour deposition method and electro deposition.

Unit-III

The basic tools of nanotechnology: Scanning electron microscopy (SEM), TEM and EDAX analysis and X-ray diffraction, A brief historical overview of atomic force microscopy (AFM) and an introduction to its basic principles & applications, Optical microscope and their description, operational principle and application for analysis of nanomaterials, UV-VIS-IR spectrophotometers, Principle of operation and application for band gap measurement.

Unit-IV

Metal nanoparticles: Size control of metal nanoparticles and their characterization, study of their properties, optical, electronic, magnetic. Surface plasmon band and its applications, role in catalysis, alloy nanoparticles, stabilization in sol, glass, and other media, change of band gap, blue shift, colour change in sol, glass, and composites, plasmon resonance.

Unit-V

Carbon nano structures: Introduction, Fullerenes, C60, C80 and C240 nanostructures, Properties & applications (mechanical, optical and electrical), Functionalization of carbon nanotubes, reactivity of carbon nanotubes, Nanosensors: Temperature sensors, smoke sensors, sensors for aerospace and defense. Accelerometer, pressure sensor, night vision system, nano tweezers, nano-cutting tools, integration of sensor with actuators and electronic circuitry biosensors.

Recommended books:

1. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill, New Delhi, 2007.

2. G. Cao, Nanostructures and Nanomaterials – Synthesis, Properties and Applications, Imperial College Press, London, 2004, chapters 3, 4 and 5.

3. C. N. R.Rao, A. Muller and A. K. Cheetham, The Chemistry of Nanomaterials, Volume 1, Wiley –VCH Verlag GmbH & Co. KgaA, Weinheim, 2004, Chapter 4

CE5- Surface Chemistry

Unit-I
Surface and Interface Chemistry: Classifications, micellization, CMC and its determination. Shape and structure of micelles, effect of additives on micellization, thermodynamics of micellization, solubilization and applications, effect of electrolytes on solubilization. Macro and micro emlusions, dispersion and aggregation of solids by surfactants.

Unit-II
Membranes and their applications: Artificial and natural membranes, Donnan membrane equilibrium, transport of electrolytes, membrane potential and ion selective electrodes.

Unit-III
Adsorption on solids and porous materials: Model for multilayer adsorption, BET isotherm and application to different types of adsorbents, adsorption by porous, non-porous and microporous solids, Estimation of specific surface area and pore size distribution.

Unit-IV
Colloid systems and their properties: Origin of the charges, electro-kinetic phenomena, electrophoresis, electroosmosis, sedimentation and streaming potential. The concept of electrical double layer and various models to explain its structure and properties, DLVO theory and stability of colloids. Smoluchowski theory of kinetics of coagulation and distribution of colloids aggregates. Organic and inorganic gels and clay colloids.

Unit-V
Methods to detect interfacial phenomena: Principle and instrumentation of ATR-FTIR spectroscopy, SFG Spectroscopy.

Recommended books:

1. Hunter, R.J., *"Foundation of colloid Science"*, Oxford University,Press,2009
2. Lyklema,J., *"Fundamentals of Interface and Colloid Science"*,Academic press San Diego,2000
3. Adamson, A.W., *"Physical Chemistry of Surface"*,5th Ed.,Jhon Wiley and Sons, NewYork, 1990
3. Kruyt, H.R., *"Colloid Chemistry"* Vol. ☐ and ☐. Elsevier Press,1991
4. Gerg, S.J. and Singh, K.S.W., *"Adsorption, Surface Area and Porosity"*, 2nd Ed., Academic Press.,U.K. 1982.

CE6- Heterocyclic Chemistry

Unit-I

Introduction to Heterocycles: Nomenclature (Hantzsch Widman System), spectral characteristics, reactivity and aromaticity of monocyclic, fused and bridged heterocycles.

Unit-II

Nonaromatic heterocycles: Different types of strains, interactions and conformational aspects on nonaromatic heterocycles. Synthesis, reactivity, and importance of the following ring systems. Azirines, Oxaranes, Thiiranes, Diazirenes, Diaziridines, Azetidines.

Unit-III

Five and six-membered heterocycles with two hetero atoms: Synthesis, reactivity, aromatic character and importance of the following heterocycles: Pyrazole, Imidazole, Oxazole, Thiazole, Pyrimidine, Pyrazine, Oxazine, and Thiazine.

Heterocycles with more than two hetero atoms: Synthesis, reactivity, aromatic character and importance of the following heterocycles: Triazoles, Oxadiazoles, Thiadiazoles, Triazines.

Unit-IV

Larger ring and other heterocycles: Synthesis and reactivity of Azepines, Oxepines and Thiepines. Synthesis and rearrangement of Diazepines. Synthesis of Benzoazepines, Benzodiazepines, Benzooxepines, Benzothiepines, Azocines, and Azonines.

Unit-V

Banzanellated azoles and dipolar structures: Banzanellated azoles: Synthesis and reactivity of Benzimidazoles, Benzoxazoles and Benzothiazoles. Heterocyles with Ring-Junction nitrogen: Synthesis and reactivity of Quinolizines, Indolizines and Imidazopyridines. Heterocycles with Dipolar structures: Betaines. Formation, aromaticity and reactivity of pyridine-N-oxides and pyridinium imides. Mesoionic heterocycles: Synthesis and aromaticity of sydnones and 1,3-dipolar addition reaction of mesoionic heterocycles.

Recommended books:

1. Heterocyclic Chemistry, T. L. Gilchrist.
2. An Introduction to the Chemistry of Heterocyclic compounds, R. M. Acheson.
3. Heterocylic chemistry, J. A. Joule & K. Mills.
4. Principals of Modern Heterocyclic Chemistry, A. Paquette.
5. Heterocyclic Chemistry, J. A. Joule & Smith.
6. Handbook of Heterocyclic Chemistry, A. R. Katritzky

CE7- Advanced Polymer Chemistry

Unit-I

Properties of commercial polymers Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers – Fire retarding polymers and electrically conducting polymers, Bio-medical polymers – contact lens, dental polymers, artificial heart, kidney, skin and blood cells

Unit-II

Polymer Additives: Role of additives in polymers, Fillers, plasticizers, anti-oxidants and stabilizers, Flame-retardants, colourants.

Unit-III

Natural polymers: Cellulose: Cellulose nitrate, cellulose acetate. viscose rayon, starch, silk, Rubber and modified rubber.

Unit-IV

Polymer supported reagents in organic chemistry: Preparation and application of polymer supported catalysts, acids, bases, phase transfer catalysts, transition metal complexes etc. Polymer supported reagents and polymer supported protecting groups including "Solid Phase" peptide synthesis.

Unit-V

Polymer Degradation and Stabilization: Types of degradation – Physical and chemical degradation.

Types of Physical degradation: a)Thermal degradation b) Photodegradation and stabilization c) Mechanical degradation.

Types of Chemical degradation: a) Solvolytic degradation b) hydrolytical degradation c) Oxidative degradation and stabilization d) biodegradation.

Recommended books:

1. Text book of Polymer science ; F.w.Billmeyer J.Willey
2. Polymer science, V.R.Gowarikar, N.V.Vishwanathan and J.Sreedhar, Wiley Eastern
3. Principles of Polymerization, George Odian III.Ed.
4. Organic Polymer Chemistry, K.J.Saunders
5. Polymer Chemistry, Golding
6. Principles of Polymer Chemistry, Flory
7. Physical Chemistry of Macromolecules, D.D.Deshpande, Vishal Publications,1985
8. Functional monomers and polymers, K.Takemoto, V.Inaki and R.M.Ottanbrite
9. Contemporary polymer chemistry, H.R.alkock and F.W.Lambe, Prentice Hall
10. Physics and Chemistry of polymers, J.M.G.Cowie, Blackie Academic and Professional.

Center for Basic Sciences (CBS)

SCHEME OF EXAMINATION

&

COURSE STRUCTURE

of

M.Sc. Integrated (Physics Stream)

UNDER

FACULTY OF SCIENCE

Approved by Board of Studies in Physics

EFFECTIVE FROM JULY 2015

Center of Basic Science
Pt. Ravishankar Shukla University
Raipur (C.G.) 492010
PH: - 0771-2262864
WEBSITE: -www.prsu.ac.in

Course structure for the M. Sc. (Integrated) Physics Stream July, 2015

(B: **B**iology, C: **C**hemistry, M: **M**athematics, P: **P**hysics, G: **G**eneral, H: **H**umanities,
BL: **B**iology **L**aboratory, CL: **C**hemistry **L**aboratory, PL: **P**hysics **L**aboratory, GL: **G**eneral
Laboratory, PE: **P**hysics **E**lective, PPr: **P**hysics **Pr**oject)

FIRST YEAR
SEMESTER –I

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
B101	Biology – I	[2 + 1]	3
C101	Chemistry – I	[2 + 1]	3
M100/101	Mathematics – I	[2 + 1]	3
P101	(A) Physics – I (PCM Stream)	[2 + 1]	3
	(B) Physics-I (Biology Stream)		
G101	Computer Basics	[2 + 1]	3
H101	Communication Skills	[2 + 1]	3
		Contact Hours /Week Laboratory	
BL101	Biology Laboratory – I	[4]	1
CL101	Chemistry Laboratory – I	[4]	2
PL101	Physics Laboratory – I	[4]	2
GL101	Computer Laboratory	[4]	2

25
(25 of 240 credits)

SEMESTER –II

Subject Code	Subject	Contact Hours /Week Theory+Tutorials	Credits
B201	Biology – II	[2 + 1]	3
C201	Chemistry – II	[2 + 1]	3
M200/201	Mathematics – II	[2 + 1]	3
P201	Physics – II (PCM & Bio Stream)	[2 + 1]	3
G201	Electronics and Instrumentation	[2 + 1]	3
G202	Glimpses of Contemporary Science	[2 + 1]	3
		Contact Hours /Week Laboratory	
BL201	Biology Laboratory – II	[4]	1
CL201	Chemistry Laboratory – II	[4]	2
PL201	Physics Laboratory – II	[4]	2
GL201	Electronics Laboratory	[4]	2

25
(50 of 240 Credits)

SECOND YEAR

SEMESTER –III

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
P301	Mathematical Physics – I	[3 + 1]	4
P302	Classical Mechanics – I	[3+ 1]	4
P303	Electromagnetism	[3 + 1]	4
P304	Waves and Oscillations	[3 + 1]	4
H301	World Literature	[2 + 0]	2
H302	History and Philosophy of Science	[2 + 0]	2
		Contact Hours / Week Laboratory	
PL301	Physics Laboratory – III	[6]	3
GL301	Applied Electronics Laboratory	[4]	2

25
(75 of 240 Credits)

SEMESTER –IV

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
P401	Mathematical Physics – II	[3 + 1]	4
P402	Quantum Mechanics – I	[3+ 1]	4
P403	Statistical Mechanics – I	[3 + 1]	4
PCB401	Physical and Chemical Kinetics	[3 + 1]	4
G401	Statistical Techniques and Applications	[3+ 1]	4
		Contact Hours / Week Laboratory	
PL401	Physics Laboratory – IV	[6]	3
GL401	Computational Laboratory and Numerical Methods	[4]	2

25
(100 of 240 Credits)

THIRD YEAR
SEMESTER –V

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
P501	Quantum Mechanics – II	[3 + 1]	4
P502	Classical Mechanics – II	[3+ 1]	4
P503	Atomic and Molecular Physics	[3 + 1]	4
PM501	Numerical Analysis	[3 + 1]	4
G502	Earth Science and Energy & Environmental Sciences	[3+ 1]	4
		Contact Hours / Week Laboratory	
PL501	Physics Laboratory – V	[6]	3
PML501	Numerical Methods Laboratory	[4]	2

25
(125 of 240 Credits)

SEMESTER –VI

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
P601	Electrodynamics	[3 + 1]	4
P602	Nuclear Physics – I	[3+ 1]	4
P603	Condensed Matter Physics – I	[3 + 1]	4
P604	Lasers	[3 + 1]	4
P605	Nonlinear Dynamics and Chaos	[3+ 1]	4
H601	Ethics of Science and IPR	[2+ 0]	2
		Contact Hours / Week Laboratory	
PL601	Physics Laboratory – VI	[6]	3

25
(150 of 240 Credits)

FOURTH YEAR
SEMESTER –VII

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
P701	Fluid Mechanics	[3 + 1]	4
P702	Quantum Mechanics – III	[3+ 1]	4
P703	Statistical Mechanics – II	[3 + 1]	4
P704	Reactor Physics and Radiation Science	[3 + 1]	4
		Contact Hours / Week Laboratory	
PL701	Advanced Physics Laboratory – I	[8]	5
PPr701	Reading Project		4

25
(175 0f 240 Credits)

SEMESTER –VIII

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
P801	Astronomy and Astrophysics	[3 + 1]	4
P802	Accelerator Physics and Applications	[3+ 1]	4
P803	Nuclear and Particle Physics	[3 + 1]	4
P804	Condensed Matter Physics – II	[3 + 1]	4
		Contact Hours / Week Laboratory	
PL801	Advanced Physics Laboratory – II	[8]	5
PPr801	Project		4

25
(200 of 240 Credits)

SEMESTER- IX

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
PPr901	Project		20

20
(220 of240 Credits)

SEMESTER- X

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
PE1001	Quantum Field Theory	[3 + 1]	4
PE1002	Non-equilibrium Statistical Mechanics	[3+ 1]	4
PE1003	Advanced Mathematical Physics	[3 + 1]	4
PE1004	General Relativity and Cosmology	[3 + 1]	4
PE1005	Experimental Techniques	[3+1]	4
PE1006	Biophysics	[3+1]]	4
PE1007	Quantum Computing and Information	[3+1]	4
PE1008	Disordered Systems	[3+1]	4
PE1009	Particle Physics	[3+1]	4
PE1010	Computational Electrodynamics	[3+1]	4

Min. 16
(240 of 240 Credits)

*Subject to availability of instructors and minimum number of interested students offering a course. The course structure for the above mentioned elective papers will be provided by the respective instructor.

P101: (B) Physics-I (Classical Physics): (For Biology Stream)

<u>**UNIT- I**</u>
Concepts of energy and mass, Linear kinematics and dynamics. Concept of force: Conservative and non-conservative forces, Friction. Conservation of momentum, energy, and angular momentum. Work-energy theorem, Centre of mass.

<u>**UNIT- II**</u>
Moment of inertia. Rotational kinematics and dynamics, Rigid body motion. Impulse and collisions, Central forces, Kinetic theory of gases, Equipartition of energy.

<u>**UNIT- III**</u>
Free oscillations in one, two, and many degrees of freedom. Linearity and superposition principle. Normal modes; Transverse and longitudinal modes. General notion of a continuous string; Resonance; Coupled pendula and oscillators, Normal coordinates.

<u>**UNIT- IV**</u>
Probability (chance, fluctuations, random walk, probability distribution, Matter wave, Wave Packet, De-Brogle's theory, uncertainty principle); Curvilinear Coordinates.

<u>**UNIT- V**</u>
Vector calculus (differentiation and integration, gradient, divergence, curl, Green's theorem, Gauss' theorem, Stokes' theorem); Fourier series (an introduction).

Suggested texts and References:
1. "The Feynman lectures in Physics" volume 1, by R. P. Feynman, R. B. Leighton, M. Sands.
2. "An introduction to mechanics", by D. Kleppner and R. Kolenkow.
3. "Mechanics", by Charles Kittel, Walter D. Knight and Malvin A. Ruderman, Berkeley Physics Course Volume 1.
4. "Waves", by F. S. Crawford, Berkeley Physics Course Volume 3.

P101: (A) Physics – I (For Physics, Chemistry and Mathematics Stream)

<u>**UNIT- I**</u>
Mechanics: Energy, mass and momentum – evolution of the concepts and definitions. Newton's three laws of mechanics; conservative forces, potential energy functions; Conservation of mechanical energy, linear momentum and angular momentum; Applications to athletics; harmonic oscillator, inverse square law force; Kepler's laws.

<u>**UNIT- II**</u>
Elementary dynamics of rigid bodies: moment of inertia, angular momentum, rotational kinetic energy, displacement and rotation of rigid bodies. Friction, illustrations of non conservative forces. Impulse, elastic and inelastic collisions, Poisson's hypothesis, deformation energy, Karate punch. Dimensional analysis via examples illustrating Buckingham Pi theorem.

UNIT- III

Thermodynamics and kinetic theory: Thermodynamics: Basic notions of thermodynamics; Macroscopic equilibrium, quasistatic processes, reversible processes; Equation of state; Zeroth law; First law for closed systems; Notion of heat, work and internal energy; Notion of state variable and path.

UNIT- IV

Exact and inexact differentials; Ideal gas and Van der Waal's gas equation, some examples of non – pV systems (qualitative); Second law (Kelvin – Planck and Clausius statements); Carnot cycle; Entropy formulation of Second law; Third law (statement); Thermodynamic potentials.

UNIT- V

Kinetic theory: Kinetic theory of ideal gas; Kinetic interpretation of temperature; Adiabatic reversible compression; Boltzmann factor; Derivation of Maxwell's velocity distribution; Average, *rms* and most probable speed; Elementary theory of transport processes (viscosity, thermal conducting and diffusion coefficient); Failure of classical physics.

Suggested texts and References:
1. Mechanics, Berkeley Physics Course Vol. 1, 2nd Edition, C. Kittel *et al.*, Tata McGraw – Hill Education, 2011.
2. An Introduction to Mechanics, 1st Edition, D. Kleppner and R. J. Kolenkow, Tata McGraw – Hill Education, 2007
3. Thermodynamics, Kinetic theory and Statistical Thermodynamics, 3rd Edition, F. W. Sears and G. L. Salinger, Narosa Publishing House, 1998.
4. Heat and Thermodynamics, 8th Edition, M. W. Zemansky and R. H. Dittman, Tata McGraw – Hill Education, 2011.
5. University Physics, 7th Edition, Francis W. Sears, Mark Zemansky and Hugh D. Young, Massachusetts: Addison Wesley, 1987.
6. Mechanics, D. S. Mathure
7. Thermal Physics, B. K. Agrawal
8. A Treaties on Heat, M. N. Saha and B. N. Shrivastav.
9. Physics: Structure and Meaning L. N. Cooper University press of New England, 1992
10. Fundamentals of Physics, 8th Edition David Halliday, Robert Resnick & Walker New Jersey: John Wiley, 2 2008
11. Mechanics 3rd Edition Keith R. Simon Massachusetts: Addison Wesley Pub. Co., 1987

PL101: Physics Laboratory – I
Introduction to experimental physics – conceptual and procedural understanding, planning of experiments; Plots (normal, semi-log, log-log); uncertainty / error in measurements and uncertainty / error analysis. Introduction to measuring instruments – concepts of standards and calibration; determination of time periods in simple pendulum and coupled strip oscillator system with emphasis on uncertainty in the measurements and accuracy requirements; study of projectile motion – understand the timing requirements; determination of surface tension of a liquid from the study of liquid drops formed under the surface of a glass surface; determination of Young's modulus of a strip of metal by double cantilever method (use of travelling microscope); study of combination of lenses and nodal points and correspondence to a thick lens; study of thermal expansion of metal – use of thermistor as a thermometer; measurement of small resistance of a

wire using Carey- Fosterbridge and determine electrical resistivity of the wire; study of time dependence of charging and discharging of capacitor using digital multimeter – use of semi-log plot.

Suggested Texts and References:
1. Advanced Practical Physics for Students, B. L. Worsnop and H. T. Flint, Methuen and Co. Ltd., London

SEMESTER-II

P201: Physics – II (For Physics, Chemistry and Mathematics Stream) & (For Biology Stream)

UNIT- I
Electricity and Magnetism: Electrostatics: Coulomb's law and Gauss' law; Electrostatic potential, uniqueness theorem, method of images; Electrostatic fields in matter; Conductors and insulators; Capacitors and capacitance; Electric current.

UNIT- II
Magnetostatics: Biot – Savart law, Ampere's law; Electromagnetic induction; Mutual inductance and self inductance; Magnetic fields in matter. Displacement current; Maxwell's equations; Alternating current circuits; Electric and magnetic properties of matter.

UNIT- III
Plane electromagnetic waves in vacuum; Polarisation; Energy and momentum in electromagnetic waves; electromagnetic radiation (qualitative); Dipole radiation formula; Larmor's formula for radiation due to accelerated charge (without proof); Synchrotron radiation (descriptive).

UNIT- IV
Optics: Interference of two beams and involving multiple reflections; Young's experiment, Fresnel's biprism, Lloyd's mirror.

UNIT- V
Optical instruments; Telescope and microscopes; Magnifying power and resolving power. Sources of light and spectra; Dispersion, polarisation, double refraction; Optical activity.

Suggested texts and References:
1. Electricity and Magnetism, Berkeley Physics Course Vol. 2, 2nd Edition, Edward M. Purcell, Tata McGraw Hill, 2011.
2. The Feynman Lectures on Physics Vol. 2, R. P. Feynman, R. B. Leighton and M. Sands, Narosa Publications, 2010.
3. The Feynman Lectures on Physics Vol. 3, R. P. Feynman, R. B. Leighton and M. Sands Narosa 2010.
4. Waves, Berkeley Physics Course Vol. 3, Frank S. Crawford, Tata McGraw – Hill, 2011.
5. Fundamentals of Optics, 4th Edition, F. A. Jenkins and H. E. White, Tata McGraw Hill, 2011.
6. University Physics, 7th Edition, Francis W. Sears, Mark Zemansky and Hugh D. Young, Massachusetts: Addison Wesley, 1987.
7. Optics , 4th Edition Eugene Hecht Massachusetts: Addison Wesley
8. "Foundations of Electromagnetic Theory 4th edition, "John R. Reitz, Fredrick Milford & RobertChrist" Massachusetts: Addison Wesley, 1993

9. Fundamentals of Optics 4th Edition Francis A. Jenkins and Harvey E. White "New York Mc Graw Hill Book Company Inc. 2001"
10. Optical Physics 3rd Edition "Stephen G. Lipson, Henry Lipson & D. S. Tannhauser" New York Cambridge University Press 1995
11. Fundamental of Optics 4th Edition Francis A. Jenkins and Harvey E. White Tata Mc Graw Hill 2011.
12. Introduction to Electrodynamics 3rd Edition David J. Grifiths New Jersey: Prentice hall

PL201: Physics Laboratory – II
Review of uncertainty / error analysis; least squares fit method; introduction to sensors / transducers; determination of 'g' (acceleration due to gravity) by free fall method; study of physical pendulum using a PC interfaced apparatus – study variation of effective 'g ' with change of angle of plane of oscillation - investigation of effect of large angle of oscillation on the motion; study of Newton's laws of motion using a PC interfaced apparatus; study of conservation of linear and angular momentum using 'Maxwell's Wheel' apparatus; study of vibrations of soft massive spring; study of torsional oscillatory system; study of refraction in a prism - double refraction in calcite and quartz; study of equipotential surface using different electrode shapes in a minimal conducting liquid medium; determination of electrical inductance by vector method and study effect of ferromagnetic core and study the effect of non-linearity of inductance with current.

Suggested Texts and References:
 1. Advanced Practical Physics for Students, B. L. Worsnop and H. T. Flint, Methuen and Co. Ltd., London

<div align="center">

SEMESTER-III

</div>

P301: Mathematical Physics – 1

UNIT- I
Review of first order differential equations, the notion of Wronskian and its properties, Series solutions of second order differential equations, Frobenius method. Rodrigues formula and classical orthogonal polynomials, recurrence relations, symmetry properties, special values, orthogonality, normalisation.

UNIT- II
Generating functions. Legendre, Hermite, Laguerre, Bessel and Hypergeometric differential equations. Integral representations of special functions. Expansion of functions in orthonormal basis.

UNIT- III
Complex variables: Notion of analyticity, Cauchy – Riemann conditions, Harmonic functions; Contour integrals, Cauchy theorem, simply and multiply connected domains, Cauchy integral formula, derivatives of analytic functions.

UNIT- IV
 Laurent series, uniform convergence; Notion of residues, residue theorem, notion of principal values, applications of residues to evaluation of improper integrals, definite integrals, indentation, branch points and branch cuts.

UNIT- V

Fourier series and simple applications. Fourier transforms, Parseval's theorem, convolution, and their simple applications. Laplace transforms, initial value problems, simple applications, transients in circuits, convolution.

Suggested Texts and References:
1. Complex Variables and Applications, R. V. Churchill and J. W. Brown, McGraw-Hill, 2009
2. Complex Variables: Introduction and Applications, 2nd Edition, M. J. Ablowitz and A. S. Fokas, Cambridge 2003
3. Differential Equations, G. F. Simmons, McGraw-Hill, 2006
4. Ordinary Differential Equations, V. I. Arnold, MIT Press 2009
5. Mathematical Methods for Physicists, 7th Edition, G. Arfken and Hans J. Weber, Elsevier 2012

P302: Classical Mechanics – I

UNIT- I

Recap- Newton's laws, vector algebra, gradient; momentum, energy, constraints, conservative forces, potential energy, angular momentum. Inertial and non – inertial frames, fictitious forces.

UNIT- II

Foucault pendulum, effects of Coriolis force. Central forces, conservation of energy and angular momentum, trajectories, orbits, 1/r potential (quadrature), classical scattering, two body problem, centre of mass and relative motions.

UNIT- III

Rigid body motion, moment of inertia tensor, energy and angular momentum, Euler's theorem, motion of tops, gyroscope, motion of the Earth. Introduction to Lagrangian through variational principle, applications of variational principle.

UNIT- IV

Relativity: Historical background, inconsistency of electrodynamics with Galilean relativity. Einstein's hypothesis and Lorentz transformation formula, length contraction, time dilation.

UNIT- V

Doppler shift. Energy, momentum and mass, mass – energy equivalence. Four vector notation, consistency of electrodynamics with relativity.

Suggested texts:
1. An Introduction to Mechanics, 1st Edition, D. Kleppner and R. J. Kolenkow, Tata McGraw – Hill Education, 2007
2. Classical Mechanics, 5th Edition, T. W. B. Kibble, F. Berkshire, World Scientific 2004.
3. Introduction to Special Relativity, R. Resnik, Wiley (India), 2012
4. Spacetime Physics, 2nd Edition, E. F. Taylor, J. A. Wheeler, W. H. Freeman and Co. 1992.
5. Classical mechanics, N. C. Rana, P. S. Joag, Tata McGraw-Hill Education, 2001.

P303: Electromagnetism
UNIT- I

Electrostatics: Coulomb's law, Electric field, Gauss' law in differential and integral forms, Scalar potential, Poisson and Laplace equations, Discontinuities in Electric field and potential: electrostatic boundary conditions, Uniqueness theorem, conductors and second uniqueness theorem, method of images, multipole expansion, work and energy in electrostatics.

UNIT- II
Electric Fields in matter: dielectrics, polarisation, bound charges, notion of electric displacement, Gauss' law in presence of dielectrics, boundary conditions, linear dielectrics: susceptibility, permittivity, dielectric constant, boundary value problems, energy in dielectric systems.

UNIT- III
Magnetostatics: Lorentz force law, steady currents, Biot – Savert law, Ampere's law, vector potential, magnetostatic boundary conditions, multipole expansion for vector potential, magnetic scalar potential. Diamagnets, paramagnets and ferromagnets, magnetisation, bound currents, the H field, boundary conditions, magnetic susceptibility and permeability.

UNIT- IV
Electrodynamics: Electromotive force, electromagnetic induction and Faraday's law, induced electric fields and inductance, energy in magnetic fields. Maxwell's equations: equation of continuity and Modification in Ampere's law, Gauge transformations, Lorentz and Coulomb gauge. Maxwell's equations in matter, integral and differential forms, boundary conditions.

UNIT- V
Poynting's theorem, conservation of momentum, angular momentum. Lossy media, Poynting's theorem for lossy media. Wave equation, electromagnetic waves in vacuum, plane waves, propagation in lossless and lossy linear media, absorption and dispersion, reflection at the interface of two lossy media, guided waves.

Suggested Texts and References:
1. Introduction to Electrodynamics, 4th Edition, D. J. Griffiths, Addison-Wesley 2012
2. Classical Electricity and Magnetism, 2nd Edition, W.K.H. Panofsky and M. Phillips, Dover 2005.
3. Engineering Electromagnetics, 2nd Edition, Nathan Eda, Springer 2007

P304: Waves and Oscillations

UNIT- I
Free oscillations, Simple harmonic motion, damped and forced oscillations; Coupled oscillators, normal modes, beats, infinite coupled oscillators and dispersion relation of sound; vibrating string; travelling and stationary waves; Amplitude, phase and energy. Derivation of wave equation for a string; Longitudinal and transverse waves.

UNIT- II
Waves in two and three dimensions, the wave vector, wave equation, linearity, superposition, Fourier decomposition of a wave, notion of wave packets, phase and group velocity. Example of mechanical waves (sound waves), speed of sound in air, effect of bubbles, natural observations and qualitative explanations.

UNIT- III
String and wind instruments. Chaldni plates. Propagation in changing media, continuity conditions, characteristic impedance. Snell's laws and translation invariant boundary, prism, total internal reflection, evanescent waves. Water waves, ocean waves, Tsunami.

UNIT- IV
Electromagnetic waves, polarisation, interference.

UNIT- V
 Fraunhofer diffraction. Shocks waves, boat wakes, linear analysis of the Kelvin wake. Alfven waves (qualitative).

Suggested Texts and References:
1. Waves, Berkeley Physics Course Vol. 3, Frank S. Crawford, Tata McGraw – Hill Education, 2011
2. Introduction to the Physics of Waves, Tim Freegarde, Cambridge Univ. Press 2012
3. The Physics of Waves, Howard Georgi (http://www.people.fas.harvard.edu/~hgeorgi/new.htm)

H301: Introduction to World Literature
What is Literature? - a discussion; Introduction to literary terms, genres, and forms of various periods, countries, languages, etc. The Novel: Class study of 'Brave New World' by Aldous Huxley; Group discussions and student presentations on other genres such as the graphic novel, detective fiction, children's literature, etc. Plays: Introduction to the history of theatre, class study of (mainly) two plays: 'Pygmalion' by G. B. Shaw and 'Fire and Rain' by Girish Karnad, the setting up of play – reading group through which the students can be introduced to several other plays. Poetry: Brief introduction; Study of poetic genres, forms, topics, figures of speech, poetic language etc. by analysing various poems from around the world. Short stories, essays and other types of writing by various authors. Screening of films based on literary works, such as Pygmalion (My Fair Lady), Fire and Rain (Agnivarsha), Persepolis (a graphic novel) and a few others.

H302: History and Philosophy of Science
History of World Science up to the Scientific Revolution: Introduction about stone age, beginning of agriculture, urban civilization and science. Science in Sumeria, Babylonia and Egypt. Natural philosophy of pre-Socratic Greece. Natural philosophy in Athens. Greek science in the Alexandrian period. Rome and decline of Ancient European science. Science and technology in China. Science and technology in the Muslim world. Technology and the craft tradition in medieval Europe. The scholarly tradition during the middle ages. Renaissance, the Copernican system of the world. Gilbert, Bacon and the experimental method. Galileo and the science of mechanics. Descartes – the mathematical method and the mechanical philosophy. The Protestant reformation and the scientific revolution. Newton –the theory of universal gravitation and optics. Alchemy and iatrochemistry. Medicine, theory of circulation of blood. Growth and characteristics of the scientificrevolution.

History of Ancient Indian Science: Indian civilization from pre-historic times to the Indus Valley Civilization. Ancient Indian mathematics and astronomy. Ancient Indian medicine and biology.   Chemistry, metallurgy and technology in general in ancient India. Strengths, weaknesses and potentialities of ancient Indian science.

Introduction to Philosophy of Science: What is science? Scientific reasoning; Explanation in science; Realism and instrumentalism; Scientific change and scientific revolutions.

Great Scientific Experiments: Group wise study and presentations by students of historically significant experiments in science.

Suggested Texts and References:
1. A History of the Sciences, Stephen F. Mason, Collier Books, Macmillan Pub. Co. (1962)
2. A Concise History of Science in India, D. M. Bose, S. N. Sen, B. V. Subbarayappa, INSA (1971)
3. Philosophy of Science – A Very Short Introduction, Samir Okasha, Oxford Univ Press (2002)
4. Great Scientific Experiments – Ron Harre, Oxford University Press (1983)
5. The Story of Physics, Lloyd Motz and Jefferson Hane Weaver, Avon Books (1992)
6. The Cambridge Illustrated History of World Science, Colin A. Ronan, Cambridge-Newnes (1982)
7. Encyclopaedia of Classical Indian Sciences, Ed. Helaine Selin and Roddam Narasimha, University Press (2007)
1. Articles from Wikipedia on History and philosophy of science

PL301: Physics Laboratory – III
Frequency response of R-C circuit (concept of cut-off freq and filter) and frequency response of LC circuit; concepts of phase difference between voltage and current in these circuits, phase factor for appliances using AC mains supply; R-L-C (series / parallel) resonance; transient response in RL- C series circuit; study of Newton's rings and interference in wedge shaped films; study of double refraction in calcite / quartz prisms, polarisation of the refracted light rays, optical activity in dextrose and fructose; soldering experience – make a gated timer with indicator; measurement of heat capacity of air; Use of thermocouple / platinum resistance thermometer, use of instrumentation amplifier in amplifying signal from thermocouple; study of the laws of a gyroscope; determination of the charge of an electron by Millikan's oil drop experiment.

Suggested Texts and References:
1. Advanced Practical Physics for Students, B. L. Worsnop and H. T. Flint, Methuen and Co. Ltd., London

GL301: Applied Electronics Laboratory
The course is based on the micro-controller system expEYES and 'Microhope' based on ATmega32 micro controller, developed at IUAC, under a UGC programme.

Use of expEYES kit for monitoring pendulum motion, charge and discharge of capacitor etc to appreciate the goal of the course; Revision of concepts of binary numbers: 'Bit', 'Byte', 'Word', hexa-decimal numbers; Concepts of microprocessor and microcontrollers - CPU, registers, memory (RAM, ROM, different kinds of ROM), data and address bus, decoder, encoder, instruction set, etc. Review of concepts of Digital to Analogue Conversion (DAC) and Analogue to Digital Conversion (ADC), Introduction to micro-controller ATmega32 (which is used in expEYES). Concepts of programming, flow chart, assembly language, and simulator. Concept of I/O programming for ATmega32 Examples of simple I/O program in assembly language, assemble it in an assembler in a PC and download the hex code into microcontroller kit 'microhope' through USB port and verify the operation. C language for writing larger programmes, such as monitoring temperature, which uses ADC of ATmega32. Concept of interrupt and its use in real time data acquisition. Introduction to elements of PYTHON language. Concepts of how expEYES system program resident in ATmaga32 is interfaced to commands from PC in Python language; Automated measurement of simple experiments under expEYES, such as, applications such as temperature monitor, pH meter, colorimeter, protein measurement experiments, etc., will be done. As a part of these applications, ntroduction will be given to sensors, such as temperature sensors, pressure sensors, humidity, pH sensors, photodetectors etc, The experiments will also include I/O programme for keypad inputs and LCD display.

Suggested Texts and References:
1. Phoenix: Computer Interfaced Science Experiments, B.P. Ajith Kumar at
   http://www.iuac.res.in/~elab/phoenix/
2. expEYES micro-controller system B.P. Ajith Kumar at http://www.iuac.res.in/~elab/phoenix/
3. The AVR micro-controller and embedded systems using assembly and C, by A.A. Mazidi, S. Naimi and S. Mnaimi, Pearson Publications, Delhi, 2013.

SEMESTER-IV
P401: Mathematical Physics – II

UNIT-I
Review of curvilinear coordinates, scale factors, Jacobian. Partial differential equations in curvilinear coordinates, classification. Laplace equation, separation of variables, boundary conditions and initial conditions, examples.

UNIT-II
Inhomogeneous equations, Green's functions in 1, 2 and 3 dimensions.

UNIT-III
Tensors calculus: contravariant and covariant notation, Levi-Civita symbol, pseudotensors, quotient rule, dual tensors.

UNIT-IV
Integral equations: Fredholm and Volterra equations, separable kernel, applications. Elementary group theory and group representations, cyclic, permutation groups; isomorphism, homomorphism.

UNIT-V
subgroups, normal subgroup, classes and cosets; orthogonal, rotation group, Lie group; equivalent, reducible, irreducible; Schur's lemma.

Suggested Texts and References:
1. Mathematical Methods for Physicists, 7th Edition, G. Arfken and Hans J. Weber, Elsevier 2012
2. Mathematics for Physicists, P. Dennery and A. Krzywicki, Dover 1996
3. Mathematics for Quantum Mechanics, 4th Edition, J. D. Jackson, Dover 2009.
4. Elements of Group Theory for Physicists, A. W. Joshi
5. Lectures on Groups and Vector Spaces for Physicists, C. J. Isham, World Scientific 1989
6. Group Theory and Its Application to Physical Problems, M. Hemmermesh, Dover 1989
6. Elements of Green's Functions and Propagation, G. Barton, Oxford 1989

P402: Quantum Mechanics – 1

UNIT- I
Origins of quantum theory (short version); Wave – particle duality, wave packets, uncertainty relation; Time dependent and time independent Schrödinger equation; Interpretative postulates; Hermitian operators, eigenfunctions and eigenvalues; nodal lines and domains; Orthonormality and completion.

UNIT- II

Energy and momentum eigenfunctions; Illustrative one dimensional phenomena (short revision if done in an earlier semester) rigid box; square well and barrier; Linear harmonic oscillator (detailed treatment).

UNIT- III

Abstract vector space formulation of quantum mechanics; Hilbert space, Dirac notation; Hermitian and unitary operators, momentum space representation; Schrödinger and Heisenberg pictures; Linear Harmonic oscillator (matrix theory).

UNIT- IV

Schrödinger equation for a central potential; Orbital angular momentum eigenfunctions (spherical harmonics) and eigenvalues; Bound state solution of Schrödinger equation for Coulomb potential, Hydrogen atom orbits and energies, degeneracy; Electron spin; Addition of two angular momenta, Clebsch – Gordon coefficients.

UNIT- V

Approximation methods: stationary perturbation theory (non – degenerate and degenerate); Stark effect; Zeeman effect; Time dependent perturbation theory; Harmonic perturbations, transition probability (Fermi's golden rule).

Suggested Texts and References:
1. Introduction to Quantum Mechanics, 2nd Edition, D. J. Griffiths, Pearson Education 2008.
2. Quantum Mechanics, 3rd Edition, L. I. Schiff, Tata McGraw-Hill 2010.
3. Quantum Mechanics I and II, Claud Cohen Tannoudji, B. Diu and F. Laloe, Wiley 2006
4. Lectures on Quantum Mechanics, S. Weinberg, Oxford University Press 2012.

P403: Statistical Mechanics – I

UNIT- I

Elementary probability theory; random walk; binomial, Poisson, log normal distributions; the Gaussian. Kinetic theory of gases.

UNIT- II

Ensembles; micro-canonical ensemble; canonical ensemble; grand canonical ensemble. Partition functions and their properties; calculation of thermodynamic quantities; Gibbs paradox; the equipartition theorem.

UNIT- III

Two level system and paramagnetism. Validity of the classical approximation; identical particles and symmetry; quantum distribution functions; Bose-Einstein statistics; Fermi-Dirac statistics;

UNIT- IV

Quantum Statistics in the classical limit; physical implications of the quantum-mechanical enumeration of states; conduction electrons in metals.

UNIT- V

Special topics: the Chandrasekhar Limit; Saha Ionization formula. Systems of interacting particles; Debye approximation; van der Waals equation; Weiss molecular-field approximation

Suggested Texts and References:
1. Thermodynamics and an Introduction to Thermostatistics, 2nd Edition, H. B. Callen, Wiley 2006
2. Fundamentals of Statistical and Thermal Physics, F. Reif, McGraw-Hill Book Company
3. Statistical Physics part 1, 3rd Edition, L. D. Landau and E. M. Lifshitz, Elsevier 2008
4. Statistical Mechanics: A Set of Lectures, R. P. Feynman, W. A. Benjamin, Inc. 1998
5. A Modern Course in Statistical Physics, L. E. Reichl, Wiley 2009

PCB 401: Physical and Chemical Kinetics

UNIT- I

Basic Concepts: Rate, order and molecularity of a reaction, First, second and third order reactions – effect of concentration on reaction rate, rate expressions and integrated form, pseudo-unimolecular and second order autocatalytic reactions, nth order reaction of a single component, effect of temperature on reaction rate – Arrhenius equation and activation energy.

UNIT- II

Complex Reactions: parallel first order reactions, series first order reactions – determination of rate constants by graphical method and the time ratio method. The stationary state, radioactive decay, general first order series and parallel reactions. Competitive, consecutive second order reactions, reversible reactions, equilibrium from the kinetic view point, complex mechanisms involving equilibria.

UNIT- III

Kinetic Measurements: Experimental determination of reaction rates and order of reactions – correlation of physical properties with concentrations, reactions in the phase, reactions at constant pressure, fractional-life period method, initial rate as a function of initial concentrations.

UNIT- IV

Reactions in Solutions: General Properties, Phenomenological theory of reaction rates, Diffusion limited rate constant, Slow reactions, Effect of ionic strength on reactions between ions, Linear free energy relationships, Relaxation methods for fast reactions.

UNIT- V

Catalysis: Homogeneous catalysis in gas phase, in solution, basis of catalytic action, catalysis and the equilibrium constant, acid base catalysis, The Bronsted catalysis law, linear free energy changes, general and specific catalysis. Heterogeneous catalysis. Negative catalysis and inhibition, Surface reactions – effect of temperature and nature of surface. Industrial catalysis.

Suggested Texts and References:
1. Chemical Kinetics : A Study of Reaction Rates in Solution, K.A. Connors, V.C.H. Publications 1990.
2. Chemical Kinetics and Dynamics, J.I. Steinfeld, J.S. Francisco and W.L. Hase, Prentice Hall 1989.
3. Chemical Kinetics and reaction dynamics, Paul L. Houston.
4. Chemical Kinetics, 3rd ed., K.J.Laidler, Harper and Row, 1987.
5. Kinetics and Mechanisms, J.W. Moore and R.G. Pearson, John Wiley and Sons, 1981.
6. Kinetics and Mechanism, A. A. Forst and R. G. Pearson, Wiley International Edition.

7. Chemical Kinetics and Reaction Dynamics, Sanjay K. Upadhay, Springer, 2006

G401: Statistical Techniques and Applications

UNIT- I
Purpose of Statistics, Events and Probabilities, Assignments of probabilities to events, Random events and variables, Probability Axioms and Theorems. Probability distributions and properties: Discrete, Continuous and Empirical distributions. Expected values: Mean, Variance, Skewness, Kurtosis, Moments and Characteristics Functions.

UNIT-II
Types of probability distributions: Binomial, Poisson, Normal, Gamma, Exponential, Chi-squared, Log-Normal, Student's t, F distributions, Central Limit Theorem.

UNIT- III
Monte Carlo techniques: Methods of generating statistical distributions: Pseudorandom numbers from computers and from probability distributions, Applications. Parameter inference: Given prior discrete hypotheses and continuous parameters, Maximum likelihood method for parameter inference. Error Analysis: Statistical and Systematic Errors, Reporting and using uncertainties. Propagation of errors, Statistical analysis of random uncertainties, Averaging Correlated/ Uncorrelated Measurements.

UNIT- IV
Deconvolution methods, Deconvolution of histograms, binning-free methods. Least-squares fitting: Linear, Polynomial, arbitrary functions: with descriptions of specific methods; Fitting composite curves. Hypothesis tests: Single and composite hypothesis, Goodness of fit tests.

UNIT- V
P-values, Chi-squared test, Likelihood Ratio, Kolmogorov- Smirnov test, Confidence Interval. Covariance and Correlation, Analysis of Variance and Covariance. Illustration of statistical techniques through hands-on use of computer programs.

Suggested Texts and References:
1. Statistics: A Guide to the Use of Statistical Methods in the Physical Sciences, R.J. Barlow, John Wiley 1989
2. The Statistical Analysis of Experimental Data, John Mandel, Dover Publications 1984
3. Data Reduction and Error Analysis for the Physical Sciences, 3rd Edition, Philip Bevington and Keith Robinson, McGraw Hill 2003

PL401: Physics Laboratory – IV
Application of PHOENIX (IUAC, New Delhi) microcontroller system for automation in 20 experiments (six sessions); study of acoustic resonance in Helmholtz resonator using PHOENIX system; Resolving power of optical grating; study of atomic spectra in hydrogen, helium, mercury; Application of gamma counts from detected by G.M. counter for study of Poisson and Gaussian distributions; study of black body radiation by optical and thermal thermal radiations; study of electrically coupled oscillators – normal and transient response. Assembling components for an experiment on thermal and electrical conductivity of metals and making of measurements.

Suggested Texts and References:
1. Phoenix: Computer Interfaced Science Experiments – http://www.iuac.res.in/~elab/phoenix/
2. The Art of Experimental Physics, D. W. Preston and D. R. Dietz, Wiley 1991

3. Manual of Experimental Physics with Indian Academy of Sciences, Bangalore kit, R. Srinivasan and K.R.S. Priolkar

GL401: Computational Laboratory and Numerical Methods
GNU Plot, FORTRAN90, Pointers and Object Oriented Programming

I. The nature of computational physics: Machine representation, precision and errors in computation. Errors and uncertainties. E.g. One should understand how to analyze whether a calculation is limited by the algorithm or round-off error. Single/double precision.

II. Basic tools for numerical analysis in science: Solution of algebraic functions – Fixed point method, Newton-Raphson method, Secant method. Numerical Integration – Rectangular method, trapezoidal method. Lagrange's interpolation.

III. Matrix Algebra: Approximate solution of a set of linear simultaneous equations by Gauss-Sidel iteration method. Exact solution by Gaussian elimination. Inversion of a matrix by Gaussian elimination. Determining all the eigenvalues of a real symmetric matrix by Householder's method of tridiagonalization followed by QR factorization of the tridiagonalized matrix.

IV. Differential Equations (ODE and PDE): Solution of an ODE by Euler's method and Runge-Kutta (4) method – comparison of convergence Solution of partial differential equation (Laplace's equation and Poisson's equation) – Boundary Value Problem – solved using Gauss-Sidel iteration followed by plotting using GNUPlot

V. Nonlinear Systems, dynamics: Fractals – generating the Mandelbrot set and Julia sets. Definition of each. Solution of nonlinear set of ODEs – Lorenz equations – Observation and definition of strange attractor and sensitive depencence upon initial conditions (butterfly effect). Study of the logistic map – non linear dynamical system – obtaining a bifurcation diagram and estimating Feigenbaum's constant.

VI. Fourier analysis of nonlinear systems: Getting used to programming using FFT subroutines. Understanding the relationship between time-domain and frequency domain. Transforming a Gaussian, understanding how temporal FWHM and spectral FWHM are related. Solving a nonlinear PDE which is amenable to solution by multiple steps of FFTs.

SEMESTER-V
P501: Quantum Mechanics – II

UNIT- I
Collision theory: Scattering cross section; Scattering by spherically symmetric potential; Differential cross section, phase shift; Scattering by rigid sphere; Born approximation.

UNIT- II
Path integral formulation of quantum mechanics; The WKB approximation, solution near a turning point, the connection formulas; Tunnelling through a barrier; The adiabatic approximation.

UNIT- III
Variational method, expectation value of energy, application to excited states, ground state of He-atom, Zero point energy of one dimensional harmonic oscillator, Vander-waals interaction.

UNIT- IV
Foundations (Introductory ideas): The EPR paradox, quantum entanglement; Bell's theorem, the No-clone theorem, Schrodinger's cat; Decoherence, quantum Zeno paradox.

UNIT- V
Symmetry in quantum mechanics; Translation, rotation and space inversion operators; Identical particles; Symmetrical and anti-symmetrical wave functions; Spin – statistics connection (empirical); Density matrix; Equation of motion of density matrix.

Suggested Texts and References:
1. Introduction to Quantum Mechanics, 2nd Editon, D. J. Griffiths, Pearson Education 2008.
2. Quantum Mechanics, 3rd Edition, L. I. Schiff, Tata McGraw-Hill 2010.
3. Quantum Mechanics I and II, Claud Cohen Tannoudji, B. Diu and F. Laloe, Wiley 2006
4. Lectures on Quantum Mechanics, S. Weinberg, Oxford University Press 2012.

P502: Classical mechanics – II
UNIT-I
Variational principle (revisited), Lagrangian formulation, constraints, generalised coordinates, applications. Hamilton's equations of motion (from Legendre transformation), Hamiltonian and total energy, cyclic coordinates, variational principle.

UNIT-II
Small oscillations, single oscillator, damped and forced oscillations, coupled oscillators, normal modes.

UNIT-III
Canonical transformations, Poisson brackets, conservation theorems.

UNIT-IV
Hamilton – Jacobi theory, action – angle variables. Canonical perturbation theory, time dependent and time independent.

UNIT-V
Lagrangian formulation of continuous media as a limiting case, extensions.

Suggested Texts and References:
1. Classical mechanics, N. C. Rana, P. S. Joag, Tata McGraw-Hill Education, 2001.
2. Mechanics, L. D. Landau, E. M. Lifshitz, Elesevier 2005.
3. Regular and Chaotic Dynamics, 2nd Edition, A. J. Lichtenberg, M. A. Lieberman, Springer 1992.
4. Classical mechanics, 3rd Edition, H. Goldstein, C. P. Poole, J. Safko, Pearson Education 2011.

P503: Atomic and Molecular Physics

UNIT- I
Many – electron atoms: One – electron wavefunctions and energies in Coulomb potential (revision); Atomic orbitals, spin – orbit coupling, Thomas precession, fine structure; Alkali atoms; Helium ground state and excited states, direct and exchange integrals; Many – electron atoms: LS and jj coupling schemes; Hartree – Fock method; Pauli's principle and the Periodic Table; Nuclear spin and hyperfine structure.

UNIT- II
Atoms in External Fields: Quantum theory of normal and anomalous Zeeman effect, Linear and quadratic Start effect; Semi – classical theory of radiation; Absorption and induced emission; Einstein's A and B coefficients, dipole approximation, intensity of radiation, selection rules.

UNIT- III
Two level atom in a coherent radiation field, Rabi frequency, radiative damping, optical Bloch equation, Broadening of spectral lines (Doppler, pressure and power broadening).

UNIT- IV
Lasers: Basic concepts, rate equation and lasing conditions, working of some common lasers. Doppler free laser spectroscopy; Crossed – beam method, saturated absorption spectroscopy, two photon spectroscopy; Laser cooling and trapping (descriptive); Atom interferometry (descriptive).

UNIT- V
Molecules: Ionic and covalent bonding, Hydrogen molecular ion (H2 +), Born – Oppenheimer approximation; Bonding and anti – bonding orbitals, Hydrogen molecule; Heitler – London method, Molecular orbital method, hybridisation, quantum mechanical treatment of rotational and vibrational spectra (diatomic and polyatomic molecules); Electronic spectra, Raman effect (classical and quantum theory); Vibrational and rotational Raman spectra; Electron spin resonance.

Suggested Texts and References:
1. Atomic Physics, Christopher Foot, Oxford University Press, 2005.
2. Intermediate Quantum Mechanics, 3rd Edition, H. A. Bethe and R. W. Jackiew, Persius 1997
3. The Physics of Atoms and Quanta: Introduction to Experiments and Theory, H. Haken, H. C. Wolf and W. D. Brewer, Springer 2005
4. Molecular Physics and Elements of Quantum Chemistry: Introduction to Experiments and Theory, H. Haken, H. C. Wolf and W. D. Brewer, Springer 2010.

PM501: Numerical Analysis

UNIT- I
Error, its sources, propagation and analysis; Errors in summation, stability in numerical analysis. Linear algebraic equations: Gaussian elimination, direct triangular decomposition, matrix inversion.

UNIT- II
Rootfinding: review of bisection method, Newton's method and secant method; real roots of polynomials, Laguerre's method. Matrix eigenvalue problems: Power method, eigenvalues of real symmetric matrices using Jacobi method, applications.

UNIT-III
Interpolation theory: Polynomial interpolation, Newton's divided differences, forward differences, interpolation errors, cubic splines. Approximation of functions: Taylor's theorem, remainder term; Least squares approximation problem, Orthogonal polynomials.

UNIT- IV
Numerical integration: review of trapezoidal and Simpson's rules, Gaussian quadrature; Error estimation. Numerical differentiation. Monte Carlo methods.

UNIT- V

Least squares problems: Linear least squares, examples; Non – linear least squares. Ordinary differential equations: stability, predictor – corrector method, Runge – Kutta methods, boundary value problems, basis expansion methods, applications. Eigenvalue problems for differential equations, applications. Solutions of PDE's using differential quadrature: elementary treatment. Applications to diffusion equation, wave equation, etc.

Suggested Texts and references:
1. An introduction to Numerical Analysis, 2nd Edition, Kendall Atkinson, Wiley 2012
2. Numerical Methods for Scientists and Engineers, H. M. Antia, Hindustan Book Agency 2012.
3. Numerical Receipes in Fortran, 2nd Edition, W. H. Press *et al.*, Cambridge University Press 2000.

G501: Earth Science and Energy & Environmental Sciences
Earth Science

Origin of the earth, type of rocks in different layers, their physical and chemical properties, mechanism of their formation and destruction. Radioactivity and its role in geochronology, Plate tectonics and geodynamics and the role of mantle plumes in sustaining these processes. Gravity, electrical and magnetic properties of the different layers in the earth. Their variations in different geological terrains. Instrumentation, field procedures used in these studies. Response of the earth to the elastic (Seismic) and electromagnetic waves, use of this phenomena to study the earth's interior. Geodynamo and the internal magnetic field of the earth. Paleomagnetic studies, Polar wandering and reversal, possible theoretical arguments for understanding the phenomena. Seismology and its use in understanding of the different layers in the earth's interior. Utility of the different geophysical techniques (discussed above) in exploration for academic as well as for harnessing resources.

Suggested Texts and references:
1. The magnetic field of the Earth, Merill, R.T. McElhinny, M.W. and McFadden, P.L. International Geophysical Series.
2. Earth Science by Edward J. Tarbuck, E.J. and Lutgens, F.K.
3. Introduction to Applied Geophysics: Exploring the Shallow Subsurface Burger, H.R., Sheehan, A.F., C.H.
4. Mantle Plumes and Their Record in Earth History, Condie, K.C., 2001, Cambridge University Press, Cambridge, UK
1. Applied Geophysics (Paperback) W M Telford, Robert E Sheriff and L P Geldart.

Energy and Environmental Sciences

Introduction to Environmental Science. Natural Environments: Ecosystems and ecology, biodiversity. Socio-cultural environments: demography, population density, human rganizations. Land use and its planning. Global climate change and effects on environment. Carbon cycle from human activity, calculation of carbon budgets. Water harvesting, storage and treatment. Natural calamities, hazards, and effects of human activity: Chemical and other technological hazards. Various case studies of natural calamities and human-induced disasters. Causes, effects, forecasting, preparedness, planning measures, technological solutions, social interventions. Concept of sustainability, individual and social, and local and global actions for a sustainable future. Introduction to energy Sources - evolution of energy sources with time. Power production, per capita consumption in the world, and relation to development index. Energy scenario in India: Various issues related to consumption and demands -energy crisis issues in India. Renewable and

non-renewable energy sources - technology and commercialization of energy sources, local (decentralized) versus centralized energy production, constraints and opportunities of renewable energy (hydrocarbon and coal based energy sources). Energy conservation – calculation of energy requirements for typical and home and industrial applications. Alternative to fossil fuels - solar, wind, tidal, geothermal. Bio-based fuels. Hydrogen as a fuel. Energy transport and storages, comparison of energy sources - passage from source to delivery (source, production, transport, delivery) - efficiencies, losses and wastes. Nuclear energy: Power production: Components of a reactor and its working, types of reactors and comparison. India's three stage nuclear program. Nuclear fuel cycle. Thorium based reactors. Regulations on nuclear energy.

Energy and Environmental Sciences
1. Energy in Perspective, J. B. Marion, University of Maryland, Academic Press, (1974)
2. Energy and Environment, Robert A. Ristinen and Jack J. Kraushaar, 2nd Edn., John Wiley and Sons, Inc. (2006).
3. Renewable Energy, Boyle Godfrey, Oxford University Press (2004)
4. Environment, Problems and Solutions, D.K. Asthana and Meera Asthana, S.Chand and Co.(2006)
5.Text Book on Environmental Chemistry, Balaram Pani, I.K.International Publishing House(2007).

PL501: Physics Laboratory – V
Study of diffraction by single slit, double slit and multiple slits leading to grating, quantitative determination and compare with simulation; Study of Michelson interferometer and determination of refractive index of air; study of Fabry-Perot interferometer; Study of Zeeman effect using Fabry- Perot Interferometer; study of characteristics of scintillation counter used in nuclear radiation detection; study of Hall effect in semiconductors; Introduction to Labview software for automation and use of NI data acquisition card in PC (six sessions).

Suggested Texts and references:
1. The Art of Experimental Physics, D. W. Preston and D. R. Dietz, Wiley 1991

PML501: Numerical Methods Laboratory
The methods developed in Numerical Analysis (P501) are to be implemented on a computer. Emphasis to be given on applications to physical problems.

Suggested Texts and references:
1.   Numerical Receipes in Fortran, 2nd Edition, W. H. Press *et al.*, Cambridge University Press 2000
2.   An Introduction to Computational Physics, 2nd Edition, Tao Pang, Cambridge University Press 2010

SEMESTER-VI

P601: Electrodynamics

UNIT- I
Review of Maxwell's equations, vector and scalar potentials, gauge transformations.
Radiating systems: electric dipole fields and radiation, magnetic dipole and electric quadrupole fields, antenna, spherical wave solutions of the scalar wave equation.

UNIT- II

Multipole expansion of the electromagnetic fields, energy and angular momenta of multipole radiation, angular distribution of multipole radiation, multipole moments, multipole radiation in atoms and nuclei, multipole radiation from linear centre fed antenna.

UNIT- III

Scattering and Diffraction problems: scattering at long wavelength, perturbation theory of scattering, explaination of blue sky (due to Rayleigh), scalar diffraction theory.

UNIT- IV

Covariant formulation of electrodynamics: four vector potential, electromagnetic field tensor, covariant description of sources in material media, field equations in a material medium. Retarded potentials, Jefimenko's generalisations of Coulomb and Biot – Savert laws, Lienard – Wiechert potentials.

UNIT- V

Fields of a moving charge. Cerenkov radiation. Covariant formulation of the conservation laws of electrodynamics.

Suggested Texts and References:
1. Introduction to Electrodynamics, 4th Edition, D. J. Griffiths, Addison-Wesley 2012
2. Classical Electricity and Magnetism, 2nd Edition, W.K.H. Panofsky and M. Phillips, Dover 2005.
3. Classical Electrodynamics, 3rd Edition, J. D. Jackson, Wiley 2012
4. Lectures on Electromagnetism, 2nd Edition, Ashok Das, Hindustan Book Agency 2013.

P602: Nuclear Physics – I

UNIT- I
Nuclear Properties: Size – nuclear radius, charge distribution, matter distribution. Mass- binding energy, liquid drop model/mass formula. Spin, Parity, isospin. Electromagnetic moments- magnetic dipole and electric quadrupole moments/nuclear shapes.

UNIT- II

Nuclear stability, alpha, beta, gamma decays, fission. Experimental methods for size, mass, spin, moments to be included.

UNIT-III
Nuclear Forces: Nuclear interaction, saturation of nuclear density, constancy of binding energy per nucleon. Bound two nucleon system, Deuteron problem, absence of bound pp, nn. N-N scattering – as a function of energy, phase shift, cross section. Salient features of nuclear force. Yukawa's theory of nuclear interaction (basics).

UNIT- IV
Nuclear Structure: Magic numbers, shell model, spin orbit interaction, deformed shell model.
Nuclear excited states vibration, rotation, Collective model. Electromagnetic interactions in nuclei: multipole transitions, selection rules, life times, electron capture, internal conversion, isomers, Coulomb excitation.

UNIT- V

Nuclear Reactions: Kinematics, Q value, excitation energy, conservation laws, cross section, mean free path. Types of nuclear reactions, experimental observables, excitation function, angular distribution, spectra. Compound nuclear reactions, Resonances, level density, temperature, Bohr model. Direct nuclear reactions, optical model, pick up and stripping reactions, spectroscopic factor Nuclear fission and fusion reactions.

Suggested Texts and References:
1. Introductory Nuclear Physics, K.S. Krane, Wiley 2008
2. Concepts of Nuclear Physics, B. L. Cohen, McGraw Hill 1971
3. Introductory Nuclear Physics, S. S. M. Wong, Prentice – Hall 2010
4. Introduction to Nuclear and Particle Physics, 2nd Edition, A. Das and T. Ferbel, World Scientific 2004

P603: Condensed Matter Physics – I

UNIT- I

Crystal Structure and x-ray diffraction: Crystalline and amorphous solids, translational symmetry. Elementary ideas about crystal structure, lattice and bases, unit cell, reciprocal lattice, fundamental types of lattices, Miller indices, lattice planes, simple cubic, f.c.c. and b.c.c. lattices. Simple crystal structures, Closed packed structure, Determination of crystal structure with X-rays, Neutrons and Electron diffraction-Diffraction of waves by crystals, Laue and Bragg equations, Brillouin Zones, Fourier Analysis of the basis. Debye waller factor, X ray broadening -size and temperature effects. X-ray diffraction of liquids and disordered solids- introduction to radial distribution functions.

UNIT- II

Lattice Vibrations: Elastic waves, Thermal properties: Einstein's and Debye's theories of specific heats of solids, Thermal conductivity, Phonons, Lattice waves, Dynamics of a chain of similar atoms and chain of two types of atoms; optical and acoustic modes; Inelastic scattering of x-rays, neutrons and light by phonons, Optical properties of solids: interaction of light with ionic crystals. Raman scattering and Brillouin scattering.

UNIT- III

The Free electron model: Drude Model, Electon conductivity, Heat capacity of conduction electrons, Fermi surface, Sommerfield model, Thermal conductivity of metals, Hall effect, AC conductivity and optical properties, Wiedemann-Franz law, Failure of the Free-electron model, optical properties of metals.

UNIT- IV

Basics of Semiconductors and device: Crystal structure, Band structure, Intrinsic and extrinsic semiconductors, Concept of majority and minority carriers, Energy gap, Mobility, conductivity, Hall effect, Diffusion, Optical properties: Absorption, Luminescence, Photoconductivity, effect of disorder on absorption. Interpretation of energy band diagrams. Devices: p-n diode (derivation of Shockley equation), tunnel diode, photodiode, solar cell, LED, Lasers.

UNIT- V

Superconductivity: Introduction (Kamerlingh Onnes experiment), effect of magnetic field, Type-I and type-II superconductors, Isotope effect. Meissner effect. Heat capacity. Energy gap. Electrodynamics of superconductivity: London's equation, Thermodynamics of the transition, Intermediate state of Type 1, Mixed state of type 2, Flux Quantization, Salient points of BCS theory, Cooper problem, Definition of coherence length, Josephson effect

Suggested Texts and References:
1. Elementary Solid State Physics, M. Ali Omar, Pearson Education 2008.
2. Introduction to Solid State Physics, 8th Edition, C. Kittel, Wiley 2012.
3. Solid State Physics, N. W. Ashcroft and N. D. Mermin, Cengage 2003.
4. Physics of Semiconductor Devices, 3rd Edition, S. M. Sze and K. K. Ng, 2007.
5. Introduction to Superconductivity, A. C. Rose -Innes, E. H. Rhoderik, Pergamon Press
6. Solid State Physics, J. P. McKelvey, Krieger Publishing Co. 1993.
7. Electron theory of solids, J. M. Ziman, Cambridge University Press, 2011.

P604: Lasers

Unit- I
Laser Characteristics –Spontaneous and stimulated emission, Einstein's quantum theory of radiation, theory of some optical processes, coherence and monochromacity, kinetics of optical absorption, line broadening mechanism, Basic principle of lasers, population inversion, laser pumping, two & three level laser systems, resonator, Q-factor, losses in cavity, threshold condition, quantum yield.

Unit – II
Laser Systems- Solid state lasers- the ruby laser, Nd:YAG laser, ND: Glass laser, semiconductor lasers – features of semiconductor lasers, intrinsic semiconductor lasers, Gas laser -neutral atom gas laser, He-Ne laser, molecular gas lasers, CO2 laser, Liquid lasers, dye lasers and chemical laser.

Unit-III
Advances in laser Physics, Production of giant pulse -Q-switching, giant pulse dynamics, laser amplifiers, mode locking and pulling, Non-linear optics, Harmonic generation, second harmonic generation, Phase matching, third harmonic generation, optical mixing, parametric generation and self-focusing of light.

Unit – IV
Multi-photon processes; multi-quantum photoelectric effect, Theory of two-photon process, three- photon process, second harmonic generation, parametric generation of light, Laser spectroscopy : Rayleigh and Raman scattering, Stimulated Raman effect, Hyper-Raman effect, Coherent anti-stokes Raman Scattering, Photo-acoustic Raman spectroscopy.

Unit – V
Laser Applications – ether drift and absolute rotation of the Earth, isotope separation, plasma, thermonuclear fusion, laser applications in chemistry, biology, astronomy, engineering and medicine.
Communication by lasers: ranging, fiber Optics Communication, Optical fiber, numerical aperture, propagation of light in a medium with variable index, pulse dispersion.

TEXT AND REFERENCE BOOKS:
1. Laud, B.B.: Lasers and nonlinear optics, (New Age Int.Pub.1996).
2. Thyagarajan, K and Ghatak, A.K.: Lasers theory and applications (Plenum press, 1981).
3. Ghatak, A.K.and Thyagarajan, K : Optical electronics (Cambridge Univ. Press 1999).
4. Seigman, A.E.: Lasers (Oxford Univ. Press 1986)
5. Maitland, A. and Dunn, M.H. : Laser Physics (N.H.Amsterdam, 1969).
6. Hecht, J.The laser Guide book (McGraw Hill, NY, 1986).

7. Demtroder, W. : Laser Spectroscopy (Springe series in chemical physics vol.5,Springe verlag, Berlin, 1981).
8. **Harper, P.G.and Wherrett B.S. (Ed.): Non-linear-optics (Acad.press, 1977).**

P605: Nonlinear Dynamics and Chaos

UNIT-I
Dynamical Systems, phase portraits, vector fields, nullclines, flows, discrete dynamical systems, 1-d maps. Fixed points, linearization of vector fields, canonical forms, generalized eigenvectors, semisimple – nilpotent decomposition, Jordan canonical form.

UNIT-II
Classification of fixed points. Hartman -Grobman theorem, homeomorphism, Stable Manifold Theorem, Centre Manifold Theorem, examples of manifolds. Index theory, Lyapunov functions and stability analysis, Limit cycles, Poincare-Benedixon Dynamical Systems, phase portraits, vector fields, nullclines, flows, discrete dynamical systems, 1-d maps, Fixed points.

UNIT-III
Linearization of vector fields, canonical forms, generalized eigen vectors, semisimple-nilpotent decomposition, Jordan canonical form, classification of fixed points. Hartman-Grobman theorem, homeomorphism, Stable Manifold Theorem, Centre Manifold Theorem, examples of manifolds. Index theory, Lyapunov functions and stability analysis, Limit cycles, Poincare-Benedixon Theorem. Gronwall's inequality.

UNIT-IV
The Variational Equation, exploring neighbourhoods, Lyapunov exponents, Monodromy matrix, Floquet exponents. Bifurcations: Saddle-Node, Transcritical, Pitchfork and Hopf Bifurcation. 1-d maps, linear stability of fixed points and higher order fixed points, chain rule, lyapunov exponent, bifurcation diagram, finding period-n orbits in 1-d maps. 2-d maps, Linearization, the Henon map.

UNIT-V
Poincare surface of section. Symbolic dynamics, Sensitivity to initial conditions, Chaos, Partitions, Transition matrix, Entropies, Smale Horseshoe. Invariant density, the Perron-Frobenius operator. Fractals. Hamiltonian Dynamics.

Suggested Texts and References:
1. Nonlinear Dynamics And Chaos: With Applications To Physics, Biology, Chemistry and Engineering, S. Strogatz, Addison-Wesley 2001
2. Chaos: An Introduction to Dynamical Systems, K.T. Aligood, T.D. Sauer, J.A. Yorke, Springer 2000
3. Differential Equations, Dynamical Systems and an Introduction to Chaos, M. Hirsh, S. Smale and R. Devaney, Elsevier Academic Press, 2012
4. Chaos and Integrability in Nonlinear Dynamics: An Introduction, M. Tabor, John Wiley & Sons,1989
5. Chaos: Classical and Quantum, P. Cvitanovic *et al.*

H601: Ethics of Science and IPR
Introduction to a Collective, Participatory Teaching-learning Program: A Science of Our own. Science Stands the Test of Ethics … Some indicators. Levels of Moral Development - Does it mean anything? Medical Ethics: Different themes pertaining to medical ethics including ethical

issues in public health. History, Philosophy and Psychology of Ethics: History of Political Economy and Modern Ethics. Environmental Ethics.

Intellectual Property Rights and Associated Issues: History of Patenting. Digitalizing Culture-I: Free Software and Free Culture. Digitalizing Culture-II: Concentration and appropriation of Power by the few as well as Possibility of Distributive Justice.

Journals and Publishers: Monopolistic practices by Academic Publishers. Quest for Determining what is Virtuous: Ethics in Practice. Collaborative Projects by the Class. Teaching the Teachers and other Virtuous Inquiries.

PL601: Physics Laboratory – VI
Study of quantum mechanics through acoustic analogue (four sessions); Fourier analysis / synthesis – use of simulation; Study of characteristics of a coaxial cable and determination of speed of electromagnetic waves in the coaxial cable; determination of specific charge (e/m) of electron; Study of Faraday rotation and determination of Verdit's constant in a glass material; investigation of chaos in a spring based coupled oscillator system; Introduction to workshop practice (two sessions); Introduction to vacuum practice (two sessions).

Suggested Texts and References:
1. The Art of Experimental Physics, D. W. Preston and D. R. Dietz, Wiley 1991

Semester-VII
P701: Fluid Mechanics
UNIT-I
Validity of hydrodynamical description. Kinematics of the flow field. Stress-strain relationship. Basic equations governing conservation of mass, momentum & energy.

UNIT-II
Navier-Stokes equation for viscous flows. Shear and bulk viscosity and radiative diffusivity in fluids. Viscous and thermal boundary layers, Potential flows, Water waves. Kelvin's circulation theorem, Stokes's flow Lubrication theory.

UNIT-III
Virial theorem in the tensor form. Magnetohydrodynamic flows. Generalized Ohm's law in the presence of Hall current &Ambipolar diffusion, Magneto-gravity-acoustic modes.

UNIT-IV
Classical hydrodynamic and hydromagnetic linear stability problems: Rayleigh-Taylor and Kelvin- Helmholtz instabilities. Jeans' gravitational instability; Benard convection. Parker instability and magnetic buoyancy. Thermal instability. Non-linear Benard problem.

UNIT-V
Spherical accretion flows onto compact objects and accretion disks. High Speed flow of gases. Shock waves and blast waves. Supernova hydrodynamics. Physiological hydrodynamics. Blood flow in human heart.

Suggested Texts and References:
1. Hydrodynamics, 6th Edition, H. Lamb, Dover 1945
2. An Introduction to Fluid Dynamics, G.K. Batchelor, Cambridge University Press, 2000
3. Fluid Mechanics, 2nd Edition, L.D. Landau and E.M. Lifshitz, Elsevier 1987

4. Magnetohydrodynamics, 2nd Edition, T.G. Cowling, Hilger 1976
5. Introduction to Physics of Fluids and Solids, J. Trefil, Dover 1975.

P702: Quantum Mechanics – III

UNIT- I
Relativistic Equations: Lorentz transformations, covariant notation, Klein – Gordon equation, difficulties with probability interpretation of one – particle K-G equation; Dirac equation; Properties of γ matrices.

UNIT- II
Dirac equation in external electromagnetic field; Non – relativistic reduction; Gyrofactor for spin; Lorentz covariance of Dirac equation; Bilinear covariants.

UNIT- III
Solutions of Dirac equation: Plane wave solutions; Negative energy solutions; Hole theoretic interpretation; Spin; Dirac momentum space spinors; Orthonormality and completeness relations; Projection operators for energy, helicity and spin; Trace theorems; Exact solution of Dirac equation for Coulomb potential; Energy levels of Hydrogen atom in Dirac theory; Fine structure splitting; Relativistic corrections and Lamb shift.

UNIT- IV
Introduction to quantum field theory: Lagrangian field theory, symmetry and conservation laws, Klein – Gordon field (real and complex); Covariant commutators, the K-G propagator; Dirac field; Anti-commutation relations, the Fermion propagator; Electromagnetic field; Covariant quantisation, the photon propagator.

UNIT- V
Feynman rules for QED: Dyson expansion of S – matrix; Feynman diagrams in momentum space, Feynman rules, QED processes in lowest order.

Suggested Texts and References:
1. Relativistic Quantum Mechanics vol. 1: J. D. Bjorken and S. D. Drell, McGraw-Hill 1998
2. Intermediate Quantum Mechanics, H. A. Bethe and R. W. Jackiew, Perseus Books 1997
3. Quantum Field Theory, 2nd Edition, F. Mandl and G. Shaw, Wiley 2010
4. Advanced Quantum Mechanics, F. Schwabl, Springer 2008

P703: Statistical Mechanics – II

UNIT-I
Transport theory using the relaxation time approximation; Boltzmann differential equation formulation; examples of the Boltzmann equation method. Stochastic Processes; Random Walk; Auto-catalytic processes.

UNIT-II
Diffusion equation; Langevin equation; Fokker- Planck equation.

UNIT-III

Ising Model; mean-field theory; Landau theory of second order phase transition; Peierls argument; the Bethe-Peierls approximation; Kramers-Wannier duality argument; Pade Approximant.

UNIT-IV

Phase transition and Critical Phenomenon: critical exponents; exponent inequalities; static scaling hypothesis; block spins and the Kadanoff construction.

UNIT-V

Renormalization Group: Decimation; Migdal-Kadanoff method; general renormalization group prescription; examples. Monte-Carlo Methods in statistical mechanics; Metropolis algorithm; Gilespie method.

Suggested Texts and References:
1. Fundamentals of Statistical and Thermal Physics, F. Reif, McGraw-Hill Book Company
2. Statistical Physics part 1, 3rd Edition, L. D. Landau and E. M. Lifshitz, Elsevier 2008
3. Statistical Mechanics: A Set of Lectures, R. P. Feynman, W. A. Benjamin, Inc. 1998
4. A Modern Course in Statistical Physics, L. E. Reichl, Wiley 2009

P704: Reactor Physics.

UNIT- I

Fission process: Liquid drop model, fission rate, reactor power, prompt and delayed neutrons, fission gammas, fission products energy balance, photo neutrons. fissile, fertile and fissionable materials. Fission product activity and decay heat after shut down.
Interaction of Neutrons with Matter: Production of neutrons and nuclear reactions with thermal and fast neutrons, transmutation.

UNIT- II

Concept of microscopic cross section: Inelastic and elastic scattering, Maxwell-Boltzmann distribution and its departure Variation of cross-section with energy, **f**ast, resonance and thermal ranges. 1/v law of neuron cross-section, Resonance absorption, Doppler effect. Eta vs E curve, conversion & breeding concepts-Thorium utilization.
Diffusion of neutrons: Fick's law and its validity, steady state neutron diffusion equation, concepts of neutron flux and current, interface conditions, diffusion coefficient, diffusion length and extrapolation distance.

UNIT- III

Chain Reaction: Four Factor formula, conceptual treatment of diffusion of one group neutrons in non multiplying and multiplying media, infinite and effective multiplication factors bare homogeneous reactor-concepts of material and geometric buckling, sub criticality and super criticality, critical mass, non leakage probabilities in bare homogeneous cores, neutron cycle and lifetime in finite and in infinite reactor system.
Slowing down process: Neutron slowing down, slowing down power and moderating ratio for moderators. Slowing down with spatial migration, Fermi age concepts, migration length, use of reflectors/blankets, reflector savings.
Heterogeneous reactors: Multigroup neutron diffusion with special reference to 2 group approach, Heterogeneous reactors, comparison with homogeneous reactors, unit-cell concepts.

UNIT- IV

Reactor kinetics: Time dependent neutron diffusion equation, one group kinetic equation, prompt neutron life time, Point kinetic model to illustrate importance of delayed neutrons, reactor period, reactivity and its units. Fuel burn-up units.

Neutron Poisons: Xenon and Samarium Poisons, Xenon loads (operating and post shutdown), Variation of xenon load with power and enrichment. Xenon oscillations and their control.

UNIT- V

Reactivity coefficients: Temperature coefficients of reactivity and void coefficient of reactivity, their relevance to reactor safety. techniques to control reactors, typical reactivity balance, long-term burnup, fuel management. Reactor control system – requirements of physics aspects. Reactor shutdown mechanisms and neutron monitoring during operation and shut down. Approach to criticality, physics measurements and calibrations/validations. Reactivity worth measurements of control rods.

Research Reactors at Trombay, Indian PHWRs.

Suggested Texts and References
1. Nuclear Reactor Engineering: Reactor Systems Engineering, Samuel Glasstone and Alexander Sesonske, 4th Edition, 2012
2. Introduction to Nuclear Engineering, 3rd Ed., John R. Lamarsh and Anthony J. Baratta, 2001.
3. Nuclear Reactor Analysis, James J. Duderstadt and Louis J. Hamilton, 1976
4. Nuclear Energy: An Introduction to the Concepts, Systems, and Applications of Nuclear Processes, 6th Ed., Raymond Murray and Keith E. Holbert, 2008.
5. Fundamentals of Nuclear Reactor Physics, Elmer E. Lewis, 2008.
6. Nuclear Reactor Physics, 2nd Ed., Weston M. Stacy, 2007
7. Nuclear Energy: Principles, Practices and Prospects, David Bodansky, 2008.

PL701: Advanced Physics Laboratory – I
Nuclear Physics
Spectral features of photoelectric absorption and Compton scattering with scintillation detectors (i) Inorganic: NaI(Tl), BaF2 (ii) Organic: BC501A and plastic. Energy calibration, energy resolution, photopeak and total efficiency, relative intensity, photoelectric and Compton cross-sections, radiation shielding. Alpha spectroscopy with a silicon surface barrier detector. Fine structure of alpha spectrum and determination of age of source. Fast timing and coincidence measurements using BaF2 and BC501A detectors. Angular correlation of gamma rays using NaI(Tl) detectors. High resolution, low-energy photon measurements with a silicon drift detector: Internal conversion studies, elemental composition through X-Ray Fluorescence (XRF) analysis. Geiger-Muller counter: operating characteristics, dead time measurement, determination of mass absorption coefficient, verification of inverse square law. Lifetime measurements: from nanoseconds through minutes using fast coincidence and decay studies. High-resolution gamma ray measurements with high-purity germanium detectors. Classic experiments: Rutherford scattering, cloud chamber, beta spectrometer. Spectrum analysis techniques and fitting routines: data/peak fitting, energy and efficiency calibration, 1D and 2D histograms.
(Selected experiments from the above list are performed based on number of contact hours prescribed)

Condensed Matter
Growth of metallic thin films by physical vapor deposition techniques like thermal evaporation and DC magnetron sputtering. Tuning of growth parameters to change the deposition rate and

hence thickness of the films. Introduction to vacuum techniques: vacuum pumps, rotary pump, diffusion pump and turbo molecular pumps. Measurement of vacuum: thermocouple gauges, hot and cold cathode gauges. Thickness measurement of thin films by quartz crystal monitor.

Structural characterization of materials (some known and some unknown) by X-ray diffraction (XRD) and X-ray fluorescence (XRF) (a) Phase identification (b) Chemical composition (c) difference between powder diffraction pattern of single and polycrystalline systems (d) Reasons for line broadening in XRD: Rachinger correction and estimation of particle size from Debye-Scherer formula. (e) Identifying crystal structure and determination of lattice constant.

Introduction to low temperature measurements: operation of a closed cycle cryostat, low temperature thermometers, controlling temperatures using PID feedback using temperature controllers, making electrical contacts on thin films and measuring DC resistance with sourcemeter using four probe method-advantages and disadvantages of the technique, temperature dependent (300-20K) measurement of electrical resistivity of metallic thin films and comparing the room temperature value with the standard. Determination of superconducting transition temperature of a high temperature superconductor using electrical transport measurements. Determination of band gap of a semiconductor: highly doped Si by fitting the temperature dependent resistance to the standard variation in semiconductors. Concepts of measuring electrical resistance in labs: from metals to dielectrics. Introducing GPIB interfacing of electronic instruments with the computer and writing LABVIEW programs to interface temperature controller and sourcemeter.

Introduction to phase sensitive measurements: using of a dual phase lock-in amplifier. Measurement of the superconducting transition temperature of a superconducting thin film using a mutual inductance technique down to 2.6K (working of a cryogen free system). Measuring AC resistance of a milliohm resistor using phase sensitive detection and studying the frequency and amplitude variation of the resistance: introduction to noise, White noise and 1/f noise.

Suggested Texts and References:
1. Radiation Detection and Measurement, Glenn F. Knoll, John Wiley 2010
2. Techniques for Nuclear and Particle Physics Experiments: William R. Leo, Springer 1995
3. Basic Vacuum technology, 2nd Edition, A. Chambers, R. K. Fitch and B. S. Halliday, IOP 1998
4. Physical Vapor Deposition, R. J. Hill, McGraw-Hill 2005
5. Elements of X-ray Diffraction, 3rd Edition, B. D. Cullity and S. R. Stock, Prentice Hall 2001
6. Introduction to Solid State Physics, 8th Edition, C. Kittel, Wiley 2012.

SEMESTER-VIII

P801: Astronomy and Astrophysics

UNIT-I
Stellar Physics: Equations governing the structure of stars: Mechanical & Thermal equilibrium. Virial theorem. Modes of energy transfer in stars: radiative & convective transport of energy. Auxiliary input: equation of state, opacity and energy generation by thermonulcear processes. Boundary conditions at the stellar surface & at the centre.

UNIT-II
Models with linear & quadratic density profiles. Polytropic models. Mass-luminosity-radius relations for low, intermediate & high mass stars. Sources of opacity and nucleosynthesis in stars. Manufacturing of iron-peak and heavier elements by rapid neutron capture processes. Mixing

length theory of convective transport of hear. Completely convective stars. Hertzsprung-Russel diagram. Pre-main sequence contraction and the Hayashi phase. Zero-age main sequence.

UNIT-III
Stellar evolution: main sequence, red giant and asymptotic giant branch. Advanced stages of stellar evolution: white dwarfs, neutron stars & black holes. Physics and astrophysics of collapsed objects: pulsars, X-ray &gamma ray sources. Spherical accretion and Bondi solution. Physics of accretion discs. Stellar rotation and magnetism.

UNIT-IV
Galactic Physics: Units in astronomy, co-ordinate system, multi-wavelength sky (radio, IR, Optical, UV, X-ray, Gamma ray), distance ladder, Milkyway Galaxy, interstellar medium, basics of star formation, spiral and elliptical galaxies (morphology, content and kinematics), evidences for dark matter, . astronomy and society (including citizen science), constraints and prospects of astronomy and astrophysics research in India.

UNIT-V
AGNs, evidences for supermassive black holes, M-sigma and similar correlations, radio galaxies, synchrotron radiation, accretion onto black hole, physical processes behind black holegalaxy co-evolution (merger, infall and feedback), clusters of galaxies (contents and kinematics), high redshift galaxies, cosmic evolution of galaxies and black holes, hierarchical structure formation, cosmic-web, GMRT

Suggested Texts and References:
1. The Internal Constitution of Stars, A. S. Eddington, Cambridge University Press, 1988.
2. An Introduction to the Study of Stellar Structure, S.Chandrasekhar, Dover Publications, 2003.
3. The stucture & Evolution of the Stars, M.Schwarzschild, Dover Publications, 1962.
4. Cox and Giuli's Principles of Stellar Structure, 2nd Ed., A. Weiss et al., Cambridge, 2003.
5. The Physical Universe: An Introducing to Astronomy, F. H.Shu, University Science Books, 1982.
6. Galactic Astronomy, James Binny and Michael Merrifield, Princeton University Press, 1998.
7. An Introduction to Active Galactic Nuclei, B. M. Peterson, Cambridge University Press, 1997.
8. Extragalactic Astronomy and Cosmology: An Introduction, Peter Schneider, Springer, 2006.
9.Physics of the Interstellar & Intergalactic Medium, Bruce T. Draine, Princeton Univ. Press, 2011.

P802: Accelerator Physics and Applications

UNIT-I
Transverse beam dynamics: Accelerator coordinates; Canonical transformation to accelerators coordinates; Guide field; Dipole and Quadrupole Magnets; Hills equation and solution; Twiss parameters; Matrix formulation; Dispersion; Design of lattices; Field and gradient errors; Chromaticity; sextupole magnets and dynamics aperture.

UNIT-II
Longitudinal beam dynamics: Fields and forces; acceleration by time varying fields; relativistic equations; Overview of acceleration; transit time factor; main RF parameters; momentum compaction factor; transition energy; Equations related to synchrotron; synchronous particle; synchrotron oscillations; principle of phase stability; RF acceleration for synchronous and for non-synchronous particle; small amplitude oscillations; Oscillations with Hamiltonian formalism; limits of stable region; adiabatic damping.

UNIT-III

Linear accelerators: Basic methods of linear acceleration; Fundamental parameters of accelerating structures; Energy gain in linear accelerating structures; Q, Shunt-impedance, transit-time factor; periodic accelerating structures; RFQs; Microwave topics for linacs; Single particle dynamics in linear accelerators; Multi-particle dynamics in linear accelerators.

UNIT-IV

Synchrotron radiation: Introduction to electromagnetic radiation; Radiation of accelerated charged particles; radiation from wigglers and undulators; Electron dynamics with radiation; Low emittance lattices; synchrotronradiation sources.

UNIT-V

Free-electron lasers: Introduction; electron dynamics in the undulator; spontaneous emission; electron dynamics in the laser field; dynamics of the laser field; dimensionless equations of motion; solution in the small-signal, small-gain regime; Madey theorem; three-dimensional effects; undulators; X-ray laser. Advanced accelerator concepts: Photo injectors; laser-wakefield acceleration; plasma-wakefield acceleration; linear colliders; muon colliders.

Suggested Texts and References:
1. An Introduction to the Physics of High-Energy Accelerators, D. A. Edwards & M. J. Syphers
2. An Introduction to Particle Accelerators, Edmund Wilson
3. Introduction to Accelerator Physics, Arvind Jain
4. R. F. Linear Accelerators, T. P. Wangler
5. Classical Electrodynamics, 3rd Edition, J. D. Jackson, Wiley 2012

P803: Nuclear and Particle Physics

UNIT-I

Nuclear Reactions: Partial wave decomposition, phase shifts and partial wave analysis of the cross sections in terms of phase shifts. Behaviour of phase shifts in different situations. Black sphere scattering. Optical theorem and reciprocity theorem. Unitarity.

Optical potential: Basic definition. Relation between the imaginary part, W of the OP and σ_{abs} , and between W and mean free path. Folding model and a high energy estimate of the OP.

UNIT-II

Catagorisation of Nuclear Reaction mechanisms:

Low energies: Discrete region, Continuum Region: (a) Discrete Region: Decaying states. Relation between the width and the mean life time. Energy definition: Lorentzian or Breit-Wigner. Resonance scattering. Derivation of the resonance cross section from phase shift description of cross section. Transmission through a square well and resonances in continuum. Coulomb barrier penetration for charged particles scattering and centrifugal barrier for l non-zero states. Angular distributions of the particles in resonance scattering. Application to hydrogen burning in stars. (b) Continuum Region: Bohr's compound nucleus model.

UNIT-III

Direct Reactions: Cross section in terms of the T-matrix. Phase space, and its evaluation for simple cases. Lippmann Schwinger equation for the scattering wave function, and its formal solution. On-shell and off-shell scattering. Plane wave and distorted wave approximation to the T-matrix(PWBA, DWBA). Application to various direct reactions like, stripping, pick-up, knock-out etc.High energy scattering. Glauber theory. Eikonal approximation to the scattering wave function.Evaluation of scattering cross section in eikonal approximation. Introduction to heavy-ion scatteringand the physics with radioactive ion beams.

UNIT-IV

Nuclear Structure: Generalization of the single-particle shell model, residual interactions, Fermi gas model. Single-particle energies in a deformed potential, shell corrections and the Strutinski method. Pairing: BCS model and the Bogolyubov transformation. Hartree-Fock method: general variational approach, Hartree-Fock equations and applications. Nuclear shape parametrization, quadrupole and higher- order deformations. Collective rotation and vibration; Giant resonances. Cranking model, phenomena at high spin including super-deformation. introduction to Density-Functional Models, including relativistic mean field. Selected contemporary research topics: Superheavy nuclei; Spectroscopy of drip-line nuclei.

UNIT-V

Particle Physics: Symmetries and conservation laws, conserved quantities in reactions of particles. Relativistic kinematics in particle reactions, invariants, resonances, decays of resonances and their decays etc. Particle classification, mesons and baryons, SU(3) multiplets, quark model. Quarks, gluons, QCD interaction, colour neutrality. Detection of quarks and gluons, structure function in deep inelastic reactions. Quark and lepton families, weak interactions as guage theory, W and Z bosons. Symmetry breaking and generation of masses, Higgs bosons. Present boundary (strings, grand unification, matter-anti-matter asymmetry, dark matter and energy - seminar, qualitative)

Suggested Texts and References:
1. Subatomic Physics, E. M. Henley & A. Garcia, World Scientific
2. Concepts of Nuclear Physics, B. C. Cohen, McGraw-Hill.
3. Introduction to Nuclear and Particle Physics, A. Das and T. Ferbel, World Scientific.
4. Structure of the Nucleus: M.A. Preston and R.K. Bhaduri, Levant Books, 2008
5. Nuclear Models: W. Greiner and J.A. Maruhn, Springer, 1996
6. Nuclear Structure from a Simple Perspective: R. F. Casten, Oxford University Press, 1990
7. Theory of Nuclear Structure: M.K. Pal, Affiliated East-West Press, 1982
8. An Introduction to Quarks and Partons, F. E. Close, Academic Press 1980
9. Quarks and Leptons: An Introductory Course in Modern Particle Physics, F. Halzen and A. D. Martin, John Wiley 1984
10. Introduction to High Energy Physics, 4th Edition, D. Perkins, Cambridge 2000

P804: Condensed Matter Physics – II

UNIT-I

Superconductivity: Revision, Introduction to second quantization, BCS theory, Electron tunneling and energy gap, Josephson effect (AC and DC). GL theory and concept of penetration depth, coherence length and surface energy, Flux quantization.

UNIT-II
Modified London Equation of Mixed Phase, Interaction between Flux tubes, Flux flow, Flux pinning, Magnetization of Mixed State: Bogoliubov transformation, Boundary between normal metal and superconductor, Andreev Reflection and Proximity effect.

UNIT-III
Magnetism: Quantum theory of magnetism: Rationalization of the Heisenberg Hamiltonian, Hubbard model and Stoner Model: Derivation of susceptibility, Spin wave using Holstein-Primakov transformation.

UNIT-IV
Introduction to Density Functional Theory
Introduction to Special topics: Integer and Fractional Quantum hall effect, unconventional superconductivity, frustrated magnets, Josephson junction qubits, Graphene physics, Topological insulators.

UNIT-V
Kondo Physics, Metamaterials, Physics of photonic band gap materials, quantum cascade lasers, free electron lasers, organic electronics etc.

Note: Special topics in Fermi Liquid Theory may be covered if time permits.

Suggested Texts and References:
1. Introduction to Superconductivity, 2nd Edition, M. Tinkham, Dover 2004
2. Superconductivity, J. B. Ketterson and S. N. Song, Cambridge 1999
3. Basic Solid State Physics by A. K. Raychaudhuri
4. Magnetism in Solids, D. H. Martin, Butterworth 1967
5. Quantum theory of Magnetism, 3rd Edition, R. M. White, Springer 2006
6. Electronic Structure, Basic Theory & Practical Methods, R. Martin, Cambridge 2008

PL801: Advanced Physics Laboratory – II
Introduction to Observational Astronomy: Transmission of radiation through atmosphere in different bands, need for space platforms for invisible astronomies, Introduction to Optical, Infrared, Ultra-violet, X-ray and Gamma-ray astronomy, what do me measure and learn from different wavebands.

Introductory Astronomy and Different types of Optical Telescopes: Astronomical parameters like Apparent and Absolute magnitude, Flux, Luminosity and its dependence on size and temperature of stars, Atmospheric Extinction, Coordinate System in Astronomy Refracting and Reflecting telescopes, different focal plane configurations, their applications and relative merits and demerits. Reflectivity and its wavelength dependence, "seeing" and factors affecting it, use of active and adaptive optics in modern telescopes to overcome atmospheric and thermal effects, calculation of focal length, focal ratio, magnification, field of view, plate scale, diffraction limit of telescopes.

Introduction to Focal Plane Detectors for Optical, infrared and UV astronomy: Developments and evolution of modern Optical and Infrared imaging detectors: Photographic Plates, Phototubes, Image Intensifiers, Charge Coupled Devices (CCDs), Bolometers and how they work, their characterization and parameters (charge transfer efficiency, quantum efficiency, flat fielding etc.). CCDs uses in Imaging, morphological and Spectroscopic studies, Infrared Detectors and IR Arrays, UV Imaging and Photon Counting Detectors.

Different types of Focal Plane Instruments: Imagers, Photometers, Fast Photometers for photon counting, limitations of PMT and CCD bases photometers, Importance of spectroscopy, Design and description of Low and High Resolution Spectrometers and their applications, Polarimeters and their applications.

Interaction of radiation with matter: (a) Passage of charged and neutral particles through matter, Ionization loss formulae and dependence on different parameters, relativistic rise in ionization loss, detection of neutrons, Bremsstrahlung process, Cerenkov radiation and its application (b) Interaction of photons with matter: Photoelectric interaction, mass absorption formula and dependence on energy, atomic number etc, Thompson scattering, Compton scattering, Pair production process, formula and dependence on energy, atomic number, radiation length, critical energy

Introduction to Different Types of Gas-Filled Radiation Detectors: Role of development of new detection techniques in new discoveries in high energy physics and astrophysics, different kind of detection techniques for charged and neutral radiation Dependence of charge multiplication on high voltage and pressure, Townsend coefficient, need for use of inert gases, quench gas, mobility of electrons and ions (a) Ionization Chamber (IC), description of a typical IC, its characteristics, application of IC in physics (b) Proportional Counters (PC): Single and multi cell PCs, filling gases, Penning effect, charge multiplication process, energy resolution of PC, Fano factor, use of PCs in high energy physics, and astronomy especially in X-ray astronomy (c) Geiger Mueller (GM)Counter: Typical GM counter, its characteristics, applications of GM counter

Scintillation Counters, Cerenkov Detectors and other Solid State Detectors: Scintillation processes, dependence on energy, charge and atomic number, Photomultiplier (PMT) for detection of light, PMT characteristics, charge multiplication and use of PMTs with scintillators (a) Organic Scintillation Counters: Plastic Scintillators and light yield, their use in charged particle detection, a typical PS detector and its characteristics (b) Inorganic Scintillation Counters: Scintillation medium and need for activators, Sodium Iodide (NaI) and Caesium Iodide detectors, their light output, application of these detectors in physics and astrophysics (c) Silicon detectors and their applications in X-ray Astronomy, Germanium Detectors, Cadmium -Telluride devices and their arrays

Observational X-ray Astronomy: Birth and evolution of X-ray Astronomy, different types of X-ray sources, Discovery of X-ray Binaries, their broad properties, optical identification, classification in Low Mass X-ray binaries (LMXBs) and High Mass X-ray Binaries (HMXBs), their unique characteristics, estimation of mass of the compact star in X-ray binaries from the binary parameters (a) Neutron Star Binaries (NSB): X-ray Pulsars in Binaries, Rotation powered pulsars in SNRs, detailed discussion of their timing and spectral properties, New physics and astrophysics learnt from their studies (b) Black Hole Binaries (BHB): Inference about black hole nature, time variability, spectral measurements, mass of black hole

X-ray Radiation Processes: (a) Thermal Emission, Black Body emission, Thermal Bremstrahlung (free-free emission),spectral line formation in thermal plasma, examples of thermal spectra, measurement of temperature and elemental abundances from spectral data (b) Non-thermal Emission: Synchrotron mechanism (magnetic bremstrahlung), spectral shape, polarized emission, Inverse Compton Scattering, spectrum of radiation, examples of non-thermal spectra, Cyclotron process in strongly magnetized stars and formation of cyclotron lines, determination of magnetic field of the stars

Experiments to be performed:

1. Measuring energy resolution (R) of a Cadmium Telluride Detector using X-rays of different energies (E) from radioactive sources and deriving expression for variation of R with E.
2. Solar Constant measurement.
3. Measurement of Solar Limb Darkening.
4. Observing an Optical Binary Star and deriving its light curve.
5. Determine Pulsation period and binary light curve of an accreting Neutron star from X-ray data.
6. Measuring X-ray Energy Spectrum of a Black Hole Binary and fit it with different spectral models.
7. Characteristics of a Proportional Counter and dependence of its energy resolution on different parameters of the PC.

Center for Basic Sciences

(CBS)

SCHEME OF EXAMINATION

&

COURSE STRUCTURE

of

SEMESTER IX and X

M.Sc. Integrated (Physics Stream)

UNDER

FACULTY OF SCIENCE

Approved by Board of Studies in Physics

EFFECTIVE FROM FEBRUARY 2020

Center of Basic Sciences
Pt. Ravishankar Shukla University
Raipur (C.G.) 492010
PH: - 0771-2262864
WEBSITE: -www.prsu.ac.in

Approved by Board of Studies in Physics on 07, January 2020

PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR

CENTER FOR BASIC SCIENCES
Pt. Ravishankar Shukla University, Raipur

SEMESTER-X (Physics Streams)

Subject code *	Subject	Subject Contact hrs/per week Theory+Tutorial	Credits
PE1001	Quantum Field Theory	[4 + 1]	5
PE1002	General Relativity and Cosmology	[4 + 1]	5
PE1003	Experimental Techniques	[4 + 1]	5
PE1004	CCD Imaging and Spectroscopy	[4 + 1]	5
PE1005	Biophysics	[4 + 1]	5
PE1006	Particle Physics	[4 + 1]	5

Min. 20
(Total 240 credits)

*Four Subjects will be offered according to the availability of instructors and minimum number of interested students offering a course.

07/01/2020

07/01/2020

Center for Basic Sciences

Pt. Ravishankar Shukla University, Raipur

PHYSICS STREAM SYLLABUS

SEMESTER X

PE1001 Quantum Field Theory

UNIT-I

Preliminaries: Why Quantum Field Theory, Creation and annihilation operators, Special relativity, Space and time in relativistic quantum theory, natural units

UNIT - II

Canonical Quantization: General Formulation. Conjugate Momentum and Quantization. Neutral Scalar Field. Commutation Relations, Normal Ordering, Bose Symmetry, Fock Space. Charged Scalar Field. U(1) Invariance, Charge
Conservation, Particles and Antiparticles. Time Ordered Product, Feynman Propagator for Scalar Fields, Bose- Einstein Distribution, Propagators at Finite Temperature.

UNIT - III

Dirac Field: The Dirac Equation, Relativistic Covariance. Anti-Commutators. Quantization of the Dirac Field, Electrons and Positrons. Connection between Spin and Statistics. Discrete Symmetries, Parity, Charge Conjugation, Time Reversal, CPT Theorem.

UNIT - IV

Gauge Field: Gauge Invariance and Gauge Fixing. Quantization of the Electromagnetic Field, Propagator, Vacuum Fluctuations.

UNIT - V

Interacting Theory and Elementary Processes: Wick's Theorem. Feynman Rules and Feynman Diagrams for Spinor Electrodynamics, Lowest Order Cross-Section
for Electron-Electron, Electron-Positron and Electron- Photon Scattering.

References:

1. Quantum Field Theory, C. Itzykson and J. B. Zuber, McGraw-Hill Book Co, 1985.
2. Quantum Field Theory, L. H. Ryder, Cambridge University Press, 2008.
3. Field Theory, A Modern Primer, P. Ramond, Benjamin, 1980.
4. The Quantum Theory of Fields, Vol I, S. Weinberg, Cambridge University Press, 1996.

5. Introduction to The Theory of Quantum Fields, N. N. Bogoliubov and D. V. Shirkov, Interscience, 1960.

6. An Introduction to Quantum Field Theory, M. E. Peskin and D. V. Schroeder, Westview Press, 1995.

7. Quantum Field Theory: Mandl and Shaw

8. A first book of Quantum Field Theory, Amitabha Lahiri, Palash B. Pal, Alpha Science International Ltd., 2000

PE1002 General Relativity and Cosmology

UNIT - I
Review of Newtonian Mechanics. Special theory of relativity. Prelude to General relativity, historical developments, 4-Vectors and 4-tensors, examples from physics

UNIT - II
Principle of Equivalence, Equations of motion, Gravitational force, Tensor Analysis in Riemannian space, Effects of Gravitation, Riemann-Christoffel curvature tensor, Ricci Tensor, Curvature Scalar, Einstein Field Equations, Experimental tests of GT, Scwartzchild Solution,

UNIT - III
Introduction to Cosmology, The cosmic history and inventory, The expanding Universe

UNIT- IV
Friedmann Equations and Cosmological Models, The Standard cosmological model, The inflationary Universe, Big-Bang Hypothesis

UNIT- V
Primordial nucleosynthesis and the thermal history of the Universe. Perturbations in an expanding Universe, Growth of perturbations, Dark Matter Halos

References:
1. A first course in General Relativity- B. Schutz
2. Gravity: HJ. Hartle
3. The Classical Theory of Fields: Landau and Lifshitz
4. Gravitation and Cosmology: S. Weinberg5. Introducing Einstein's Relativity: D'Inverno
5. Introducing Einstein's General Relativity - Ray D'Inverno
6. The Early Universe - Kolb and Turner
7. Introduction to Cosmology - Barbara Ryden4. Modern Cosmology - Scott Dodelson
8. Principles of Physical Cosmology - P.J.E. Peebles
9. Large Scale Structure of the Universe - P.J.E. Peebles
10. Structure Formation in the Universe - T. Padmanabhan

07/01/2020

07/01/2020

PE1003 Experimental Techniques

UNIT – I

Vacuum technology: gases, gas flow, pressure and flow measurement, vacuum pumps, pumping mechanisms, ultrahigh vacuum, leak detection

UNIT – II

Optical systems: optical components, optical materials, optical sources Charge particle optics: electrostatic lenses, charged-particle sources, energy and mass analyzer

UNIT – III

Detectors: optical detectors, photoemission detectors, particle and ionizing radiation detectors, signal to noise ration detection, surface barrier detector.

UNIT – IV

Particle detectors and radioactive Decay: Interactions of charged particles and photons with matter; gaseous ionization detectors, scintillation counter, solid state detectors

UNIT – V

Electronics: electronic noise, survey of analog and digital I/Cs, signal processing, data acquisition and control systems, data analysis evaluation

References:

1. The art of Measurement, by Bernhard Kramer, VCH publication
2. Building Scientific apparatus by J. H. Moore et al.
3. Experiments in Modern Physics, Second Edition by Adrian C. Melissinos, Jim Napolitano
4. Vacuum Technology, A. Roth North-Holland Publisher
5. Charge Particle Beams, by Stanley Humphries, John Wiley and Sons
6. Principles of charged Particles Acceleration, by Stanley Humphries, John Wiley and Sons
7. Radiation detection and Measurements, G. Knoll, 3rd Edition
8. Techniques for Nuclear and particles physics experiments, W. R. Leo, 2nd edition, Springer
9. The Physics of Micro & Nanofabrication, Ivor Brodie,and Julius J. Muray, Springer
10. Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM, R.Egerton, Springer, 2005
11. Egerton, Springer, 2005Modern Spectroscopy, J. M. Hollas, John Wiley, 4th Edition, 2004

PE1004 CCD Imaging and Spectroscopy

UNIT-I

Introduction : Why use CCDs?, CCD manufacturing and operation, CCD operation, CCD types, CCD coatings, Analog-to-digital converters

UNIT-II

Characterization of charge-coupled devices: Quantum efficiency, Charge diffusion, Charge transfer efficiency, Readout noise, Dark current, CCD pixel size, pixel binning, full well capacity, and windowing, Overscan and bias, CCD gain and dynamic range,

UNIT-III

CCD imaging, Photometry and astrometry: Image or plate scale, Flat fielding, Calculation of read noise and gain, Signal-to-noise ratio, Basic CCD data reduction, CCD imaging, Stellar photometry from digital images, Two-dimensional profile fitting, Difference image photometry, Aperture photometry, Absolute versus differential photometry, High speed photometry, PSF shaped photometry, Astrometry, Pixel sampling
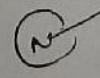
UNIT-IV

Review of spectrographs: CCD spectrographs, CCD spectroscopy, Signal-to-noise calculations for spectroscopy, Data reduction for CCD spectroscopy, Extended object spectroscopy, Slitless spectroscopy

UNIT-V

CCDs used in space and at short wavelengths : CCDs in space, Radiation damage in CCDs, CCDs in the UV and EUV (300–3000 Å) spectral range, CCDs in the X-ray, (<500 Å) spectral range

References:

1. Handbook of CCD Astronomy, Second editionS. B. Howell
2. Stellar Magnitudes from Digital Pictures, Adams, M., Christian, C., Mould, J., Stryker, L., & Tody, D., 1980, Kitt Peak National Observatory publication.
3. The Next Generation Space Telescope, Bely, P.-Y., Burrows, C., & Illingworth, G. (eds.), 1989, Space Telescope Science Institute publication.
4. Blouke, M., Yang, F., Heidtmann, D., & Janesick, J., 1988, in Instrumentation for Ground-Based Optical Astronomy, ed. L. B. Robinson, Springer-Verlag, p. 462.
5. Bonanno, G., 1995, in New Developments in Array Technology and Applications, eds. A. G. D. Philip, K. A. Janes, & A. R. Upgren, Kluwer, p. 39.
6. Born, M. & Wolf, E., 1959, Principles of Optics, MacMillan, Chap. VIII.
7. Bowen, I. S., 1960a, in Astronomical Techniques, ed. W. A. Hiltner, University of Chicago Press, Chap. 2.
8. Brown, R. (ed.), 1993, The Future of Space Imaging, Space Telescope Science Institute publication, Chap 8.

PE1005 Biophysics

UNIT- I

Mathematical Methods in Biophysics : Functions of One Variable and Ordinary Differential Equations, Functions of Several Variables: Diffusion Equation in One Dimension., Random Walks and Diffusion, Random Variables, Probability Distribution, Mean, and Variance , Diffusion Equation in Three Dimensions., Complex Numbers, Complex Variables, and Schrodinger's Equation , Solving Linear Homogeneous Differential Equations.,
Fourier Transforms, Nonlinear Equations: Patterns, Switches and Oscillators

UNIT- II

Quantum Mechanics Basic to Biophysical Methods: Quantum Mechanics Postulates, . One-Dimensional Problems, The Harmonic Oscillator, The Hydrogen Atom, Approximate Methods, Many Electron Atoms and Molecules , The Interaction of Matter and Light

UNIT- III

Computational Modeling of Receptor–Ligand Binding and Cellular Signaling Processes: Differential Equation-Based Mean-Field Modeling, Application: Clustering of Receptor–Ligand Complexes, Modeling Membrane Deformation as a Result of Receptor–Ligand Binding, Limitations of Mean-Field Differential Equation-Based Modeling, Master Equation: Calculating the Time Evolution of a Chemically Reacting System,

UNIT- IV

Stochastic Simulation Algorithms: Stochastic Simulation Algorithm (SSA) of Gillespie, Application of the Stochastic Simulation Algorithm (SSA), Free Energy-Based Metropolis Monte Carlo Simulation, Application of Metropolis Monte Carlo Algorithm, Stochastic Simulation Algorithm with Reaction and Diffusion: Probabilistic Rate Constant–Based Method,Mapping Probabilistic and Physical Parameters, Modeling Binding between Multivalent Receptors and Ligands, Multivalent Receptor–Ligand Binding and Multi-molecule Signaling Complex Formation, Application of Stochastic Simulation Algorithm with Reaction and Diffusion,Choosing the Most Efficient Simulation Method

UNIT- V

Fluorescence Spectroscopy: Fundamental Process of Fluorescence,
Fluorescence Microscopy, Types of Biological Fluorophores, Application of Fluorescence in Biophysical Research, Dynamic Processes Probed by Fluorescence
Electrophysiological Measurements of Membrane Proteins :
Membrane Bioelectricity, . Electrochemical Driving Force, Voltage Clamp versus Current Clamp, Principles of Silver Chloride Electrodes, Capacitive Current and Ionic Current.Gating and Permeation Functions of Ion Channels, Two-Electrode Voltage Clamp for Xenopus Oocyte Recordings , Patch-Clamp Recordings , Patch-Clamp Fluorometry

References
1. Fundamental Concepts in Biophysics, Thomas Jue

2. Alon U. 2006. An introduction to systems biology: design principles of biological circuits. Boca Raton: Chapman & Hall.

3. Berg HC. 1993. Random walks in biology. Princeton: Princeton UP.

4. Nelson P. 2004. Biological physics: energy, information and life. New York: W.H. Freeman and Company.

5. Van Kampen NG. 1992. Stochastic processes in physics and chemistry. Amsterdam: North Holland.

6. Shankar R. 1994. Principles of quantum mechanics. New York: Plenum.

7. Cohen-Tannoudji C, Diu B, Laloe F. 1977. Quantum mechanics. Trans SR Hemley, N Ostrowsky, D Ostrowsky, New York: Wiley.

8. Lauffenburger DA, Linderman JJ. 1993. Models for binding, trafficking and signaling. Oxford: Oxford UP.

9. Fall CP, Marland S, Wagner JM, Tyson JJ, eds. 2002. Computational cell biology. New York: Springer

PE1006 Particle Physics

UNIT-I
Elementary particles, discrete symmetries and conservation laws, Symmetries and Quarks.

UNIT-II
Klein-Gordon equation, concept of antiparticle, Lorentz symmetry and scalar / vector / spinor fields.

UNIT-III
Dirac equation, Scattering processes of spin-1/2 particles (Feynmans rules as thumbrule QFT course), propagators.

UNIT-IV
Current-current interactions, weak interaction, Fermi theory, Gauge symmetries, spontaneous symmetry breaking, Higgs mechanism

UNIT-V
Electroweak interaction, Glashow-Salam-Weinberg model, Intoduction to QCD, structure of hadrons (form factors, structure func-tions), parton model, Deep inelastic sattering.

References:
1. Quarks and Leptons: An Introductory Course in Modern Particle Physics - FrancisHalzen, Alan D. Martin
2. Introduction to Elementary Particles, David Griffiths
3. Concepts of Particle Physics, Volume I, Kurt Gottfried and Victor F. Weisskopf, 1986, Oxford University Press,
4. Classical Electrodynamics second edition, J.D. Jackson, 1975, John Wiley & Sons, Inc., (chapters 11 and 12)
5. Introduction to High Energy Physics, fourth edition, Donald H. Perkins, 2000, Cambridge University Press,

6. Experimental Techniques in High Energy Physics, Thomas Ferbel (editor), 1987, Addison Wesley

7. Gauge Theory of Elementary Particle Physics, Ta-Pei Cheng and Ling-Fong Li, 1984, Oxford University Press

8. Weak Interactions of Leptons and Quarks, E.D. Commins and P.H. Bucksbaum, 1983, Cambridge University Press

Center for Basic Sciences
Pt. Ravishankar Shukla University, Raipur

Course structure for the M. Sc. (Integrated) Mathematics stream
w.e.f. July 1st , 2015

(P: **P**hysics, M: **M**athematics, C: **C**hemistry, B: **B**iology, G: **G**eneral, H: **H**umanity, ME: **M**ath **E**lective, MPr : **M**ath **P**roject)

Semester Scheme

There shall be 10 semesters in Integrated M.Sc. Mathematics Course. Five out of thirty elective courses should be taken from the elective courses offered by the School of Mathematical Sciences. Credit points in each semester is indicated in the table below. **Minimum credit points** required to pass each semester is **10.** A total of **minimum 100 credit points** is required to get   **M.Sc. degree in Mathematics** from the School of Mathematical Sciences.

Year	Semester	Subjects			Credit Points Min	Credit Points Max	Cumulative Credit Points
		Theory	Practical	Project			
1st Year	Sem. I	5(x3)+ 1(x2) = 18	4(x2)= 08	----	10	25	25
	Sem. II	5(x3)+ 1(x2) = 18	4(x2)= 08	----	10	25	50
2nd Year	Sem. III	5(x4)+2(x2)= 24	1(x1)= 01	----	10	25	75
	Sem. IV	5(x4)= 20	1(x4)+1(x1) = 05	----	10	25	100
3rd Year	Sem. V	6(x4)= 24	1(x1)= 02	----	10	25	125
	Sem VI	5(x4)+1(x2)= 22	1(x3)=03	----	10	25	150
4th Year	Sem VII	5(x4) = 20	----	05	10	25	175
	Sem VIII	5(x4) = 20	----	05	10	25	200
5th Year	Sem IX	----	----	20	10	20	220
	Sem X	Elective Papers 5(x4)=20	----	----	10	20	240
Total Credit Points							240
Minimum Credit Points Required to get M.Sc. degree in Mathematics							100

1

SEMESTER –I

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
B101	Biology – I	[2 + 1]	3
C101	Chemistry – I	[2 + 1]	3
MB101/M101	Mathematics – I	[2 + 1]	3
P101	Physics – I	[2 + 1]	3
G101	Computer Basics	[2 + 1]	3
H101	Communication Skills	[2 + 0]	2
		Lab Hours per Week	
BL101	Biology Laboratory – I	[4]	2
CL101	Chemistry Laboratory – I	[4]	2
PL101	Physics Laboratory – I	[4]	2
GL101	Computer Laboratory	[4]	2
		Semester Credits	**25**
		Subtotal	**25**

MB101: Mathematics – 1   (For Biology Stream)

Unit-I The idea of derivative of a function, polynomials, slope and tangent line, derivatives of trigonometric functions, product and quotient rules. Notion of limits and continuous functions.

Elementary results pertaining to limits of functions: product and quotient rules. Higher order derivatives, examples. Maxima and minima, curve tracing, Conic sections: circle, ellipse, hyperbola and parabola; equations, focus, directrix, latus rectum. Generalised conic section equation, exponential and logarithmic functions and their derivatives.

Unit-II Application of derivatives to root finding: Newton's method (to be supplemented by an introduction to iterative processes). Mean value theorem of differential calculus, Rolle's theorem, applications. l'Hôpital's rule. The chain rule of differentiation, Implicit differentiation, Inverse functions and their derivatives, Inverse trigonometric functions, Applications.

Concept of infinite series, Geometric series, convergence tests; Taylor series, Maclaurin series for elementary functions, power series, simple applications.

Unit-III Notion of an integral, integral as limit of sums; anti-derivatives, area under a curve, definite integrals, indefinite integrals. Rules of integration: integration by parts, integration by substitution. Properties of definite integrals including mean value theorem for integral calculus. Fundamental theorem of integral calculus. Integrals involving polynomial, exponential, logarithmic, trigonometric, inverse trigonometric functions. Application of integrals to areas, length of a plane curve, volumes of solids of revolution.

2

Unit-IV Complex numbers: real and imaginary parts, The complex plane, Complex algebra (complex conjugate, absolute value, complex equations, graphs, physical applications). Elementary functions of complex numbers, Euler's formula, Powers and roots of complex numbers. The exponential and trigonometric functions, Hyperbolic functions, Logarithms, Complex roots and powers, Inverse trigonometric and hyperbolic functions, Some applications.

Unit-V Separable equations, Linear first order equations, Other methods for first order equations, Second order linear equations with constant coefficients and both zero and non-zero right hand side, Other second order equations.

Suggested Texts and References:
1) Calculus: Gilbert Strang (MIT Courseware)
2) Calculus: M. Weir, J. Hass and F. R. Giordano (Pearson Education)

M101: Mathematics – I (For Physics, Mathematics & Chemistry Stream)

Unit-I Introduction to coordinate geometry: Equation of a straight line and circle. Introduction to trigonometry (including addition formulas for sine and cosine) through coordinate geometry. AP and GP and inequalities of the mean. Binomial theorem for integer powers.

Unit-II Complex numbers: real and imaginary parts, the complex plane, complex algebra (complex conjugate, absolute value, complex equations, graphs, physical applications). Consequences of Euler's formula.

Unit-III The idea of derivative of a function, effects of small changes, slope and tangent line, derivatives of polynomials and trigonometric functions, product and quotient rules. Notion of limits and continuous functions. Higher order derivatives, examples. Maxima and minima. Graphical representation of elementary functions such as polynomials, conics, trigonometric functions, exponentials, logarithms and the sawtooth functions. Inverse functions and their graphical representations. Derivatives of exponential, hyperbolic and logarithmic functions. Application of derivatives to root finding: Newton – Raphson method. The chain rule of differentiation, implicit differentiation, inverse functions and their derivatives.

Unit-IV Concept of sum of infinite series, geometric series, harmonic series, simple convergence tests. Taylor series, applications to elementary functions, binomial expansion for non-integral powers. Notion of an integral, integral as limit of sums; anti-derivatives, area under a curve, definite integrals, indefinite integrals. Rules of integration: integration by parts, integration by substitution. Properties of definite integrals. Integrals involving elementary functions. Application of integrals to areas and volumes of solids of revolution.

Unit-V System of linear equations, notion of a matrix, determinant. Simple properties of matrices and their inverses. Examples of inverting 2X2 and 3X3 matrices. Elementary discussion on scalars and vectors, norm of a vector, dot product, projections, cross product, triple products, applications to areas and volumes.

Suggested Texts and References:
1. Calculus, Gilbert Strang (MIT Courseware) http://ocw.mit.edu/resources/res-18-001- calculus-online-textbook-spring-2005/textbook/
2. Thomas' Calculus, 11th Edition, M. Weir, J. Hass and F. R. Giordano, Pearson

Education.
3. Mathematical Methods in the Physical Sciences, 3rd Ed., Mary L. Boas, Wiley Student Ed.,
    Wiley India (Reprint) 2009 (for complex numbers and differential equations)
4. Elementary Linear Algebra, 10th Ed., Howard Anton and Chris Rorres, Wiley, 2011.
5. Introduction to Linear Algebra, 4th Edition, Gilbert Strang, Wellesley Cambridge Press,
    2009.

M101: Mathematics – I (For Physics, Mathematics & Chemistry Stream)

Unit I Numbers, Functions and Sequences: Real Numbers, Functions, Sequences – Convergent, Bounded and Monotone, Limit theorems. Limit and Continuity: Limit of a function at a point, Continuity of functions, Discontinuities of functions, Properties of continuous functions. Differentiation: Differentiation, Chain rule, Successive differentiation, Rolle 's Theorem and mean value theorem.

Unit II   Maxima, Minima and Curve Sketching: Sufficient conditions for a function to be increasing/decreasing, Sufficient conditions for a local extremum, Absolute minimum/maximum, Convex/concave functions, Asymptotes, Curve sketching.
Integration: Integral from upper and lower sums, Integral as a limit of Riemann sums, Fundamental theorem of calculus and its applications. Logarithmic and Exponential functions: Logarithmic functions, Exponential functions, Power functions, l'Hôpital's rule. Applications of Integration: Arc length of a plane curve, Arc length of a plane curve in parametric form, Area of a surface of revolution, Volume of a solid of revolution by slicing, by the washer method and by the shell method.

Unit-III Limit and Continuity of Scalar Fields: Spaces $\mathbf{R^2}$ and $\mathbf{R^3}$, Scalar fields, level curves and contour lines, Limit of a scalar field, Continuity of a scalar field, Properties of continuous scalar fields.
Differentiation of Scalar Fields: Partial derivatives, Differentiability, Chain rules, Implicit differentiation, Directional derivatives, Gradient of a scalar field, Tangent plane and normal to a surface, Higher order partial derivatives, Maxima and minima, Saddle points, Second derivative test for maxima/minima/saddle points.Vector Fields: Vector fields and their properties, Curves in space, Tangent vector, Basic idea of divergence and curl.

Unit-IV Complex Numbers: Real and imaginary parts, The complex plane, Complex algebra (complex conjugate, absolute value, complex equations, graphs, physical applications), Elementary functions of complex numbers, Euler's formula, Powers and roots of complex numbers, The exponential and trigonometric functions, Hyperbolic functions, Logarithms, Complex roots and powers, Inverse trigonometric and hyperbolic functions, Some applications.

Unit V Ordinary Differential Equations: Separable equations, Linear first order equations, Other methods for first order equations, Second order linear equations with constant coefficients and both zero and non-zero right hand side, Other second order equations, The Laplace transform, Solution of differential equations by Laplace transforms.

Suggested Texts and References:
1.Calculus @ iitb – Concepts,Examples and Quizzes, Inder K. Rana, Version 2, 2010
   (Math4all).
2. Introduction to Real Analysis, 3rd Ed., Robert G. Bartle and Donald R. Sherbert, Wiley
3. Student Ed., Wiley India (4th Reprint) 2007.

4

4. Mathematical Methods in the Physical Sciences, Mary L. Boas, 3rd Edition, Wiley Student Ed.,Wiley India (Reprint) 2009 (for complex numbers and ordinary differential equations).

SEMESTER –II

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
B201	Biology – II	[2 + 1]	3
C201	Chemistry – II	[2 + 1]	3
MB201/M201	Mathematics – II	[2 + 1]	3
P201	Physics – II (Optics, Electricity & Magnetism)	[2 + 1]	3
G201	Electronics and Instrumentation	[2 + 1]	3
G202	Glimpses of Contemporary Science	[2 + 0]	2
		Contact Hours / Week Laboratory	
BL201	Biology Laboratory	[4]	2
CL201	Chemistry Laboratory	[4]	2
PL201	Physics Laboratory	[4]	2
GL201	Electronics Laboratory	[4]	2
		Semester Credits	**25**
		Subtotal	**50**

MB201: Mathematics – II   (**For Biology Stream**)

Unit I   Functions of several variables, partial derivatives, geometric interpretation, properties of partial derivatives, chain rule, applications. Elementary discussion on scalars and vectors, norm of a vector, dot product, projections. Linear equations and matrices, matrix operations. Concept of a determinant, its properties, evaluation of a determinant, cross product as a determinant, lines and planes. Elementary ideas of tensors.

Unit II   Vector functions. Gradient of a function, geometric interpretation, properties and applications; divergence and curl of a vector function, geometric interpretation, properties and applications; higher derivatives, Laplacian. Line integrals. Double and triple integrals, their properties and applications to areas, volumes, etc.

Unit III   Gradient theorem, Green's theorem, Stokes' theorem, divergence theorem, applications. Proofs of Stokes' and divergence theorems through physical examples (such as circulation in a 2 dimensional plane and accumulation of fluid in a given volume).

Unit IV   Curvilinear coordinate systems, spherical and cylindrical coordinates, area and volume elements, illustrations. Gradient, divergence and curl in curvilinear coordinate systems.

Unit V   Introduction to linear algebra. Vector spaces, linear dependence and independence, notion of basis, and dimension, subspaces. Examples. More on matrices: special kinds of matrices, their properties.

5

Eignevalues and eigenvectors, secular determinant, characteristic polynomial. Eigenvalues and eigenvectors of a real symmetric matrix. Illustrative examples. Applications of linear algebra.

Suggested Texts and References (for M100 and M200)
1) Calculus: Gilbert Strang (MIT Courseware)
2) Calculus: Thomas
3) Elementary Linear Algebra: Howard Anton and Chris Rorres
4) Introduction to Linear Algebra: Gilbert Strang (MIT Courseware)
5) Mathematical Methods for Scientists and Engineers: George B. Arfken and Hans J. Weber (for curvilinear coordinates, beta and gamma functions only)

M201: Mathematics – II (For Physics & Chemistry Stream)

Unit I Differential equations: separable equations, first order differential equations. Second order differential equations and Wronskian; equations with constant coefficients, homogeneous and inhomogeneous equations.

Unit II Scalar functions of several variables, partial derivatives, geometric interpretation (maxima, minima, saddle points), properties of partial derivatives, chain rule, applications. Gradient of a function, geometric interpretation, properties and applications.

Unit III Vector functions. Derivatives of a vector function, divergence and curl, geometric interpretation, properties and applications; higher derivatives, Laplacian.

Unit IV Spherical and cylindrical coordinates, area and volume elements, illustrations. Gradient and divergence in spherical and cylindrical coordinates.

Unit V Line integrals. Double and triple integrals, their properties and applications to areas, volumes, etc. Gradient theorem, divergence theorem, Stokes' theorem, applications. Illustrations from fluid flow and electromagnetism.

Suggested Texts and References
1. Calculus, Gilbert Strang (MIT Courseware) http://ocw.mit.edu/resources/res-18-001-calculus-online-textbook-spring-2005/textbook/
2. Thomas' Calculus, 11th Edition, M. Weir, J. Hass and F. R. Giordano, Pearson Education.
3. Mathematical Methods in the Physical Sciences, 3rd Ed., Mary L. Boas, Wiley Student Ed., Wiley India (Reprint) 2009 (for complex numbers and differential equations)
4. Elementary Linear Algebra, 10th Edition, Howard Anton and Chris Rorres, Wiley Student Ed., Wiley 2011.
5. Introduction to Linear Algebra, 4th Edition, Gilbert Strang, Wellesley Cambridge Press, 2009.

M201: Mathematics – II (For Physics & Chemistry Stream)

Unit I Algebra of matrices (real numbers and other fields), special matrices (scalar, diagonal, upper and lower triangular, etc.). Linear equations and their matrix representations, row-echelon form, Gauss- Jordan elimination, general and particular solutions, homogeneous equations. Invertible matrices and elementary matrices, computation of inverse using elementary row operations. Determinants and their properties, minors and cofactors, determinant of a product of matrices, adjoint of a matrix, invertible matrices and determinants. Cramer's rule. Rank of a

matrix, rank and invertibility. Vector spaces (real numbers and other fields). Examples including the space of polynomials, the space of functions, the solution space of a system of homogeneous linear equations, and row and column spaces of a matrix. Span, linear independence, basis, dimension and its uniqueness.

Unit II Linear transformations, isomorphisms, kernel and image, the dimension formula. Eigenvalues and eigenvectors of a square matrix or a linear operator, computation of eigenvalues and eigenvectors, characteristic polynomial, sums and products of eigenvalues, similar matrices, diagonalization.

Unit III Review of geometric properties of vectors in $\mathbf{R^2}$ **and** $\mathbf{R^3}$, dot, cross and scalar triple products, their properties and their geometric interpretation. Vector fields, review of definitions and basic properties of gradient, divergence, directional derivatives, divergence, curl and the Laplace operator. Paths and curves in $\mathbf{R^2}$ and $\mathbf{R^3}$, tangent, velocity, acceleration and force vectors, arc length.

Unit IV A brief overview of differentials. Double integrals as limits of Riemann sums and as volumes, their computation as iterated integrals, elementary regions. Triple integrals as limits of Riemann sums, their computation as iterated integrals, elementary regions. Change of variables, the Jacobian determinant, spherical and cylindrical coordinates.

Unit V Application of double and triple integrals to finding volume, centre of mass, etc. Line integrals, their dependence on parametrization, their computation, work done. Parametrized surfaces, normal to a surface, surface area, surface integrals and their dependence on parametrization, their computation. Oriented surfaces, statement of Green's theorem and its application to computing the area of a region, statements of Stokes' theorem, and Gauss' divergence theorem. Conservative vector fields.

Suggested Texts and References:
1. A Course in Linear Algebra with Applications, 2nd Edition, D. J. S. Robinson, World Scientific 2006.
2. Calculus and Analytic Geometry, 9th Edition, G. B. Thomas and R. L. Finney, Pearson Education 2002.
3. Basic Multivariable Calculus, J. Marsden, A. Tromba and A. Weinstein, Springer (India),2009.
4. Calculus @ iitb–Concepts, Examples and Quizzes, Inder K. Rana, Version 2, 2010(Math4all).

M201 : Mathematics II (Calculus and Linear Algebra)
(For Mathematics Stream only)

Unit I Recollection and rigorous treatment of continuity and differentiability of a function of one variable.Riemann integration, proof of the Fundamental Theorem of Calculus. Functions of two and three variables, double and triple integrals.

Unit II Line integrals. Parametrized surfaces, oriented surfaces. Stokes Theorem, Gauss Divergence Theorem (both without proof).

Unit III Recollection of the algebra of matrices (mainly over the field of real numbers, but mention other fields also), linear equations, row-echelon form, Gauss-Jordan elimination. Determinants, rank of a matrix, rank and invertibility.

Unit IV Vector spaces (mainly over the field of real numbers, but mention other fields also), span, linear independence, basis, dimension and its uniqueness (without proof).

Unit V Linear transformations, kernel and image, the rank-nullity formula. Eigen values and eigenvectors of a square matrix or a linear operator.

References
[1] D.J.S. Robinson, A Course in Linear Algebra with Applications, World Scientific.
[2] G. B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th ed., Addison-Wesley/Narosa,1998.
[3] J. Marsden, A. Tromba and A. Weinstein, Basic Multivariable Calculus, Springer
[4] Inder K. Rana, Calculus@iitb, Concepts and Examples, Version 1.2, math4all 2009.

SECOND YEAR
SEMESTER –III

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
M301	Foundations	[3 + 1]	4
M302	Analysis I	[3+ 1]	4
M303	Algebra I	[3 + 1]	4
M304	Discrete Mathematics	[3 + 1]	4
M305	Computational Mathematics I	[3 + 1]	4
H301	World Literature	[2 + 0]	2
H302	History and Philosophy of Science	[2 + 0]	2
		Lab Hours per Week	
GL301	Computation Mathematics Laboratory	[2]	1
		Semester Credits	**25**
		Subtotal	**75**

M301 : Foundations

Unit I Logic: Quantifiers, negations, examples of various mathematical and non-mathematical statements. Exercises and examples.
Set Theory: Definitions, subsets, unions, intersections, complements, symmetric difference, De Morgan's laws for arbitrary collection of sets. Power set of a set.

Unit II Relations and maps: Cartesian product of two sets. Relations between two sets. Examples of relations. Definition of a map, injective, surjective and bijective maps. A map is invertible if and only if it is bijective. Inverse image of a set with respect to a map. Relation between inverse images and set theoretic operations. Equivalence relations (with lots of examples). Schroeder-Bernstein theorem.

8

Unit III Finite and Infinite sets: Finite sets, maps between finite sets, proof that number of elements in a finite set is well defined. Definition of a countable set (inclusive of a finite set). Countably infinite and uncountable sets. Examples. Proof that every infinite set has a proper, countably infinite subset. Uncountability of P(N).

Unit IV Partially Ordered Sets: Concept of partial order, total order, examples. Chains, Zorn's Lemma.

Unit V Peano's Axioms. Well-Ordering Principle. Weak and Strong Principles of Mathematical Induction. Transfinite Induction. Axiom of Choice, product of an arbitrary family of sets. Equivalence of Axiom of Choice, Zorn's Lemma and Well-ordering principle.

Additional Topics (Optional)
  (i) Dedekind's Construction of Real Numbers.
  (ii) Decimal, dyadic, triadic expansions of real numbers.
  (iii) Cantor Sets.

References
[1] Naive Set Theory, P. Halmos.
[2] Set Theory and Logic, R. Stoll.
    A lot of the material can be found in the beginning sections of the following books:
[3] Methods of Real Analysis, R. Goldberg.
[4] Topology, J. Munkres.
[5] Elementary Number Theory, D. Burton.
[6] Real Analysis, Bartle and Sherbert.

M302 : Analysis I

Unit I Real Number System: Concept of a field, ordered field, examples of ordered fields, supremum, infimum. Order completeness of **R, Q** is not order complete. Absolute values, Archimedean property of **R. C** as a field, and the fact that **C** cannot be made into an ordered field. Denseness of **Q** in **R.** Every positive real number has a unique positive n-th root.

Unit II Sequences: Sequences, limit of a sequence, basic properties like $\lim_n(x_n y_n) = (\lim_n x_n)(\lim_n y_n)$. Bounded sequences, monotone sequences, a monotone increasing sequence bounded above converges to it's supremum. Sandwich theorem and its applications. Using the Arithmetic mean-Geometric mean inequality to prove results like $\lim_{n \to \infty}\left(1 + \frac{1}{n}\right)^n$ and $\lim_n(1 - \frac{1}{n})^n$ and are equal, $\lim_n \sqrt[n]{n} = 1$ and $\lim_n a^{\frac{1}{n}} = 1$. Cauchy's first limit theorem, Cauchy's second theorem.
Subsequences and Cauchy sequences: Every sequence of real numbers has a monotone subsequence. Definition of a Cauchy sequence. Cauchy completeness of **R, Q** is not Cauchy complete.

Unit III Infinite Series: Basic notions on the convergence of infinite series. Absolute and conditional convergence. Comparison test, ratio test, root test, alternating series test, Theorem of Dirichlet, Statement of Riemann's rearrangement theorem, Cauchy product of two series. Power series, radius of convergence via examples.

9

Unit IV Continuous functions: Continuity, sequential and neighbourhood definitions, basic properties such as sums and products of continuous functions are continuous. Intermediate Value Theorem, Continuous functions on closed and bounded intervals, Monotone continuous functions, inverse functions, Uniform Continuity, examples and counter-examples.

Differentiable functions: Definition : as a function infinitesimally approximable by a linear map, equivalence with Newton ratio definition, basic properties. One-sided derivatives, The O; o and ~ notations with illustrative examples. Chain rule with complete proof (using above definition). Local monotonicity, relation between the sign of f' and local monotonicity. Proofs of Rolle's theorem and the Cauchy-Lagrange Mean value theorem. L'Hospital's rule and applications. Higher derivatives and Taylor's theorem, estimation of the remainder in Taylor's theorem, example:

$$f(x) = \begin{cases} e^{-\frac{1}{x^2}} & x \neq 0 \\ 0 & x = 0 \end{cases} \text{ . Convex functions.}$$

Unit V   Riemann Integration: Definition via upper and lower Riemann sums, basic properties. Riemann integrability, Thm : $f : [a, b] \to \mathbf{R}$ continuous implies f is Riemann integrable, examples of Riemann integrable functions which are not continuous on $[a, b]$. Thm : if $f : [a, b] \to \mathbf{R}$ is Riemann integrable then so is $|f|$ and $|\int_a^b f(x)dx| \leq \int_a^b |f(x)|dx$. Cauchy-Schwartz inequality

Improper integrals, power series and elementary functions : Cauchy's condition for existence of improper integrals, test for convergence. Examples : $\int \frac{\sin x}{x} dx, \int \cos x^2 dx, \int \sin x^2 dx$. Power series and basic properties, continuity of the sum, validity of term by term differentiation. Binomial theorem for arbitrary real coeficients. Elementary transcendental functions e^x, sin x, cos x and their inverse functions, $\log x, \ tan^{-1} x$, Gudermannian and other examples.

References
[1] Introduction to Real Analysis : R. Bartle & D. Sherbert, Wiley.
[2] A First Course in Analysis : G. Pedrick

M303 : Algebra I (Groups, rings, fields)

Unit I Recollection of equivalence relations and equivalence classes, congruence classes of integers modulo n. Definition of a group, examples including matrices, permutation groups, groups of symmetry, roots of unity. First properties of a group, laws of exponents, finite and infinite groups.

Unit II Subgroups and cosets, order of an element, Lagrange theorem, normal subgroups, quotient groups. Detailed look at the group S_n of permutations, cycles and transpositions, even and odd permutations, the alternating group, simplicity of A_n for n ≥ 5.

Unit III Homomorphisms, kernel, image, isomorphism, the fundamental theorem of group Homomorphisms. Cyclic groups, subgroups and quotients of cyclic groups, finite and infinite cyclic groups.

Unit IV Cayleys theorem on representing a group as a permutation group. Conjugacy classes, centre, class equation, centre of a p-group. Sylow theorems, solvable and nilpotent groups.

Unit V Definition of a ring, examples including congruence classes modulo n, ideals and Homomorphisms, quotient rings, polynomial ring in one variable over a ring, units, fields, non-zero divisors, integral domains. Rings of fractions, field of fractions of an integral domain. PID, unique factorization in the ring of integers and in the polynomial ring over a field, Gauss Lemma.

References
[1] M. Artin, Algebra, Prentice Hall of India, 1994.
[2] D.S. Dummit and R.M. Foote, Abstract Algebra, 2nd Ed., John Wiley, 2002.
[3] N. Jacobson, Basic Algebra II, Hindustan Publishing Corporation, 1983.
[4] S. Lang, Algebra, 3rd ed. Springer (India) 2004.

M 304 : Discrete Mathematics

Unit I Combinatorics: Permutations and combinations. Linear equations and their relation to distribution into boxes.Distributions with repetitions and non-repetitions. Combinatorial derivation of these formulae. Pigeonhole Principle and applications.

Unit II Binomial and multinomial theorems. Inclusion-Exclusion Principle and Applications. Recurrence Relations and Generating Functions. Partitions of a number. Number of partitions. Brief introduction to the combinatorics of Young tableaux.

Unit III Graph theory: Vertices and edges. Graphs and special types like complete graph, bipartite graph. Degree of a vertex, weighted graphs. Traveling Salesman's Problem. Koenigsberg Seven-bridge puzzle. Walks, Paths, Circuits.

Unit IV Euler Graphs, Hamiltonian Paths and Circuits. Trees and algorithms to find trees in a given   graph. Planar Graphs.

Unit V Spaning trees and cut sets. Minimal spanning trees and algorithms for their computer implementation: the Kruskal's algorithm. Coloring in graph theory. The four colour problem.

References
[1] Richard Stanley, Enumerative Combinatorics.
[2] Alan Tucker, Applied Combinatorics.
[3] F. Harrary, Graph Theory.
[4] Narsingh Deo, Graph Theory.

M305 : Computational Mathematics I

Unit I Basics of Spreadsheet Programmes (such as Libreoffce/gnumeric).

Unit II Inroduction to Mathematica including writing simple programmes.

Unit III Detailed exploration of notion of calculus of one variable, and simple multivariable calculus using Mathematica.

Unit IV Basic Linear Algebra Using Mathematica.

Unit V Numerical Solutions of Linear and Non-linear equations using Mathematica. Developing Programmes for each of these methods.

References
[1] Selwyn Hollis, CalcLabs with Mathematica for Single Variable Calculus, Fifth Edition.
[2] Selwyn Hollis, CalcLabs with Mathematica for Multivariable Calculus, Fifth Edition.
[3] Kenneth Shiskowski, Karl Frinkle, Principles of Linear Algebra with Mathematica.

H301 : World Literature

Unit I   What is literature? - A discussion; introduction to literary terms, genres, and forms of various periods, countries, languages, etc.

Unit II   The novel: Class study of 'Brave New World' by Aldous Huxley; group discussions and student presentations on other genres such as the graphic novel, detective fiction, children's literature, etc.

Unit III Plays: Introduction to the history of theatre, class study of (mainly) two plays: 'Pygmalion' by G. B. Shaw and 'Fire and Rain' by Girish Karnad, the setting up of a play-reading group through which the students can be introduced to several other plays.

Unit IV   Poetry: Brief introduction, study of poetic genres, forms, topics, figures of speech, poetic language, etc. by analyzing various poems from around the world. Short stories, essays, and other types of writing by various authors.

Unit V Screening of films based on literary works, such as Pygmalion (My Fair Lady), Fire and Rain (Agnivarsha), Persepolis (a graphic novel), and many others.

SEMESTER –IV

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
M401	Analysis II	[3 + 1]	4
M402	Algebra II	[3+ 1]	4
M403	Elementary Number Theory	[3 + 1]	4
M404	Topology I	[3 + 1]	4
G401	Statistical Techniques and Applications	[3 + 1]	4

12

		Lab Hours per Week	
GL401	Computational Laboratory & Numerical Methods	[8]	4
GL402	Statistical Techniques Laboratory	[2]	1
		Semester Credits	**25**
		Subtotal	**100**

M401 : Analysis II (Multivariable Calculus)

Unit I   Linear maps from $\mathbf{R}^n$ to $\mathbf{R}^m$, Directional derivative, partial derivative, total derivative, Jacobian, Mean value theorem and Taylors theorem for several variables, Chain Rule.

Unit II   Parametrized surfaces, coordinate transformations, Inverse function theorem , Implicit function theorem, Rank theorem.

Unit III Critical points, maxima and minima, saddle points, Lagrange multiplier method.

Unit IV   Multiple integrals, Riemann and Darboux integrals, Iterated integrals, Improper integrals, Change of
variables.

Unit V Integration on curves and surfaces, Greens theorem, Differential forms, Divergence, Stokes theorem.

References
[1] M. Spivak, Calculus on Manifolds.
[2] W. Fleming, Functions of Several Variables, 2nd Ed., Springer-Verlag, 1977.
[3] J.E.Marsden, A.J. Tromba and A. Weinstein, Basic Multivariable Calculus.
[4] W. Rudin, Principles of Mathematical Analysis, 3rd ed., McGraw-Hill, 1984.
[5] A Modern Approach to Classical Theorems of Advanced Calculus, W. A. Benjamin, Inc., 1965.

M402 : Algebra II (Linear Algebra)

Unit I   Modules over a commutative ring, submodules and quotient modules, generators,homomorphisms, exact sequences, finitely generated free modules.

Unit II   Vector spaces as modules over a field, subspaces, quotient spaces.Span and linear independence, basis, dimension.

Unit III Linear maps and their corrrespondence with matrices with respect to given bases, change of bases.

Unit IV Eigenvalues, eigenvectors, eigenspaces, characteristic polynomial, Cayley-Hamilton.

Unit V   Bilinear forms, inner product spaces, Gram-Schmidt process, diagonalization, spectral theorem.

Note: Jordan and rational canonical forms to be done in M602 in Semester VI as an application of

13

the structure of finitely generated modules over a PID.

References
[1] M. Artin, Algebra, Prentice Hall of India, 1994.
[2] D.S. Dummit and R. M. Foote, Abstract Algebra, 2nd Ed., John Wiley, 2002.
[3] K. Ho_man and R. Kunze, Linear Algebra, Prentice Hall, 1992.
[4] N. Jacobson, Basic Algebra II, Hindustan Publishing Corporation, 1983.
[5] S. Lang, Algebra, 3rd ed. Springer (India) 2004.

M403 : Elementary Number theory

Unit I Fundamental theorem of arithmetic, divisibility in integers.Prime numbers and infinitude of primes. Infinitude of primes of special types. Special primes like Fermat primes, Mersenne primes, Lucas primes etc. Euclidean algorithm, greatest common divisor, least common multiple.

Unit II Equivalence relations and the notion of congruences. Wilson's theorem and Fermat's little theorem. Chinese remainder theorem. Continued fractions and their applications. Primitive roots, Euler's Phi function. Sum of divisors and number of divisors, Möbius inversion.

Unit III Quadratic residues and non-residues with examples. Euler's Criterion, Gauss' Lemma. Quadratic reciprocity and applications. Applications of quadratic reciprocity to calculation of symbols.

Unit IV Legendre symbol: Definition and basic properties. Fermat's two square theorem, Lagrange's four square theorem.

Unit V Pythagorean triples. Diophantine equations and Bachet's equation. The duplication formula.

References
[1] D. Burton, Elementary Number Theory.
[2] Kenneth H. Rosen, Elementary number theory and its applications.
[3] Niven, Ivan M.; Zuckerman, Herbert S.; Montgomery, Hugh L, An Introduction to the Theory of Numbers.

M404 : Topology I

Unit I Recollection of some set theory, particularly the following topics:
(i) Equipotence of sets, Schroeder-Bernstein theorem, countable and uncountable sets, countability
of **Q** and uncountability of **R**:
(ii) Equivalence relations, Zorn's lemma, axiom of choice.
Metric spaces: Definition and basic examples including the following:
(i) The discrete metric on any set.
(ii) **R** and $\mathbf{R^n}$ with Euclidean metrics, Cauchy-Schwarz inequality, definition of a norm on a finite dimensional **R**-vector space and the metric defined by a norm.
(iii) The set **C**[0, 1] with the metric given by $\sup |f(t) - g(t)|$ (resp. $\int_0^1 |f(t) - g(t)| dt$).
(iv) Metric subspaces, examples.

Unit II Topology generated by a metric: Open and closed balls, open and closed sets, complement of an open (closed) set, arbitrary unions (intersections) of open (closed) sets, finite

14

intersections (unions) of open (closed) sets, open (closed) ball is an open (closed) set, a set is open if and only if it is a union of open balls, Hausdorff property of a metric space.

Equivalence of metrics, examples, the metrics on $\mathbf{R}^2$ given by $|x_1 - y_1| + |x_2 - y_2|$ (resp. $\max\{|x_1 - y_1|, |x_2 - y_2|\}$) is equivalent to the Euclidean metric, the shapes of open balls under these metrics.Limit points, isolated points, interior points, closure, interior and boundary of a set, dense and nowhere dense sets.

Unit III Continuous maps: $\varepsilon - \delta$ definition and characterization in terms of inverse images of open (resp. closed) sets, composite of continuous maps, pointwise sums and products of continuous maps into $\mathbf{R}$; homeomorphism, isometry, an isometry is a homeomorphism but not conversely, uniformly continuous maps, examples.

Complete metric spaces: Cauchy sequences and convergent sequences, a subspace of a complete metric space is complete if and only if it is closed, Cantor intersection theorem, Baire categorytheorem and its applications, completion of a metric space.

General topological spaces, stronger and weaker topologies, continuous maps, homeomorphisms, bases and subbases, finite products of topological spaces.

Unit IV Compactness for general topological spaces: Finite subcoverings of open coverings and finite intersection property, continuous image of a compact set is compact, compactness and Hausdorff property.

Compactness for metric spaces**:** Bolzano-Weierstrass property, the Lebesgue number for an open covering, sequentially compact and totally bounded metric spaces, Heine-Borel theorem, compact subsets of **R**; a continuous map from a compact metric space is uniformly continuous.

Unit V Connectedness: definition, continuous image of a connected set is connected, characterization in terms of continuous maps into the discrete space **N**, connected subsets of **R**; intermediate value theorem as a corollary, countable (arbitrary) union of connected sets, connected components,

References
[1] E. T. Copson, Metric spaces.
[2] M. Eisenberg, Topology.
[3] R.H. Kasriel, Undergraduate topology.
[4] W. Rudin, Principles of mathematical analysis.
[5] G. F. Simmons, Topology and modern analysis.
[6] W. A. Sutherland, Introduction to metric and topological spaces.

G401: Statistical Techniques and Applications

Unit-I Purpose of Statistics, Events and Probabilities, Assignments of probabilities to events, Random events and variables, Probability Axioms and Theorems. Probability distributions and properties: Discrete, Continuous and Empirical distributions.

Unit-II Expected values: Mean, Variance, Skewness, Kurtosis, Moments and Characteristics Functions. Types of probability distributions: Binomial, Poisson, Normal, Gamma, Exponential, Chi-squared, Log-Normal, Student's t, F distributions, Central Limit Theorem.

Unit-III Monte Carlo techniques: Methods of generating statistical distributions: Pseudorandom numbers from computers and from probability distributions, Applications. Parameter inference: Given prior discrete hypotheses and continuous parameters, Maximum likelihood method for parameter inference.

Unit-IV Error Analysis: Statistical and Systematic Errors, Reporting and using uncertainties, Propagation of errors, Statistical analysis of random uncertainties, Averaging Correlated/ Uncorrelated Measurements. Deconvolution methods, Deconvolution of histograms, binning-free methods. Least-squares fitting: Linear, Polynomial, arbitrary functions: with descriptions of specific methods; Fitting composite curves.

Unit-V Hypothesis tests: Single and composite hypothesis, Goodness of fit tests, P-values, Chi-squared test, Likelihood Ratio, Kolmogorov- Smirnov test, Confidence Interval. Covariance and Correlation, Analysis of Variance and Covariance. Illustration of statistical techniques through hands-on use of computer programs.

Suggested Texts and References:
1. Statistics: A Guide to the Use of Statistical Methods in the Physical Sciences, R.J. Barlow, John Wiley 1989
2. The Statistical Analysis of Experimental Data, John Mandel, Dover Publications 1984
3. Data Reduction and Error Analysis for the Physical Sciences, 3rd Edition, Philip Bevington and Keith Robinson, McGraw Hill 2003

<u>**THIRD YEAR**</u>
SEMESTER –V

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
M501	Analysis III	[3 + 1]	4
M502	Algebra III	[3+ 1]	4
M503	Topology II	[3 + 1]	4
M504	Probability Theory	[3 + 1]	4
G501	Earth Science & Energy & Environmental Sciences	[3 + 1]	4
PM501	Numerical Analysis	[3 + 1]	4
		Lab Hours per Week	
PML501	Numerical Methods Laboratory	[2]	1
		Semester Credits	**25**
		Subtotal	**125**

M501 : Analysis III (Measure Theory and Integration)

Unit I Sigma algebra of sets, measure spaces. Lebesgues outer measure on the Real line. Measurable set in the sense of Caratheodory. Translation invariance of Lebesgue measure. Existence of a non-Lebesgue measurable set. Cantor set- uncountable set with measure zero.

Unit II Measurable functions, types of convergence of measurable functions. The Lebesgue integral for simple functions, nonnegative measurable functions and Lebesgue integrable function, in general.

Unit III Convergence theorems- monotone and dominated convergence theorems. Comparison of Riemann and Lebesgue integrals. Riemanns theorem on functions which are continuous almost everywhere.

Unit V The product measure and Fubinis theorem. The L^p spaces and the norm topology. Inequalities of Hölder and Minkowski. Completeness of L^p and L^∞ spaces.

References
[1] H.L. Royden, Real Analysis, Pearson Education.
[2] G. DeBarra, Introduction to Measure Theory, Van Nostrand Reinhold.
[3] I. K. Rana, An Introduction to Measure and Integration, Narosa.
[4] H.S. Bear, A Primer on Lebesgue Integration, Academic press.

M502 : Algebra III (Galois Theory)

Unit I Prime and maximal ideals in a commutative ring and their elementary properties.

Unit II Field extensions, prime fields, characteristic of a field, algebraic field extensions, finite field extensions, splitting fields, algebraic closure, separable extensions, normal extensions,

Unit III Finite Galois extensions, Fundamental Theorem of Galois Theory.

Unit IV Solvability by radicals.

Unit V Extensions of finite fields.

References
[1] M. Artin, Algebra, Prentice Hall of India, 1994.
[2] D. S. Dummit and R. M. Foote, Abstract Algebra, 2nd Ed., John Wiley, 2002.
[3] N. Jacobson, Basic Algebra I & II, Hindustan Publishing Corporation, 1983.
[4] S. Lang, Algebra, 3rd ed. Springer (India) 2004.
[5] R. Lidl and H. Niederreiter, Introduction to Finite Fields and Their Applications, Cambridge University Press, 1986.

M503 : Topology II

Unit I Review of some notions from Topology I. Basic Separation axioms and first and second countability
axioms. Examples.

Unit II Products and quotients. Tychonoff's theorem. Product of connected spaces is connected. Weak

topology on X induced by a family of maps $f_\alpha : X \to X_\alpha$ where each X_α is a topological space. The coherent topology on Y induced by a family of maps $g_\alpha : Y_\alpha \to Y$ where Y_α are given topological spaces. Examples of quotients to illustrate the universal property such as embeddings of **RP²** and the Klein's bottle in **R⁴**.

Unit III Completely regular spaces and its embeddings in a product of intervals. Compactification, Alexandroff and Stone-Cech compactifications.

Unit IV Normal spaces and the theorems of Urysohn and Tietze. The metrization theorem of Urysohn.

Unit V Local compactness, local connectedness and local path-connectedness and their basic properties. If $q : X \to Y$ is a quotient map and Z is locally compact Hausdorff space then q ×id : X ×Z →Y ×Z is also a quotient map. Locally finite families of sets and Partitions of unity. Baire Category theorem for locally compact Hausdorff spaces.

References

[1] G. F. Simmons, Topology and modern analysis
[2] W. A. Sutherland, Introduction to metric and topological spaces.
[3] S. Willard, General Topology, Dover, New York.

M 504 : Probability Theory

Unit I Probability as a measure, Probability space, conditional probability, independence of events, Bayes formula. Random variables, distribution functions, expected value and variance. Standard Probability distributions: Binomial, Poisson and Normal distribution.

Unit II Borel-Cantelli lemmas, zero-one laws. Sequences of random variables, convergence theorems, Various modes of convergence. Weak law and the strong law of large numbers.

Unit III Central limit theorem: DeMoivre-Laplace theorem, weak convergence, characteristic functions, inversion formula, moment generating function.

Unit IV Random walks, Markov Chains, Recurrence and Transience.

Unit V Conditional Expectation, Martingales.

References

[1] Marek Capinski and Tomasz Zastawniak, Probability through Problems, Springer, Indian Reprint 2008.
[2] P. Billingsley, Probability and Measure, 3rd ed., John Wiley & Sons, New York, 1995.
[3] J. Rosenthal, A First Look at Rigorous Probability, World Scientific, Singapore, 2000.
[4] A.N. Shiryayev, Probability, 2nd ed., Springer, New York, 1995.
[5] K.L. Chung, A Course in Probability Theory, Academic Press, New York, 1974.

SEMESTER –VI

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits

M601	Analysis IV	[3 + 1]	4
M602	Algebra IV	[3+ 1]	4
M603	Differential Geometry & Applications	[3 + 1]	4
M604	Differential Equations & Dynamical Systems	[3 + 1]	4
M605	Computational Mathematics II	[3 + 1]	4
PM601	Ethics of Science and IPR	[2 + 0]	2
		Lab Hours per Week	
PML601	Numerical Methods Laboratory	[6]	3
		Semester Credits	**25**
		Subtotal	**150**

M601 : Analysis IV (Complex Analysis)

Unit I Complex numbers and Riemann sphere. Mobius transformations.

Unit II Analytic functions. Cauchy-Riemann conditions, harmonic functions, Elementary functions, Power series, Conformal mappings.

Unit III Contour integrals, Cauchy theorem for simply and multiply connected domains. Cauchy integral formula, Winding number.

Unit IV Morera's theorem. Liouville's theorem, Fundamental theorem of Algebra. Zeros of an analytic function and Taylors theorem. Isolated singularities and residues, Laurent series, Evaluation of real integrals.

Unit V Zeros and Poles, Argument principle, Rouchs theorem.

References
[1] L.Ahlfors, Complex Analysis.
[2] R.V. Churchill and J. W. Brown, Complex Variables and Applications, International Student Edition,Mc-Graw Hill, 4th ed., 1984.
[3] B.R. Palka, An Introduction to Complex Function Theory, UTM Springer-Verlag, 1991.

M602 : Algebra IV (Rings and Modules: Some Structure Theory)

Unit I Recollection of modules, submodules, quotient modules, homomorphisms.

Unit II External and internal direct sums of modules. Tensor product of modules over a commutative ring. Functorial properties of and Hom.

Unit III Definitions and elementary properties of projective and injective modules over a commutative ring.

Unit IV Structure of finitely generated modules over a PID. Applications to matrices and linear maps over field: rational and Jordan canonical forms.

Unit V Simple modules over a not necessarily commutative ring, modules of finite length, Jordan-Holder Theorem, Schur's lemma.

(**Optional, if time permits**) Semisimple modules over a not necessarily commutative ring, Wedderburn Structure Theorem for semisimple rings.

References

[1] M. Artin, Algebra, Prentice Hall of India, 1994.
[2] D.S. Dummit and R. M. Foote, Abstract Algebra, 2nd Ed., John Wiley, 2002.
[3] N. Jacobson, Basic Algebra I & II, Hindustan Publishing Corporation, 1983.
[4] S. Lang, Algebra, 3rd ed. Springer (India) 2004.

M603 : Differential Geometry & Applications

Unit I Curvature of curves in E^n: Parametrized Curves, Existence of Arc length parametrization, Curvature of plane curves, Frennet-Serret theory of (arc-length parametrized) curves in E^3, Curvature of (arc-length parametrized) curves in En, Curvature theory for parametrized curves in E^n. Significance of the sign of curvature, Rigidity of curves in E^n.

Unit II Euler's Theory of curves on Surfaces **:** Surface patches and local coordinates, Examples of surfaces in E^3, curves on a surface, tangents to the surface at a point, Vector fields along curves, Parallel vector fields, vector fields on surfaces, normal vector _elds, the First Fundamental form, Normal curvature of curves on a surface, Geodesics, geodesic Curvature, Christoffel symbols, Gauss' formula,Principal Curvatures, Euler's theorem.

Unit III Gauss' theory of Curvature of Surfaces **:** The Second Fundamental Form, Weingarten map and the Shape operator, Gaussian Curvature, Gauss' Theorema Egregium, Guass-Codazzi equations,Computation of First/Second fundamental form, curvature etc. for surfaces of revolution and other examples.

Unit IV More Surface theory**:** Isoperimetric Inequality, Mean Curvature and Minimal Surfaces (introduction), surfaces of constant curvature, Geodesic coordinates, Notion of orientation, examples of non-orientable surfaces, Euler characteristic, statement of Gauss-Bonnet Theorem.

Unit V Modern Perspective on Surfaces: Tangent planes, Parallel Transport, Afine Connections, Riemannian metrics on surfaces.

References

[1] Elementary Differential Geometry : Andrew Pressley, Springer Undergraduate Mathematics Series.
[2] Elementary Differential Geometry : J. Thorpe, Elsevier.
[3] Differential Geometry of Curves and Surfaces : M. do Carmo.
[4] Elements of Differential Geometry : R. Millman & G. Parker.

M604 : Differential Equations & Dynamical Systems

Unit I Basic existence and uniqueness of systems of ordinary differential equations satisfying the Lipschitz's condition. Examples illustrating non-uniqueness when Lipschitz or other relevant conditions are dropped. Gronwall's lemma and its applications to continuity of the solutions with

respect to initial conditions. Smooth dependence on initial conditions and the variational equation. Maximal interval of existence and global solutions. Proof that if (a, b) is the maximal interval of existence and a < 1 then the graph of the solution must exit every compact subset of the domain on the differential equation.

Unit II   Linear systems and fundamental systems of solutions. Wronskians and its basic properties. The Abel Liouville formula. The dimensionality of the space of solutions. Fundamental matrix. The method of variation of parameters.

Unit III Linear systems with constant coefficients and the structure of the solutions. Matrix exponentials and methods for computing them. Solving the in-homogeneous system. The Laplace transform and its applications.

Unit IV Second order scalar linear differential equations. The Sturm comparison and separation theorems and regular Sturm-Liouville problems.

Unit V Series solutions of ordinary differential equations and a detailed analytic study of the differential equations of Bessel and Legendre. Dynamical systems and basic notions of dynamical systems such as ows, rectification theorem, rest points and its stability. Liouville's theorem on the preservation of phase volume. First integrals and their applications.

References
[1] R. Courant and D. Hilbert, Methods of Mathematical Physics, Volume - I
[2] W. Hurewicz, Lectures on ordinary differential equations, Dover, New York.
[3] . F. Simmons, Differential equations with applications and historical notes, McGraw Hill.

M605 : Computational Mathematics II

Unit I   Introduction to SAGE. Using SAGE to explore basics notions of Linear algebra, Number theory, Group Theory

Unit II Solving linear and non-linear optimization problems using Mathematica. Developing programmes for various numerical optimization techniques.

Unit III . Exploration of Galois theory and Finite Fields Using Sage/Singular/Kash etc.

Unit IV Basics of discrete mathematics using Sage/Mathematica. Exploring advanced notions of Complex Analysis and Differential Equations using Mathematica.

Unit V Applied Linear Algebra using Mathematica, various matrix factorizations and their applications.

SEMESTER –VII

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits

M701	Functional Analysis	[3 + 1]	4
M702	Commutative Algebra	[3+ 1]	4
M703	Differential Topology	[3 + 1]	4
M704	Partial Differential Equations	[3 + 1]	4
M705	Representation Theory of Finite Groups	[3 + 1]	4
MPr701	Project		5
		Semester Credits	**25**
		Subtotal	**175**

M701 : Functional Analysis

Unit I Normed linear spaces. Riesz lemma. Heine-Borel theorem. Continuity of linear maps. Hahn-Banach extension and separation theorems.

Unit II Banach spaces. Subspaces, product spaces and quotient spaces. Standard examples of Banach spaces like l^p, L^p, C([0; 1]) etc.Uniform boundedness principle. Closed graph theorem. Open mapping theorem. Bounded inverse theorem.

Unit III   Spectrum of a bounded operator. Eigenspectrum. Gelfand-Mazur theorem and spectral radius formula. Dual spaces. Transpose of a bounded linear map. Standard examples.

Unit IV   Hilbert spaces. Bessel inequality, Riesz-Schauder theorem, Fourier expansion, Parseval's formula.

Unit V In the framework of a Hilbert space: Projection theorem. Riesz representation theorem. Uniqueness of Hahn-Banach extension.

References
[1] J.B. Conway, A course in Functional Analysis, Springer-Verlag, Berlin, 1985.
[2] G. Go_man and G. Pedrick, First course in functional analysis, Prentice-Hall, 1974.
[3] E. Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons, NY, 1978.
[4] B.V. Limaye, Functional Analysis, 2nd ed., New Age International, New Delhi, 1996.
[5] A. Taylor and D. Lay, Introduction to functional analysis, Wiley, New York, 1980.

M702 : Commutative Algebra

Unit I Prime and maximal ideals in a commutative ring, nil and Jacobson radicals, Nakayamas lemma, local rings.

Unit II Rings and modules of fractions, correspondence between prime ideals, localization.

Unit III   Modules of finite length, Noetherian and Artinian modules. Primary decomposition in a Noetherian module, associated primes, support of a module.

Unit IV   Graded rings and modules, Artin-Rees, Krull-intersection, Hilbert-Samuel function of a local ring, dimension theory, principal ideal theorem.

22

Unit V Integral extensions, Noethers normalization lemma, Hilberts Nullstellensatz (algebraic and geometric versions).

References

[1] M.F Atiyah and I.G MacDonald, Introduction to Commutative Algebra, Addison-Wesley, 1969.
[2] D. Eisenbud, Commutative Algebra with a view toward algebraic geometry, Springer-Verlag, Berlin, 2003.
[3] H. Matsumura, Commutative ring theory, Cambridge Studies in Advanced Mathematics No. 8, Cambridge University Press, Cambridge, 1980.
[4] S. Raghavan, B. Singh and R. Sridharan, Homological methods in commutative algebra, TIFR Math. Pamphlet No.5, Oxford, 1975.
[5] B. Singh, Basic Commutative Algebra, World Scientific, 2011.

M703 : Differential Topology

Unit I Differentiable functions on $\mathbf{R}^n$: Review of differentiable functions $\mathbf{f} : \mathbf{R}^n \to \mathbf{R}^m$, Implicit and Inverse function theorems, Immersions and Submersions, critical points, critical and regular values.

Unit II Manifolds: Level sets, sub-manifolds of $\mathbf{R}^n$, immersed and embedded sub-manifolds, tangent spaces, differentiable functions between sub-manifolds of R_n, abstract differential manifolds and tangent spaces.

Unit III Differentiable functions on Manifolds: Differentiable functions $f : M \to N$, critical points, Sard's theorem, non-degenerate critical points, Morse Lemma, Manifolds with boundary, Brouwer fixed point theorem, mod 2 degree of a mapping.

Unit IV Transversality: Orientation of Manifolds, oriented intersection number, Brouwer degree, transverse intersections.

Unit V Integration on Manifolds: Vector field and Differential forms, integration of forms, Stokes' theorem, exact and closed forms, Poincar Lemma, Introduction to de Rham theory.

References

[1] Topology from a Di_erentiable Viewpoint : J. Milnor.
[2] Di_erential Topology : V. Guellemin & A. Pollack.
[3] Di_erential Topology : M. Hirsch.

M704 : Partial Differential Equations

Unit I Generalities on the origins of partial differential equations. Generalities on the Cauchy problem for a scalar linear equation of arbitrary order. The concept of characteristics. The Cauchy-Kowalevsky theorem and the Holmgren's uniqueness theorem. The fundamental equations of mathematical physics as paradigms for the study of Elliptic, Hyperbolic and Parabolic equations.

Unit II   Quasilinear first order scalar partial differential equations and the method of characteristics. Detailed discussion of the inviscid Burger's equation illustrating the formation of discontinuities in finite time. The fully nonlinear scalar equation and Eikonal equation. The Hamilton-Jacobi equation.

Unit III Detailed analysis of the Laplace and Poisson's equations. Green's function for the Laplacian and its basic properties. Integral representation of solutions and its consequences such as the analyticity of solutions. The mean value property for harmonic functions and maximum principles. Harnack inequality.

Unit IV The wave equation and the Cauchy problem for the wave equation. The Euler-Poisson-Darboux
equation and integral representation for the wave equation in dimensions two and three. Properties of solutions such as finite speed of propagation. Domain of dependence and domain of inuence.

Unit V The Cauchy problem for the heat equation and the integral representation for the solutions of The Cauchy problem for Cauchy data satisfying suitable growth restrictions. Infinite speed of propagation of signals. Example of non-uniqueness. Fourier methods for solving initial boundary value problems.

References
[1] R. Courant and D. Hilbert, Methods of Mathematical Physics, Volume - II
[2] R. C. McOwen, Partial differential equations, Pearson Education, 2004.

M705 : Representation Theory of Finite Groups

Unit I Recollection of left and right modules, direct sums, tensor products.

Unit II Semi-simplicity of rings and modules, Schur0s lemma, Maschke0s Theorem,

Unit III Wedderburn0s Structure Theorem. The group algebra.

Unit IV Representations of a finite group over a field, induced representations, characters, orthogonality relations.

Unit V Representations of some special groups. Burnside's $p^a q^b$ theorem.

References
[1] M. Artin, Algebra, Prentice Hall of India, 1994.
[2] M. Burrow, Representation Theory of Finite Groups, Academic Press, 1965.
[3] D.S. Dummit and R. M. Foote, Abstract Algebra, 2nd Ed., John Wiley, 2002.
[4] N. Jacobson, Basic Algebra I & II, Hindustan Publishing Corporation, 1983.
[5] S. Lang, Algebra, 3rd ed. Springer (India) 2004.
[6] J .P. Serre, Linear Representation of Groups, Springer-Verlag, 1977.

SEMESTER –VIII

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
M801	Fourier Analysis	[3 + 1]	4
M802	Algebraic Number Theory	[3+ 1]	4

M803	Algebraic Topology	[3 + 1]	4
M804	Stochastic Analysis	[3 + 1]	4
M805	Computational Mathematics III	[3 + 1]	4
MPr801	Project		5
		Semester Credits	**25**
		Subtotal	**200**

M801 : Fourier Analysis

Unit I Fourier series. Discussion of convergence of Fourier series.

Unit II Uniqueness of Fourier Series, Convolutions, Cesaro and Abel Summability, Fejer`s theorem, Dirichlets theorem, Poisson Kernel and summability kernels. Example of a continuous function with divergent Fourier series.

Unit III Summability of Fourier series for functions in L^1 , L^2 and L^p spaces. Fourier-transforms of integrable functions. Basic properties of Fourier transforms, Poisson summation formula, Hausdorff-Young inequality, Riesz-Thorin Interpolation theorem.

Unit IV Schwartz class of rapidly decreasing functions, Fourier transforms of rapidly decreasing functions, Riemann Lebesgue lemma, Fourier Inversion Theorem, Fourier transforms of Gaussians, Plancheral theorem, Paley-Weiner theorem.

Unit V Distributions and Fourier Transforms: Calculus of Distributions, Tempered Distributions: Fourier transforms of tempered distributions, Convolutions, Applications to PDEs.

References
[1] Y. Katznelson, Introduction to Harmonic Analysis, Dover.
[2] R. E. Edwards, Fourier Series, Academic Press.
[3] E. M. Stein and R. Shakarchi, Fourier Analysis: An Introduction, Princeton University Press, Princeton 2003.
[4] W. Rudin, Fourier Analysis on groups, Interscience.

M802 : Algebraic Number Theory

Unit I   Field extensions and examples of field extensions of rational numbers, real numbers and complex numbers. Monic polynomials, Integral extensions, Minimal polynomial, Characteristic polynomial.

Unit II   Integral closure and examples of rings which are integrally closed. Examples of rings which are not integrally closed. The ring of integers. The ring of Gaussian integers. Quadratic extensions and description of the ring of integers in quadratic number fields. Units in quadratic number fields and relations to continued fractions.

Unit III Noetherian rings, Rings of dimension one. Dedekind domains. Norms and traces. Derive formulae relating norms and traces for towers of field extensions. Discriminant and calculations of the discriminant in the special context of quadratic number fields. Different and it's applications.

Unit IV Cyclotomic extensions and calculation of the discriminant in this case. Factorization of ideals into prime ideals and its relation to the discriminant. Ramification theory, residual degree and its relation to the degree of the extension. Ramified primes in quadratic number fields.

Unit V Ideal class group. Geometric ideas involving volumes. Minkowski's theorem and its application to proving finiteness of the ideal class group. Real and complex embeddings. Structure of finitely generated abelian groups. Dirichlet's Unit Theorem and the rank of the group of units. Discrete valuation rings, Local fields.

References
[1] Janusz, Algebraic Number Fields.
[2] Neukirch, Algebraic Number Theory.
[3] Marcus, Number Fields.

M803 : Algebraic Topology

Unit I Review of quotient spaces and its universal properties. Examples on RP^n, Klein's bottle, Mobius band, CP^n, $SO(n, R)$. Connectedness and path connectedness of spaces such as $SO(n, R)$ and other similar examples. Topological groups and their basic properties. Proof that if H is a connected subgroup such that G/H is also connected (as a topological space) then G is connected. Quaternions, S^3 and $SO(3, R)$. Connected, locally path connected space is path connected.

Unit II Paths and homotopies of paths. The fundamental group and its basic properties. The fundamental group of a topological group is abelian. Homotopy of maps, retraction and deformation retraction. The fundamental group of a product. The fundamental group of the circle. Brouwer's fixed poin theorem. Degree of a map. Applications such as the fundamental theorem of algebra, Borsuk-Ulam theorem and the Perron Frobenius theorem.

Unit V Covering spaces and its basic properties. Examples such as the real line as a covering space of a circle, the double cover $\eta : S^n \to RP^n$, the double cover $\eta : S^3 \to SO(3, R)$. Relationship to the fundamental group. Lifting criterion and Deck transformations. Equivalence of covering spaces. Universal covering spaces. Regular coverings and its various equivalent formulations such as the transitivity of the action of the Deck group. The Galois theory of covering spaces.

Unit IV Orbit spaces. Fundamental group of the Klein's bottle and torus. Relation between covering spaces and Orientation of smooth manifolds. Non orientabilty of RP^2 illustrated via covering spaces.

Unit V Free groups and its basic properties, free products with amalgamations. Concept of push outs in the context of topological spaces and groups. Seifert Van Kampen theorem and its applications. Basic notions of knot theory such as the group of a knot. Wirtinger's algorithm for calculating the Group of a knot illustrated with simple examples.

References
[1] E. L. Lima, Fundamental groups and covering spaces, A. K. Peters, 2003.
[2] W. Massey, Introduction to algebraic topology. Springer Verlag.

M804 : Stochastic Analysis

26

Unit I Preliminaries: Martingales and properties. Brownian Motion- definition and construction, Markov property, stopping times, strong Markov property zeros of one dimensional Brownian motion.

Unit II   Reection principle, hitting times, higher dimensional Brownian Motion, recurrence and transience,occupation times, exit times, change of time, Levys theorem.

Unit III Stochastic Calculus: Predictable processes, continuous local martingales, variance and covariance processes.

Unit IV Integration with respect to bounded martingales and local martingales, Kunita Watanabe inequality, Ito s formula, stochastic integral, change of variables.

Unit V Stochastic differential equations, weak solutions, Change of measure, Change of time, Girsanovs theorem.

References
[1] Richard Durrett, Stochastc Calculus A Practical Introduction, CRC Press 1996.
[2] Karatzas I. and Steven Shreve, Brownian Motion and Stochastic Calculus, Springer.
[3] Oksendal Bernt, Stochastic Differential Equations, Springer.
[4] J.Michael Steele, Stochastic Calculus and Financial Applications, Springer, 2000

M805 : Computational Mathematics III

Unit I Differential Geometry of curves and surfaces using Mathematica. Exploring Differential Equation and Dynamical System using XPPAUT or some other specialized software.

Unit II   Design of Experiments and Statistics Quality control using R. Project/Math Modeling problem using any Mathematical Software and developing Mathematica packages for various specific methods.

Unit III   Exploring solutions of Partial Differential equations using Mathematica. Developing programmes to solve problems numerically.

Unit IV Exploring basic Notions of Commutative algebra using Sage/Singular /Kash etc.

Unit V Advanced notion of optimization techniques using Mathematica. Project/Math Modeling problem using any Mathematical Software and developing Mathematica packages for various specific methods.

References
[1] Alfred Gray, Elsa Abbena, Simon Salamon, Modern Differential Geometry of Curves and Surfaces with Mathematica, Third Edition.

<u>FIFTH YEAR</u>
SEMESTER –IX

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
MPr901	Project		20
		Semester Credits	**20**
		Subtotal	**220**

SEMESTER –X

Subject Code	Subject	Contact Hours / Week Theory+Tutorials	Credits
ME1001	Elective 1	[3 + 1]	4
ME1002	Elective 2	[3+ 1]	4
ME1003	Elective 3	[3 + 1]	4
ME1004	Elective 4	[3 + 1]	4
ME1005	Elective 5	[3 + 1]	4
		Semester Credits	**20**
	Total Credits (with 5 Electives)		**240**
	Minimum required		**240**

Electives

Students shall opt 5 Electives from the 30 Electives offered by School of Mathematical Sciences in the Xth semester

1. **Advanced Commutative Algebra & Applications.**
2. **Advanced Differential Topology.**
3. **Advanced Numerical Techniques.**
4. **Combinatorics & Enumeration.**
5. **Lie Groups & Geometry**
6. **Topics in Algebraic Geometry.**
7. **Advanced Algebraic Topology & Applications.**
8. **Advanced Differential Geometry & Applications.**
9. **Algebraic curves.**
10. **Analytic number theory.**
11. **Class field theory.**
12. **Coding Theory & Cryptography.**
13. **Combinatorial Design Theory.**
14. **Econometrics.**
15. **Elliptic curves.**
16. **Financial Mathematics.**
17. **Finite Fields & Applications.**
18. **Fluid Mechanics.**

28

19. Fractals & Applications.
20. Geometric algebra.
21. Homological Algebra & Applications.
22. Industrial Mathematics.
23. Introduction to algebraic groups.
24. Mathematical Applications to Engineering.
25. Mathematics & Nano Technology.
26. Modular forms.
27. Operator Theory.
28. Perturbation Theory.
29. Quantum Computing.
30. Wavelet Analysis & Applications.

29

Center for Basic Sciences (CBS)

SCHEME OF EXAMINATION
&
COURSE STRUCTURE
Of
SEMESTER IX and X
M.Sc. Integrated (Mathematics Stream)
UNDER
FACULTY OF SCIENCE
EFFECTIVE FROM JANUARY 2020

Center of Basic Science
Pt. Ravishankar Shukla University
Raipur (C.G.) 492010
PH: - 0771-2262864
WEBSITE: -www.prsu.ac.in

Approved by Board of Studies in Mathematics
Pt. Ravishankar Shukla University, Raipur (C.G.)

CENTER FOR BASIC SCIENCES
Pt. Ravishankar Shukla University, Raipur

5 Year Integrated M.Sc. (Mathematics)
Under
Faculty of Science

SEMESTER-X (Mathematics Stream)

Subject		Subject Contact hrs/per week Theory+Tutorial	Credits
ME 1001	Electives I	[4 + 1]	5
ME 1002	Electives II	[4 + 1]	5
ME 1003	Electives III	[4 + 1]	5
ME 1004	Elective IV	[4 + 1]	5
		Total	20

Min. 20
(Total 240 credits)

*Four Subjects will be offered according to the availability of instructors and more than 50% of students opting for a course.

22-02-2020

<u>Elective-1: Integrated M.Sc. 10th Semester (Mathematics)</u>

<u>Dynamical Systems Using Matlab</u>

Introduction to Matlab

Unit-I: Arithmetic Operations, built-in-MATH functions, scalar variables, creating arrays, built-in functions for handling arrays, mathematical operations with arrarys, script files, two dimensional plots, programming in MATLAB, polynomial, curve fitting, and interpolation, three-dimensional plots.

Discrete Dynamical Systems

Unit-II: One-dimensional maps, cobweb plot: graphical representation of an orbit, stability of fixed points, periodic points, the family of logistic maps, sensitive dependence on initial conditions, analysis of logistic map, Periodic Windows, Feigenbaum number, chaos in logistic map.

Unit-III: higher-dimensional maps, sinks, sources, and saddles, nonlinear maps and the jacobian matrix, stable and unstable manifolds, lyapunov exponents, Numerical Calculation of Lyapunov Exponent, chaotic orbits. Strange Attractors, Gaussian and Hénon Maps. Julia Sets and the Mandelbrot Set.
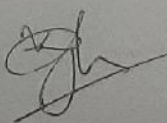
Differential Dynamical Systems
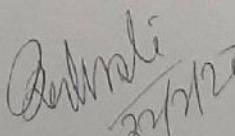
Unit-IV: Differential dynamical systems, existence and uniqueness theorem, phase portraits, vector fields, nullclines, flows, fixed points, linearization of vector fields, planar systems, canonical forms, eigenvectors defining stable and unstable manifolds, phase portraits of linear systems in the plane, linearization and Hartman's theorem, limit cycles, existence and uniqueness of limit cycles in the plane, Lyapunov functions and stability.

Unit-V: Nonlinear systems and stability, bifurcations of nonlinear systems, normal forms, multistability and bistability, the Rössler system and chaos, the Lorenz equations, Chua's circuit, and the Belousov–Zhabotinski reaction.

Books and References:

1. Dynamical Systems with Applications using MATLAB® 2nd edition, Stephen Lynch, Springer International Publishing Switzerland 2014.
2. CHAOS: An Introduction to Dynamical Systems, Kathleen T. Alligood Tim D. Sauer James A. Yorke, Springer-Verlag .
3. Nonlinear Dynamics And Chaos: With Applications to Physics, Biology, Chemistry, and Engineering, Steven H. Strogatz, CRC Press Taylor & Francis Group, 2018.
4. Differential Equations, Dynamical Systems, and an Introduction to Chaos, Morris W. Hirsch , Stephen Smale , Robert L. Devaney , Elsevier, 2013.
5. Dynamical Systems with Applications using Mathematica, 2nd edition, Stephen Lynch , Springer International Publishing, 2017.

1

22-02-2020

Mathematical Biology

Unit- I: Simple Single Species Models: **Continuous Population Models**, Exponential Growth, The Logistic Population Model, Harvesting in Population Models, Constant-Yield and Constant-Effort Harvesting, Eutrophication of a Lake; A Case Study.
Discrete–Time Metered Models, Systems of Two Difference Equations, Oscillation in Flour Beetle Populations: A Case Study.

Unit-II: Continuous Single-Species Population Models with Delays: Models with Delay in Per Capita Growth Rates, Delayed-Recruitment Models, Models with Distributed Delay, Harvesting in Delayed Recruitment Models, Nicholson's Blowflies: A Case Study.

Unit-III: Models for Interacting Species: The Lotka–Volterra Equations, The Chemostat Model, Equilibria and Linearization, Qualitative Behavior of Solutions of Linear Systems, Periodic Solutions and Limit Cycles, Species in Competition, Kolmogorov Models, Mutualism, The Spruce Budworm: A Case Study.
The Community Matrix, the Nature of Interactions Between Species, Invading Species and Coexistence.

Unit-IV: Harvesting in Two-species Models: Harvesting of Species in Competition, Harvesting of Predator–Prey Systems, Intermittent Harvesting of Predator–Prey Systems, Some Economic Aspects of Harvesting, Optimization of Harvesting Returns, A Nonlinear Optimization Problem, Economic Interpretation of the Maximum Principle.

Unit-V: Models for Populations with Age and Spatial Structure: Linear model with age structure, The Method of Characteristics, Nonlinear Continuous Models, Models with Discrete Age Groups, Some Simple Examples of Metapopulation Models, A General Metapopulation Model, A Metapopulation Model with Residence and Travel, The Diffusion Equation, Solution by Separation of Variables, Solutions in Unbounded Regions, Linear Reaction–Diffusion Equations, Nonlinear Reaction–Diffusion Equations, Diffusion in Two Dimensions.

Books and References:

1. Mathematical Models in Population Biology and Epidemiology, 2nd edition, Fred Brauer, Carlos Castillo-Chavez, Texts in Applied Mathematics 40, Springer, 2012.
2. Elements of Mathematical Ecology, Mark Kot, Cambridge University Press, 2001.
3. Mathematical Biology-I: An Introduction, James D. Murray, Springer, 2002.
4. Mathematical Biology-II: Spatial Models and Biomedical Applications, James D. Murray, Springer, 2003.

Elective-3: Integrated M.Sc. 10th Semester (Mathematics)

Financial Mathematics

Unit I: Review Of probability, finite probability space.

Unit II: Derivatives security, interest rates, other financial instruments, Arbitrage and pricing, risk less issue, yield curves, mean terms matching and immunization, interest rate models.

Unit III: Dependent annual rates of return, random walk and Markov process, stochastic calculus.

Unit IV: option pricing, portfolio optimization, Fokker-plank equation, distribution and green functions.

Unit V: Feynman-kac formula options, dividends revisited. Exotic options.

Books and References:
1. Financial mathematics, Richard Brass, Springer, 2003
2. Mathematics of financial derivatives, Wilmott & Howison, Springer, 2005
3. Hand book of stochastic methods, Gardiner, Wiely, 2000
4. The Mathematics of Financial Derivatives: A Student Introduction, Wilmott, Dewynne and Howison, Cambridge University Press, 1995
5. Futures, and Other Derivatives, 5th ed, Hull, Prentice Hall, 2000

Elective-4: Integrated M.Sc. 10th Semester (Mathematics)

Non-linear Analysis

Unit-I: Calculus in Banach space
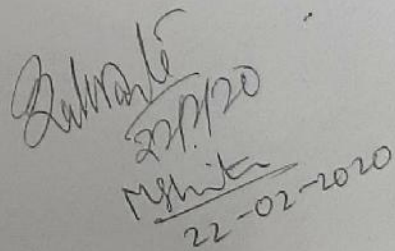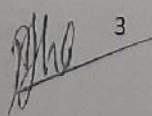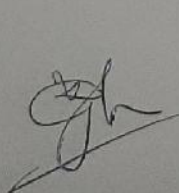
Various form of continuiuty, geometry in normed spaces and duality mappings, Gateaux and Frechet derivative, properties of derivatives, Taylor theorem, inverse function theorem and impliocit function theorem, subdeifferential of convex function.

Unit-II: Monotone operators

Monotone operators, Maximal monotone operators and its propwerties, constructive solution of operator equations, subdifferential and monotonicity, some generalization of monotone operator.

Unit-III: Fixed point theorems

Banach contraction principle and its generalizations, nonexpansive mappings, fixed point theorem of Brouwder and Schauder. Fixed point theorems for multi-functions, common fixed point theorems, sequence of contractions, generalized contractions and fixed points.

3

Unit-IV: Applications of monotone operators theory

Introduction, Sobolev space, differential equation, nonlinear differential equations, integral equation, Nonlinear ammerstein integral equation, Generalized Hammerstein integral equation.

Unit-V: Applications of fixed point theorems

Application to Geometry of Banach Spaces, Application to System of Linear Equations, Perron–Frobenius, Fundamental Theorem of Algebra, Game Theory and Nash Equilibria, Differential eqautions, integral equations.

Books and References:

1. Some topics in nonlinear analysis, M. C. Joshi and R. K. Bose, Wiley Eastern limited, New Delhi, 1985.
2. An introduction to nonlinear analysis and fixed point theory, H. K. Pathak, Springer, 2018.
3. Nonlinear functional analysis and its applications-I, Fixed point theorem, Zeidler, Springer, Heidelberg, 1986.
4. Nonlinear functional analysis, Akerker, Narosa publishing house, New Delhi.

Elective-5: Integrated M.Sc. 10th Semester (Mathematics)

Operations Research
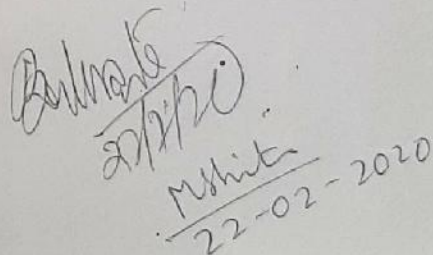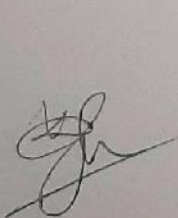
Unit I Introduction, Nature and Scope of operations research. Linear Programming: Introduction, Mathematical formulation of the problem, Graphical Solution methods, Mathematical solution of linear programming problem, Slack and Surplus variables. Matrix formulation of general linear programming problems.

Unit II The Simplex Method: Simplex algorithm, Computational procedures, Artificial variables, Two phase Simplex Method, Formulation of linear programming problems and its solution by simplex method.

Unit III Unrestricted variables, problems of degeneracy, Principle of duality in simplex method, Formation of dual with mixed type of constraints, Solution of primal and dual constraints.

Unit IV Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space, M/G/1.

Unit V Game Theory: Introduction, Two persons zero sum games, The maxmin and minimax principles. Graphical Solution: Reduction of game problem to LPP.

4

22-02-2020

Books and References:

1. Introduction to Operations Research', Hillier, F.S. and G.J. Lieberman, , 9th Ed., 2010, McGraw Hill, New York.
2. Operation Research, Kanti Swarup,P K Gupta, Man Mohan, Sultanchand and Sons.
3. Operation Research, Theory and Application, J.K. Sharma, Macmillan India.
4. Linear Programming, N.P. Loomba, Tata Mc-Graw Hill.
5. Operation Research: An Introduction, H.A. Taha, Macmillan India.

Elective-6: Integrated M.Sc. 10th Semester (Mathematics)

Introduction to Cryptography

Unit-I:

Classical Cryptosystems: Some Simple Cryptosystems, Monoalphabatic and Polyalphabatic cipher, The Shift Cipher, The Substitution Cipher, The Affine Cipher, The Vigenere Cipher, The Hill Cipher, The Permutation Cipher, Cryptanalysis, Some Cryptanalytic Attacks, Stream ciphers, Synchronous Stream Cipher, Linear Feedback Shift Register (LFSR), Non-Synchronous stream Cipher, Autokey Cipher.
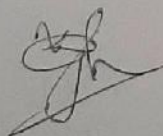
Unit-II:
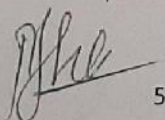
Block Ciphers: Mode of operations in block cipher: Electronic Codebook (ECB), Ciphertext Chaining (CBC), Ciphertext FeedBack (CFB), Output FeedBack (OFB), Counter (CTR), DES & AES: The Data Encryption Standard (DES), Feistel Ciphers, Description of DES, Security analysis of DES, Differential & Linear Cryptanalysis of DES, Triple DES, The Advanced Encryption Standard (AES), Finite field GF(28), Description of AES, analysis of AES.
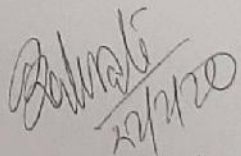
Unit-III:

Shannon's Theory of Perfect Secrecy: Perfect Secrecy, Birthday Paradox, Vernam One Time Pad, Random Numbers, Pseudorandom Numbers. **Prime Number Generation:** Trial Division, Fermat Test, Carmichael Numbers, Miller Rabin Test, Random Primes.
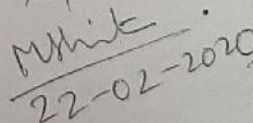
Unit-IV: Public Key Cryptography:

Principle of Public Key Cryptography, RSA Cryptosystem, Factoring problem, Cryptanalysis of RSA, RSA-OAEP, Rabin Cryptosystem, Security of Rabin Cryptosystem, Quadratic Residue Problem, Diffie-Hellman (DH) Key Exchange Protocol, Discrete Logarithm Problem (DLP), ElGamal Cryptosystem, ElGamal& DH, Algorithms for DLP. Elliptic Curve, Elliptic Curve Cryptosystem (ECC), Elliptic Curve Discrete Logarithm Problem (ECDLP).

5

22/2/20

22-02-2020

Unit-V: Cryptographic Hash Functions:

Hash and Compression Functions, Security of Hash Functions, Modification Detection Code (MDC0. Message Authentication Codes (MAC), Random Oracle Model, Iterated Hash Functions, Merkle-Damgard Hash Function, MD-5, SHA-1, Others Hash Functions.

Digital Signatures: Security Requirements for Signature Schemes, Signature and Hash Functions, RSA Signature, ElGamal Signature, Digital Signature Algorithm (DSA), ECDSA, Undeniable Signature, Blind Signature.

Books and References:

1. J Buchmann, Introduction to Cryptography, Springer (India) 2004
2. S. Padhye, R A Sahu, V Saraswat, Introduction to Cryptography, CRC Press, 2018
3. D R Stinson, Cryptography: Theory and Practice. CRC Press, 2000.
4. Bruce Schenier, Applied cryptography, John Wiley & Sons, 1996.
5. B Forouzan, Cryptography and Network security, Tata McGraw Hill, 2011
6. Wenbo Mao, Modern Cryptography: Theory and Practice. Pearsion Education, 2004
7. W Starling, Cryptography and Network security, Pearson Education, 2004.

Elective-7: Integrated M.Sc. 10th Semester (Mathematics)
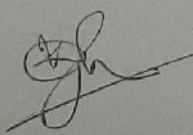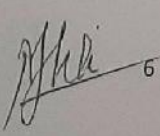
Introduction to Nonlinear Optimization

Unit-I: Mathematical Preliminaries, the Space R^n, $R^{n \times m}$, Inner Products and Norms, Eigen values and Eigen vectors, Basic Topological Concepts.
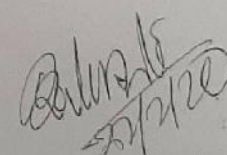
Unit-II: Optimality Conditions for Unconstrained Optimization: Global and Local Optima, Classification of Matrices, Second Order Optimality Conditions, Global Optimality Conditions, Quadratic Functions.

Unit-III: Least Squares: Solution of over determined Systems, Data Fitting, Regularized Least Squares, Denoising, Nonlinear Least Squares. Descent Directions Methods, The Gradient Method, The Condition Number, Diagonal Scaling, The Gauss–Newton Method, The Fermat–Weber Problem, Convergence Analysis of the Gradient Method.

Unit-IV: Newton's Method, Pure Newton's Method, Damped Newton's Method, The Cholesky Factorization. Convex Sets, Algebraic Operations with Convex Sets, The Convex Hull, Convex Cones, Topological Properties of Convex Sets, Extreme Points.

Unit-V: Convex Functions, First Order Characterizations of Convex Functions, Second Order Characterization of Convex Functions, Operations Preserving Convexity, Level Sets of Convex Functions, Maxima of Convex Functions, Convexity and Inequalities, Convex Optimization, The Orthogonal Projection Operator, Optimization over a Convex Set, Stationarity in Convex Problems, The Orthogonal Projection Revisited, The Gradient Projection Method, Sparsity Constrained Problems.

Books and References:

1. Introduction to Nonlinear Optimization Theory, Algorithms, and Applications with MATLAB, Amir Beck, Society for Industrial and Applied Mathematics, 2014.
2. Optimization Theory and Methods: Nonlinear Programming, Wenyu Sun, Ya-Xiang Yuan, Springer, 2006.
3. Nonlinear Optimization, Francisco J. Aragón, Miguel A. Goberna Marco A. López, Margarita M. L. Rodríguez, Springer Undergraduate Texts in Mathematics and Technology, 2019.
4. Nonlinear Optimization: Methods and Applications, H. A. Eiselt, Carl-Louis Sandblom, Springer 2019.

Elective-8: Integrated M.Sc. 10th Semester (Mathematics)

Complex Network

UNIT-I: Fundamentals of Graph Theory; Directed, Weighted and Bipartite Graphs, Trees. Complex Network, Basics, history and importance of Complex Network.

UNIT-II: Centrality Measures: The Importance of Being Central, Connected Graphs and Irreducible Matrices, Degree and Eigenvector Centrality, Measures Based on Shortest Paths, Group Centrality.
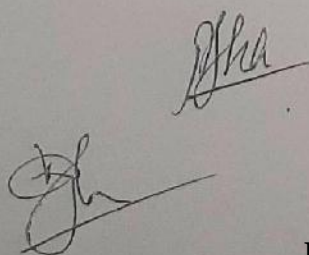
Unit –III: Random Graphs: Erd"os and Rényi (ER) Models, Degree Distribution, Trees, Cycles and Complete Sub-graphs, Giant Connected Component, Scientific Collaboration Networks, Characteristic Path Length.
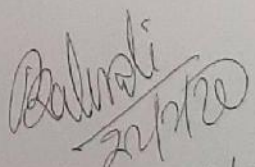
Unit-IV: Small-World Networks: Six Degrees of Separation, The Brain of a Worm, Clustering Coefficient, The Watts–Strogatz (WS) Model, Variations to the Theme, Navigating Small-World Networks.

Unit-V: Generalised Random Graphs: The World Wide Web, Power-Law Degree Distributions, The Configuration Model, Random Graphs with Arbitrary Degree Distribution, Scale-Free Random Graphs, Probability Generating Functions. Models of Growing Graphs, Degree Correlations.

Books and References:

1. Complex Networks : Principles, Methods and Applications , Vito Latora , Vincenzo Nicosia , Giovanni Russo , Cambridge University Press, 2017
2. Graph Theory and Complex Networks: An Introduction, Maarten van Steen, Maarten van Steen, 2010.
3. Lectures on Complex Networks, S. N. Dorogovtsev, Clarendon Press Oxford, 2010.
4. The Structure Of Complex Networks: Thoery and Applications, Ernesto Estrada, Oxford University Press, 2011

7

मूल विज्ञान केन्द्र ,पं. रविशंकर शुक्ल विश्वविद्यालय ,रायपुर (छ.ग.)

रचनात्मक हिंदी भाषा

इकाई I—   (1) मानक हिंदी भाषा , वर्तनी लेखन में अशुद्धियाँ , शब्द शुद्धि, वाक्य शुद्धि,

हिंदी भाषा के विकास में हिंदीतर एवं विदेशी विद्वानों का योगदान,

(2) उसने कहा था , कहानी— चंद्रधर शर्मा गुलेरी ।

इकाई II—   (1) पत्राचार औपचारिक व अनौपचारिक पत्र एवं संप्रेषण कौशल ।

(2) मनुष्य ही साहित्य का लक्ष्य है । (हजारी प्रसाद द्विवेदी)

इकाई III—   (1) पारिभाषिक शब्दावली की परिभाषा एवं स्वरुप तथा निर्माण की प्रकिया (विज्ञान
–तकनीकी), शब्द भंडार ।

(2) सादगी, सत्य और अहिंसा –मोहनदास करमचंद गांधी (आत्मकथांश)

इकाई IV—   (1) देवनागरी लिपि, वाग्यंत्र और ध्वनि उत्पादन में उनकी भूमिका , स्वर व्यंजन का वर्गीकरण
,IPA अंतरराष्ट्रीय ध्वनि लिपि ।

(2) नमामि छत्तीसगढ. (छत्तीसगढ. का सांस्कृतिक वैभव) : डॉ हीरालाल शुक्ल (आलेख) ।

इकाई V— (1) अनुवाद , परिभाषा ,प्रकिया , अनुवादक के गुण , सफल अनुवाद, हिंदी से अंग्रेजी अनुवाद ।

(2) योग की शक्ति –डॉ. हरिवंश राय बच्चन (डायरी) ।

(3) पृथक छत्तीसगढ. राज्य –विष्णु खरे (कविता) ।

Suggested Texts and References:

Sr.No.	Author	Title	Publisher
1.	तिवारी भोलानाथ	हिन्दी भाषा की संरचना	पाण्डूलिपि प्रकाशन ,दिल्ली
2.	प्रसाद वासुदेवनंदन	आधुनिक हिंदी व्याकरण और रचना	भारती भवन प्रकाशन ,पटना
3.	बाहरी हरदेव	पारिभाषिक शब्दावली कोश	राजकमल प्रकाशन दिल्ली
4.	वधान अमरसिंह	भाषा और सूचना प्रौद्योगिकी	भावना प्रकाशन,दिल्ली
5.	गुरु कामता प्रसाद	हिंदी व्याकरण	लोकभारती प्रकाशन ,इलाहाबाद

ES101-ENVIRONMENTAL STUDIES

UNIT – I   THE MULTI DISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES :

Definition ,scope and importance

Need for publish awareness.

(5 cr.)

UNIT-II   Natural Resources :

Renewable and non-renewable resources:

Natural resources and associated problems .

(a)   Forest resources : use and over – exploitation, deforestation, case studies, timber extraction,Mining, dams and their effects on forests and tribal people .

(b)   Water resources : use and over-utilization of surface and ground water,floods, drought,Conflicts over water , dams benefits and problems .

(c)   Mineral resources : use and explotation, environmental effects of extracting and using Mineral resources, case studies .

(d) Food resources : World food problems , changes caused by agriculture and overgrazing, Effects of modern agriculture , fertilizer –pesticide problems , water logging , salinity Case studies.

(e) Energy resources : Growing energy needs , renewable and non renewable energy sources Use of alternate energy sources ,case studies.

(f)   Land resources : land as a resources , land degradation, man induced landslides , soil erosion & desertification.

-   Role of an individual in consertification of natural resources.
-   Equitable use of resources for sustainable life –styles.

(5 cr.)

UNIT- III   Concept of an ecosystems.

Structure and function of an ecosystem.

-   Producers , consumers and decomposers .
-   Energy flow in the ecosystem .
-   Ecological succession.
-   Food chains, food webs and ecological pyramids .

(5 cr.)

UNIT-IV   Introduction , types ,characteristic features , structure and function of the following

Ecosystem:
a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystem (ponds , streams, lakes, rivers, oceans,estuaries

(5 cr.)

UNIT- V   SOCIAL ISSUES AND THE ENVIRONMENT
- Environment Protection Act.
- Air (prevention and control of pollution) Act.
- Wildlife protection Act.
- Forest conservation Act.
- Issues involved in enforcement of environmental legislation .
- Public awareness.
- Value Education
- HIV/ADIS
- Women and child welfare.
- Role of information technology in Environment and Human Health.
- Case studies.

(5 cr.)

Field work

- Visit to a local area to document environment assets – river / forest/grassland/hill/ Mountain.
- Visit to local polluted site : Urban/Rural/Industrial/Agriculture.

Sr.No.	Author	Title	Publisher
1.	Agarwal K.C.	Environmental Biology 2001	Nidi Publ. Ltd.Bikaner
2.	Bharucha Erach	The Biodiversity of India	Mapin Publishing Pvt. Ltd. Ahmedabad 380013, India .
3.	Bruinner R.C.	Hazardous Waste Incineration, 1989	Mc Graw Hill Inc. 480p.
4.	Bharucha E.	Textbook for Environmental Studies for undergraduate Cources.	UGC, New Delhi & Bharti Vidyapeeth Inst. Of Environment edu. & Research ,Pune.
5.	Begon M.,Town send C.R. ,Harper J.L.	Ecology From Individuals to Ecosystems	4th edition , Blackwell Publishing (TB)

(TB)   Textbook.

H 101: Communication Skills(COMMON TO ALL BRANCHES)

Unit-I

An interactive session (with examples) on what is communication, communication in the natural and civilized worlds, types of human communication: visual / non-verbal / verbal, written / spoken, etc

Unit-II

An overview of mass media; a brief discussion of their types (with examples). The concepts of facilitating factors, barriers, and filters in communication; the seven C's of effective communication.

Unit-III

Verbal communication: How to speak / listen effectively (in interpersonal communication), types of publicspeaking, tips for effective public speaking, how to make effective presentations. The role of written text in communication,

Unit-IV

Types of writing (academic/creative/general; formal/informal etc.) with examples of good/bad writing and their analysis. Introduction to letter writing, with stress on formal correspondence; email do's and don'ts.

Unit-V

Academic writing- an overview; explanation of various terms used in academic writing; parts of a paper/thesis;aspects such as formal language, grammatical accuracy, etc. Common grammatical/punctuation errors andhow to avoid them (example-based instruction)

Books Recommended:

S.No	Author	Book	Publication
1	Rajendra Pal and JS Kurlahalli	Essentials of Business Communication	S.Chand& Sons
2	Michael Alley	The Craft of Scientific Writing (3rd Edition)	Springer, Newyork, 1996
3	Philip Reubens (General editor)	Science and Technical Writing – A Manual of Style (2nd Edition)	Routledge, Newyork, 2001
4	Edmond H. Weiss	Writing Remedies – Practical Exercises for Technical Writing	Universities Press (India) Ltd. , Hyderabad,2000
5	M. Ashraf Rizvi	Effective Technical Communication	Tata Mc Graw – Hill New Delhi, 2005
6	DH Menzel ,HM Jones& LGBoyd	Writing Technical Papers	Mc Graw Hill, 1961
7	KL Turbian	A Manual for Writers of Term Papers Thesis and Dissertation	University of Chicago Press, 1973.

ES201: Environmental Studies

Unit-I: Biodiversity and its Conservation: Introduction- Definition: genetics, species and ecosystem diversity. Bio geographical classification of India. Value of biodiversity: consumptive use productive use, social, ethical, aesthetical and option value. Biodiversity at global, National and local levels. India as mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in situ and ex-situ conservation of biodiversity.

Unit-II: Environmental pollution. Definition Causes, effects and control measures of- a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Nuclear hazards.

Unit-III: Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies Disaster management: floods, earthquake, cyclone and landslides.

Unit-IV: Human population and the Environment: Population growth, variation among nation. Population explosion- Family welfare programme. Environment and human health. Human Rights.

Unit-V: Social Issues and the Envionment: From unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people, its problems and concerns. Case studies. Environment ethies: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products.

H201Subject: Communication Skills (Lab)

Course Outcome: After learning the course the students should be able to
1. To know the process of communication and its components.
2. To improve the language skills i.e. Listening Skills, Speaking Skills, Reading Skills and Writing Skills (LSRW).
3. Construct basic and intermediate skills in English / Hindi language.
4. To enhance phonetic competence, comprehension skills, presentation skills, group discussion skills etc.
5. To build confidence for communicating in English /Hindi and create interest for the life-long learning of English/Hindi language.

Unit 1
Elementary Phonetics (Speech Mechanism. The Description of Speech Sounds, The Phoneme the syllable; Intonation and Word Accent)
Formal (Extempore and Mock Interviews) and Informal Speaking(Situational Dialogues and Role play), Telephoning (Telephonic Conversations)

Unit 2
Paralinguistic features of speaking (voice modulation, pitch, tone, etc.)
Paper Presentation (Non-Technical & current Affairs), Use of Audio-Visual aids: Preparation slides, power point presentation etc.

Unit 3
Body Language(Gestures / Postures during Role Play/Speaking and JAM (Just-a-Minute) Session and Group Discussion

Unit 4
Listening and Comprehending spokenmaterial in Standard Indian English, British English and American English;Exercises on Listening Comprehension,Exercises on Reading Comprehension
Effective Writing (Business Letters, Covering Letter, Resume on Word Document. Translation and Precis Writing)

Unit 5
Grammar:(English/ Hindi)
Grammar in use: Errors of Accidence and syntax with reference to Parts of Speech; Agreement of Subject and Verb; Tense and Concord; Use of connectives, Question tags.
Voice and Narration.
Indianism in English: Punctuation and Vocabulary, Building (Antonym, Synonym, Verbal Analogy and One Word Substitution.

H301: World Literature (COMMON TO ALL BRANCHES)

Unit-I
What is Literature? - a discussion; Introduction to literary terms, genres, and forms of various periods, countries, languages, etc.

Unit-II
The Novel: Class study of 'Brave New World' by Aldous Huxley; Group discussions and student presentations on other genres such as the graphic novel, detective fiction, children's literature, etc.

Unit-III
Plays: Introduction to the history of theatre, class study of (mainly) two plays: 'Pygmalion' by G. B. Shaw and 'Fire and Rain' by Girish Karnad, the setting up of play –reading group through which the students can be introduced to several other plays.

Unit-IV
Poetry: Brief introduction; Study of poetic genres, forms, topics, figures of speech, poetic language etc. by analysing various poems from around the world

Unit-V
Short stories, essays and other types of writing by various authors. Screening of films based on literary works, such as Pygmalion (My Fair Lady), Fire and Rain (Agnivarsha), Persepolis (a graphic novel) and a few others.

Books Recommended:

S.No	Author	Book	Publication
1	IforIvans London	A Short History of English Literature	London: Penguin Books, 1976
2	Kettle Arnold	An Introduction to English Novel Vol. I, Vol. II	New. Delhi: Universal Book store, 1993.
3	Eagleton, Terry.	The English Novel: An Introduction	Oxford: Basil Blackwell. 1983
4	M.H. Abrams)	A Glossary of Literary Terms	Wadsworth Publishing; 10th edition (January 10, 2011
5	J.A. Cuddon	Dictionary of Literary Terms and Literary	(London: Penguin, 2004)
6	Girish Karnad	The Fire and the Rain	New Delhi, Oxford University Press, 1998
7	Aldous Huxley	'Brave New World'	New York: Harper Perennial, 1989
8	G. B. Shaw	Pygmalion	Longman Literature. Harlow: Longman, 1991

मूल विज्ञान केंद्र, पं. रविशंकर शुक्ल विश्वविद्यालय, रायपुर (छ.ग.)
एम.एस–सी. (इंटीग्रेटेड) तृतीय सेमेस्टर
प्रयोजनमूलक हिंदी (**FH301**)
Functional Hindi

इकाई I-   (1)   प्रयोजनमूलक हिंदी का स्वरूप एवं महत्व
          (2)   भाषा के विविध रूप– बोली, उपभाषा, राजभाषा, राष्ट्रभाषा, संपर्क भाषा, साहित्यिक भाषा।

इकाई II-   (1)   मीडिया की भाषा– समाचार पत्र, विज्ञापन
          (2)   श्रव्य माध्यम, दृश्य–श्रव्य माध्यम

इकाई III- (1)   पल्लवन– परिभाषा, पल्लवन एवं व्याख्या, आशय कुशल विस्तारक के गुण, सूक्तिपरक वाक्यों का पल्लवन
          (2)   झलमला पदुमलाल पुन्नालाल बख्शी कहानी

इकाई IV-   (1)   शब्द रचना– उपसर्ग संस्कृत, हिंदी, उर्दू के उपसर्गों का परिचय
          (2)   प्रत्यय–परिभाषा, प्रत्यय के भेद

इकाई V-   (1)   चीफ की दावत – भीष्म साहनी कहानी
          (2)   मजदूरी और प्रेम – सरदार पूर्ण सिंह

संदर्भ ग्रंथ–
1. प्रयोजनमूलक हिंदी की नयी भूमिका कैलाश नाथ पाण्डेय, लोकभारती प्रकाशन, इलाहाबाद।
2. प्रयोजनमूलक व्यावहारिक हिंदी भाषा कैलाश चंद्र भाटिया, तक्षशिला प्रकाशन, जयपुर।
3. भाषा प्रौद्योगिकी एवं भाषा प्रबंधन सूर्य प्रसाद दीक्षित, किताबघर, नई दिल्ली
4. हिंदी भाषा और संस्कृति म.प्र. हिंदी ग्रंथ अकादमी, भोपाल सं. राजेन्द्र मिश्र
5. कार्यालयी हिंदी, श्री प्रकाशन, रायपुर, प्रो. केशरीलाल वर्मा
6. अच्छी हिंदी, रामचंद्र वर्मा, लोकभारती प्रकाशन, इलाहाबाद (उ.प्र.)
7. अच्छी हिंदी, किशोरी दास वाजपेयी, मीनाक्षी प्रकाशन मेरठ (उ.प्र.)
8. भारतीयता के अमर स्वर प्रधान सं. डॉ. घनंजय वर्मा, म.प्र. हिंदी ग्रंथ अकादमी भोपाल।
9. प्रयोजनमूलक हिंदी डॉ. चितरंजन कर वैभव प्रकाशन रायपुर (छ.ग.)

H401Subject: Communication Skills (Lab)

Course Outcome: After learning the course the students should be able to
1. To know the process of communication and its components.
2. To improve the language skills i.e. Listening Skills, Speaking Skills, Reading Skills and Writing Skills (LSRW).
3. Construct basic and intermediate skills in English / Hindi language.
4. To enhance phonetic competence, comprehension skills, presentation skills, group discussion skills etc.
5. To build confidence for communicating in English /Hindi and create interest for the life-long learning of English/Hindi language.

Unit 1
Elementary Phonetics (Speech Mechanism. The Description of Speech Sounds, The Phoneme the syllable; Intonation and Word Accent)
Formal (Extempore and Mock Interviews) and Informal Speaking(Situational Dialogues and Role play), Telephoning (Telephonic Conversations)

Unit 2
Paralinguistic features of speaking (voice modulation, pitch, tone, etc.)
Paper Presentation (Non-Technical & current Affairs), Use of Audio-Visual aids: Preparation slides, power point presentation etc.

Unit 3
Body Language(Gestures / Postures during Role Play/Speaking and JAM (Just-a-Minute) Session and Group Discussion

Unit 4
Listening and Comprehending spokenmaterial in Standard Indian English, British English and American English;Exercises on Listening Comprehension,Exercises on Reading Comprehension
Effective Writing (Business Letters, Covering Letter, Resume on Word Document. Translation and Precis Writing)

Unit 5
Grammar:(English/ Hindi)
Grammar in use: Errors of Accidence and syntax with reference to Parts of Speech; Agreement of Subject and Verb; Tense and Concord; Use of connectives, Question tags. Voice and Narration.
Indianism in English: Punctuation and Vocabulary, Building (Antonym, Synonym, Verbal Analogy and One Word Substitution.

CBS – Five Years Integrated Course, M.Sc. V Semester

Scientific Writing (H501)

Unit 1

Introduction: What is Scientific Writing; Needs and importance, main features and elements of scientific writing. Tools and types of Scientific Writing , Scientific writing Vs other forms of writing, Different methods of Research, Types of Research.

Unit 2

Scientific Writing in Research: Mechanics of writing. How to write a Research Paper, Project Proposal components of a full length research paper, Research/ Project Report writing, Formulation of Hypothesis, Do's and Don'ts of writing a Research Paper.

Unit 3

Technical Writing:
Types of technical documents: Full length research paper, Letters to editor, Book chapter, Review, Conference report, Title/Thesis statement, Abstract/key words, Aims and objectives, Rationale of the paper, Work plan, Materials and methodology, Results and discussion, Key issues and arguments, Acknowledgement, Conflict of interest statement, Reference and Bibliography.

Unit 4

Scientometrics: How to cite and how to do Referencing, Literature Search Technique: using SCOPUS, Google Scholar, PUBMED, Web of Science, Indian Citation Index, and RG Styles of referencing: APA, MLA, Oxford, Harvard, Chicago Annotated bibliography Tools for citing and referencing: Footnote, Endnote etc.

Unit 5

Research Paper and Thesis Designing: Components, Types and Importance Research ethics, Institutional ethics committee, Proof Reading, Studying Peer Review and Impact Factor of Journals, Synopsis Designing, Writing Preface, Acknowledgements, Plagiarism – Pitfall (software to check plagiarism).

Book Recommended :

S. No.	Author	Book	Publication
1	Various	The Oxford Book of Modern Science writing	Oxford University Press
2	Robert A. Day and Barbara	How to write and Publish a Scientific paper	Cambridge University Press
3	Angelika Hofmann	Scientific Writing and Communication: Papers Proposals and Presentations	Oxford University Press
4	Jennifer Peat, Elizabeth-Elliott, Louise Baur and Victoria Keena	Scientific Writing: Easy when you know how	BMJ Books
5	Hans F. Ebel, Claus Bliefert, William E. Russey	The Art of Scientific Writing	WILEY-VCH Publishers

CBS – Five Years Integrated Course, M.Sc. VI Semester

Scientific Writing Lab / Applications of Scientific Writing (H602)

Effective Writing skills: Structuring Scientific Paper for Journals (Category A, B, C and D) Tables, Figures, Equations and Pictures using Excel, Improving Writing Style, Punctuation, Mechanism of Scientific Writing, Capitalization and Spelling, Collecting, organizing and evaluating data, Making deductions and reading conclusions.

Project writing: Technical Resumes & Cover Letters Components of a research proposal: Project summary, Key words, Origin of the proposal, Major Objectives, Methodology, Instrument facility available in the PI's department, Overview of status of Research and Development in the subject, Importance of the proposed project in the context of current status, Bibliography, Making Report of a Project / Research Paper
Formulation of projects, Funding Agencies: their Templates and Assignments on Project Submission.
Presentations: Oral, and Power Point Presentation of Scientific Research Paper in Seminars, Conferences, Research Meetings and gatherings, Audience Analysis in Presentation, Conducting Seminars and Conferences etc.