



**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 2020-21

S. No.	Department	Pg. No.
1	School of Studies in Ancient Indian History Culture & Tourism & Hotel Management	1-44
2	School of Studies in Anthropology	45-127
3	School of Studies in Biotechnology	128-182
4	School of Studies in Chemistry	183-238
5	Swami Vivekanand Memorial School of Studies in Comparative Religion, Philosophy and Yoga	239-262
6	School of Studies in Computer Science & IT	263-333
7	School of Studies in Economics	334-362
8	School of Studies in Environmental Science	363-394
9	School of Studies in Electronics and Photonics	395-511
10	School of Studies in Geography	512-516
11	School of Studies in Geology and WRM	517-563
12	School of Studies in History	564-654
13	School of Studies in Law	655-809
14	School of Studies in Library & Information Science	810-837
15	School of Studies in Life Science	838-939
16	School of Studies in Literature and Languages	940-1098
17	Institute of Management	1099-1128
18	School of Studies in Mathematics	1129-1184
19	University Institute of Pharmacy	1185-1252
20	School of Studies in Physical Education	1253-1371
21	School of Studies in Physics and Astrophysics	1372-1415
22	School of Studies in Psychology	1416-1531
23	School of Regional Studies and Research	1532-1594
24	School of Studies in Sociology & Social work	1595-1681
25	School of Studies in Statistics	1682-1685
26	Institute of Teacher Education	1686-1824
27	Centre for Women’s Studies	1825-1841
28	Renewable Energy Technology & Management	1842-1938
29	Centre for Basic Sciences	1939-2144

सत्र 2020-21

पाठ्यक्रम

पं. रविशंकर शुक्ल विश्वविद्यालय, रायपुर  
प्राचीन भारतीय इतिहास, संस्कृति एवं पुरातत्व  
अध्ययनशाला

एम. ए. प्रथम, द्वितीय, तृतीय एवं चतुर्थ सेमेस्टर



प्राचीन भारतीय इतिहास संस्कृति एवं पुरातत्व अध्ययनशाला  
पं. रविशंकर शुक्ल विश्वविद्यालय, रायपुर

सत्र 2015.2016

**Semester - I**

No.	Name of the Paper	Internal	Theory	Total
<b>Compulsory Papers</b>				
1	Pre historic India	20	80	100
2	History of India Indus valley civilization to 4th Cent. B.C.	20	80	100
3	History of India 4th Century B.C. to 319 A.D.	20	80	100

**Optional Paper (Any Two)  
Semester I & II Group A or B**

**GROUP A**

4	Art and Iconography Part-I	20	80	100
5	Architecture Part-- I	20	80	100

**GROUP B**

4	Ancient Indian Social and Economic Institutions Part-I	20	80	100
5	Ancient Indian Polity Part-I	20	80	100

# Compulsory Paper-I

## Pre Historic India

### प्रागैतिहासिक भारत

Maximum Marks- 80

#### Unit-1

1. Palaeo-environment and changing culture  
परिवर्तित संस्कृति एवं जीवाष्म पर्यावरण
2. Geo archaeology: Palaeontology, Palaeo Botony  
भू-पुरातत्व : जीवाष्म विज्ञान एवं पुरा वनस्पतिशास्त्र

#### Unit-2

Tool type and its technique of manufacture  
प्रागैतिहासिक प्रस्तर उपकरण, प्रकार एवं निर्माण तकनीक

#### Unit-3

Palaeolithic cultures: Lower Palaeolithic, Middle Palaeolithic, Upper Palaeolithic, distribution stratigraphy and cultural distribution in Himalyan context (Extra Peninsular India) and Paninsular India.

पुराप्रागैतिहासिक संस्कृति, निम्न पुरापाषाण काल, मध्य पुरापाषाण काल, उच्च पुरापाषाण काल का स्तर-विन्यास एवं वितरण क्षेत्र भारतीय उपमहाद्वीप के संदर्भ में

#### Unit:4

1. Mesolithic cultures: alluvial Plain adaptation, Horse shoe lae sites, sandstone landscape, plateau occupation.  
मध्यपाषाण काल का अभिग्रहण क्षेत्र एवं भू-परिदृश्य- कछारी क्षेत्र, रतीली क्षेत्र घुड़नाल आकार झील तथा पठारी क्षेत्र
2. Neolithic cuktures of India  
नव पाषाणकालीन भारत

#### Unit:5

Sites with special reference to Sohan, Belan, Narmada, Mahanadi, Son, Godawari.

पुरास्थल- सोहन, बेलन, नर्मदा, महानदी एवं गोदावरी घाटियों के विशेष संदर्भ में।

#### **Books Recommended:-**

Krishnaswami, V.D. –Stone Age India, Ancient India No.3.  
IAR --- Relevant Portions. Excavations & Exploration.  
Braidwood, R.J. Prehistoric India.  
Ghosh, A. – Encyclopedia of Indian Archaeology  
Pandey, R.P. – Pre-historic Archaeology Of Madhya Pradesh.  
Sankalia, H.D. Prehistory and Protohistory of India & Pakistan.  
Jayaswal, Vidula—Bhartiya Itihas ke aadicharn ki roopreekha.  
Mishra, D.P----Protohistory of India(English and Hindi)

## Compulsory Paper-II

भारत का इतिहास (सिंधु घाटी सभ्यता से 4 थीं शताब्दी ई.पूर्व तक)  
History Of India, From Indus Valley Civilization To 4<sup>th</sup> B.C.

### Unit-1

1. प्राचीन भारतीय इतिहास के अध्ययन स्रोत.  
Sources of ancient Indian History
2. साहित्यिक एवं पुरातात्विक स्रोत.  
Archaeological and Literary sources.

### Unit-2

1. सिन्धु घाटी की सभ्यता का उद्भव एवं विकास.  
Origin and Development of Indus Valley Civilization
2. सिन्धु सभ्यता के प्रमुख नगर मोहनजोदड़ो, हड़प्पा, कालीबंगा  
Important sites of Indus valley. Mohan Jodaro, Harrappa and Kalibanga.

### Unit-3

1. वैदिक काल— आर्य कौन थे ,उनके मूल स्थान व ऋग्वैदिक कालीन एवं उत्तर वैदिक कालीन राजनीतिक, सामाजिक, धार्मिक एवं आर्थिक स्थितियों  
Vedic age—who were the Aryans? Their original place.  
Vedic and Later Vedic Age, Polity, Society, Economy and religion.

### Unit-4

1. महाजनपद काल  
Mahajanapada Period
2. छठवीं शताब्दी ई. पूर्व में भारत की राजनीतिक परिस्थितियों  
Political Conditions in the 6<sup>th</sup> cent. B.C.

### Unit-5

1. नन्दवंश के शासन काल तक मगध साम्राज्य का उत्कर्ष  
Rise of Magadha upto the Nanda Period.
3. सिकन्दर का भारत पर आक्रमण और इसका भारतीय सभ्यता एवं संस्कृति पर प्रभाव  
Alexander's Invasion of India and its impact on Indian Culture and Society.

### **Books Recommended:-**

Ray, H.C. –Dynastic History of Northern India, Vol.I & II (Relevant Chapters)  
Wheeler, M.—Indus Civilization  
Narayan, A.K. --- Indogreeks.  
Pandey, Vimal Chandra ---Prachin Bharat ka Rajnetik evam Sanskritik Itihaas.  
Thapriyaal, K.K.—Shindhu Sabyata.  
Cambridge History of India Vol.-I

# Compulsory Paper-III

## भारत का इतिहास (4 थीं शताब्दी ई.पू.से 319 ई. तक) History Of India, From 4th B.C. To 319 A.D.

### Unit-1

1. राजनीतिक शक्ति के रूप में मौर्यों का उत्कर्ष.  
Rise of Mauryas as the political power.
2. चन्द्रगुप्त मौर्य और उनका साम्राज्य विस्तार.  
Chandragupta Maurya and expansion of his Empire.

### Unit-2

1. बिन्दुसार एवं अशोक का राजत्व काल.  
Bindusar and Ashok and their times.
2. मौर्य साम्राज्य का पतन  
Decline of the Mauryan Empire.

### Unit-3

1. शुंग राजवंश (Sunga Dynasty)
2. सातवाहन वंश (Satavahan Dynasty)
3. कलिंग नरेश खारवेल (Chedi dynasty of kalinga)

### Unit-4

1. हिन्द-यूनानी शासन (Indo-Greek Rulers)
2. पश्चिम भारत के शक क्षत्रप (Western Shatrapa rulers)

### Unit-5

1. कुषाण साम्राज्य का उत्कर्ष एवं पतन (Rise and Decline of Kushan Dynasty)
2. गुप्त वंश के अभ्युदय से पूर्व उत्तरी भारत के जनपदीय राजवंशों एवं राज्यों का अध्ययन (Political Condition of Northern India Before The Rise of Guptas)

### **Books Recommended:-**

Ray, H.C. –Dynastic History of Northern India, Vol.I & II (Relevant Chapters)  
Pandey, Vimal Chandra ---Prachin Bharat ka Rajnetik evam Sanskritik Itihaas.  
Pandey,R.N.—Uttar bharat ka Rjnetik Itihas  
Bhandarkar ,R D—Ashoka  
Majundar,R C, Pusalkar, A.D. –Age if Imperial Unity.  
Puri,B. N -- India Under the Kushans.

# Group-A

एम0ए0 (प्रथम सेमेस्टर)  
वैकल्पिक प्रश्न-पत्र (चतुर्थ)  
कला एवं प्रतिमा विज्ञान (Art & Iconography)  
Part-I

## Unit-1

1. भारतीय कला की परम्परा एवं इसकी प्रमुख विशेषताएं  
Art tradition of India and its salient features.
2. भारत की प्रागैतिहासिक कला  
Pre-historic art of India.
3. सिन्धु घाटी – मूर्तिकला, मृण्मय, मुहरे  
Indus Valley- Sculptures, Terracotta & Seal.

## Unit-2

1. शिशुनाग एवं नन्द युग की कला  
Art of Shaisunaga and Nanda Age.
2. मौर्य कला  
Mauryan Art.

## Unit-3

1. शुंग कालीन कला, यक्ष एवं यक्षिणी मूर्तियां  
Art of the Sunga period-Yaksha & Yakshini Images,
2. सांची, भरहत्त, बोध गया, अमरावती की कला  
Sculptures of Sanchi, Bharhut, Bodhi Gaya and Amaravati
3. बुद्ध प्रतिमा की उत्पत्ति एवं विकास  
Origin And Development of Buddha Image.

## Unit-4

1. कुषाण कला के केन्द्र  
Main schools of Art in the Kushana period.  
(a) गंधार कला केन्द्र Gandhara School of Art.  
(b) मथुरा कला केन्द्र Mathura School of Art
2. गुप्त कला Art of Gupta :  
(a) गुप्त मूर्तिकला Gupta Sculptures.  
(b) अजन्ता एवं बाघ की चित्रकला Paintings of Ajanta & Bagh

### **Books Recommended:-**

Agrawal, V. S. – Indian Art

Ray, Nihar Ranjan—Maurayn and Sunga art.

Kumar swami A.K. – Earlt Indian Iconography

Banerjee, J N ---Development of Hindu Iconography.

Singh, A K --- Bhartiya Vastukala tatha Kala ke mool tatwa

Ray, Udaya Narayan—Bhartiya Kala.

**एम0ए0 (प्रथम सेमेस्टर)**  
**वैकल्पिक प्रश्न-पत्र (पंचम)**  
**स्थापत्य (Architecture)**

**Unit-1**

- 01 प्राचीन भारतीय स्थापत्य के साहित्यिक एवं पुरातात्विक स्रोत  
Literary and Archeological sources of Ancient Indian Architecture.
02. प्राचीन भारतीय स्थापत्य का उद्भव  
Origin of Ancient Indian Architecture.

**Unit-2**

- 01 सिन्धु घाटी सभ्यता के स्थापत्य:— मोहन जोदड़ो के नगर योजना, सभा भवन, महास्नानागार एवं हडप्पा के धान्यागार  
Architecture of Indus valley civilization:- PECIAL reference to great bath of Mohanjodaro, assembly hall, Godown of Harappa.
02. मौर्यकालीन कुम्हराहार का राजप्रसाद  
Palace architecture of Mauryas-Kumarahar.

**Unit-3**

01. स्तूप वास्तु का उद्भव  
Origin of Stupa Architecture.
02. स्तूप वास्तु के प्रकार एवं उसके अंग  
Types and main features of Stupa Architecture.

**Unit-4**

- 01 भरहुत, सांची, बाधगया एवं अमरावती के स्तूप वास्तु  
Bharut, Sanchi, Bodhgaya and Amaravati Stupas.

**Unit-5**

01. पूर्वी भारत के गुहा वास्तु:— उदयगिरि,खंडगिरि,एवं बराबर.  
Rock Architecture of Eastern Ghats- Udayagiri Khandagiri and Barabar
02. पश्चिमी घाट के गुहा:— भाजा ,कोण्डेन, नासिक, कार्ले  
Rock Architecture of western Ghats-Bhaja Kondane , Nasik, and Karle

**Books Recommended:-**

Agrawal, V. S. – Indian Art

Ray, Nihar Ranjan—Maurayn and Sunga art.

Brown, Percy—Indian Architecture Buddhist and hindu.

Kumarswami, A.K.—Early Indian architecture.

Agrawal, P.K. – Gupta Temple Architecture.

Ray, U N. –Prachin Bhartiya Nagar evam nagrik Jeevan.

Vajpayee K.D. –Vastukala Ka Itihaas.

Upadhyaya Vasudeva— Prachin Bhartiya Guha Stup and Mandir.

## Group-B

एम0ए0 (प्रथम सेमेस्टर)

वैकल्पिक प्रश्न-पत्र (चतुर्थ)

प्राचीन भारतीय सामाजिक एवं आर्थिक संस्थाएँ

**Ancient Indian Social & Economic Institute**

### Part-I

#### Unit-1

- 01 प्राचीन भारतीय सामाजिक इतिहास के स्रोत ।  
Sources of ancient Indian social History
- 02 प्राचीन भारतीय सामाजिक चिंतन की अवधारणा ।  
Thought and Concept of Ancient Indian Society.
- 03 वर्ण व्यवस्था का उद्भव एवं विकास ।  
Origin and development of Varna system.

#### Unit-2

- 01 प्राचीन भारतीय जाति व्यवस्था का उद्भव एवं विकास ।  
Origin and development of caste system in Ancient India.
- 02 आश्रम व्यवस्था Ashram System
- 03 पुरुषार्थ Purusharth.

#### Unit-3

- 01 प्राचीन भारतीय परिवार का स्वरूप एवं विकास ।  
Ancient Indian family system- Form and development.
- 02 परिवार की संपत्ति में उत्तराधिकार एवं पुत्र का स्थान ।  
Heir of Family property and the position of son.
- 03 स्त्रियों का स्थान परिवार एवं समाज ।  
Position of women in family and society.

#### Unit-4

- 01 हिन्दु संस्कार का अर्थ एवं प्रयोजन ।  
Meaning and aims of Hindu Sanskars.
- 02 संस्कारों की संख्या एवं मुख्य संस्कार ।  
Important Sanskars and their numbers.
- 03 विवाह संस्कार एवं उसका महत्त्व ।  
Importance of Hindu Marriage Sanskar.

#### Unit-5

- 01 प्राचीन भारतीय शिक्षा पद्धति ।  
Ancient Indian education system
- 02 प्राचीन भारत के प्रमुख शिक्षा केन्द्र ।  
Main education centers of Ancient India Nalanda, Vikramshila and Vallabhi .

नालंदा विश्वविद्यालय, विक्रमशिला विश्वविद्यालय, वल्लभी विश्वविद्यालय

#### **Books Recommended:-**

Altekar, A. S. –Education in Ancient India., Position of Women in Ancient India.

Kane, P.V. –History of Dharmashastra. Vol-2,3

Majumdar ,R.C.—Corporate Life of Ancient India.

Sarkar, D.C.—Study in the social and Economic History.

Prabhu P.N.—Hindu Social organization

Pandey R.V.—Hindu Sanskar.

Parhar, Dinesh Nandini—Chhattisgarh ka samajik arthik Itihaas.

**एम0ए0 प्रथम सेमेस्टर**  
**वैकल्पिक प्रश्न-पत्र पंचम**  
**प्राचीन भारतीय राजशास्त्र Ancient Indian Polity.**

**Part-I**

**Unit-1**

- 01 प्राचीन भारतीय राजशास्त्र के स्रोत  
Sources of ancient Indian Polity.
- 02 राज्य के अंग – सप्तांग सिद्धांत  
Parts of State—Theory of Saptang.
- 03 राज्य की उत्पत्ति ।  
Origin of State.

**Unit-2**

- 01 राज्य के प्रकार ।  
Types of States.
- 02 राज्य का उद्देश्य, आदर्श एवं कार्य  
Aims and objects of Ideal state.

**Unit-3**

- 01 नागरिक ।  
Citizens
- 02 सभा, समिति ।  
Sabha and Samiti
- 03 पौर-जनपद ।  
Paur and Janpad.

**Unit-4**

- 01 प्राचीन भारतीय प्रमुख गणराज्य एवं उनके कार्य एवं प्रशासन  
Republican states and their functions and administrations.
- 02 गणराज्यों की निर्वाचन व्यवस्था  
Election system of Republicans
- 03 गणराज्यों की प्रशासनिक व्यवस्था  
Administrative system of republicans.

**Unit-5**

- 01 राजा की उत्पत्ति ।  
Origin of Kingship
- 02 राज्य के अधिकार एवं कर्तव्य ।  
Rights and Duties of King.
- 03 राजा के अधिकारों पर नियंत्रण  
Control over king's rights.

**Books Recommended:-**

- Altekar, A. S. – State and Government of Ancient India hindi/English.  
Jaiswal K.P. –Hindu Polity hindi/English.  
Majumdar ,R.C.—Corporate Life of Ancient India.  
Sharma R,S.—Prachin Bhartiya Rajnaitik Vichar evam Sansthayen.  
Kane, P.V. –History of Dharmashastra. Vol-2.



## Semester- II

No.	Name of the Paper	Internal	Theroy	Total
<b>Compulsory Papers</b>				
1	(I) History of India from 319 A.G. to 550 A.D.	20	80	100
2	(II) History of India From 550 A.G. to 1300 A.D.	20	80	100
11	Survey and Field Work			100

**Optional Paper (Any Two)  
Semester I & II Group A or B  
GROUP A**

4	Art and Iconography Part--II	20	80	100
5	Architecture Part- II	20	80	100

**GROUP B**

4	Ancient Indian Social and Economic Institutions Part--II	20	80	100
5	Ancient Indian Polity Part--II	20	80	100

एम0ए0; द्वितीय सेमेस्टर  
अनिवार्य प्रश्न-पत्र प्रथम  
भारत का इतिहास (319 ई. से 550 ई. तक)  
History Of India, From 319 A.D. To 550 A.D.

**Unit-1**

- 1- xq|rjkt oa'k dk vH;qn; ]tkfr ,oa ewy LFkku -  
Origin of Gupta Dynasty and their cast and place .
- 2- izkjafkkd xq|r ujs'k & Jhxq|r vkSj ?kVksRdp-  
Early Gupta Dynasty Rulers –Shri Gupta and Ghatotkatch.
- 3- pUnzxq|r izFke--Chandragupta -I, leqnxq|r- Samudragupta

**Unit-2**

- 1- jkexq|r- Ramgupta, pUnzxq|r f}rh;- Chandragupta -II
- 2- dqekj xq|r izFke- Kumar Gupta –I, Ldan xq|r- Skandagupta.

**Unit-3**

- 1- Lda/kxq|r ds i'pkr xq|roa'k dk vuqdze-  
Post Skandagupta Rulers
- 2- okdkVd oa'k dk bfrgk ■ ,oa xq|r okdkVd ■ EcU/k- History of Vakatak Dynasty &  
Relationship of Gupta and Vakatak Kings.
- 3- gpk oa'k- Huns

**Unit-4**

- 1- o/kZu oa'k- Vardhan Dynasty.
- 2- ekS[kjh- Maukhri Dynasty.
- 3- ekx/k xq|r Magadha gupta Dynasty.

**Unit-5**

- 1- izkjafkkd pkyqD;- Early Chalukya Dynasty.
- 2- iYyo oa'k Pallav Dynasty.

**Books Recommended:-**

Ray, H. C. –Dynastic History of North India. Vol.-2  
Chaudhry, H.C. R. –Political History of Ancient India  
Pandey ,V.C.—Pracin bharat ka Itihaas.  
Gopalachari,R.S.—History of Pallavas of Kanchi.  
Goyal, Shriram,--Gupta kaaleen bharat.  
Upadhyaya vasudev-- Gupta Rajvans ka itihaas.

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Hkkjr dk bfrgk ■ 550 b- ■ 1300 bZ- rd  
**History Of India, From 550 A.D. To 1300 A.D.**

**Unit-1**

1. राजपूतों की उत्पत्ति, Origin of Rajput Dynasty
2. गुर्जर प्रतिहार, Gurjar Pratihar Dynasty
3. पाल, Paal Dynasty

**Unit-2**

1. चंदेल, Chandela Dynasty
2. परमार, Parmaar Dynasty
3. कलचुरि Kalchuri Dynasty

**Unit-3**

1. चाहमान, Chahmaan Dynasty
2. गहडवाल Gahadawal Dynasty

**Unit-4**

1. राष्ट्रकूट Rastrakuta Dynasty
2. परवती चालुक्य Later Chalukya Dynasty

**Unit-5**

1. चोल Chola Dynasty
2. पांड्य Pandya Dynasty

**Books Recommended:-**

Ray, H. C. –Dynastic History of North India. Vol.-2  
Chaudhry, H.C. R. –Political History of Ancient India  
Pandey, V.C.—Pracin bharat ka Itihaas.  
Gopalachari, R.S.—History of Pallavas of Kanchi.  
Tripathi R.S.—History of Kanya kubja.  
Chatopadyaya, S-- early History of North India  
Pathak, Vishudhanand—Uttar Bharat ka Rajnaitik Itihaas  
Yaajdaani—Deecan ka Prachin itihaas.

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**Survey and Fieldwork.—Practical Record and**  
**Viva-voce.**

In the Practical examination following shall be the allotment of marks:-

1. Practical Record:- 20Marks
2. Practical Examination:-- 30 Marks
3. Survey and Field Report:- 50 Marks

**COURSE:-**

1. Identification and Sketch work of Pre-Historical Tools and Potteries.
2. Study of Indus-Valley Seals
3. Prepration of Ground Plans of Temples, Stupas and Chaityas
4. Survey on any Archaeological or Historical Site.

**OPTIONAL GROUP A**  
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**dyk ,oa izftek foKku Art and Iconography**  
**Part-II**

**Unit-1**

1. मध्यकालीन मूर्तिकला एवं क्षेत्रीय शैलियों  
Regional Art styles in Medieval period
2. पल्लवकालीन कला एवं मूर्तिशिल्प .  
Art and Iconography of Pallava age.
3. चालुक्यकालीन कला एवं मूर्तिशिल्प.  
Art and Iconography of Chalukyas Age.
4. चोलकालीन कला एवं मूर्तिकला. Art and Iconography of Chola Age

**Unit-2**

1. पालकालीन कला एवं मूर्तिकला. Art and Iconography of Paal age
2. चंदेलकालीन कला एवं मूर्तिकला. Art and Iconography of Chandela age
3. कलचुरिकालीन कला एवं मूर्तिकला. Art and Iconography of Kalachuris age
4. परमारकालीन कला एवं मूर्तिकला. Art and Iconography of Parmars age.

**Unit-3**

1. उड़ीसा की मूर्तिकला एवं शिल्प. Iconography and sculpture of Orrisa.
2. दक्षिण कोसल मूर्तिकला एवं शिल्प Iconography and sculpture of South Kosal
3. राष्ट्रकूटकालीन मूर्तिकला एवं शिल्प. Iconography and sculpture of Rastrakutas.

**Unit-4**

1. भारत में मूर्ति पूजा की उत्पत्ति एवं प्राचीनता.  
Antiquity of Image worship in India.
2. प्रतिमा विज्ञान—आयुध वाहन, आसन और मुद्रा के संदर्भ में.  
Iconography –In context of aayudh vahan, aasan and Mudra.
3. शैव प्रतिमा विज्ञान. Iconography of shiva
4. वैष्णव प्रतिमा विज्ञान. Iconography of Vaishnav.

## Unit-5

1. ब्राम्हण धर्म के देवी--देवताओं का प्रतिमा विज्ञान—ब्रम्हा, शाक्त, सूर्य एवं नवग्रह. Iconography of Main Brahminical god and goddess—Brahma, Vishnu, surya, navagrah, Laksmi and Parvati.
2. बुद्ध एवं बोधिसत्त्व का प्रतिमा विज्ञान.  
Iconography of Buddha and Bhodhisatva.
3. जैन प्रतिमा विज्ञान—ऋषभनाथ, पार्श्वनाथ एवं महावीर के विशेष संदर्भ में.  
Iconography of Jains—Rishabh nath, parshavnath and Mahavir.

### **Books Recommended:-**

Agrawal, V. S. – Indian Art  
Ray, Nihar Ranjan—Maurayn and Sunga art.  
Kumar swami A.K. – Earlt Indian Iconography  
Banergee, J N ---Development of Hindu Iconography.  
Singh, A K --- Bhartiya Vastukala tatha Kala ke mool tatwa  
Ray, Udaya Narayan—Bhartiya Kala.  
Kumarswami, A.K. – Early Indian Iconography.  
Kumarswami, A.K— Origin of Buddha image.

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### **LFkkiR;(Architecture)**

## **Part-II**

### **Unit-1**

01. मंदिर वास्तु का उद्भव,  
Origin of Temple Architecture.
02. मंदिर वस्तु का प्रमुख शैली,  
Main Types of Temple Architecture.

### **Unit-2**

01. गुप्त कालीन मंदिर वास्तु की विशेषताये  
Specific Features of Gupta Temple Architecture.
02. प्रारंभिक गुप्त कालीन मंदिर,  
Early Gupta Temple Architecture.
03. प्रारंभिक इस्टीका निर्मित मंदिर वास्त भीतरगाँव, एवं सिरपुर,  
Early Brick Temples of Bhitara Gao and Sirpur.

### **Unit-3**

01. प्रारंभिक चालुक्य मंदिर वास्तु,  
Early Chalukya Temple Architecture.
02. उडीसा के मंदिर वास्तु लिंगराज एवं कोणार्क के विशेषतम संदर्भ में  
Orissian Temple Architecture With special reference to Lingaraj and Konark Temple.

### **Unit-4**

01. चंदेल कालीन मंदिर वास्तु—खजुराहो  
Chandela Temple Architecture at Khajuraho.
02. कलचुरि एवं परमार कालीन मंदिर वास्तु  
Temple Architecture of Kalchuri and Parmars.

### **Unit-5**

01. मंदिर वास्तु—एलिफेन्टा एवं एलोरा  
Rock Cut Temple Architecture of Elephanta and Elora

**Books Recommended:-**

- Agrawal, V. S. – Indian Art  
Ray, Nihar Ranjan—Maurayn and Sunga art.  
Brown, Percy—Indian Architecture Buddhist and hindu.  
Kumarswami, A.K.—Early Indian architecture.  
Agrawal, P.K. – Gupta Temple Architecture.  
Ray, U N. –Prachin Bhartiya Nagar evam nagrik Jeewan.  
Vajpayee K.D. –Vastukala Ka Itihaas.  
Upadhyaya Vasudeva— Prachin Bhartiya Guha Stup and Mandir.  
Kramirisch,S. – Hindu Temples.  
Krishnadev—Uttar Bharat ke Mandir.  
Srinivasan K.R.—Temples of South India. Dharamrajarath & its Sculputures.  
Deheja V. –Early Buddhist Rock Temples.

**OPTIONAL GROUP B**

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**Anciant Indian Social & Economic Institution  
Part-II**

**Unit-1**

01. प्राचीन भारतीय आर्थिक इतिहास के स्रोत.  
Sources of Ancient Indian Economic History.
02. प्राचीन भारतीय आर्थिक इतिहास की चिंतन एवं अवधारणा.  
Ancient Indian Economic thought and Concept.

**Unit-2**

01. प्राचीन भारतीय कृषि का स्वरूप सिंधुघाटी की सभ्यता से पूर्व मध्यकाल तक ।  
form of agriculture in Ancient India—Indus valley civilization to Medieval Period.
02. प्राचीन भारत में भू-स्वामित्व संबंधित सिद्धान्त एवं भू-स्वामित्व का प्रकार ।  
Theories of Land Ownership and types of Owner in Ancient India

**Unit-3**

01. प्राचीन भारत में उद्योग एवं व्यवसाय की स्थिति सिंधु सभ्यता से पूर्व मध्य काल तक ।  
Position of Trade and Commerce in Ancient India— Indus valley civilization to Middle Period.
02. प्राचीन भारतीय वाणिज्य का स्वरूप एवं श्रेणी संगठनों का स्वरूप ।  
Ancient Indian Trade Organisations and their functions.

**Unit-4**

01. प्राचीन भारतीय आय एवं व्यय का साधन एवं स्वरूप ।  
sources and types of Income and Expenditure in Ancient India.
02. विनिमय का साधन एवं प्रकार ।

### Unit-5

01. प्राचीन भारतीय तौल एवं माप प्रणाली ।  
Ancient Indian Weight and Mesurment-Tecnique.
02. प्राचीन भारतीय प्रमुख व्यवसायिक पथ प्रणाली ।  
Major Trade routes in Ancient India.

### Books Recommended:-

Jha D.N.—Revenu system in Post Maurya and Gupta Time.  
Altekar,A.S.-- Ancient Indian Administration.  
Bhatnagar K.P.—Indian Ruler Economy  
Majumdar R.P.--Corporate Life Of Ancient India.  
Randhawa M.S.—History of Agriculture in Ancient India.  
Pranath—A Study Economic Condition of Ancient India  
Motichand—Trade and Trade routes of Ancient India.

## Anciant Indian Polity Part-II

### Unit-1

- 1 मंत्रिपरिषद के कार्य. Funtions of Ministry
- 2 केन्द्रीय और प्रांतीय प्रशासनिक व्यवस्था. Ancient Indian Administration system of the central and Provinces.

### Unit-2

- 1 प्राचीन भारतीय न्याय व्यवस्था—व्यवहार न्यायालय,,सम्पत्ति का अधिकार एवं उत्तराधिकार, Ancient Indian Judiciary System and Rights of Property and Ownership.
- 2 अपराध एवं दंड. Crime and Punishment.
- 3 भू—राजस्व एवं कर व्यवस्था. Taxation system of Ancient India.

### Unit-3

1. अंतरराज्य संबंध एवं मंडल सिद्धांत. Interstate Relation and Mandal Theories.
2. दूत और दौत्य संबंध एवं षाड्गुण्य नीति. Ambassador and spy role and duties in Ancient India.

### Unit-4

1. प्राचीन भारत में सैन्य व्यवस्था. Ancient Indian military system.
2. ग्राम शासन. Rural Administration

### Unit-5

1. मौर्यकालीन प्रशासनिक व्यवस्था. Administration of Mauryan Period.

2. गुप्तकालीन प्रशासनिक व्यवस्था. Administration of Gupta Period.
3. हर्षकालीन प्रशासनिक व्यवस्था. Administration of Harsha Period.

**Books Recommended:-**

Altekar, A. S. – State and Government of Ancient India hindi/English.  
 Jaiswal K.P. –Hindu Polity hindi/English.  
 Majumdar ,R.C.—Corporate Life of Ancient India.  
 Sharma R,S.—Prachin Bhartiya Rajnaitik Vichar evam Sansthayen.  
 Kane, P.V. –History of Dharmashastra. Vol-2.  
 Mukharjee—Local self Government In Ancient India.  
 Ghoshal U N—A history of Indian Political Idea., Hindu revenue System.  
 Sarkar,D.K. --- Sukra neeti saar.  
 Prasad, Beni-- State in Ancient India.

**SemesterIII**

No.	Name of the Paper	Internal	Theroy	Total
<b>Compulsory Papers</b>				
1	Numismatics Part--I	20	80	100
2	Epigraphy & Palaeography Part--I	20	80	100
3	Historiography, Concept and Methods	20	80	100

**Optional Paper (Any Two)  
Semester III & IV Group A or B**

**GROUP C**

4	Tourism Part--I	20	80	100
5	Museology Part--I	20	80	100

**GROUP D**



6	Political and Cultural History of Chhattisgarh Part--I	20	80	100
7	History of Archaeology Part--I	20	80	100

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**Unit-1**

01. इतिहास के स्रोत के रूप में मुद्राओं का महत्व.  
Importance of Coins as a source of history.
02. मुद्रा की उत्पत्ति एवं प्राचीनता  
Origin and antiquity of Coinage.
03. मुद्रा प्रचलन का अधिकार  
Rights of issuing coins.

**Unit-2**

01. मुद्रा निर्माण पद्धति  
Techniques of menting the coins.
02. आहत मुद्राएँ एवं वर्गीकरण  
Classification of Punchmark coins.

**Unit-3**

01. जनपदीय मुद्राएँ पांचाल, कौशबी,मथुरा,उज्जैनी,तक्षशिला  
Regional coins-- Kausambi, Mathura, Ujjani and Taxila.

**Unit-4**

01. नगर राज्य एवं निगम के मुद्राएँ  
Coins of City, state and Nigam
02. गणराज्यों के मुद्राएँ :- मालव, यौधेय,अर्जुनायन, औदुम्बर.  
Republican state coins—Malav, yavdhaye,arjunayan and audumbar.

**Unit-5**

01. इंडोग्रीक Indogreek coins

**Books Recommended:-**

- Cunningham, A— Coins Of Ancient India.  
Altekar, A.S. -- Ancient Indian Coins. Catalogs of Indian coins.  
Gupta ,P.L.— Mudrayen  
Chakravarty, S.K. -- Ancient Indian Numismatics  
Narayan , A.K.—The Indo Greek coins.  
Sarkar, D.C.—Study of the Indian Coins.

**Epigraphy & Paliography**

**Unit-1**

01. इतिहास के स्रोत के रूप में अभिलेखों का महत्त्व.  
Importance of the Inscriptions as a source of History.
02. प्राचीन भारत में लेखन कला का उद्भव एवं विकास.  
Origin and development of Ancient writing techniques.

**Unit-2**

01. प्राचीन भारतीय अभिलेखों का माध्यम एवं प्रकार.  
Types and Medium of Ancient Indian Epigraphy.
02. अशोक कालीन ब्राह्मी लिपि का स्वरूप.  
Form of Ashokan Brahmi Script.
03. गुप्तकालीन ब्राह्मी लिपि का स्वरूप.  
Form of Guptas Brahmi Script.

**Unit-3**

- निम्न अभिलेखों का ऐतिहासिक एवं सांस्कृतिक अध्ययन.  
Historical and cultural study of the following inscriptions.
01. अशोक के 12 वॉ शिलालेख 12<sup>th</sup> Rock Edict of Ashoka.
  02. अशोक के 13 वॉ शिलालेख 13<sup>th</sup> Rock Edict of Ashoka.
  03. अशोक के 7 वॉ लघु शिलालेख 7<sup>th</sup> Pillar inscription of Ashoka.

**Unit-4**

- निम्न अभिलेखों का ऐतिहासिक एवं सांस्कृतिक अध्ययन. .  
Historical and cultural study of the following inscriptions.
01. बेसनगर का गरुड स्तंभ अभिलेख Basenagar Pillar Inscription.
  02. कनिष्क द्वारा 41 राज्य वर्ष में जारी आरा अभिलेख Aara Inscriptions of

- Kaniskha in 41<sup>st</sup> Year.
03. मिनांडर का शिनकोट अस्थि मंजूषा अभिलेख Sinkoh Gasket Inscription of Minander.

### Unit-5

निम्न अभिलेखों का ऐतिहासिक एवं सांस्कृतिक अध्ययन.  
Historical and cultural study of the following inscriptions.

01. खारवेल का हाथी गुफा अभिलेख Hathigumpha inscription of Kharwell.  
02. रुद्रदामन का जूनागढ़ अभिलेख Junagarh Inscription of Rudradaman./  
03. गोतमी बलश्री का नामिक अभिलेख Nasik Inscription of Gootamibalshri.

### Books Recommended:-

Ojha, G H.—Prachin bharti Lipi maala.  
Rajbali pandey— Indian Paleography.  
Hultsch, E. --- Cospus inscription Indicarum. Vol-1  
Upadhayay Vasudev—Prachin Bhartiya Abhileekh Ka Adhyan.  
Vajpayee K.D. —EtihassikBhartiya abhileekh.  
Parhar, Dinesh Nandini—Madhya Bhart ka Leekhan evam utkirnan Takneek ka udbhv evam vikas.

## vfuok;Z iz'u&i=] r`rh; bfrgk■ ys[ku dh fof/k ,o vo/kkjϙkk,a Histography, Concept and Methods

### Unit :1

Meaning and Scope of History.  
What is history? Collection and selection of Data (Literature, Oral tradition, Contemporary tradition etc.)  
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### Unit:2

History and other disciplenes: Archaeology ,Geography, Sociology, Economics, Philosophy, Anthropology  
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### Unit:3

Traditions of historical writing: Greco-Roman, Chinese, ancient Indian, Arabic.  
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### Unit:4

Approaches to History: Orientalist, Imperialist, Nationalist, Subaltern, Marxist.  
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### Unit:5

Major theories of History: Materialistic, Cynical, Theory of Toynbee, Theory of Spenglar.  
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**Bookd Recommended:-**

- Carr E.H. – What is History.  
Collingwood - The idea of History.  
Reiaier, G.I. – History its Puruose and Methods.  
Gardiner - Theories of History.  
Thompson - History of Historical Thinking Social Reasearch Council  
Monographs: Theory and Practicle in Historical Study.  
Pandey, G.C. – Itihasa, Svarupa Evam Siddhanta.  
Pathak, V.S. – Ancient Historeans of India.

**GROUP C  
OPTIONAL  
PAPER**

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**Part-I**

**Unit-1**

संग्रहालय का परिचय Introduction to Museum.

- (1) संग्रहालय का अर्थ एवं परिभाषा Meaning and Definition of Museum.
- (2) संग्रहालय के प्रकार Types of Museum.

**Unit-2**

संग्रहालय का इतिहास एवं विकास History and development of Museums.

- (1) प्रारंभिक चरण के संग्रहालय (1798–1898 ई.) Early Museum.(1798-1898 )
- (2) द्वितीय चरण के संग्रहालय (1899–1947 ई.)  
Second phase of Museum.( 1899-1947)
- (3) तृतीय चरण के संग्रहालय (1947–2010 ई.)  
Third Phase Museums(1947-2010)

**Unit-3**

संग्रहालय का वर्गीकरण Classification of Museums.

- (1) प्रशासनिक आधार Administrative Basis.
- (2) संग्रह की प्रकृति के आधार पर Antiquity Basis.

**Unit-4**

संग्रहालय के कार्य Funtion of Museums.

- (1) प्रारंभिक कार्य (संग्रहण, पंजीकरण, अभिलेखीकरण)  
Primary Work.(Collection, Registration, Documentation.)
- (2) द्वितीयक कार्य (प्रबंधन, सुरक्षा, प्रकाशन)

Secondary Work (Management, security and Publication)

## Unit-5

संग्रहालय की सुरक्षा एवं परिरक्षा Security and Precaution of Museums.

- (1) सुरक्षा (चोरी से बचाव, आग से बचाव, वस्तुओं के स्थानान्तरण में सावधानियाँ) Security( safety from theft, fire, shifting.)
- (2) परिरक्षा (आपेक्षित आर्द्रता, पर्यावरण, प्रकाश, कीड़े मकोड़ों से बचाव) Precaution(Humidity, Environment,Light, Insects)

### Books Recommended:-

Ghosh, D.P.—Studies in Museums and Museology in India.

Kaunwall S.S. – Technical studies in the field of Museums and Fine arts.

Kaunwall S.S. – Protection and conservation of Museum collections.

Chaudhary Rai A.D. .Rai Neelima—sangrahalaya anusheelan

## Tourism Part-I

### Unit-1

1. पर्यटन का उद्भव और विकास  
(Origin & Development of Tourism in India)
2. पर्यटन की परिभाषा, उद्देश्य एवं अवधारणा  
(Definition, Object and Concept of Tourism in India.)
3. पर्यटन के प्रकार ( Types of Tourism)

### Unit-2

1. भारत पर्यटन संगठन (Tourism organization of India)
2. अन्तराष्ट्रीय पर्यटन संगठन ( International Tourism Organization)

### Unit-3

1. टूर आपरेटर और उसकी कार्यप्रणाली ( Tour operator and its functions)
2. ट्रेवल एजेंसी का गठन और कार्यप्रणाली ( Travel Agency and its functions)
3. यात्राक्रम और उसका महत्व ( Itinerary and its importance)

### Unit-4

1. अन्तराष्ट्रीय पर्यटन सम्बंधी औपचारिकताएँ  
(Formalities for International Tourism)
2. पासपोर्ट, वीसा, विदेशी मुद्रा, बीमा  
(Passport, Visa, Foreign Currency Insurance)

### Unit-5

1. पर्यटन में आवास व्यवस्था का महत्व  
(Importance of Accommodation in Tourism)
2. पर्यटन-आवास का उद्भव एवं विकास  
(Origine and Development of Tourism Accommodation)
3. विभिन्न प्रकार के आवास ( Types of ACC)

**GROUP D**  
**Political and Cultural History of Chhattisgarh**  
**Part-I**

**Unit-1**

01. छत्तीसगढ़ का भूतात्विक संरचना एवं भौगोलिक स्थिति  
Geological condition and Geographical location of Chhattisgarh region.
02. छत्तीसगढ़ क्षेत्र का परिचय एवं नामकरण  
Name and introduction of Chhattisgarh region.

**Unit-2**

छत्तीसगढ़ के इतिहास के स्रोत— साहित्य, अभिलेख, सिक्के, एवं मुद्रायें, स्मारक एवं मूर्तियाँ.  
Sources of History in Chhattisgarh region- Literature, Epigraphs, Coins, Monuments and Sculptures.

**Unit-3**

01. प्राग एवं आद्य इतिहास:— महत्वपूर्ण स्थल, शैलचित्रकला एवं महापाषाणीय स्मारक,  
Pre and Proto History- Important Rock Paintings & Megaliths
02. वैदिक काल से चौथी शताब्दी ई. तक का इतिहास  
History of Chhattisgarh from Vedic period to 4<sup>th</sup> C B.C.

**Unit-4**

01. गुप्त और वाकाटक वंश का छत्तीसगढ़ से संबंध एवं प्रभाव  
Impacts and Relations of Gupta- Vakataka Dynasty in Chhattisgarh region
02. नल वंश एवं राजर्षि तुल्य कुल का इतिहास एवं वंशक्रम

## Unit-5

शरभपुरीय राजवंश का उद्भव,विकास एवं पतन,तथा छत्तीसगढ के इतिहास में उनका स्थान

Origin, development and fall of Sharabhpuriya clan and its place in the history of Chhattisgarh.

### **Books Recommended:-**

Goyal, Shriram—Gupta kaleen Bharat.

Mirashi, V. V.—Corpus indicarum Vol-4 Part-1&2

Mirashi, V. V.— Kalchuri naresh evam unka kaal.

Neema, S. R.—Political History of Surya wanshi and South koshal and Orrisa.

Pyarelaal Gupa—Prachin Chhattisgarh.

Parihar, Dinesh Nandini,-- Dakshin Koshall ka itihaas,

Parihar, Dinesh Nandini,-- Prachin Chhattisgarh ka samajik evam arthik itihis.

Singhdev, J. P.—Cultural Profile of South koshal.

Jain, V. C. —Utkeerna leekh.

Pandey, Shyam Kumar—Dakshin Koshal ka Itihis.

Nigam, L. S. —Dakshin kosal ka itihis

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(History of Archeaology)

## Unit-1

- 1 पुरातत्व की परिभाषा एवं क्षेत्र Definition and scope of archaeology.
- 2 प्रारंभिक खोज Early Discoveries.
- 3 वैज्ञानिक दृष्टि से पुरातत्व के अध्ययन एवं विकास में परिवर्तन  
Changes in attitude and development of Scientific temper.

## Unit-2

- 1 भारतीय पुरातत्व का इतिहास History of Indian Archeaology.
- 2 भारत में पुरातत्व की अद्यतन प्रवृत्तियाँ एवं प्रयोग  
Recent trends and their application in India.
- 3 स्तर विन्यास, स्तरों के निर्माण के कारक एवं प्रक्रिया  
Stratigraphy , factor and process of formation of layers.
- 4 स्तरों की पहचान एवं उनका अभिलेखीकरण तथा सांस्कृतिक क्रम का पुर्ननिर्धारण, Identification and documentation of various layers and recording of the cultural sequence.

## Unit-3

- 1 सर्वेक्षण का उद्देश्य एवं विधियाँ Aims and method of the exploration.
- 2 उत्खनन का उद्देश्य एवं विधियाँ Aims and method of excavation.
- 3 बहुसांस्कृतिक बसाहट—ग्रामीण बसाहट, नगरीय बसाहट  
Multicultural settlement, village settlement and city settlements.

## Unit-4

- 1 समुद्री पुरातत्व अध्ययन की पद्धति एवं महत्व



- Underwater archaeology- method and importance.  
 2 उत्खनन से प्राप्त सामग्रियों का अभिलेखीकरण  
 Method of recording of excavated findings.

### Unit-5

- 1 तिथि निर्धारण की सापेक्ष पद्धतियाँ Dating Methods- traditional  
 2 तिथि निर्धारण की वैज्ञानिक पद्धतियाँ – रेडियों कार्बन विधि,  
 थर्मोल्युमिसेंस, पोटेशियम आर्गन विधि, Scientific Dating methods—Radio  
 carbon dating, thermo-luminescence method, Potassium argon method.

### Books Recommended:-

Pandey, J.N. Puratattva vimarsha

Sakalya, H.D.—Indian Archeology Today.

Sakalya, H.D.—Prehistory and Protohistory of India and Pakistan. 1974

Sakalya, H.D.—Prehistory of India 1977.

Subbarao, B.—The Prehistory of India.

Kenyan, K.M.—Field Archeology.

## Semester - IV

No.	Name of the Paper	Internal	Theory	Total
<b>Compulsory Papers</b>				
1	Numismatics Part--II	20	80	100
2	Epigraphy & Palaeography Part--II	20	80	100
3	Survey and Field Work			100

### Optional Paper (Any Two Paper GROUP C or D)

#### GROUP C

4	Tourism Part--II	20	80	100
5	Museology Part--II	20	80	100

#### GROUP D

4	Political and Cultural History of Chhattisgarh Part--II	20	80	100
5	History of Archaeology Part--II	20	80	100

**एम0ए0 चतुर्थ सेमेस्टर  
अनिवार्य प्रश्न-पत्र -I  
मुद्राशास्त्र, Numismatics  
Part-II**

**Unit-1**

01. कुषाण मुद्राएँ की सामान्य विशेषताएँ, General Importance of Kushan coins.
02. कनिष्क के पूर्व की मुद्राएँ Pre-Kaniskha coins.
03. कनिष्क की मुद्राएँ Kaniskha coins.
04. कनिष्क के पाश्चात की मुद्राएँ Post- Kaniskha coins.

**Unit-2**

01. सातवाहन मुद्राएँ Satavahana coins.
02. शक मुद्राएँ Shakha coins.
03. पश्चिम भारत के शक-शत्रुपों के मुद्राएँ, Coins of western shaka Satrapa
04. नाग मुद्राएँ Naag coins

**Unit-3**

01. गुप्त मुद्राओं की सामान्य विशेषताएँ General Importance of Gupta coins.
02. चंद्रगुप्त कुमारदेवी शैली की मुद्राएँ Coins of Chandragupta (Kumaradevi).
03. काँच की मुद्रा और समस्या Problems with Kach coins.
04. समुद्रगुप्त Coins of Samudragupta.

**Unit-4**

01. रामगुप्त की मुद्राएँ . Coins of Ramgupta
02. चुद्रगुप्त द्वितीय की मुद्राएँ . Coins of Samudragupta-II
03. कुमारगुप्त प्रथम की मुद्राएँ Coins of Kumargupta-I

## Unit-5

04. स्कंदगुप्त की मुद्राएँ . Coins of Skandagupta
01. स्कंदगुप्त के पश्चात् गुप्त शासकों की मुद्राएँ Post-Gupta Coins after Skandagupta.
02. गुप्तवंश की चाँदी की मुद्राएँ Gupta Silver Coins.
03. गुप्तवंश की ताँबे की मुद्राएँ Gupta copper Coins.

### **Books Recommended:-**

- Cunningham, A— Coins Of Ancient India.  
Altekar, A.S. -- Ancient Indian Coins. Catlogs of Indian coins.  
Gupta ,P.L.— Mudrayen  
Chakravarty, S.K. -- Ancient Indian Numismatics  
Narayan , A.K.—The Indo Greek coins.  
Sarkar, D.C.—Study of the Indian Coins.

## एम०ए० चतुर्थ सेमेस्टर अनिवार्य प्रश्न-पत्र II अभिलेख एवं पुरालिपि शास्त्र. Epigraphy & Paliography Part-II

### Unit-1

निम्नलिखित अभिलेखों का ऐतिहासिक एवं सांस्कृतिक अध्ययन  
Historical and cultural study of the following inscriptions:-

01. समुद्रगुप्त का प्रयाग स्तम्भ लेख  
Samudragupta's Allahabad pillar inscription.
02. चन्द्र का मेहरौली लौह स्तम्भ लेख  
Chandra's Iron pillar inscription at Mehrauli.
03. प्रभावती गुप्ता का पूना ताम्र पत्र  
Prabhavati Gupta's copperplate at Poona.

### Unit-2

निम्नलिखित अभिलेखों का ऐतिहासिक एवं सांस्कृतिक अध्ययन  
Historical and cultural study of the following inscriptions:-

01. कुमारगुप्त एवं बन्धुवर्मन का मंदसार अभिलेख  
Kumargupta and Bandhu varman's inscription at mandsaar.
02. स्कंदगुप्त का भितरी अभिलेख  
Skandagupta's inscription at Bhitari
03. हर्ष का बंशखेरा ताम्रपत्र  
Harsha's copperplate at Banshakhera.

### Unit-3

निम्नलिखित अभिलेखों का ऐतिहासिक एवं सांस्कृतिक अध्ययन  
Historical and cultural study of the following inscriptions:-

01. पुलकेशीन द्वितीय का ऐहोल अभिलेख Aihole inscription of Pulkeshin II.
02. अमोघवर्ष का संजान ताम्रपत्र Sanjaan copperplate of Amoghvarsha.
03. नन्न का भांदक अभिलेख Bhandak inscription of Nanna.

#### Unit-4

निम्नलिखित अभिलेखों का ऐतिहासिक एवं सांस्कृतिक अध्ययन  
Historical and cultural study of the following inscriptions:-

01. महारानी वासटा का सिरपुर लक्ष्मण मंदिर अभिलेख  
Queen Vaasata's Lakshmantemple inscription at Sirpur.
02. धंग का खजुराहों अभिलेख Khajuraho Inscription of Dhanga.
03. धर्मपाल का खलिमपुर अभिलेख Khalimpur Inscription of Dharmapaal.

#### Unit-5

01. भोज का ग्वालियर प्रशस्ति लेख Gwalior inscription of Bhooj.
02. युवराज देव द्वितीय का बिलहरी अभिलेख  
Bilhari inscription of Yuvaraaj dev-II.
03. जाजल्लदेव प्रथम का रतनपुर शिलालेख Ratanpur inscription of Jaajaldev-I

#### **Books Recommended:-**

Hultzsch, E. --- Cospus inscription Indicarum. Vol-1

Upadhayay Vasudev—Prachin Bhartiya Abhileekh Ka Adhyan.

Vajpayee K.D. —EtihaasikBhartiya abhileekh.

Parhar, Dinesh Nandini—Madhya Bhart ka Leekhan evam utkirnan Takneek ka udbhv evam vikas.

Jain V.C.—Utkiirn Lekh.

Vajpayee K.D.—Etihaasik Bhartiya Abhileekh.

**COMPULSORY PAPER-III**  
**SURVEY AND FIELD WORK- REPORTS & VIVA**  
**OPTIONAL PAPER GROUP C**  
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**■axzgky; foKku] Museology**  
**Part-II**

#### Unit-1

संग्रहालय योजना एवं प्रशासन Administration and planning of Museums

- (1) भवन, आरक्षित संग्रह का भण्डार Buildings, Reservation and Storage.
- (2) प्रशासन (बजट, बीमा, व्यवसायिक आचार संहिता)  
Administration (Budget, Insurance, commercial Etiquettes)

#### Unit-2

भारतीय पुरा सम्पदा अधिनियम Indian Antiquity Act.

- (1) प्राचीन स्मारक संरक्षक अधिनियम Ancient Monument Preservation act.
- (2) पुरानिखात अधिनियम Antiquity Act.
- (3) पुरानियति नियंत्रण अधिनियम Antiquity control Act.

#### Unit-3

देश के प्रमुख संग्रहालय Important Indian Museums.

- (1) राष्ट्रीय संग्रहालय जनपथ, नई दिल्ली  
National Museum, Janpath Newdelhi.
- (2) प्रिंस आफ वेल्स म्यूजियम मुम्बई Prince of Whales Museum Mumbai.
- (3) भारतीय संग्रहालय, कलकत्ता Indian Museum Kolkata.
- (4) मानव संग्रहालय, भोपाल Man Museum Bhopal.

#### Unit-4

छत्तीसगढ़ के संग्रहालय Museums of Chhattisgarh.

History and types of Museums of Chhattisgarh

(2) छत्तीसगढ़ के प्रमुख संग्रहालय – महंत घासीदास स्मारक संग्रहालय, रायपुर, जिला संग्रहालय, बिलासपुर, जगदलपुर अन्य संग्रहालय इन्दिरा कला संगीत वि.वि. संग्रहालय, खैरागढ़ जिला पुरातत्व सघ के संग्रहालय, स्थल संग्रहालय (पुरातात्विक संग्रहालय)

Main Museums in Chhattisgarh—Mahant Ghasidas Museum, Raipur, District Museum, Bilaspur & Jagdalpur; Indira kala sangeet viswavidyalaya Khairagarh, Puratatva sangh museum of khairagarh, Site museum (Archeological Museum)

### Unit-5

संग्रहालय शिक्षा Museum Education.

- (i) दर्शक Visitor (ii) प्रदर्शनी Exhibitions (iii) प्रकाशन Publications  
(iv) शोध Research.

### Books Recommended:-

Ghosh, D.P.—Studies in Museums and Museology in India.

Kaunwall S.S. – Technical studies in the field of Museums and Fine arts.

Kaunwal S.S. – Protection and conservation of Museum collections.

Chaudhary Rai A.D. ,Rai Neelima—sangrahalaya anusheelan

## PAPER- V TOURISM, i;ZVu

### Unit-1

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New Thrust areas of Tourism:- Definition and Concept  
(Adventure Tourism, Ecotourism and Sustainable Tourism.)

### Unit-2

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Means of Communication, Ticketing and Reservation Facilities.

### Unit-3

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International Tourist: - Provisions of Law regarding passport, visa, immigration and customs.

### Unit-4

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lkaph] Hkwous'oj] egkcfyiqje] ratkSj] gEih½

Brief information about Main Historical Monuments of Tourist importance with special reference to various zones as divided by the department of Tourism, Government of India.(Jaipur, Agra, Khajuraho,Sanchi, Bhubaneswar, Mahablipuram, Tanjor, Hampi.)

### Unit-5

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01 Main centers of tourist intrest in Chhattisgarh .

NRrhix< d izeq[k esyk] R;kSgkj ,o [kjhnnkj]-

02. Fairs, Festivals and shopping in Chhattisgarh.

## **Books Recommended:-**

Acharya, Ram: - Tourism in India.

Acharya, Ram: - Tourism and Cultural heritage of India.

Bhatia, A.K.:- Tourism, Development Principles and Practices.

Krishnalal & Gupta, S.P.:-Tourism Museums

Robinson-- A Geography of Tourism

Publicity Brouchers published by the Department of Tourism, Government Of India. And Government of Madhya Pradesh.

## **GROUP-D** **,e0,0 %prqFk ■ sesLVj½** **iz'u&i= prqFkZ**

## **NRrhIx< dk jktuhfrd, oa lkaLd'frd bfrgk■ %6oh 'krk-ls 13 oh 'krk- bZ-rd½** **Political and Cultural History of Chhattisgarh (6<sup>th</sup> C to 13<sup>th</sup> C)**

### **Part II**

#### **Unit-1**

01. मेकल का पाण्ड्य वंश. Pandu Dynasty of Maikal.
02. दक्षिण कोसल के पाण्डवंश Pandu Dynasty of Koshal.

#### **Unit-2**

01. छत्तीसगढ़ के कलचुरि वंश का उद्भव.  
Origin of Kalchuri Dynasti of Chhattisgarh.
02. रतनपुर के कलचुरि शासक Kalchuri Rulers of Ratanpur.

#### **Unit-3**

01. बस्तर के छिन्दक नाग वंशीय शासक Chindaknaag Dynasty of Bastar.
02. कवर्धा के फणीनागवंशीय शासक Phaninaag rulers of Kawardha.
03. कांकेर के सोमवंशीय शासक Soomvanshi rulers of Kanker.

#### **Unit-4**

छत्तीसगढ़ के धार्मिक, सामाजिक एवं आर्थिक इतिहास.  
Social, Economic and Religious History of Chhattisgarh

#### **Unit-5**

छत्तीसगढ़ की स्थापत्य एवं मूर्तिकला Art and Achitecture of Chhattisgarh.

## **Books Recommended:-**

- Goyal, Shriram—Gupta kaleen Bharat.  
Mirashi, V.V.—Corpus indicarum Vol-4 Part-1&2  
Mirashi, V.V.— Kalchuri naresh evam unka kaal.  
Neema, S.R.—Political History of Surya wanshi and South koshal and Orrisa.  
Pyarelaal Gupa—Prachin Chhattisgarh.  
Parihar, Dinesh Nandini.-- Dakshin Koshall ka itihaas,  
Parihar, Dinesh Nandini.-- Prachin Chhattisgarh ka samajik evam arthik itihas.  
Singhdev, J.P.—Cultural Profile of South koshal.  
Jain, V.C. —Utkeerna leekh.  
Pandey, Shyam Kumar—Dakshin Koshal ka Itihas.

## **History of Archaeology**

### **Unit-1**

- (1) पुरातत्व के प्रौद्योगिक सौपान – पाषाणिक, कास्ययुग, लौहयुग  
Tool techniques of Archeology—Paleolithic age, Mesolithic and Neolithic.
- (2) आर्थिक – प्रौद्योगिक सौपान पुरापाषाण, मध्य पाषाण, नवपाषाण Economic development of prehistoric period- Paleolithic age, Mesolithic and Neolithic, chalcolithic

### **Unit-2**

- (1) पुरातात्विक तकनीक क परिभाषिक शब्दावली  
Archeological Techniques and technical terminology.
- (2) सांस्कृतिक क्रम का पुर्ननिर्धारण cultural sequence

### **Unit-3**

- (1) पुरातत्व के प्रति जागरूकता Awareness of archaeology.
- (2) स्मारकों का धार्मिक, सार्वजनिक महत्व एवं उनके प्रति दृष्टिकोण  
General awareness of historical and religious monuments.

### **Unit-4**

- (1) उत्खनित स्थलों का संरक्षण की विभिन्न पद्धतियाँ  
Preservation techniques of excavated sites.
- (2) संरक्षण की रासायनिक एवं अन्य पद्धतियाँ chemical preservation techniques.

## Unit-5

- (1) प्राचीन स्मारक संरक्षण अधिनियम Ancient Monument preservation act.
- (2) पुरानिखात अधिनियम Treasure Trove Act
- (3) पुरानियति नियंत्रण अधिनियम
- (4) पुरावशेष एवं बहुमूल्य कलाकृति अधिनियम Antiquity and Precious artifact act.

### **Books Recommended:-**

Pandey, J.N. Puratatva vimarsha  
Sakalya, H.D.—Indian Archeaology Today.  
Sakalya, H.D.—Prehistory and Protohistory of India and Pakistan. 1974  
Sakalya, H.D.—Prehistory of India 1977.  
Subbarao, B.—The Prehistory of India.  
Kenyan, K.M.—Field Archeaology.



अध्ययन शाला का नाम	– प्राचीन भारतीय इतिहास संस्कृति एवं पुरातत्व अध्ययनशाला
पाठ्यक्रम	– च्वाँइस बेस्ड पाठ्यक्रम द्वितीय सेमेस्टर
प्रश्न पत्र का नाम	– <b>Element of Ancient Indian History &amp; Archaeology</b>
कुल क्रेडिट	– <b>03 कुल अंक – 80–20</b>
पाठ्यक्रम विवरण	–

## PAPER – I

### Elements of Ancient Indian History & Archaeology

#### **Credit: - 1**

Meaning & scope of History & Archaeology  
 Features of Palaeolithic, Mesolithic & Neolithic cultures  
 General survey of Harappa culture  
 Vedic Culture  
 Mahajanpada period  
 Rise of Mauryan dynasty  
 Gupta dynasty  
 Political condition of Southern & Northern India (6<sup>th</sup> – 12<sup>th</sup> Century A.D.) [General Survey]

#### **Credit: - 2**

Elements of Epigraphy & Numismatics  
 Importance of Epigraphy & Numismatics  
 Important Inscriptions -  
 Origin & development of Ancient Indian scripts  
 Types & techniques of Ancient Indian coins

#### **Credit: - 3**

Elements of Art & Archaeology  
 Gandhara , Mathura, Gupta Art  
 Introduction of Stupa, Caves & Temples  
 Exploration, Excavation & Dating methods

#### **Books Recommended:-**

Ghosh, A.	– Encyclopaedia of Indian Archaeology
Mishra, D.P.	– Protohistory of India (English and Hindi)
Pandey, Vimal Chandra	– Prachin Bharat ka Rajnetik evam Sanskritik Itihaas.
Pandey, R.N.	– Uttar bharat ka Rjnetik Itihas
Agrawal, V. S.	– Indian Art
Upadhyaya Vasudeva	– Prachin Bhartiya Guha Stup and Mandir.
Cunningham, A.	– Coins of Ancient India.
Sarkar, D.C.	– Study of the Indian Coins.
Ojha, G H.	– Prachin Bhartiya Lipi maala.
Rajbali Pandey	– Indian Palaeography

अध्ययन शाला का नाम	– प्राचीन भारतीय इतिहास संस्कृति एवं पुरातत्व अध्ययनशाला
पाठ्यक्रम	– चॉइस बेस्ड पाठ्यक्रम तृतीय सेमेस्टर
प्रश्न पत्र का नाम	– <b>Elements of Ancient Indian Culture &amp; Religion</b>
कुल क्रेडिट	– <b>03 कुल अंक – 80–20</b>
पाठ्यक्रम विवरण	–

## PAPER – II

### Elements of Ancient Indian Culture & Religion

#### Credit: - 1

##### Ancient Indian social system

Varna Ashrama

Purushartha, Sanskara

Family system

Position of women

##### Ancient Indian Economic Condition

Ancient Indian Economic thoughts & concepts

Land ownership

Trade organizations

Sources of Income & Expenditure

#### Credit:- 2

##### Origin & Development of Brahmanism

Vaishnavism and their sects

Shaivism and their sects

Shakt, Shaurya & Ganpatya

#### Credit:- 3

##### Origin and development of Buddhism & Jainism

Buddhism and their sects

Jainism and their sects

#### Books Recommended:-

Jaiswal K.P.	– Hindu Polity Hindi/English.
Shiv Swaroop Sahay	– Prachin Bharat Ka Dharmik Itihaas
J. P. Mishra	– Prachin Bharat Ka Samajik Itihaas
Kane, P.V.	– History of Dharmashastra, 5 Vols.
Majumdar, R.C.	– Corporate Life in Ancient India
Parihar, Dinesh Nandini	– Chhattisgarh ka Samajik Arthik Itihaas

PT. RAVISHANKAR SHUKLA UNIVERSITY,  
RAIPUR  
SESSION 2017-18

**POST GRADUATE DIPLOMA IN TOURISM AND HOTEL MANAGEMENT**  
SCHEME OF THE EXAMINATION FOR THE ACADEMIC YEAR  
**2016-2017**

Paper No. Name of the Papers Max. Marks

1. Tourism : Concept, Policy & Planning 100

2. Tourism Products of India 100

3. Travel Agency, Tour Operation & Marketing for  
Hospitality & Tourism  
100

4. Hotel Management 100

Project Report 100

Viva-Voce 50

Professional Training 50

**Total 600**

(Dr. Dinesh Nandini Parihar)

**DIRECTOR**

## **PAPER-I**

### **TOURISM: CONCEPT, POLICY AND PLANNING**

#### **UNIT-I**

Concepts, Definitions, Growth & Development of Tourism. Types of Tourists. Forms of Tourism. Tourism System- Nature and Characteristics. Components of Tourism Industry.

#### **UNIT-II**

Travel Motivators. Demand for Tourism. Characteristics of Supply. Life Cycle Stages. Tourism Impacts- Costs and Benefits of Tourism.

#### **UNIT-III**

New thrust areas of Tourism:- Adventure Tourism, Eco-Tourism, Sustainable Tourism, Heritage Tourism, MICE, Role of ITDC, ASI, Ministries of Railways & Civil Aviation in the Promotion of Tourism. Organization and Working of Chhattisgarh Tourism Board. An Overview of Organizations and Associations like- IATO, TAAI, WTO, ICAO & IATA.

#### **UNIT-IV**

Concept Need and Objective of Public Tourism Policy. An outline of L.K. Jha Committee-1963. National Tourism Policy-1982. National Committee Report-1988. National Action Plan on Tourism-1992.

#### **UNIT-V**

Tourism Planning:- Background, Approach and Process. Tourism Planning at National, Regional, State and Local levels. An important feature of Five Year Tourism Plans in India. Destination Life Cycle, Concept of Carrying Capacity, Sustainable and Eco-tourism. Eco-Tourism & Community participation in Tourism Planning.

## **PAPER-II**

### **TOURISM PRODUCTS OF INDIA**

#### **UNIT-I**

Tourism Products, Concepts and Classifications. Typology of Attractions. Glimpses of India's Cultural Heritage.

#### **UNIT-II**

Indian Architecture: - Hindu, Buddhist, Jain and Indo-Islamic. Indian Painting:- Important Schools and Types.

#### **UNIT-III**

Performing Arts of India: - Classical and Folk Dances. Indian Music:- Prominent Schools of Indian classical music, Folk Music and Important Instruments.

#### **UNIT-IV**

Important World Heritage Sites in India. Places of Tourist Interest in Chhattisgarh State. Important Wildlife Sanctuaries and National Parks. Adventure and Eco- Tourism Destinations. Yoga and Meditation as a tourism products.

#### **UNIT-V**

Handicrafts:- Important objects and centers connected therein, craft melas. Fairs and Festivals of Tourist significance. Indian Cuisine.

## **PAPER-III**

# **TRAVEL AGENCY, TOUR OPERATION & MARKETING FOR HOSPITALITY & TOURISM**

### **UNIT-I**

History and growth of Travel agency business. Definitions of Travel Agent and Tour Operator. Differentiations & interrelationships of TA & TO, Future prospects.

### **UNIT-II**

Itinerary preparation:- Important Considerations, Costing, Packaging & Promotion. Definition of Tour Package. Types and Forms of Package Tours, Designing, Preparation and Costing of Tour Packages.

### **UNIT-III**

Passport, Visa, Health, Customs and Currency Regulations. Baggage Rules and Travel Insurance. An overview of CRS and Ticketing. Types of Tours available in India. Intrain Passes etc.

### **UNIT-IV**

Definition Concept and Scope of Marketing. Service Marketing and its Special Features. Tourism and Hospitality Marketing:- its Uniqueness.

### **UNIT-V**

Market Segmentation. Identifying Market Segments and Selecting Target Markets. Marketing Mix vis-à-vis Hospitality and Tourism.

## **PAPER-IV**

# **HOTEL MANAGEMENT**

### **UNIT-I**

#### **HOTEL INDUSTRY AND ITS GROWTH**

- 1.1 Introduction.
- 1.2 Evolution of Hotel.
- 1.3 Growth and Development.
- 1.4 Importance of Hotel and Tourism in India.

### **UNIT-II**

#### **FOOD AND BEVERAGE SERVICE**

- 2.1 Introduction
- 2.2 Restaurant: - Types of Restaurant, Restaurant Brigade, The Hostess, Etiquettes of Restaurant Staff, Points while waiting at the table.
- 2.3 Equipments:

# PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR

## POST GRADUATE DIPLOMA IN TOURISM AND HOTEL MANAGEMENT SCHEME OF THE EXAMINATION FOR THE ACADEMIC YEAR

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- 1.1 Introduction.
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### **UNIT-II**

#### **FOOD AND BEVERAGE SERVICE**

- 2.1 Introduction
- 2.2 Restaurant: - Types of Restaurant, Restaurant Brigade, The Hostess, Etiquettes of Restaurant Staff, Points while waiting at the table.
- 2.3 Equipments: - Measurement, Sideboard, Mise-en-Place, Mise-en-scene, Service, Equipment and use, Bar Equipment.
- 2.4 Menu and Food Service: - Classes of Menu, Taking an Order, Type of Food Service, Breakfast Service (English and Continental).
- 2.5 Beverages: - Beverages Chart, Types of wine, Food and wine chart, Spirit.
- 2.6 Banquets: - Types of Banquets, Outdoor Catering.

### **UNIT-III**

- 3.1 Information: - Types of Hotel, Classification of Hotel, Basis of Charging a guest, Reception terms, Job Description, Co-ordination and other department.
- 3.2 Reception: - Art of Reception, Arrival and Departure, Register, Rules for F.O. Staff, Room Status System, Rooming Procedure, Black List, Wake calls, G-H Card. Scanty Baggage and Left Luggage
- 3.3 Reservation: - Modes of Reservation, Reservation forms, Guest- Registration, Welcome Slip.
- 3.4 Cashier: - Credit in Hotel, Credit Cards, Traveler's cheque, Handling guest valuables.

### **UNIT-IV**

#### **HOUSEKEEPING**

- 4.1 Introduction.
- 4.2 House Keeping: - Layout of Housekeeping Department, Layout Organisation of Housekeeping Department.
- 4.3 Housekeeping Staff:- Job Description, Qualities of Housekeeping Staff, Co-Ordination with other Departments.
- 4.4 Linen and Uniform:- Types of uniform used, Types of Linens used, Parstock, Exchange of Linen and Uniforms.
- 4.5 Housekeeping Activities:- Public area Cleaning, Housekeeping Supply room, Key control, Lost and Found Procedure, Inventory Control.

### **UNIT-V**

#### **FOOD AND BEVERAGE PRODUCTION**

- 5.1 Introduction and Popular cuisine.
- 5.2 Preparation of Ingredients.
- 5.3 Cooking Methods.
- 5.4 Kitchen chart and Duties of Kitchen Staff.





## **Courses of the Coursework for Ph. D. in the subject of Ancient Indian History, Culture & Archaeology**

1. The eligible candidate shall be required to undertake coursework for a minimum period of one semester i.e. 90 lectures.
2. The 1<sup>st</sup> course i.e. **Research Methodology** will consist of 50 lectures.
3. The 2<sup>nd</sup> course i.e. **Basics of Computer Application** will consist of 20 lectures.
4. The 3<sup>rd</sup> course i.e. **Review of Literature** in the relevant subject will consist of 20 lectures.
5. Each course will be of 100 marks.

### **Course I**

#### **Research Methodology (Theoretical)**

*Max. Marks 100*

- UNIT – I      Fundamentals of Research, its importance and scope.
- UNIT – II      Selection of Research Problem and planning of research.
- UNIT – III     Data collection. Library work, manuscripts, private and public collection, field surveys, Explorations, Photography Laboratory work, Application of computer and Statistical methods.
- UNIT – IV     Identification and formulation of problems and hypothesis.  
Methods of Research in Indian History, Bibliography, Footnotes/Citation, Diacritical marks, summarizing, paraphrasing, quotation.
- UNIT – V      Importance of Library in research work, Significance of Maps, Photographs and illustrations in thesis.

## Course II

### Basics of Computer Application (Theoretical & Practical)

*Max. Marks 100*

#### UNIT – I **Introduction to Computers**

Basic Terminology of Computers, Computer Generations, Classification of Computers, Input And Output Devices, Central Processing Unit, Computer Memory : Primary And Secondary Storage Devices, Computer Software : (I) System Software (Ii) Application Software (Iii) General Purpose Software, Operating System(OS) :(I) Functions of OS (Ii) Advance Concepts Related To OS – Multiprogramming, Multiprocessing, Multitasking, Spooling, Timesharing, Virtual Memory.

#### UNIT – II **Preparation of a Document using MS-Word**

Introduction To MS Word- Toolbar, Title Bar, The Ribbon, Creating A New Document, Entering Text, Saving And Printing It, Using Paragraph Tab Options, Using Insert Tab- In Creating Tables, Inserting Picture, Clip Art, Shapes And Chart To A Document, Header And Footer, Page Formatting- Margins, Orientation, Text Wrapping , Creating A Reference List And Citations, Use of Spelling And Grammar Checks, Auto Correct, Word Count, Comparing or Combining Document, Editing And Reviewing Document, Macros, Mail Merge.

#### UNIT – III **Use of MS Excel and MS Power point**

Introduction To MS Excel – Spreadsheet or Worksheet Details, Use of Spreadsheet In Research, Data Storing, Various Data Types, Use of Formulae And Functions, Formatting Worksheets - Inserting And Deleting Rows And Columns, Alignment, Creating And Modifying Charts And Graphs, Creating Pivot Table And Pivot Charts, Manipulation And Analysis of Data.

Introduction To MS- Power Point, Features And Functions, Creating And Saving Presentation, Adding Slides To A Presentation, Inserting Animation, Creating Tables And Charts, Customizing Presentation, Running A Slideshow.

#### UNIT – IV **Introduction to Internet**

Internet And Its Application, World Wide Web (www), TCP/IP, WWW Browsers (Internet Explorer, Google Chrome), Internet Search Engines (Yahoo, Google), Computer Networks- LAN, MAN, WAN, Other Technologies- Mobile Commerce, Bluetooth, Wireless Fidelity (Wi-Fi), Anti-Plagiarism Software, Viruses And Its Types, Protection From Viruses, Firewall, Use of online Sources of Data For Literature Survey.

#### UNIT – V **Use of Computers in Research in History**

## Course III

### Review of Literature

*Max. Marks 100*

Note: The candidate shall review standard relevant texts and research papers in the broad research area.

**School of Studies in Anthropology  
Pt. Ravishankar Shukla University, Raipur**

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***M.A./M.Sc. ANTHROPOLOGY***

***Semester – I***

**July 2020 - December 2020**

*[Handwritten signatures and marks]*

**M.A./M.Sc. ANTHROPOLOGY**

**SEMESTER-I**

**PAPER I - FUNDAMENTALS OF SOCIAL/ CULTURAL ANTHROPOLOGY**

**MAX. Marks- 80**

**MIN. Marks - 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT – I**

***Anthropology and Social Anthropology:***

- Meaning and Scope of Anthropology.
- Divisions of Anthropology.
- Scope of Social-Cultural Anthropology.
- Social-Cultural Anthropology and its relation with other social sciences, life sciences, medical sciences and humanities.

***Culture and Institutions:***

- Theory of Culture: attributes of Culture, culture traits, culture complex, culture area, integration of culture, paradoxes of culture.
- Some basic concepts: Civilization, Society, Social structure, Social Organization, Community, Social Institutions, Groups and Status & Role.

**UNIT – II**

***Social Organizations:***

- Family: 1. Typology 2. Residence 3. Functions.
- Marriage: 1. Typology 2. Mate selection 3. Cross-cousin 4. Sororate 5. Dowry and bride price.
- Kinship :
  1. Kin: consanguine , Affinal.
  2. Kinship terminology : classificatory and descriptive, Terms of reference and address.
  3. Kinship behavior: Joking and avoidance relationship.



4. Kinship system and its importance in Social structure, Descent Groups.
  5. Kinship terminology: Classificatory and Descriptive.
- Moiety and Phratry.
  - Social Stratification.
  - Status of women (Gender).
  - Tribe and Class.

### UNIT – III

***Economic organization:***

- Property: Individual and Collective.
- Concept of Primitive communism.
- Concept of value in primitive economy.
- Stages of Economy: collection, hunting, fishing, pastoralism, Cultivation (Shifting cultivation and Settled Subsistence)
- Surplus and market economy.
- Systems of trade-exchange: Reciprocity, Redistribution, barter and markets.

***Political organization:***

- Law and social control.
- Concept of authority and leadership.
- Types of political organization: Band, Tribe, State, Kingship and chiefdom.
- Primitive law and Justice.
- Types of Punishment.
- Ethnicity and Nationality.

### UNIT – IV

***Religion and Magic:***

- Anthropological approaches to the study of religion: Evolutionary, Psychological and Functional.
- Primitive Religion: Animism, Animatism, Bongalism, Totemism.
- Magic: function and types.
- Magico-religious functionaries: Shaman, Priest, Medicine man, Sorcerer, witch.
- Symbolism in religion and rituals.
- Religion, Magic and Science.

***Arts:***

- Art and Aesthetics: Forms of music, dance forms, musical instruments.
- Painting: Ritualistic and Symbolic.
- Artifacts: Carvings, Mould, Masks etc.

***Human Language:***

- Human Language: Origin and evolution of human language.
- Language, culture and society.





### Recommended Readings:

1. Barnouw, V. 1979. Anthropology: A General Introduction, The Dorsey Press, Illinois.
2. Holmes, L. D. Anthropology: An Introduction, The Ronald Press Company, New York.
3. Sharma and Sharma. 1997. Anthropology, Atlantic Publishers and Distributors, New Delhi.
4. Hunter & Whitten. The Study of Cultural Anthropology, Harper & Row Publishers, New York.
5. Moore, A. 1978. Cultural Anthropology, Harper & Row Publishers, New York.
6. Kaplan, D. & Manners, R. A. Culture Theory, Prentice Hall of India Private Ltd., New Delhi.
7. Herskovitz, M. J. Cultural Anthropology, Oxford & IBH Publishing Co., New Delhi.
8. Mair, L. 1965. An Introduction to Social Anthropology, Clarendon Press, Oxford.
9. Majumdar, D.N. & Madan, T. 1986. An Introduction to Social Anthropology, National Publishing House, New Delhi.
10. Mishra, U. S. Samajik Sanskritik Manavshastra, Palka Prakashan, Delhi.
11. Shrivastava, A. R. N. Samajik Manav Vigyan Vivechan (in Hindi), Madhya Pradesh Hindi Granth Academy, Bhopal.
12. Evans-Pritchard, Social Anthropology.
13. Honnigmann, J. Handbook of Social and Cultural Anthropology.
14. Fox, Robin. Kinship and Marriage.
15. Sahlins & Service. Evolution and Culture. The University of Michigan Press, Ann Arbor.
16. Barth, F. Ethnic Group and Boundaries.
17. Barnet, H.G. Innovation. The Basis of Culture Change.
18. Rogers E.M. & Schmacher, F.F. Communication of Innovation.
19. Rogers, E.M. Diffusion of Innovation.
20. Rad-cliffe Brown, A.R. Structure and Function in Primitive Society.
21. Harris, Marvin. Cultural Anthropology.
22. Malinowsky, B.K. Scientific Theory of Culture and Other Essay.
23. Foster, G.M. Tradition, Cultures and Impact of Technological Change.
24. Dalton, George. Tribal and Peasant Economics: Readings in Economic Anthropology.
25. Kluckhohn, C. Mirror for Man.
26. Herskovits, M.J. Man and His Works.
27. Ember and Ember, Anthropology
28. Nas, Manning. Primitive and Peasant Economic Systems
29. Bohannan, Paul. Social Anthropology
30. Jacob, Awsrem. General Anthropology
31. Levi Strauss, Elements of Kinship
32. Schumachr, E.F. Small is Beautiful
33. Evans- Pritchrd, E.E. Primitive Religion
34. Norbeck. Primitive Religion
35. Lowie, R.H. Primitive Social Organization
36. Lowie, R.H. Social Organization



**M.A./M.Sc. ANTHROPOLOGY**

**SEMESTER-I**

**PAPER II- FUNDAMENTALS OF PHYSICAL/ BIOLOGICAL ANTHROPOLOGY**

**MAX. Marks- 80**

**MIN. Marks - 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
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- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT-I**

***Physical Anthropology:***

- History, Definition, Meaning and Scope of Physical Anthropology.
- Relationship of Physical Anthropology with Physical, Biological and Medical Sciences.
- History and Development of Physical Anthropology in India.
- New Physical Anthropology.

**UNIT-II**

***Organic Evolution & Primate behavior:***

- Theories of Organic Evolution: Lamarckism, Darwinism, Synthetic Theory, Neutral Theory of molecular evolution, concept of clad genesis and anagenesis.
- Man's place in Animal Kingdom.
- Primate behavior (With reference to Higher Primates).

**UNIT-III**

***Comparative anatomy & Evolution:***

- Comparative anatomy of Man and Apes.
- Hominid Evolution.
- Erect posture and Bipedalism.
- Evolution of Teeth, Chin, Foot and Pelvis.

**UNIT-IV**

***Human Variation:***

Page 9 of 68



- Concept of Race
- Modern Human Variation : Typological Model, Population Model and Clinal Model; overview of Classification proposed by Blumenbach, Deniker, Hooton, Coon, Garn and Birdsell.
- Criteria of Racial classification- Skin, Hair and eye colour, Stature, Eyes, Lips and Ears, Face and Lower Jaw, Blood Groups, Dermatoglyphics.
- Distribution and Characteristics: Caucasoid, Negroid, Mongoloid.
- Racial classification of Indian Population –Risley, Guha. & S. S. Sarkar
- Causes of Human Variation.

#### Recommended Readings:

1. Comas, J. 1960. Manual of Physical Anthropology, Springfield, Charles C. Thomas.
2. Sarkar, R. M. 1976. Fundamentals of Physical Anthropology. Blackie (India).
3. Das, B. M. 1985. Outlines of Physical Anthropology, Kitab Mahal, New Delhi.
4. Shrivastav, A. R. N. 1994. Sharirik Manav Vigyan (in Hindi), Gyandeepr Prakashan, Allahabad.
5. Barnouw, V. 1979. Anthropology: A General Introduction, The Dorsey Press, Illinois.
6. Hooton, E. A. Up from the Ape, The Macmillan Co., New York.
7. Lasker, G.B. and Tyzzer, R.N. Physical Anthropology, Holt Rinechart & Winston, New York.
8. Shukla, B.R.K. and Rastogi, S. Physical Anthropology and Human Genetics: An Introduction, Palka Prakashan, Delhi.
9. Buettner-Janusch, J. Origins of Man, Wiley Eastern Pvt. Ltd. New Delhi.
10. Montagu, M.F.A. The Concept of Race, The Free Press, New York.
11. Montagu, M.F.A. An Introduction to Physical Anthropology, Charles C Thomas, Springfield  
1. Illinois.
12. Harrison, G.A., Weiner, J.S., Tanner, J.M. and Barnicot, N.A. Human Biology: An Introduction to Human Evolution, Variation And Growth, Clarendon Press, Oxford.
13. Ashley, Montague. Concept of Race.
14. Backer, P.T. & Weiner (eds.). Biology of Human Adaptability.
15. M. Ember and Ember. Anthropology.
16. Harrison, G.A. and Boyce, J. The Structure of Human Population.
17. Sarkar S.S. Aboriginal races of India.
18. Sahlins and Service. Evolution and Culture.
19. Simpson, G.G. The Meaning of Evolution.
20. Williams B.J. Evolution and Human Origin



**M.A. / M.SC. ANTHROPOLOGY**

**SEMESTER-I**

**PAPER III - PREHISTORIC ARCHAEOLOGY AND PALAEO-ANTHROPOLOGY**

**MAX. Marks- 80**

**MIN. Marks – 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT – I**

- Introduction: Definition, Subject matter, Branches, Aims and Applications.
- Framework of Archaeological Cultures.
- Relationship with Other Branches of Anthropology, Earth Sciences, Physical sciences, Life Sciences and Social Sciences.

**UNIT – II**

- Geological Time Scale.
- Pleistocene Epoch: Glacial-interglacial; Pluvial-Inter-Pluvial Climatic Cycles, Impact on Cultural Development.
- Climatic Markers: Moraines, Terraces, Sea-level Changes, loess, Soil, Dune & Fossils.
- Tool Technology: Flaking (Primary & Secondary), Grinding and Polishing Techniques used during Stone Age.
- Dating Techniques:
- Relative Dating: Stratigraphy, River Terraces, Raised Sea-Beaches, Typo-technology, Fluorine Dating, Pollen Dating.
- Absolute dating: Radio-active Carbon, Potassium-Argon, Uranium- Thorium, Dendrochronology, Thermoluminescence, Fission-Track & Obsidian Hydration.

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### UNIT – III

- Lower Palaeolithic of Europe: Distribution, Chronology, Stratigraphy, Assemblage, Abbevillian, Acheulian, Associated Human Fossils .
- Middle Palaeolithic of Europe: Distribution, Chronology, Stratigraphy, Assemblage, Traditions, Associated Human Fossils .
- Upper Palaeolithic of Europe: Perigordian, Aurignasian, Solutrean, Magdalenian; Prehistoric Art (Home Art and Cave Art).
- Mesolithic Culture of Europe: Azilian, Tardenoisean, Austerian, Maglamosean, Kitchen Midden, Campegnian.

### UNIT – IV

- Australopithecus Species: Discoveries, Distribution, Chronology, Salient features, Phylogeny.
- Homo erectus: Discoveries, Distribution, Chronology, Salient features, Phylogeny.
- Homo sapiens neanderthalensis: Discoveries, Distribution, Chronology, Salient features, Phylogeny.
- Homo sapiens sapiens (Cro-Magnon, Chancelade, Grimaldi): Discoveries, Distribution, Chronology, Salient features, Phylogeny.

### Recommended Readings:

1. A grawal, D.P. & M.G. Yadava. 1995. Dating the human past.
2. Bhattacharya, D.K. 1977. Palaeolithic Europe.
3. Bordes, F. 1968. The Old Stone age. Weidenfeld and Nicolson.
4. Burkitt, M.C. 1969. Old Stone Age: Study of Palaeolithic Times.
5. Campbell, B. C. 1979. Humankind emerging, II edition.
6. Clark, W. E. L. 1964. The Fossil Evidence for Human Evolution, The University of Chicago Press, Chicago.
7. Coles, J. M. & E. S. Higgs. The Archaeology of early man. Faber and Faber.
8. Grazioli, P. Paleolithic Art.
9. Howell, W. Mankind in the making.
10. Johanson, D & E. Maitland. 1981. Lucy- The beginnings of humankind.
11. Knudson, S.J. 1978. Culture in retrospect: An introduction to Archaeology.
12. Oakley, K.P. 1972. Man the tool maker
13. Roe, Derek 1970. Prehistory: An introduction.
14. Sankalia, H.D. 1964. Stone age tools: their techniques, names and probable functions, Pune, Deccan College.
15. Sankalia, H.D. 1974. Prehistory and Protohistory of Early India and Pakistan.
16. Allchin and Allchin, 1982. The rise of civilization in India and Pakistan, Select Book Service Syndicate, New Delhi.
17. Zeuner, F.E. Pleistocene Period.

18. Agrawal, D.P. The Archaeology of India, Curzon Press.
19. Ashley, Montague. Physical Anthropology and Archaeology.
20. Barmown, Victor. Physical Anthropology and Archacology, Illinois, The Dorse Press HomeWood.
21. Banerjee. Iron Age in India. Munshiram Manoharlal.
22. Brothwell D. & Higgs E. (ed.). Science in Archaeology. Thames and Hudson.
23. Budtzer, K.W. Environment and Archaeology.
24. Clark, D.L. Analytical Archaeology. Methuen and Co. Ltd.
25. Das, B.M. Outlines of Physical Anthropology. Kitab Mahal.
26. James, J. Hester, Introduction to Archaeology. Holt, Rinehart and Winston.
27. Michel, J.W., Dating Method in Archaeology. Seminar Press.
28. Sakalia, H.D., New Archaeology – Its Scope and Application to India, Ethnographic and Folk Culture Society.
29. Zeuner, F.E. Pleistocene Period. Hutchinson.

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**M.A./M.SC. ANTHROPOLOGY**

**SEMESTER-I  
PAPER IV- RESEARCH METHODS IN ANTHROPOLOGY**

**MAX. Marks- 80  
MIN. Marks - 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT – I**

- Field work tradition in Anthropology: Covering all branches of Anthropology to gain holistic perspective.
- Social research and Social survey.
- Hypothesis: Sources, characteristics, importance and types of hypothesis.
- Methods: Logical, Historical, Comparative, Philosophical and Scientific method.
- Ethnographic method.
- Types of Research, Qualitative and Quantitative Research.
- Inductive and Deductive approaches to research.

**UNIT – II**

- Research design : Review of literature, aims & objectives, hypotheses, research questions, conceptual model, types of research design, evaluation research.
- Techniques of data collection- Primary data collection: Observation, Questionnaire, Interview, Schedule, Case study, Audio-visual recording, Geneology.
- Grounded Theory, Exploration and Excavation, Introduction to GIS.
- Secondary Data collection: Census, National Sample Survey, Models and Paradigms.
- Data collection: Choice of Suitable Technique.
- Participatory Methods: Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA), Rapid Participatory Appraisal (RPA), Focus Group.

**UNIT – III**

- Data: Definition and characteristics.



- Types of Data: Geographical, Chronological, Qualitative and Quantitative, Nominal, Ordinal, Ratio and Interval.
- Sources of Data: Primary and Secondary sources.
- Tabulation: General, Special purpose & Machine tabulation.
- Techniques of Analysis : Content analysis, Discourse analysis and Narratives.
- Analysis and Interpretation of data.
- Preparation of report, Dissertation and Scientific papers.
- Graphic and Diagrammatic presentation of data.

#### UNIT – IV

- Scope, utility and importance of statistics in Anthropology.
- Sampling: Types of Random and Non random sampling
- Measures of Central Tendency- Mean, Mode, Median & dispersion.
- Variables: Univariate, Bivariate and Multivariate analysis.
- Scaling techniques.

#### Recommended Readings:

1. Goode & Hatt. Methods in Social Research.
2. Young, P. V. Scientific Social Surveys and Research.
3. Danda, Ajit. Research Methodology in Anthropology, Inter- India, New Delhi.
4. Gupta, S. P. Statistics Methods.
5. Elhance, D. N. Practical Problems in Statistics, Kitab Mahal, Allahabad.
6. Levin, J. Elementary Statistics in Social Research.
7. Sarin, S.S. and Balchandani, M.K. Fundamentals of Statistics. Ratan Prakashan Mandir, Agra.
8. Fernandes & Tondon, Participatory Research.
9. Fisher, Michael. Application in Computing for Social Anthropologists, London, Routledge.
10. H. Russel. Bernard, Handbook of Methods in Cultural Anthropology, Altamira Press.
11. Kaplan, Abraham. The Conduct of Enquiry: Methodology for Behavioural Sciences.
12. Kassam & Mustafa. Participatory Research.
13. Madrigal, Lorena. Statistics for Anthropology.
14. Mukherjee, Neela. Participatory Rural Appraisal and Questionnaire Survey.
15. Pelto P.S. & Pelto G.H. Anthropological Research: the structure of inquiry. London, Cambridge University Press.
16. Renfrew, C. (ed.). The Explanation of Culture Change: Models in Prehistory. Duckworth.
17. Sankalia, H.D. Stone Age Tools, Families and Techniques, Pune, Deccan College.
18. Trigger, B.G. Beyond History the Methods of Prehistory. Holt, Rinehart and Winston.
19. Young, Pauline. Scientific Social Survey and Research.

M.A./M.Sc. ANTHROPOLOGY

SEMESTER-I

LAB COURSE I -PRACTICALS IN CRANIOLOGY AND CRANIOMETRY

MAX. Marks- 80

MIN. Marks - 27

- Description of Human Skull and its importance in biological anthropology.
- Craniology and Forensic science.
- Following Craniometric measurements are to be taken on atleast 2 skulls.

**Measurements**

- Maximum cranial length
- Glabella-inion length
- Nasion-inion length
- Glabella-lambda length
- Length of foramen magnum
- Maximum Cranial breadth
- Minimum frontal breadth
- Maximum frontal breadth
- Bi-auricular breadth
- Greatest occipital breadth
- Bi- mastoid breadth
- Minimum breadth of skull
- Breadth of foramen magnum
- Basion bregma height
- Auriculo bregmatic height
- Calvarial height
- Occipital chord
- Outer bi-orbital breadth
- Inner bi-orbital breadth
- Bi-orbital breadth
- Bizygomatic breadth
- Bimaxillary breadth
- Morphological facial height
- Upper facial height
- Inter orbital breadth
- Orbital breadth, Orbital height
- Nasal breadth
- Nasal height
- Length of nasal bone
- Maxillo-alveolar length
- Maxillo alveolar breadth



- Palatal length
- Palatal breadth
- Palatal height
- Bi-condylar breadth
- Bigonial breadth
- Symphysial height
- Height of ramus.
- **Angles**
- Total profile angle
- Nasal profile angle
- Profile angle of nasal roof
- Metopic angle
- Inclination angle of foramen magnum
- Calvarial base angle
- Bregma angle of Schwalbe
- Mandibular angle.

#### Index

- Cranial index
- Facial index
- Nasal index

#### Measurement on Craniograph

(At least on 2 skulls)

- Calvarial height
- Lambda calvarial height
- Frontal perpendicular
- Parietal perpendicular
- Occipital perpendicular.

#### Recommended Readings:

1. Singh, S.P. Kinanthropometry
2. Ashley Montagu, M.F.A. Hand Book of Anthropometry. Charles. C. Thomas. Illinois.
3. Singh, I.P. Bhasin, M.K. Anthropometry. Bharti Bhawan, New Delhi.
4. Weiner, J.S. & Lourie. J.A. Human Biology: A Guide to Field Methods. I.B.P. Hand
5. Book No. 9 Blackwell Scientific Publication, Oxford.
6. Mitra, M. 1990. Prayogik Manav Vigyan- Bhag -2. Madhya Pradesh Hindi Granth
7. Academy (in Hindi).
8. Mitra, M. & Chaube, R. 2004. Prayogik Manav Vigyan (Sharirik) Bhag -2. Madhya
9. Pradesh Hindi Granth Academy (in Hindi).

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 Chakravarty



M.A./M.Sc. ANTHROPOLOGY

SEMESTER-I  
LAB COURSE II- PRACTICALS IN OSTEOLOGY AND OSTEOMETRY

MAX. Marks- 80  
MIN. Marks - 27

Description of Human skeletal bones and its importance in biological anthropology, Osteology and forensic science.

Following **Osteometric** measurements are to be taken on bones.

**CLAVICLE**

**Measurements**

- Maximum length
- Vertical diameter in the middle
- Sagittal diameter in middle
- Girth in the middle
- Breadths of curvature of shaft

**Angles**

- Inner and outer

**Indices**

- Caliber index
- Cross section index

**SCAPULA**

**Measurements**

- Anatomical breadth
- Anatomical length
- Length of Cranial border
- Length of axillary border
- Projective length of spine
- Anatomical breadth of supra-spinous fossa
- Anatomical breadth of infraspinous fossa
- Length of glenoid fossa
- Breadth of glenoid fossa
- Projective breadth of supraspinous fossa
- Projective breadth of infraspinous fossa

**Angles**

- Supraspinous angle
- Infraspinous angle
- Breadth-Length angle
- Axillo-Spinal angle
- Vertebral border angle

**Indices**

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- Scapular index
- Supra spinal index
- Infra spinal index
- Marginal index
- Length breadth index of glenoid fossa

## HUMERUS

### Measurements

- Maximum length
- Breadth of proximal epiphysis
- Breadth of distal epiphysis
- Least girth of shaft
- Maximum transverse diameter of head
- Maximum Vertical diameter of Head
- Maximum Diameter in middle
- Girth in middle of shaft
- Minimum diameter in middle

### Angles

- Torsion angle
- Capito-diaphysial angle
- Condylo-diaphysial angle

### Indices

- Caliber index
- Cross-section index of shaft
- Cross-section index of head

## RADIUS

### Measurements

- Maximum length
- Physiological length
- Least girth of shaft
- Transverse diameter of shaft
- Sagittal diameter of shaft

### Angles

- Collo-diaphysial angle
- Torsion angle

### Indices

- Caliber index
- Cross section index of shaft
- Curvature index

## ULNA

### Measurements

- Maximum length
- Physiological length



- Least girth of shaft
- Breadth of olecranon
- Height of olecranon

#### Angles

- Olecranon- coronoid angle
- Joint axis angle

#### Indices

- Caliber index
- Cross-section index of shaft
- Curvature index

#### FEMUR

##### Measurements

- Maximum length
- Trochanteric length
- Sagittal diameter of middle of shaft
- Physiological length
- Transverse diameter of middle shaft
- Girth of middle of shaft

#### Angles

- Torsion angle,
- Collo-diaphysial angle
- Condylo diaphysial angle

#### Recommended Readings:

1. Singh, S.P. Kinanthropometry
2. Ashley Montagu, M.F.A. Hand Book of Anthropometry. Charles. C. Thomas. Illinois.
3. Singh, I.P. Bhasin, M.K. Anthropometry. Bharti Bhawan, New Delhi.
4. Weiner, J.S. & Lourie. J.A. Human Biology: A Guide to Field Methods. I.B.P. 11and
5. Book No. 9 Blackwell Scientific Publication, Oxford.
6. Mitra, M. 1990. Prayogik Manav Vigyan- Bhag -2. Madhya Pradesh Hindi Granth
7. Academy (in Hindi).
8. Mitra, M. & Chaube, R. 2004. Prayogik Manav Vigyan (Sharirik) Bhag -2. Madhya
9. Pradesh Hindi Granth Academy (in Hindi).

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**School of Studies in Anthropology  
Pt. Ravishankar Shukla University, Raipur**

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***M.A./M.Sc. ANTHROPOLOGY***

***Semester – II***

**January 2021 - June 2021**

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**M.A./M.Sc. ANTHROPOLOGY**  
**SEMESTER-II**  
**PAPER I – INDIAN ARCHAEOLOGY**

**MAX. Marks- 80**  
**MIN. Marks - 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT-I**

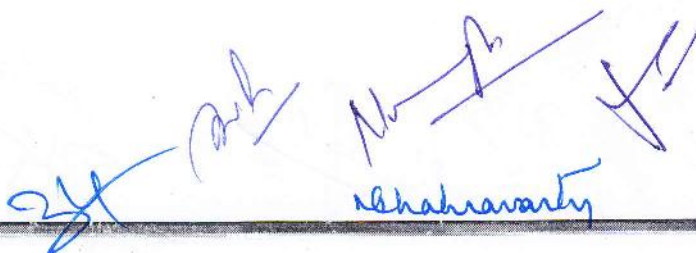
- Historical development of Prehistoric Archaeology.
- Framework of Archaeological Cultures
- Terminology Issues
- Exploration and Excavation Techniques.

**UNIT-II**

- Lower Paleolithic cultures of India: Distribution, Stratigraphy, Chronology, Tool Kit, Soanian & Madrasian Traditions, Development & Associated fossils.
- Middle Paleolithic Cultures of India: Distribution, Stratigraphy, Chronology, Tool Kit, Development & Associated fossils.
- Upper Paleolithic Cultures of India: Distribution, Chronology, Assemblage, Art (Rock Art & Cave Art), Development

**UNIT-III**

- Mesolithic Cultures of India: Discoveries, Chronology, Tool kit, Stratigraphy, Development, Lifeways, Burial Practices, Associated Flora and Fauna.
- Neolithic Cultures of India: Neolithic Revolution, Discoveries, Chronology, Assemblage, Emergence of Human settlements, Regional Variations.

  
Shahavarty

#### UNIT-IV

- Chalcolithic Cultures of India: Distribution, Chronology, Assemblage, Traditions, Lifeways
- Indus Civilization: Discoveries, Distribution, Chronology, Town-planning, Religion, Trade, Origin & Decay Theories.
- Megalithic Culture of India: Distribution, Chronology, Assemblage, Types, Living Megalithic Traditions.

#### Recommended Readings:

1. Agrawal, D.P. The Archeology of India.
2. Allchin and Allchin, 1982. The Rise of Civilization in India and Pakistan, Select Book Service
3. Syndicate, New Delhi.
4. Bhattacharya, D.K. 1987. Pre-historic Archaeology: A comparative study of human succession.
5. Bhattacharya, D.K. 1994. Outline of Indian Prehistory.
6. Pandey, J. N. 2000. Puratatva Vimarsh (in Hindi)
7. Misra, V. N. & M. S. Mate 1995. Indian Prehistory; 1964.
8. Choubey, R. Puratatvik Manavvigyan (in Hindi)
9. Sankalia, H. D. 1974. Pre and Protohistory of India and Pakistan.
10. Varma, R.K. & N. Varma, 2001. Puratatva Anushilan
11. Wheeler, R.E.M. 1959. Early India & Pakistan.

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M.A./M.Sc. ANTHROPOLOGY

SEMESTER-II  
PAPER II - FUNDAMENTALS OF HUMAN GENETICS

MAX. Marks- 80  
MIN. Marks - 27

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

UNIT-I

- History, Definition and Scope of Human Genetics.
- Branches of Human Genetics.
- Concept of Gene.
- Elementary principles of Genetics.
- Structure and function of DNA, RNA and Proteins.
- Genetic code.

UNIT-II

- Cell Division- Mitosis and Meiosis.
- Mendelism. Application of Mende's theory in man.
- Methods of studying human heredity: Pedigree method, Twin method, Linkage Studies.

UNIT-III

- Multiple alleles and blood groups
- Inheritance of ABO, MN and Rh blood groups.
- Compatible and Incompatible mating.
- Concept of gene frequencies.

#### UNIT-IV

- Autosomal Dominant and Recessive inheritance.
- Sex-linked, Sex-limited and Sex-influenced inheritance.
- Polygenic inheritance.

#### Recommended Readings:

1. Curt Stern. 1968. Principles of Human Genetics. Eurasia Publishing House (Pvt.) Ltd., Ram Nagar, New Delhi-1 (India).
2. Winchester, A. M. 1967. Genetics, Oxford & IBH Publishing Co.
3. Bhasin, V. 1994. People, Health and Disease: The Indian Scenario, Kamla- Raj Enterprises, Delhi.
4. Bhasin, M., K., Walter, H. and Danker-Hopfe, H. 1992. The Distribution of Genetical, Morphological and behavioural
5. Traits among the Peoples of Indian Region, Kamla- Raj Enterprises, Delhi.
6. Bhamrah and Chaturvedi, A Text Book of Genetics.
7. Mange and Mange, Basic Human Genetics.
8. Rothwell, N.V., Human Genetics.
9. Harrison et al. Human Biology.
10. Ashley Montagu, Concept of Race.
11. Shukla, B.R.K. & Rastogi, S., Physical Anthropology and human Genetics.
12. Dalela and Verma, T Text Book of Genetics.
13. Bodmer & Cavalli Sforza, Genetics, Evolution and Man.
14. King and Stansfield, A Dictionary of Genetics.
15. Brudette, W.J., Methodology in Human Genetics.
16. Yunis, J.J. (Ed.), Biochemical Methods in Red Cell Genetics.
17. Harris, H., Human Biochemical Genetics.

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**M.A./M.SC. ANTHROPOLOGY**  
**SEMESTER-II**  
**PAPER III - MEDICAL ANTHROPOLOGY**

**MAX. Marks- 80**  
**MIN. Marks – 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT – I**

- Meaning and scope of Medical Anthropology
- Changing concepts of health and disease
- Culture and lifestyle in relation to health and disease.
- Ethno medicine.
- Magico-Religious practices.
- Indigenous medical systems and medical practitioner
- Ethno-botany
- Ethno-pharmacology.
- Ethno-biology.
- Ethnography of tribal medical system with special reference to tribes of central India.
- Resurgence of traditional medical systems in the west and India.

**UNIT- II**

- Epidemiology basic principles: epidemiology of common communicable and non-communicable diseases- 1. Malaria 2. T.B. 3. Leprosy 4. STD 5. Diabetes, 6. HIV/AIDS 7. Cancer 8. Cardiovascular diseases.
- Mental health,
- National disease control programmes.
- Plural and alternative systems of medicine traditional system as part of culture and life style: 1. Ayurveda 2. Unani 3. Naturopathy 4. Tibetan 5. Chinese basic principles.



### UNIT -III

- Medical statistics measurement of morbidity and mortality rates incidence and other statistics.
- Health promotion and health programmes.
- Nutrition
- RCH
- Family welfare
- Health education ageing (Peoples perspectives to be focused)
- Health and environment: water pollution, air pollution, noise pollution.
- International Health : WHO, UNICEF, USAID, Food Foundation etc.

### UNIT -IV

- National health policy: Historical Review.
- Health care delivery in India rural and urban, Response of the people.
- Voluntary efforts in community health and development: Some case studies of community participation.
- Anthropological approach to health systems research, use of an anthropological research method in health system research.
- Evaluation judicious mix of qualitative and quantitative research methods.

### Recommended Readings:

1. Medical Anthropology: Foster, George
2. Handbook of Medical Anthropology: Freeman, H.E. et al
3. Culture, Disease and Healing: Landy, D.
4. Culture, Health and Illness: Helman Cecil, Wright Bristol, 1985
5. Folk illness and Ethnomedicine: Banerjee B.G. and R. Jalota
6. Applied Anthropology in Medicine: Coudil, W.
7. Social Anthropology and Medicine: Loudon, J.B. (ASA Monograph)
8. Doctors and Society: Madan T.N.
9. Forensic Anthropology: Steward T.D.
10. Crime and Detection: Symans, J.
11. Methods in Forensic Anthropology: Nicoles
12. Forensic Science and laboratory: Turner
13. Practical Finger printing: Bridges
14. Finger, Palm and Sole Prints: Chatterjee
15. Methods in Forensic Science: Lundquist, F. and A.S. Curry
16. Modern Trends in Forensic Medicine: Ment
17. Anthropology Part-I: Jha and Baranwal
18. Harold Cummins and Charles Midlo. 1961. Finger Prints, Palms and Soles: An Introduction to Dermatoglyphics, Dover Publications, New York.
19. Medicine, Magic and Religion, Rivers, W.H.R.
20. The Cultural Frontiers of Health, Hasan, K.
21. Traditional Medicine and Health Care Coverage (WHO), Bannermann et al.

22. Folk and Modern Medicine, Kakar, D.N.
23. Asian Medical System, Leslie, C. (Ed.).
24. People"s Health in People"s Hand, Anti, A.H. & Bhatia
25. Women"s Autonomy, Education and Reproductive Health, Jajeebhoy, S.
26. Ministry of Health and Family Welfare, National Health Policy
27. W.H.O., World Health Reports.
28. National Institute of Health & Family Welfare, Maternal and Child Welfare
29. Health, Culture and Community, Paul, B.D.
30. Cultural Patterns and Technological Change, Mead, M.
31. Culture, Health and Disease, Read, M.
32. Dash, J., Patra, P.K. and Sathpathy, K.C. Dimensions of Healthcare practices, SSDN  
Publishers, New Delhi.

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**M.A./M.SC. ANTHROPOLOGY**

**SEMESTER-II**

**PAPER IV - BIostatISTICS AND COMPUTER APPLICATIONS**

**MAX. Marks- 80**

**MIN. Marks – 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT-I**

- Measures of Dispersion: Dispersion, Range, Variance, Standard Deviation, Standard Errors, Skewness and Kurtosis.
- Correlation: Simple correlation, Grouped and ungrouped data, Karl Pearson's Coefficient of Correlation.

**UNIT-II**

- Parametric and non parametric test.
- Test of Significance: Non- parametric Tests: Chi-square Test, Goodness of fit.
- Parametric Test: t-test, Z-test.
- Regression analysis: Linear regression and logistic regression
- Bivariate and multivariate Analysis

**UNIT-III**

- Population Study: Vital Statistics.
- Fertility and Fertility rates.
- Mortality and Mortality rates: Infant Mortality and Infant Mortality rates & Maternal Mortality.
- Factors affecting Fertility and Mortality.
- Morbidity and Morbidity rates.
- Migration and Migration rates.

#### UNIT-IV

- Introduction to Computer: History & Types of Computers.
- Computer hardware and software.
- Operating System : Windows.
- MS Office: 1. MS-Word 2. MS-Excel 3. MS-Power Point
- Internet: Use of Internet in Anthropological Research, epg Pathshala, N-List.
- Anti virus.
- Data Analysis Softwares: SPSS 16.0, MS-Excel.
- Referencing Softwares : Mandelley.

#### Recommended Readings:

1. Gupta, S.P., Statistical Methods.
2. Sarin, S.S. and Balchandani, M.K., Fundamentals of Statistics. Ratan Prakashan Mandir, Agra.
3. Summar, M., Computers: Concepts and Uses.
4. Wardlaw, A.C., Practical Statistics for experimental biologists.
5. Zar, J.H., Biostatistical Analysis.
6. Elhance, D. N., Practical Problems in Statistics, Kitab Mahal, Allahabad.
7. Sarin, S.S. and Balchandani, M.K., Fundamentals of Statistics. Ratan Prakashan Mandir, Agra.
8. Fernandes & Tondon, Participatory Research.
9. Fisher, Michael. Application in Computing for Social Anthropologists, London, Routledge.
10. H. Russel. Bernard, Handbook of Methods in Cultural Anthropology, Altamira Press.
11. Kaplan, Abraham, The Conduct of Enquiry: Methodology for Behavioural Sciences.
12. Madrigal, Lorena, Statistics for Anthropology.
13. Pradhan, Ashok, Janjatiya Janankiki



**M.A./M.SC. ANTHROPOLOGY**  
**SEMESTER-II**  
**LAB COURSE I – PRACTICALS IN ARCHAEOLOGY**

**MAX. Marks- 80**  
**MIN. Marks - 27**

- 1) Tools: Typology, Functions & Technology.
- 2) Sketching and description of representative Prehistoric tools:
  - (a) Stone tools
  - (b) Bone tools
  - (c) Pottery
- 3) Site Types: Kill sites, Habitation sites, Industry sites, Quarry sites, Burial sites.
- 4) Visit to Museum, Excavation Site.
- 5) Conservation & Preservation of Antiquities.

**Recommended Readings:**

1. Mitra, Mitashree & Ramesh Choubey. Prayogik Manavvigyan (in Hindi).
2. Oakley, K.P. 1972. Man the Tool Maker.
3. Reddy, Rami. Tool techniques in Prehistory.
4. Sankalia, H. D. 1964. Stone age tools: Their techniques, names & probable functions.

**M.A./M.Sc. ANTHROPOLOGY**

**SEMESTER-II  
LAB. COURSE II- COMPULSORY FIELDWORK**

**MAX. Marks- 80**

**MIN. Marks - 27**

The course is designed to make the student carry out field work in the 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 in the village.

1. Field work tradition in anthropology.
2. Preparation for fieldwork: Physical, Psychological and Academic.
3. Rapport building - initial contact.
4. Review of data collection methods (as per Research method).

Two typed copies of analyzed data is to be submitted in the department in the form of a Field work Report

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**School of Studies in Anthropology  
Pt. Ravishankar Shukla University, Raipur**

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***M.A./M.Sc. ANTHROPOLOGY***

***Semester – III***

**June 2021 - December 2021**

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M.A./M.SC. ANTHROPOLOGY

SEMESTER-III  
PAPER I - APPLIED ANTHROPOLOGY (GROUP - A & - B)

MAX. Marks- 80  
MIN. Marks - 27

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

UNIT- I

- Meaning and Scope of Applied Biological Anthropology.
- Anthropology of Sports.
- Nutritional Anthropology.
- Designing of defense equipments.
- Defense Services.

UNIT- II

- Applications of Human Genetics: Medico - Legal cases, Eugenics.
- Genetic screening, Genetic counseling, Genetic engineering.
- Human Genomics & its applications.

UNIT -III

- Meaning & Scope of Applied Social Anthropology.
- Applied & Action anthropology.
- Applications of Anthropological theory and methodology in the field of tribal development.

#### UNIT- IV

- Applied anthropology in industry.
- Applied anthropology in education.
- Applied anthropology in public health
- National health Mission.

#### Recommended Readings:

1. Kroeber. Anthropology Today.
2. Curt Stern. 1968. Principles of Human Genetics. Eurasia Publishing House (Pvt.) Ltd., Ram Nagar, New Delhi-1(India).
3. Steine. Biosocial Genetics.
4. Karp, E. Genetic Engineering.
5. Bodmer and Cavalli-Sforza. Genetics of Human Populations.
6. Backer, PT and Weiner (Eds), The Biology of Human Adaptability.
7. Beal, Virginia, Nutrition and the Life Span
8. Craig, Human Development
9. Eveleth, PB and Tanner, JM Worldwide Variation in Human Growth
10. Forbes, GB, Human Body Composition
11. Sodhi, HS, Sports Anthropology
12. Willigt, JV, Applied Anthropology: An Introduction
13. Stern, C., Principles of Human Genetics.
14. Shukla, B.R.K. & Rastogi, S., Physical Anthropology and Human Genetics An Introduction.
15. McKusick, V.A., Human Genetics.



M.A./M.SC. ANTHROPOLOGY

SEMESTER-III  
GROUP - A : PHYSICAL ANTHROPOLOGY  
PAPER II - ADVANCED HUMAN BIOLOGY

MAX. Marks- 80  
MIN. Marks – 27

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

UNIT-1

- Gene expressivity: Lethal genes, Sub-lethal genes, modifying genes, Co-dominance,Suppressor genes, Selfish gene Variable Penetrance in man.
- Sex determination in man.
- Dermatoglyphics: Identification, Topography, Finger prints pattern-identification, pattern intensity, Furuhata and Dankmeijer's index.
- Palmar Dermatoglyphics- Configurational areas, Main line formula and Index & transversality, atd angle and flexion creases.

UNIT-2

- Probability.
- Hardy-Weinberg law, Testing Equilibrium,Applications of Hardy Weinberg Law in Human Population Genetics.
- Genetic Polymorphism: Transient and Balanced.
- Concept of Gene Pool and Gene Frequency.

UNIT-3

- Human Chromosomes, Chromosome Karyotype – Banding Techniques.
- Numerical and Structural Chromosomal abnormalities
- Inborn errors of Metabolism: G6PD Deficiency, PKU, Alkaptonuria.
- Genetic Counseling and pre-natal diagnosis.



#### UNIT-4

- Occurrence of Mutation: Mutation Rate- Direct and Indirect Method.
- Selection in Human Population, Selection Relaxation, Selection Leading to Changes in Gene.
- Frequency and Selection leading to change in Genetic Equilibrium.
- Inbreeding : Definition and Concept, Inbreeding with Pedigree.
- Coefficient of Inbreeding. Genetics Consequences of inbreeding in Human Population.
- Genetic hazards of radiation.

#### Recommended Readings:

1. Crow & Kimura. 1970. An Introduction to Population Genetics Theory, Harper & Row Publishers, New York.
2. Curt Stern. 1968. Principle of Human Genetics, Eurasia Publishing House (Pvt.) Ltd., Ram Nagar, New Delhi-1
3. (India).
4. Li, C. C. Population Genetics, Chicago University Press, Chicago.
5. Baker, P.T. & Weiner (Eds.), The Biology of Human Adaptability.
6. Beal, Virginia, Nutrition and the Life Span.
7. Beutler, E., Red Cell Metabolism: A Manual of Biochemical Methods.
8. Bouge, D., Principles of Demography.
9. Brock and Mayo, The Biochemical Genetics of Man.
10. Burdette, W.J., Methodology of Human Genetics.
11. Craig, Human Development.
12. Dixit, M., Human Nutrition Principles and Applications in India.
13. Emery A.E.H., Elements of Medical Genetics.
14. Eveleth, P.B. & Tanner, J.M., Worldwide variations in Human Growth.
15. Giblett, E.R., Genetics Markers in Human Blood.
16. Li, C.C., Human Genetics
17. Malhotra, K.C. & ISIIG, Calcutta, Statistical Methods in Human Population Genetics, IBRAD, ISI
18. Wright, S., Evolution and Genetics of Population
19. Stanfield, W.D., Theory and Problems of Genetics.
20. Burdette, WJ, Methodology in Human Genetics
21. Crow, J.F. & Kimura, M., An Introduction to Population Genetic Theory
22. Rothwell, N.V., Human Genetics.
23. Mange, J.E. & Mange, A.P., Basic Human Genetics.
24. Bhamarh, H.S. & Chaturvedi, C.M., A Textbook of Genetics.



**M.A./M.Sc. ANTHROPOLOGY**

**SEMESTER -III  
GROUP - A : PHYSICAL ANTHROPOLOGY  
PAPER III – HUMAN GROWTH AND NUTRITION**

**MAX. Marks- 80**

**MIN. Marks - 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT – I**

- Human growth and Development: Pre-natal and Post-natal growth, infancy, Childhood, adolescence, adulthood, senility.
- Human growth curves Catch up and Catch down growth.
- Basic methods of growth studies - Cross-sectional, Longitudinal, Mixed Longitudinal Linked longitudinal.

**UNIT – II**

- Factors affecting growth: Heredity, Environment & hormonal.
- Human Adaptation : Allen's and Bergmann's rule
- Concept of age: chronological, skeletal, dental, morphological.

**UNIT – III**

- Nutrition: Basic terms and concepts.
- Concept of Balanced Diet, Malnutrition, Under nutrition, Overnutrition, Obesity etc.
- Special problems related to growth and nutrition growth at risk; infants, pregnant and lactating mothers, old age problems, birth weight variations; abnormal growth failure.
- Evaluation of nutritional status through Anthropometric and Clinical signs of malnutrition.

**UNIT – IV**

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No. 13  
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- Growth Programmes: ANP, ICDS, SNP, Mid-Day meal programme; Vitamin-A prophylaxis programme, Anemiaprophylaxis Programme, Goiter control programme, Nutritional deficiency diseases: Nicotinic acid deficiency, Vitamin-C, Vitamin-D deficiency.
- Problem of Malnutrition.
- Morbidity and Mortality in India.
- IMR. Role of maternal education, Immunization programme in India.

#### Recommended Readings:

1. Tanner, J. M. 1962. Growth at Adolescence, Blackwell Scientific Publications, Oxford.
2. Lowrey, G. H. 1978. Growth & development of children, Year book Medical Publishers, Chicago – London.
3. Swaminathan, M. 1985. Essentials of Food and Nutrition, The Bangalore Printing and Publishing Co. Ltd.
4. Gopalan, C., Rama Sastri, B., V. & Balasubremian, S., C. 2002. Nutritive value of Indian foods, National Institute of Nutrition, ICMR, Hyderabad.
5. Parasmani dasgupta and Roland Hauspie , 2001. Perspectives in Human Growth, Development and Maturation, Kluwer Academic Publishers, London.
6. Marshall, W. A. 1977. Human Growth and its Disorders, Academic Press, London.
7. Harrison, G.A., Weiner, J.S., Tanner, J.M. and Barnicot, N.A. Human Biology: An Introduction to Human Evolution, Variation and Growth, Clarendon Press, Oxford.
8. Tanner, J.M., Fetus into Man.
9. Jelliff, D.B., Community Nutritional Assessment with Special Reference to Less Developed Countries.
10. Dixit. Human Nutrition: Principles and Applications in India.
11. Shanti, G. Nutrition and Child Care: A Practical Guide.
12. B. Srilaxmi, Nutrition Science.
13. Margart Schay, Nutrition.
14. Rao, V.K.R.V. Food Nutrition and Poverty.
15. Nelson, A Text Book of Pediatrics .
16. Garrow, J.S. and James, W.P.T: Human Nutrition and Dietetics.
17. Swaminathan, M., Essentials of Food and Nutrition: Applied Aspect.
18. Eveleth, PB and Tanner, JM Worldwide Variation in Human Growth
19. Forbes, GB, Human Body Composition



M.A./M.Sc. ANTHROPOLOGY

SEMESTER-III  
GROUP - A : PHYSICAL ANTHROPOLOGY  
PAPER- IV HUMAN MOLECULAR GENETICS

MAX. Marks- 80  
MIN. Marks - 27

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

UNIT -I

- Definition and scope of Molecular Genetics.
- Nucleic acid: Structure, Chemical and physical properties of nucleic acids, spectroscopic and thermal properties of nucleic acids.
- DNA organization in chromosomes: DNA structure, DNA replications.
- RNA structure.
- Gene transcription in eukaryotes.

UNIT-II

- Techniques in Molecular Genetics: Recombinant DNA technology, Restriction enzymes, Nucleic acid hybridization, DNA cloning, DNA sequencing, Polymerase chain reaction (PCR), Southern blot, Northern and Western blot, In situ hybridization, Labeling nucleic acid probes, Transgenic organisms.

UNIT-III

- DNA Poymorphism DNA mutation and repair, Repetitive DNA.
- Gene mapping, Physical mapping, Genomic imprinting.
- Expression of eukaryoteic protein-coding genes.
- Genetic code and Protein synthesis.
- DNA Sequencing and fingerprinting

#### UNIT-IV

- Application of Genomic Technology: RFLP (Restriction fragment length polymorphism), VNTR (Variable number tandem repeat), Microsatellite repair polymorphism, Application in forensic sciences.
- Human genome project.
- Prenatal diagnosis and Genetic Counseling of molecular disorders.

#### Recommended Readings:

1. Strachan, T. and Read, A.P. 1999. Human Molecular Genetics. BIOS Scientific Publishers Ltd, Oxford. (574.8732, STT II, 84237).
2. Jackson, M., Strachan, T. and Dover, G. 1996. Human genome Evolution. BIOS Scientific Publishers Ltd., Oxford. (573.2, JAM H, 79134).
3. Levis, R. 2003. Human Genetics Concepts and Application. 4<sup>th</sup> ed. Dubuque, IA: McGraw-Hill.
4. Koolman, J and Roehm, K.H. 2005. Color Atlas of Biochemistry. 2<sup>nd</sup> ed. Thieme Stuttgart. New York.
5. Lewin. 2003. Genes VIII. 1<sup>st</sup> ed. Prentice Hall.
6. Mc Kusick, V.A. Human Genetics.
7. Rieger, R. et al., Glossary of Genetics – Classical and Molecular
8. Brock and Mayo, The Biochemical Genetics of Man
9. Winchester, A.M., Human Genetics.



M.A./M.Sc. ANTHROPOLOGY

SEMESTER-III

GROUP - A : PHYSICAL ANTHROPOLOGY

LAB COURSE I – PRACTICALS IN APPLIED BIOLOGICAL ANTHROPOLOGY

MAX. Marks- 80

MIN. Marks - 27

1. Collection of blood specimens.
2. Preparation of Hemolysates and serum & their storage.
3. Preparation & identification of Heme in Crystals.
4. Laboratory examination of blood and blood stains for criminal detection: Preliminary test, confirmatory test: Tiechmann test, Takayama test.
5. Techniques of blood grouping: ABO blood group system Rh, blood group system & MN blood group system. Personal Identification by blood grouping.
6. Calculation of gene frequencies.
7. Test of ABH saliva secretion.
8. Test of Hemoglobin determination in human blood.
9. Test for Sickle cell hemoglobin.
10. Test for Colour blindness P.T.C. taste sensitivity.
11. Examination of R.B.C. in Human Blood.
12. Examination W.B.C. in Human Blood.
13. Dermatoglyphics: Analysis of finger, palm, sole and toe prints
14. Isolation of DNA from human blood and personal identification by DNA markers.

**NOTE:** Five specimens to be analyzed by each student in the above-mentioned traits unless stated otherwise.

**Recommended Readings:**

1. Race, R. R. & Sanger, R. 1968. Blood group in man. Blackwell Scientific Publications, Oxford. (612.11825, RAR).
2. Kathleen E. Boormen and Barbara E. Dodd. An Introduction to Blood group Serology (612.11825, BOK).
3. Bhasin, M. K. and Chahal, S. M. S. 1996. A Laboratory Manual for Human blood Analysis,
4. Kamla Raj Enterprises, Delhi. Shrivastava, B. K. 1983. A Manual of Practical Physiology, Samit Medical Publications,
5. Patna. Dacie, J. V. and Lewis, S. M. 1991. Practical haematology, 5th edition, J. and A. Churchill, Livingstone.



**M.A./M.Sc. ANTHROPOLOGY**

**SEMESTER-III**

**GROUP - A : PHYSICAL ANTHROPOLOGY**

**LAB COURSE II - PRACTICAL IN HUMAN GROWTH, NUTRITION & PHYSIOLOGY**

**MAX. Marks- 80**

**MIN. Marks - 27**

**Human Growth :**

- Techniques of taking skinfold measurement: Biceps, Triceps, Sub-scapular, Supra-illiac.
- Body Proportions.
- Body Composition.
- Somatotyping.

**Nutrition:**

- Detection of nutritional status on the basis of body measurements
- Nutritional Anthropometry: Ht/Age, Wt/Age/Wt/Ht.
- Body Mass Index (BMI)
- Waist/Hip Ratio

**Physiology:**

- Examination of Pulse Rate
- Determination of Blood Pressure
- Determination of Vital Capacity
- Hand Grip

**Recommended Readings:**

1. Jelliffe, D. B. & Jelliffe, E. F. B. Nutrition & Growth, New York, Plenum.
2. Swaminathan, M. 1985. Essentials of Food and Nutrition, The Bangalore Printing and Publishing Co. Ltd.
3. Gopalan, C., Rama Sastri, B., V. & Balasubramanian, S. C. 2002. Nutritive value of Indian foods, National Institute of Nutrition, ICMR, Hyderabad.
4. Falkner, F. & Tanner, J. M. Human Growth. Vols. I, II & III, Plenum Press, New York.
5. Jelliffe, D. B. The Assessment of the nutritional status of the community, WHO, Geneva.

**M.A./M.Sc. ANTHROPOLOGY**

**SEMESTER-III  
PAPER I - APPLIED ANTHROPOLOGY (GROUP A & B)**

**MAX. Marks- 80**

**MIN. Marks - 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**Unit I**

- Meaning and Scope of Applied Biological Anthropology.
- Anthropology of Sports.
- Nutritional Anthropology.
- Designing of defence equipments.
- Defence Services.

**Unit II**

- Applications of Human Genetics: Medico - Legal genetics, Eugenics, Forensic applications.
- Genetic screening, Genetic counseling, Genetic engineering.
- Human Genomics & its applications.

**UNIT III**

- Meaning & Scope of Applied Social Anthropology.
- Applied & Action anthropology.
- Application of Anthropological theory and methodology in the field of tribal development.

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Shahavarty



#### UNIT IV

- Applied anthropology in industry.
- Applied anthropology in education.
- Applied anthropology in public health.
- National health programmes.

#### Recommended Readings:

1. Kroeber. Anthropology Today.
2. Curt Stern. 1968. Principles of Human Genetics. Eurasia Publishing House (Pvt.) Ltd., Ram Nagar, New Delhi-1 (India).
3. Steine. Biosocial Genetics.
4. Karp, E. Genetic Engineering.
5. Bodmer and Cavalli-Sforza. Genetics of Human Populations.
6. Backer, PT and Weiner (Eds), The Biology of Human Adaptability.
7. Beal, Virginia, Nutrition and the Life Span
8. Craig, Human Development
9. Eveleth, PB and Tanner, JM Worldwide Variation in Human Growth
10. Forbes, GB, Human Body Composition
11. Sodhi, IIS, Sports Anthropology
12. Willigt, JV, Applied Anthropology: An Introduction
13. Stern, C., Principles of Human Genetics.
14. Shukla, B.R.K. & Rastogi, S., Physical Anthropology and Human Genetics An Introduction.
15. McKusick, V.A., Human Genetics.

**M.A./M.Sc. ANTHROPOLOGY**

**SEMESTER-III**

**GROUP - B : SOCIAL ANTHROPOLOGY**

**PAPER II – THEORY AND METHODS IN SOCIAL-CULTURAL ANTHROPOLOGY**

**MAX. Marks- 80**

**MIN. Marks - 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT-I**

- History of Anthropology Thought : Classical School.
- Pioneers in Anthropology.
- Evolutionism : Spencer, Morgan, Tylor, Jamer Frazer.
- Neo-evolutionism : Leslie White, Julian Steward, Sahlin
- Diffusionism: Perry, Elliot Smith, Graebner, Freidrich Ratzel.
- Historical Particularism : Boas, Wissler, Kroebar.

**UNIT-II**

- Functional: B. Malinowski, Merton.
- Structural-Functionalism: Radcliffe-Brown, Evans-Pritchard, Mayer Fortes, Raymond Firth, Nadel.
- Structuralism: Levi Strauss. Leach.
- Psychological Anthropology.
- Culture and Personality Studies : Kardiner, Linton, Ruth Benedict, Cora-du-Bois, Margaret Mead, Spiro, Mary Douglas, A. Kleinman, AFC Wallace, Stephen Taylor.

**UNIT-III**

- Philosophical anthropology: Concept of Value, Cultural Relativism, Value and human rights : Herskovits.
- Cognitive Anthropology.
- Historical and Dialectical Materialism: Hegel, Marx and Engels.
- Symbolic and Interpretative Anthropology: Turner, Schneider, Geertz.
- Post-Modernism: Marcus, Fischer, Jean Baudrilard, Michel Foucault, Jacques Derrida.



#### UNIT-IV

- “Primitive” as a conceptual model in Anthropological research.
- Emic-Etic paradigms.
- Synchronic- Diachronic paradigms.
- Ethnographic method for policy planning and intervention.
- Synthesizing micro and macro paradigms, Inductive and deductive approaches.
- Dilemma of “We” and “They” in research.
- Efficacy of qualitative method and its application as an additive tool to quantification.
- Autonomous nature of Anthropology: Integration of Scientific and humanistic approaches.
- Anthropologist as scientist, citizen and humanist.

#### Recommended Readings:

1. Jha, M. Manavshastriya vichardhara- Ek Parichaya. (in Hindi).
2. Shrivastava, A.R.N. Sanskritik Manav vigyan – Siddhanta aur Uplabdhiyan ((in Hindi).
3. Harskovitz, M.J. Sanskriti ki pristhabhumi (in Hindi).
4. Muthal, S. Samajik Manav Vigyan- Saidthantik Vyavahar (in Hindi).
5. Harris, M. Rise of Anthropological Theory. Routlege and Kegan Paul, London.
6. Malinowski, B. Scientific theory of culture and other essays.
7. Evans-Pritchard. A History of Anthropological Thought.
8. Bidney, David, Theoretical Anthropology, New York, Colombia University press.
9. Erickson, Paul, Anthropological Lives: Biographies of Eminent Anthropologists, New Delhi, Reliance.
10. Sahlins & Service, Evolutions and Culture.
11. Schneider et al., Symbolic Anthropology: A Reader in the Study of Symbols and Meanings.
12. Turner, Roy, Ethnomethodology.
13. Douglas, Marry, Cultural Bias.
14. Gerttaz, Clifford, The Interpretation of Culture.
15. Ingram, John, Psychological Anthropology Reconsidered.
16. Manganaro, Marc, Modernist Anthropology: From Fieldwork to Text.
17. Nadel, S.F., The Foundations of Social Anthropology
18. Manners, R.A. & David Kaplan (Eds.), Theory in Anthropology.
19. Levis-Strauss, Structural Anthropology.
20. Malinowsky, Scientific Theory of Culture and Other Essay.
21. Redfield, R., Human Nature and the Study of Society.
22. Tyler, Stephen (Ed.), Cognitive Anthropology.
23. Redfield, Robert, Peasant Society and Culture.
24. Steward, Julian H., Contemporary Change in Traditional Society.
25. Moore, The Future of Anthropological Knowledge.
26. Hastrup, A Passage to Anthropology.
27. Schneider, Turner and Douglas. Symbolic and Interpretative Anthropology
28. Tylor, E.B. Studies in Cognitive Anthropology
29. Upadhyay and Pandey. History of Anthropological thought
30. Upadhyay and Pandey. Tribal Development in India.



**M.A./M.SC. ANTHROPOLOGY**  
**SEMESTER-III**  
**GROUP - B : SOCIAL ANTHROPOLOGY**  
**PAPER III - INDIAN ANTHROPOLOGY AND MUSEOLOGY**

**MAX. Marks- 80**  
**MIN. Marks – 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT – I**

- Approaches to the study of Indian Society, Culture and civilization : Indological, Anthropological, Historical etc.
- Ancient Culture: Vedic and later vedic age.
- Indian People: Racial, Ethnic, Linguistic and Religious elements (composition) and distribution of people. Autochthons, peopling of India: migration, hypergamy, hypogamy, DNA explanations.
- Unity and Diversity in Indian Society and Culture: linguistic, political, ethnic, communal and religious tensions and conflicts: national integration.
- Basis of Traditional Indian Social Structure and Life Style: vanasharam dharma, purushartha, impact of Buddhism, Jainism, Islam and Christianity.

**UNIT – II**

- Social Structure: Caste System: Definition and criteria of caste system, Varna and caste, caste among non-Hindus, caste outside India, dominant caste, caste-mobility-fusion, lack of fusion and fission. Backward castes and scheduled castes: statutory provisions, caste and tribe, caste in democracy.
- Indian village: a myth or reality, village a part society, Important of village studies. Jajmani system, Impact of new technology and urbanization – changing agrarian social structure, peasant movements.

Page 48 of 68

- Growth of anthropology in India: contributions of the following anthropologists: scholar administrators in 19<sup>th</sup> and 20<sup>th</sup> century in the understanding of tribal, caste and village communities and Indian social structure and civilization. List in illustrative:

1. J.H.Hutton
2. Mortimer Wheeler
3. Jhon Grierson
4. A.L.Basham
5. Haimendorf
6. V.Elwin
7. Milton Singer
8. S.C.Roy
9. G.S.Ghurye
10. L.A.K.Aiyer
11. N.K. Bose
12. D.N. Majumdar
13. I.Karve
14. M.N. Srinivas
15. S.C.Dube
16. L.P.Vidyarathi
17. Mckim Marriott
18. Robert Redfield

### UNIT – III

- History and Development of Museum Movement : Meaning and definition of museum, A short history of museum movement in India.
- Classification of Museum in India: National Museum, State Muscum, University Museum, Specialized Museum in India.
- Museum Administration, Acquisition and Arrangement of specimens; Museum Administration,
- Planning of Museum Building, Planning of Museum Gallery, Principles of Display, Lighting of Museum Galleries, Mode and ways of Acquisition of museum specimens, Arrangement of Museum.

### UNIT-IV

- Documentation and labels in Museum : Need for Documentation, Methods of Documentation, Safeguards of Records, Development of Computer based Documentations, Documentations of Ethnographic specimens, Museum Labels, Dioramas, Models and Charts, Museum Photography.



- Conservation of Museum: Causes of decay and determination of Museum objects, Care and handling of Museum objects, Packing of Museum objects, cleaning and repairing, Preservation of organic objects, Preservation of Inorganic objects.

### Recommended Readings:

1. Allchin, B. & Allchin, R. The Rise of civilization in India and Pakistan, Cambridge University Press
2. Karve, Iravati. Hindu Society- An interpretation.
3. Mandel boum, D. Society in India.
4. Marriott, M. Village India – Studies in the Little Community.
5. Singh, K. People of India – An Introduction. Anthropological Survey of India.
6. Leach, E.R. Aspects of caste in South India, Ceylon and North- West Pakistan.
7. Singer, M. When a Great Tradition Modernizes.
8. Srinivas M. N. Social change in modern India.
9. Nadeem Hasnain. Indian Anthropology.
10. Jha and Baranwal. Indian Anthropology.
11. Karve, Iravati, Kinship organization in India.
12. Sankalia, H.D., Pre and Proto History of India and Pakistan, Pune, Deccan College.
13. Vidyarthi, L.P. Sacred Complex of Kashi, A Microcosm of Indian Civilization, New Delhi, Concept Publication.
14. Haimendorf, C., Tribes of India, the Struggle for Survival.
15. Singh, K.S., Tribal Society in India.
16. Dube, S.C., India's Changing Villages.
17. Basu, T. M. Indian Museum Movement, A. K. Banerjee 89, Mahatma
18. Gandhi Road, Calcutta – 7.
19. Zeheer M. Museum Management, Ram Advani Book.
20. Aiyppan, A. & Satyamurthy, S. T. Handbook of Museum Technique, Govt. of Madras Publication, Gupta
21. Brothers Vishakhapatnam.
22. Markham, S. F. & Hargreaves, H. The Museum of India.
23. Ghosh, D. P. Problems & Trends in Museology
24. Choudhary, J. The Ethnographical collection & their display.
25. Blanderleith, N. J. The Conservation & Antiquities of works and Art.
26. UNESCO (Pub.) A Quaterly Review, Ministry of Education & Social welfare Museum.
27. Bijay K. Behera and Subodha K. Mohanty: Muscology and Museum management in India. Mayur Publication: Bhubneshwar
28. Agnihotri, V. 2003. Manav aur uski. Bhotik Sanskriti (in Hindi), K.K. Publications, Allahabad.
29. Singh, Y. Modernization in Indian Tradition.
30. Cohn, B.S. Social Anthropology of Indian Civilization.



**M.A./M.SC. ANTHROPOLOGY**

**SEMESTER-III  
GROUP - B : SOCIAL ANTHROPOLOGY  
PAPER IV – TRIBAL DEVELOPMENT**

**MAX. Marks- 80  
MIN. Marks – 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT – I**

- Definition of tribe and scheduled Tribe. Distribution of scheduled Tribes. Demographic trends. Classification and characteristics of tribal regions. Racial and linguistic classification of Scheduled Tribes. Social structure. Tribal Economy (Stages of economy). Tribal religions.
- Tribal Policy: Tribal Policy, regulatory and development measures during British India. Indian Constitutions –safeguards and provisions for Scheduled Tribes: socio-cultural, economic, education, political services, etc. History of regulatory and developmental measures in pre-Independence period. Administration of Scheduled Areas (Fifth Schedule to the Constitution), Tribal Areas (Sixth Scheduled to the Constitution) and tribal majority States. Important Regulations promulgated by Governors in Scheduled Areas.
- PESA: 73<sup>rd</sup> Amendment.

**UNIT – II**

- Tribal Economy : Forests – shifting cultivation- Forest department-its policy, Acts and regulations, Joint Forest Management : tribal agriculture – land holding – land rights-land tenures and land reforms – adoption of modern agricultural technology : allied economics- fishing and hunting ; pastoralism; village and cottage industries; distributions: consumption, saving and investments; tribal markets.
- International and National funding for tribal schemes.
- Land alienation, Indebtedness, Bonded labour and forms of tribal exploitation: Role of cooperation, cooperatives and other financial institutions; Tribal and non-tribal



interaction patterns. Impact of Acts and Regulations against land alienation and debt redemption measures.

### UNIT - III

- Tribal Education : Literacy and educational levels; educational programmes : formal, non-formal and vocational; problems in the promotion of tribal education and female education.
- House and Health : housing condition and housing programmes; health, sickness and disease – drinking water, ethno-medicine and modern medical systems; roads and communications –status and issues.
- Impact of industrializations and urbanization. Displacement of tribals as a result of land acquisition for projects and their rehabilitation.

### UNIT-IV

- Tribals unrest and revolts : Religious movement; Political movements.
- Basic issues in transition : Loss of languages and traditions, identity and problems of integration
- Planning and Development: Scheduled Tribes in Five Year Plans; Tribal development through SMPT Blocks, TD Blocks and Tribals Sub-plans; Voluntary efforts and role of tribal leadership. Resources-rich regions and resources-depleted regions. Poverty alleviation programmes. Dispersed tribals. Primitive groups. Oceanic communities.
- History of tribal movement in India with special reference to Chhattisgarh.

### Recommended Readings:

1. Chaudhary, Bhudadeb (Ed.). Tribal Development in India.
2. Elwin, V.A. Philosophy for NEFA.
3. Haimendorf. The Tribes of India: Struggle for survival.
4. Shara B.D. Basic Issues in tribal Development.

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**M.A./M.SC. ANTHROPOLOGY**

**SEMESTER-III**

**GROUP - B : SOCIAL ANTHROPOLOGY**

**LAB COURSE-I : PRACTICALS IN MUSEOLOGY**

**MAX. Marks- 80**

**MIN. Marks - 27**

- Classification of Museums.
- Techniques of display of artifacts in Museum.
- Techniques of Preservation and Conservation of Various Museum specimens/ cultural implements.

**Recommended Readings:**

1. Basu, T. M. Indian Museum Movement, A. K. Banerjee 89, Mahatma Gandhi Road, Calcutta7
2. Zeheer M. Museum Management, Ram Advani Book.
3. Aiyppan, A. & Satyamurthy, S. T. Handbook of Museum Technique, Govt. of Madras Publication, Gupta Brothers Vishakhapatnam.
4. Markham, S. F. & Hargreaves, H. The Museum of India.
5. Ghosh, D. P. Problems & Trends in Museology
6. Choudhary, J. The Ethnographical collection & their display.
7. Blanderleith, N. J. The Conservation & Antiquities of works and Art.
8. UNESCO (Pub.) A Quaterly Review, Ministry of Education & Social welfare Museum.
9. Bijay K. Behera and Subodha K. Mohanty: Muscology and Museum management in India. Mayur Publication:Bhubneshwar
10. Agnihotri, V. 2003. Manav aur uski Bhotik Sanskriti (in Hindi), K.K. Publications, Allahabad.



**M.A./M.SC. ANTHROPOLOGY**

**SEMESTER-III**

**GROUP - B : SOCIAL ANTHROPOLOGY**

**LAB COURSE-II : ETHNO-MUSEOLOGICAL FIELDWORK BASED REPORT AND SEMINAR.**

**MAX. Marks- 80**

**MIN. Marks – 27**

Draw and describe the measurement of any two from each category of Ethno-Museological Specimen in the Museum of S.O.S. in Anthropology.

A student has to present seminar along with submission of brief report containing characteristic features of material objects collected by him / her during field-work in one of the tribal groups of the Chhattisgarh on any one of the following categories.

- A) Housing patterns
- B) Agricultural implements
- C) Fishing, Hunting, Fire Appliances.
- D) Costumes and dress
- E) Ornaments
- F) Musical instruments
- G) Masks
- H) Any Other

**Recommended Readings:**

19. Choudhary, J. The Ethnographical collection & their display.
20. Agnihotri, V. 2003. Manav aur uski Bhotik Sanskriti (in Hindi), K.K. Publications, Allahabad.

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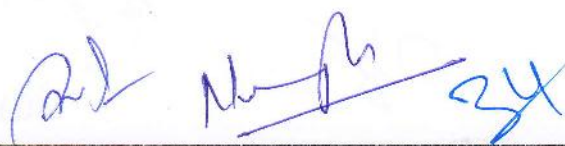
**School of Studies in Anthropology  
Pt. Ravishankar Shukla University, Raipur**

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***M.A./M.Sc. ANTHROPOLOGY***

***Semester – IV***

**January 2022 – June 2022**



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**M.A./M.Sc. ANTHROPOLOGY**

**SEMESTER-IV  
GROUP - A: PHYSICAL ANTHROPOLOGY  
Paper- I Medical Genetics**

**MAX. Marks- 80  
MIN. Marks - 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT I**

- Medical Genetics: Meaning and scope; Application of Genetics in medicine. Causation of Genetic diseases/Syndrome defects/disorders. Methods in identification of Genetic Diseases: Pedigree method, Twin Method.

**UNIT II**

- Skin- Ichthyosis, Baldness, Epiloia, the Porphyrias,
- The skeletal system – Marfan's Syndrome, Nail Patella Syndrome, Brachydactyly, Syndactyly, Polydactyly, Ankylosing Spondylitis, Rheumatoid arthritis.

**UNIT III**

- Spinabifida and anencephaly.
- Osteogenesis imperfecta. Muscle – Muscular dystrophies.
- Eye – Glaucoma, cataract, retinoblastoma. Jaws – Hare lip and palate.
- Ears - Deafness. Alimentary system : Gastric and Duodenal Ulcers, Peptic Ulcers, Cirrhosis of liver

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## UNIT IV

- Respiratory system – Cystic fibrosis.
- Cardio Vascular System – Congenital Heart Disease, Coronary Heart Diseases and Hypertension Kidney and Urino-Genital Tract – Polycystic Kidney Disease. Endocrine system – Cretinism, Goiter, Diabetes.

### Recommended Readings:

1. Strachan, T. and Read, A.P. 1999. Human Molecular Genetics. BIOS Scientific Publishers Ltd.Oxford. (574.8732, STT H, 84237).
2. Human Genetics by A.G. Motulsky and F. Vogel
3. Medical Genetics by Lynn B. Jorde et al
4. Genetic counseling by Fuhrman and F. Vogel
5. Text book of Human Genetics by Fraser and Mayo
6. Molecular structure of Human Chromosome by J J Y
7. Emery, AEH, Elements of Medical Genetics

**M.A./M.SC. ANTHROPOLOGY**

**SEMESTER-IV  
GROUP - A : PHYSICAL ANTHROPOLOGY  
PAPER- II FORENSIC ANTHROPOLOGY**

**MAX. Marks- 80  
MIN. Marks – 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**UNIT I**

Definition, Aims and scope of Forensic Anthropology, Collection and preservation of skeletal remains from crime scene, Assessment of time and cause of Death. Role of Forensic Anthropologist as Expert witness in court.

**UNIT II**

Establishment of Identity through skeletal remains, Anatomy of Human bones, Determination of Age, sex and ethnic.  
Attribution of sex and reconstruction of stature from skeletal remains, human dentition for determination of sex, age and ethnic group.

**UNIT-III**

Determination in Forensic Anthropology, Identification of finger and sole prints, details of ridge and crease character , analysis of Dermatoglyphic indices, Dermatoglyphic significance in Forensic Science.

**UNIT-IV**

• Personal Identification through somatometric and somatoscopic observation. Identification through hair, blood stains, Identification through blood, semen, urine and saliva in disputed paternity cases.

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**Recommended Readings:**

1. Introduction to Forensic Anthropology-Surider Nath
2. Action area in Anthropology-A.K.Kalla
3. Bass, W. M. Human Osteology: A Laboratory and Field Manual of the Human Skeleton. 4 the Human Skeleton.Missouri Archacological Society, 1995.
4. Blau, Soren, and Douglas Ubelaker. Handbook of Forensic Archaeology and Anthropology. Left Coast Press, 2009.
4. Boddington, A., Garland, A. N., and Janaway, R. Death, Decay, and Reconstruction: Approaches to Archaeology and Forensic Science. Manchester University Press, c.1987.
5. Byers, Steven N. Introduction to Forensic Anthropology. 4th ed. Prentice Hall, 2010.
6. Haglund, William D., Marcella H. Sorg, and Diane L. France. Human Remains: Recognition, Documentation, Recovery, and Preservation. CRC Press, c. 2002.
7. Haglund, William D., and Marcella H. Sorg. Advances in Forensic Taphonomy: Method, Theory, and Archaeological Perspectives. CRC Press, c. 2002.
8. Iscan, Mehmet Yasar, and Kennedy, K. A. R. Reconstruction of Life from the Skeleton. Alan Liss, 1989.
9. Komar, Debra, and Jane Buikstra. Forensic Anthropology: Contemporary Theory and Practice. Oxford University Press, 2007.
10. Krogman, Wilton Marion, and Iscan, Mehmet Yasar. The Human Skeleton in Forensic Medicine. Charles C. Thomas, 1986.
11. Steele, D. Gentry, and Bramblett, Claude A. The Anatomy and Biology of the Human Skeleton. 1st ed. Texas A&M University Press, c.1988.
12. Stewart, Thomas Dale. Essentials of Forensic Anthropology. Forward by Ellis R. Kerley. Charles C. Thomas,c1979.
13. Taylor, Karen. Forensic Art and Illustration. CRC Press, 2001.
14. Ubelaker, Douglas H. Human Skeletal Remains: Excavation, Analysis, and Interpretation. 2nd ed. Taraxacum, 1989.
15. White, Tom D., and Pieter A. Folkens. The Human Bone Manual. Academic Press, 2005.

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M.A./M.SC. ANTHROPOLOGY  
SEMESTER-IV  
GROUP – A AND B  
DISSERTATION/ PROJECT WORK

MM-400

In Semester IV (Group-A and Group-B) students are required to undertake a Dissertation/Project work consisting of approximately one-month preparatory work, approximately three –fourth weeks of field investigation, approximately two months for Lab work and / or data analysis and completion of the Dissertation/Project work.

The Dissertation will be selected in consultation with the faculty members decided by Head of the department, according to their specialization. Dissertations/Project work will typically be a document of about 100-150 pages with sections in the following sequence: Introduction, Objectives, Hypothesis (if necessary), Research design/ Methodology, Results, Discussion, Conclusion and Suggestions, Literature cited etc.

Presentation and Viva-Voce of the Dissertation/Project work will be in the presence of External examiner and faculty of the department.

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**M.A./M.SC. ANTHROPOLOGY**

**SEMESTER-IV**

**GROUP - B : SOCIAL ANTHROPOLOGY**

**PAPER-I DISASTER MANAGEMENT, DISPLACEMENT & REHABILITATION**

**MAX. Marks- 80**

**MIN. Marks – 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**Unit-I**

- Definition of disaster.
- Nature of disaster.
- Anthropological prospective on disaster: Natural and manmade disaster.
- Natural disaster: Causes and classification.
- People's perception of disaster. Folklore of disaster.

**Unit-II**

- Natural situation of disaster:  
1. Floods 2. Epidemics 3. Famines, 4. Earthquakes 5. Fire 6. Cyclones.
- Manmade situation of disaster:  
1. Chemical and nuclear leaks 2. Wars 3. Terrorism in India 4. Ethnic conflicts: Naxalism/Maoism.

**Unit-III**

- Development and Displacement:  
1. Dams 2. Roads and Railways 3. Development of cities 4. Establishment of industries 5. National Parks and Sanctuaries 6. Defence projects.



#### Unit-IV

- Rehabilitation policies of disaster management,
- Human factor and rehabilitation: Anthropological prospective.
- Group coordination for relocating/ reorganization of religious places.
- Restoration of families and organizing help for shelter, food and medical treatment.

#### Recommended Readings:

1. Bose, B.P.C. Disaster Policies and Administration: A Study of Three Andhra Disasters
2. Cohen, Stephen P. and C.V. Raghavulu : The Andhra Cyclone of 1977. Individual and Institutional Responses to Mass Death
3. Fernandes, Walter and Enakshi Ganduli Development, Displacement and Rehabilitation.

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**M.A. / M.SC. ANTHROPOLOGY**  
**SEMESTER-IV-GROUP-B:**  
**SOCIAL ANTHROPOLOGY**  
**PAPER II – DEVELOPMENT ANTHROPOLOGY**

**MAX. Marks- 80**  
**MIN. Marks – 27**

*Each paper will have 40 compulsory questions divisible into 4 sections.*

- i. Section-A (Multi-Choice Questions) : 20 questions of 1 mark each.
- ii. Section-B (Short Questions) : 8 questions ( two from each unit) of 2 marks each (word limit: 2-3 lines)
- iii. Section-C ( Long Questions) : 8 questions (two from each unit) of 3 marks each ( word limit : 75 words)
- iv. Section-D (Very Long Question) : 4 questions (one from each unit) of 5 marks each ( word limit : 150 words)

**Unit-I**

- Development: Meaning and evolution of the concept.
- Indices and measurements of development.
- Development theories and Models.
- Contributions of Anthropology to development studies.
- Development studies contributions to anthropological thought and method.
- Moral/Ethical issues and limitations of Development Anthropology.

**Unit-II**

- Policy and Planning : Concept of planning, formulation of policy and plan strategy- phases, targets, regions, resources and people; Participatory Approaches in Development, Anthropological perspectives and data in development planning. Conflict in people centered and programme centred paradigms.
- Agencies for development: Governmental and non-government, approaches, models, administration, training man power, peoples participation.



#### Unit-III

- Evaluation and Impact : Indices and measures; anthropological approaches - assessment of social impact, evaluation of development programmes. Gender issues in development.
- Role of values and institutions in development : Caste, religion and culture : Weber, Bailey, Epstein, Milton Singer and Madan.
- Rural Development in India: Historical Background ; Special programmes and poverty alleviation programmes. Land reforms; Panchayati Raj; Community based organizations.

#### Unit-IV

- Development of Scheduled Castes: Special component plans. Development of Scheduled caste: Constitutional provisions and safeguards, protective legislation,; structure of tribal development.
- Sustainable development : Environment, natural resources, people concern and needs.
- Case Studies in Development, NGO case studies in different regions, Success stories in cooperative management.

#### Recommended Readings:

1. Zamora, D. Mario. Perspective on cultural change and Development.
2. Vorhies et al. The Politics of Hunger
3. Rogers Everll, Communication and Development: Critical Perspectives
4. Chambers Robert. Rural Development.
5. Kapoor & Singh. Rural Development Through NGOs
6. Cochrane. Development Anthropology
7. Dalton, George (Ed), Economic Development and Social change
8. Foster, G.M. Traditional Cultures and Impact of Technological change
9. Chansarkar, B.A. Models for Planning in India
10. Krishnamachari, V.T. Community Development in India
11. Tax Sol Anthropology
12. Vidyanthi L.P. (Ed). Applied Anthropology in India
13. Upadhyay, V.S. & Pandey Gaya. Vikasatmak Manavvignyan (in Hindi), Madhya Pradesh Hindi Granth Academy, Bhopal
14. Schumacher, E. F. Small is Beautiful

**M.A./M.SC. ANTHROPOLOGY**  
**SEMESTER-IV**  
**GROUP – A AND B**  
**DISSERTATION/ PROJECT WORK**

**MM-400**

In Semester IV (Group-A and Group-B) students are required to undertake a Dissertation/Project work consisting of approximately one-month preparatory work, approximately three-four weeks of field investigation, approximately two months for Lab work and / or data analysis and completion of the Dissertation/Project work.

The Dissertation will be selected in consultation with the faculty members decided by Head of the department, according to their specialization. Dissertations/Project work will typically be a document of about 100-150 pages with sections in the following sequence: Introduction, Objectives, Hypothesis (if necessary), Research design/ Methodology, Results, Discussion, Conclusion and Suggestions, Literature cited etc. Presentation and Viva-Voce of the Dissertation/Project work will be in the presence of External examiner and faculty of the department .

Three typed copies of analyzed data is to be submitted in the department in the form of a Dissertation/ Project Report.



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*Choice Based Paper for Student for Other Disciplines*

**PAPER: I BASICS IN ANTHROPOLOGY**

Credit : 03

MAX Marks : 80

MIN Marks: 27

**UNIT-I**

- Anthropology: Definition, Branches
- Man's Place among Primates.
- Primate: Definition, Evolutionary trends.
- Blood Groups: Types, Distribution, Inheritance.

**UNIT - II**

- Archaeology: Definition, Branches, Objectives
- Outline of Indian Archaeological Cultures
- Tool Technology

**UNIT-III**

- Tribe: Definition & Characteristics Features
- Culture: Meaning, Definition & Characteristics
- Ethnographic Methods.


**Recommended Readings:**

1. Barnouw, V. 1979. Anthropology: A General Introduction, The Dorsey Press, Illinois.
2. Holmes, L. D. Anthropology: An Introduction, The Ronald Press Company, New York.
3. Sharma and Sharma. 1997. Anthropology, Atlantic Publishers and Distributors, New Delhi.
4. Hunter & Whitten. The Study of Cultural Anthropology, Harper & Row Publishers, New York.
5. Moore, A. 1978. Cultural Anthropology, Harper & Row Publishers, New York.
6. Kaplan, D. & Manners, R. A. Culture Theory, Prentice Hall of India Private Ltd., New Delhi.
7. Comas, J. 1960. Manual of Physical Anthropology, Springfield, Charles C. Thomas.
8. Sarkar, R. M. 1976. Fundamentals of Physical Anthropology. Blackie (India).
9. Das, B. M. 1985. Outlines of Physical Anthropology, Kitab Mahal, New Delhi.

10. Shrivastav, A. R. N. 1994. Sharirik Manav Vigyan (in Hindi), Gyandeeep Prakashan, Allahabad.
11. A grawal, D.P. & M.G. Yadava. 1995. Dating the human past.
12. Bhattacharya, D.K. 1977. Palaeolithic Europe.
13. Bordes, F. 1968. The Old Stone age. Weidenfeld and Nicolson.
14. Burkitt, M.C. 1969. Old Stone Age: Study of Palaeolithic Times.
15. Campbell, B. C. 1979. Humankind emerging, II edition.
16. Goode & Hatt. Methods in Social Research.
17. Young, P. V. Scientific Social Surveys and Research.
18. Danda, Ajit. Research Methodology in Anthropology, Inter- India, New Delhi.
19. Gupta, S. P. Statistics Methods.
20. Elhance, D. N. Practical Problems in Statistics, Kitab Mahal, Allahabad.
21. Levin, J. Elementary Statistics in Social Research.
22. Sarin, S.S. and Balchandani, M.K. Fundamentals of Statistics. Ratan Prakashan Mandir, Agra.



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*Choice Based Paper for Student for Other Disciplines*

**PAPER - II: APPLICATIONS OF ANTHROPOLOGY**

Credit : 03

MAX Marks : 80

MIN Marks: 27

**UNIT-I**

- Applied Biological Anthropology.
- Applications of Human Genetics.

**UNIT - II**

- Nutritional Anthropology.
- Anthropology of Sports.
- Applied anthropology in industry.
- Applied anthropology in education.

**UNIT-III**

- Applied Social Anthropology
- Action Anthropology.

**Recommended Readings:**

1. Kroeber. Anthropology Today.
2. Curt Stern. 1968. Principles of Human Genetics. Eurasia Publishing House (Pvt.) Ltd., Ram Nagar, New Delhi-1(India).
3. Steine. Biosocial Genetics.
4. Karp. F. Genetic Engineering.
5. Bodmer and Cavalli-Sforza. Genetics of Human Populations.
6. Backer, PT and Weiner (Eds), The Biology of Human Adaptability.
7. Beal, Virginia, Nutrition and the Life Span
8. Craig. Human Development
9. Eveleth, PB and Tanner, JM Worldwide Variation in Human Growth
10. Forbes, GB, Human Body Composition
11. Sodhi, HS. Sports Anthropology
12. Willigt, JV, Applied Anthropology: An Introduction
13. Stern, C., Principles of Human Genetics.
14. Shukla, B.R.K. & Rastogi, S., Physical Anthropology and Human Genetics An Introduction.
15. McKusick, V.A., Human Genetics.







**Pt. Ravishankar Shukla University, Raipur**  
**PG Diploma in Criminology and Forensic Science [Credit System]**  
**Scheme of Examination**

July 2019-December 2019					
FIRST Semester	Paper No.	Title of Papers	Marks		Credit
			(External)	(Internal)**	
	I	Fundamentals of Forensic Science and Physical Evidence	80	20	8
	II	Fundamentals of Criminology	80	20	8
	LC-I	Lab Course-I	80	20	4
	<b>Total</b>		300		20
January 2020-June 2020					
SECOND Semester	Paper No.	Title of Papers	Marks		Credit
			(External)	(Internal)**	
	I	Toxicology, Forensic Chemistry and Forensic Biology	80	20	8
	II	Fundamentals of Police Science	80	20	8
	LC-II	Lab Course-II	80	20	4
	<b>Total</b>		300		20

**P.G. Diploma in Criminology and Forensic Science**

**Semester I**

**July 2019- December-2019**

 *Shahnavaz*    


**Semester I**  
**Paper - I**  
**Fundamentals of Forensic Science and Physical Evidence**

MAX. Marks- 80

MIN. Marks - 27

**UNIT - I**

Definition, History, Development and Scope of Forensic Science.  
Scene of Crime and Collection of Physical Evidences, Packing and sending for analysis.  
Sketching of Crime Scene Spot.  
Introduction of Forensic Photography, Role of Photography in Forensic Science.  
Camera: Its parts and functioning, Enlarger and other Equipments used in Photography,  
Developing and Printing methods.

**UNIT- II**

Forensic Science and Jurisprudence, Medical Jurisprudence.  
Forensic Examination in Burning, Firearms, Poisoning, Railway cutting,  
Stabbing explosion, Sexual offences  
Death: Cause of Death, Death from Asphyxia: Drowning, Hanging, Strangulation,  
Throttling.  
Procedure in Court as per Criminal Procedure Code  
Indian Evidence Act- 45, Sections 59-73 and Sections 137 & 138.

**UNIT- III**

Introduction and Classification of Questioned Documents.  
Examination of Documents.  
Basis of Handwriting Identification – Individuality of Handwriting  
Various Writing Features and Their Estimation.  
Examination of Signatures.  
Examination of Alterations, Erasers, Over Writing, Additions and Obliterations.



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## UNIT -IV

Dermatoglyphics in Criminology & Forensic Science

History of Dermatoglyphic Prints developments

Personal identification from Finger prints

Types and Classification of Finger Prints (Henry' s Classification)


Battley' s Single Print Classification

Development and Lifting of Latent Finger Prints

Finger prints problems, Foot print, Palmar, Sole & Toe Prints, Tool marks, Lip prints.

### *References:*

1. R. Safferstin: Hand book of forensic science
2. Ohara & Osterburn : Criminalistics
3. P.L.Krik : Criminalistics
4. B.R. Sharma: Forensic Science in criminal investigation & crime
5. C.R. Parikh: Parikh' sTextbook of Medical Jurisprudence & Toxicology
6. J.V.P. Conway: Evidential Documents
7. S. Goldblatt: Document Evidence & Identification
8. C.Cummins & R. Midlo: Introduction to Dermatographics: Finger, Sole & Toe.
9. Albert Osborn Questioned documents.
10. Chales. C. Thomas Type writing identification
11. Hardless. H.R. Disputed document, handwriting and thumbs print identification.
12. Wilson. R. Harrison Suspended documents – their scientific examination
13. Hilton Scientific Examination of questioned documents
14. R.A. Goegory Scientific identification of disputed documents, Finger Prints &
15. W.R. Harris Suspected Documents

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**Semester I**  
**Paper - II**  
**Fundamentals of Criminology**

Max. Marks- 80

Min.Marks - 27

**UNIT -I**

Definition, aims, nature and scope of Criminology.  
History and Development of Criminology.  
Role of Criminology in Forensic Science.  
Relationship of Criminology with other sciences: Forensic science, Psychology,  
Anthropology, Sociology and Law.  
Schools of Criminology and its Concept.  
Pre-classical School: Demonological, School of Freewill, Classical School, Neo- Classical  
School, Geographical School, Socialistic School, Italian School, Psychological School,  
Multifactor Theory

**UNIT-II**

The Characteristics and Relationship of Concept of Crime.  
The Concept of Crime and its Socio-Legal Aspects.  
The Causes of Crime, its level and General Description  
The Differentiation approach to the assessment of Cause of Crime  
The inter connections of Social and Biological in the Cause of Crime.  
Biological problems in the complex of Anti Social Behavior

**UNIT -III**

Criminal Psychology  
Prevention of crime  
The concept of Social Prevention and limits of its functioning  
The basic principle of the Legal regulation of Social Prevention  
Juvenile Court, Rehabilitation Homes, Reformatories





#### UNIT -IV

Objects of Punishment and its Critical Analysis

Modern concept of Penology

Capital Punishment






Prison System

Modern Concept of Prison

Reformation in Judicial System

#### Recommended Books:

1. Barns & Teeters: New Horizon in Criminology
2. Conkin: Criminology
3. Suderland and cressy: The Principals of Criminology
4. Siegel Laary, J: Criminology
5. Singh Shyamdhar: Essentials of Criminology (Hindi)



## Semester I

### Lab Course - I

Max. Marks- 80

Min.Marks - 27

1. Over view of instruments.
2. Sketching of Crime scene spot and collection of Physical evidences.
3. Its Packing, Preservation and Sending.
4. Recording, Identification & Classifications of Dermatoglyphic Prints.
5. Development of Latent finger prints on glass, paper, wall, polished surface etc.
6. Photography of Latent Finger Prints, Casting of Foot prints.
7. Photographic Techniques.
8. Preliminary Examination of Questioned Documents.
9. Examination of Ink by Thin Layer Chromatography (TLC).
10. Classification of Fingerprints by Henry's Ten Digit Classification.
11. Examination of Tool marks using Comparison Microscope.
12. Classification of Lip prints: Suzuki and Tuschihasi classification.

#### References:

1. R. Safferstin: Handbook of forensic science
2. Ohara & Osterburn: Criminalistics
3. P.L.Krik: Criminalistics
4. B.R. Sharma: Forensic Science in criminal investigation & crime
5. C.R. Parikh: Parikh's Textbook of Medical Jurisprudence & Toxicology
6. J.V.P. Conway: Evidential Documents
7. S. Goldblatt: Document Evidence & Identification
8. C.Cummins & R. Midlo: Introduction to Dermatographics: Finger, Sole & Toe.
9. Albert Osborn Questioned documents.
10. Chales. C. Thomas Type writing identification
11. Hardless. H.R. Disputed document, handwriting and thumbs print identification.

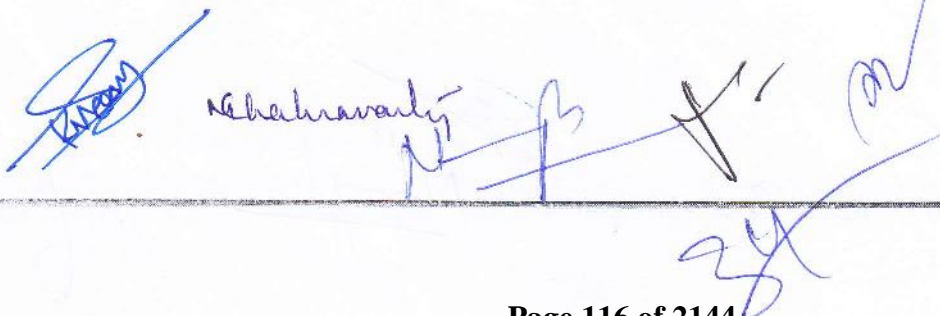
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P.G. Diploma in Criminology and Forensic Science

Semester II

January 2020- June 2020

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**Semester II**  
**Paper-I**  
**Toxicology, Forensic Chemistry and Forensic Biology**

MAX. Marks- 80

MIN. Marks - 27

**UNIT- I**

Toxicology: Definition.  
Classification of Poisons.  
Various types of Plant Poisons.  
Study of Insecticides and Pesticides.  
Examination of Poisons in Viscera, Blood and Urine.

**UNIT -II**

Introduction to Narcotic Drugs and Psychotropic Substances (NDPS) Act 1985.  
General Study of Narcotic Drugs and Psychotropic Substances.  
Examination of Narcotic Drugs.  
Adulteration in Jewelleries, Petroleum Products.  
Examination of Inflammable Liquids like Kerosene, Petrol, Diesel.

**UNIT -III**

Introduction to Forensic Biology  
Study of Body Fluids and Biological Materials: Blood, Urine, Saliva, Semen, Vaginal Swab, Vomit, Hair and Fibres, DNA.  
Role of DNA in Paternal and Maternal Disputes.  
DNA Fingerprinting and personal identification.  
Forensic Examination of Body Fluids and Biological Materials.  
Wildlife Forensics: Its role and Importance.





#### UNIT -IV

Introduction to Forensic Anthropology

Identification of Bone – Morphological, Anatomical Characteristics, Determination of Age, Sex, Race, Stature.

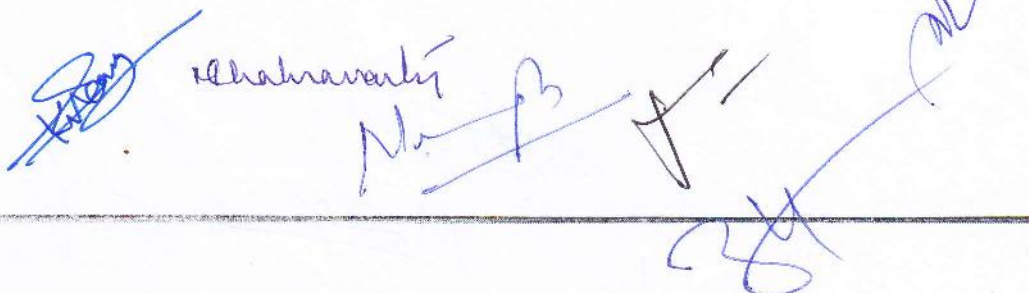
Forensic Odontology: Definition, Pattern, Type and Structure of Teeth, Age determination Identity of Person

Study of Bite Marks and their Forensic Significance.

Role in mass disaster, Diseases of teeth and their significance in personal identification.

#### References:

1. R. Safferstin: Handbook of Forensic Science
2. Ohara & Osterburn : Criminalistics
3. P.L.Krik : Criminalistics
4. B.R. Sharma: Forensic Science in Criminal Investigation & Crime
5. C.R. Parikh: Parikh' s Textbook of Medical Jurisprudence & Toxicology
6. Surinder Nath Forensic Anthropology
7. Forensic Toxicology Manual, Ministry of Home Affairs, DFS

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**Semester II**  
**Paper-I**  
**Toxicology, Forensic Chemistry and Forensic Biology**

MAX. Marks- 80

MIN. Marks - 27

**UNIT - I**

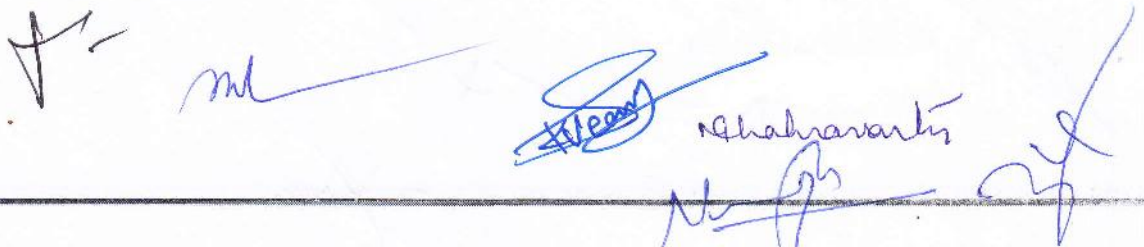
Toxicology: Definition.  
Classification of Poisons.  
Various types of Plant Poisons.  
Study of Insecticides and Pesticides.  
Examination of Poisons in Viscera, Blood and Urine.

**UNIT -II**

Introduction to Narcotic Drugs and Psychotropic Substances (NDPS) Act 1985.  
General Study of Narcotic Drugs and Psychotropic Substances.  
Examination of Narcotic Drugs.  
Adulteration in Jewelleries, Petroleum Products.  
Examination of Inflammable Liquids like Kerosene, Petrol, Diesel.

**UNIT -III**

Introduction to Forensic Biology  
Study of Body Fluids and Biological Materials: Blood, Urine, Saliva, Semen, Vaginal Swab, Vomit, Hair and Fibres, DNA.  
Role of DNA in Paternal and Maternal Disputes.  
DNA Fingerprinting and personal identification.  
Forensic Examination of Body Fluids and Biological Materials.  
Wildlife Forensics: Its role and Importance.



#### UNIT -IV

Introduction to Forensic Anthropology

Identification of Bone – Morphological, Anatomical Characteristics, Determination of Age, Sex, Race, Stature.

Forensic Odontology: Definition, Pattern, Type and Structure of Teeth, Age determination Identity of Person

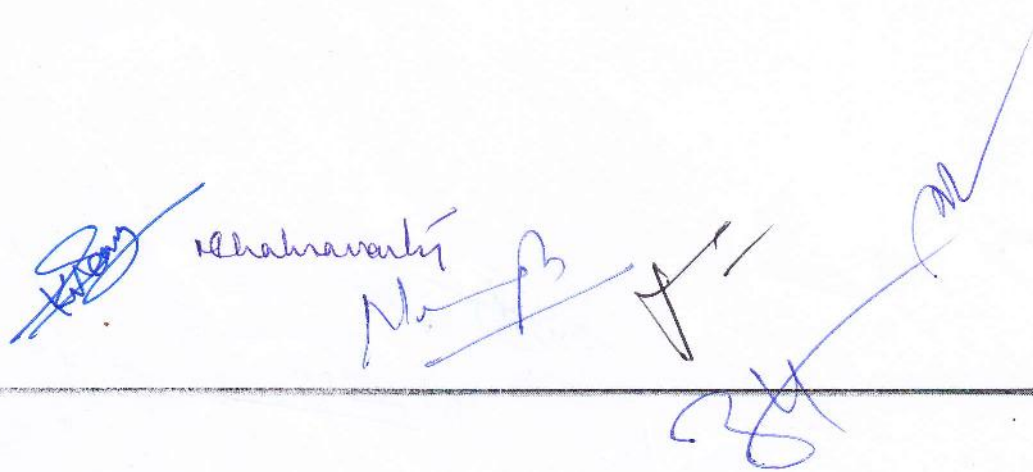
Study of Bite Marks and their Forensic Significance.

Role in mass disaster, Diseases of teeth and their significance in personal identification.

▲

#### References:

1. R. Safferstin: Handbook of Forensic Science
2. Ohara & Osterburn : Criminalistics
3. P.L.Krik : Criminalistics
4. B.R. Sharma: Forensic Science in Criminal Investigation & Crime
5. C.R. Parikh: Parikh's Textbook of Medical Jurisprudence & Toxicology
6. Surinder Nath Forensic Anthropology
7. Forensic Toxicology Manual, Ministry of Home Affairs, DFS

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**Semester II**  
**Paper - II**  
**Fundamentals of Police Science**

MAX. Marks- 80

MIN. Marks - 27

**UNIT- I**

History and Development of Police System.  
Reformation of Police System.  
Application of Police in maintenance the Law and Order.  
Limitations of Police System with reference to Human Rights

**UNIT- II**

Investigation of the following cases:

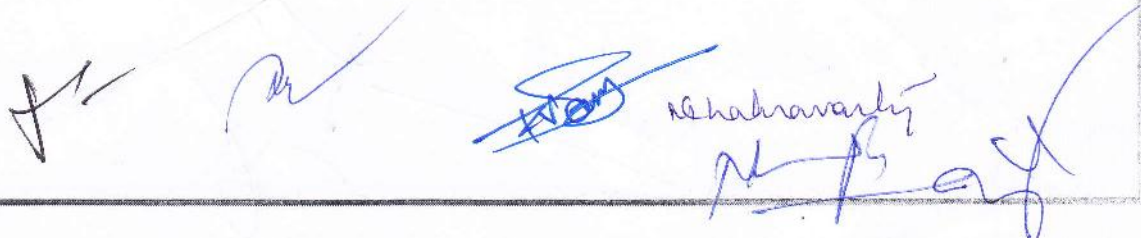
1. Murder
2. Theft and Burglary
3. Road, Railway and Air Accidents
4. Arson
5. Sting Operation

**UNIT- III**

First Information Report, Search, Seizure, Arrest  
Interrogation, Final Crime Theory, Preparation of Charge sheet.  
Procedure in Court as per Criminal Procedure Court  
Simons Trial, Warrant Trial, Case Diary.

**UNIT- IV**

Role of Community in Police Corruption.  
Use of Criminal Profiling in Crime Investigation.  
Police System in India and its various organizations  
Modernization of Police System with reference to Control system and Modern equipment

  
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Semester II  
Paper - III  
Lab Course - II


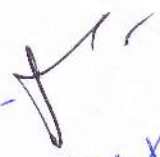

Max. Marks- 80

Max.Marks - 27

1. Determination of height of an individual by the long bones.
2. Determination of Sex of an individual by the Skull, Pelvic, Girdles and Long bones.
3. Determination of age of an individual by the skull and Long bones.
4. Identification of Drugs, Pesticides by Thin Layer Chromatography (TLC).
5. Preliminary and Confirmatory Examination of Blood.
6. Examination of Saliva.
7. Isolation of DNA from Blood, Saliva, Hair root.
8. Personal identification through DNA markers
9. Morphological & Microscopic examination of hair and fibers.
10. Examination of Inflammable liquids.
11. Analysis and Study of Bite Marks.

References:

1. R. Safferstin: Handbook of Forensic Science
2. Ohara & Ostarburn : Criminalistics.
3. P.L.Krik : Criminalistics
4. B.R. Sharma: Forensic Science in Criminal Investigation & Crime
5. C.R. Parikh: Parikh's Textbook of Medical Jurisprudence & Toxicology
6. Surinder Nath: Forensic Anthropology
7. Forensic Toxicology Manual, Ministry of Home Affairs, DFS

  
Neha Chavanti  
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## PROPOSED COURSE WORK FOR Ph. D. IN ANTHROPOLOGY 2020

All eligible candidates for Ph.D., after being qualified in the Ph.D. entrance examination shall be required to undertake course work for a minimum period of one semester. The candidates possessing M.Phil. Degree from a recognized university shall be exempted from the Ph.D. Course work as per the revised Ordinance No. 45.

On the recommendation of the supervisor(s), the course work may be carried out by the candidates in sister schools/departments/institutes either within or outside the university.

The candidate failing to pass the course with 50% marks shall have to reappear at the examination within the next twelve months.

The scheme of course work for Ph.D. is as under:

S.No.	Course No.	Title of the Paper	Marks
1	I	Research Methodology and Computer Applications	100
2	II	Review of Concerned Literature, Seminar and Project Work	100
Total			200

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N. Ghosh  
2 Years  
Shahawarty



PROPOSED COURSE WORK FOR Ph. D. IN ANTHROPOLOGY

Course No. I: Research Methodology and Computer Applications

Maximum Marks: 100

The course is designed to examine theories of research methods in Anthropology. This part will be done through lectures, assigned reading, class discussions and individual consociation. Students will not only learn various techniques for collecting and analyzing information but its appropriate use and limitations. A variety of tools will be addressed to. It also includes problems of access, reports and ethics in conducting research; data gathering through interviewing, participant observation, personal documents, photos, tapes; data collection; computer applications; and analysis and interpretation in context of theory. It deals with theory and methodology of research.

Unit 1. Research Process: An Overview

- a. Field work, Survey, investigation
- b. Inductive and Deductive reasoning
- c. Reality, Observable Universe, Theory and Fact
- d. Hypothesis
- e. Research Design.

Unit 2. Recent Methods, Techniques and Approaches

- a. Participatory Research
- b. Action Research
- c. Operations Research
- d. Public-Private Partnership
- e. Mixed Methods

Unit 3. Quantitative Methods

- a. Management of data
- b. Basic Statistical Concepts: Measures of Central Tendency, Measures of dispersion
- c. Parametric test-t Test, ANOVA
- d. Non Parametric test-Chi-square test
- e. Correlation, Pearson's (grouped and ungrouped)
- f. Multivariable Statistics: Multiple regressions, Factor analysis

- g. Software's – a. SPSS b. Microsoft office

#### Unit 4. Qualitative Methods

- a. Philosophy of Qualitative research
- b. Research Methods
- c. Tools and Techniques
- d. Qualitative data analysis

#### Unit 5. Scientific writing skills

- a. Thesis, Report, Scientific Papers in journals and Book Chapters
- b. Writing and scientific research proposal
- c. References, Bibliographies & related Software: Different citation styles (APA, MLA, Chicago etc), Mandalay
- d. Citation, Impact Factor, h-index
- e. Online Scientific databases: Journals, Achieves, JSTOR, UGC- Infonet and others, Census of India, NFHS and DHS databases, Secondary data its use in Anthropological Research
- f. How to make Presentation: Flash Presentation
- g. Plagiarism and related Software

#### REFERENCES:

Natasha Mack, Cynthia Woodson, Kathleen M. Macqueen, Greg Guest, Emily Namey, 2005; Qualitative Research Methods: A Data Collector's Field Guide, Family Health International, North Carolina, USA.

K. / Lincoln, Yvonna S: Competing paradigms in qualitative research, in: Denzin, Norman Theories and issues 2nd edition, Sage, London, 2003.

Silverman, David: Interpreting qualitative data. Methods for analyzing talk text and interaction, Sage London, 1993.

Keohane, Robert O. / King, Gary / Verba, Sidney: Designing social inquiry –Scientific inference in qualitative research, Princeton 1994.

Creswell, John W.: Qualitative, quantitative and mixed methods approaches, Sage, London, 2003.



C. Frankfort-Nachmias, & Nachmias, D 1996 'Research Methods in Social Sciences', Arnold, London.

Danda Ajit 1992 'Research Methodology in Anthropology', Inter-India, New Delhi.

Pelto, P.S. & Pelto, G.H. 1979 'Anthropological Research', Cambridge University Press, London.

Wilkinson, T.S. & Bhandarkar, P.L. 1994 'Methodology and Techniques of Social Research', Himalaya Publishing House, Bombay.

W. Laurence Neuman 1997 'Social Research Methods', Allyn & Bacon.

Fetterman David 1989 'Ethnography Step by Step', Sage publication.

Hammersley, M 1983 'Ethnography Principles in Practice Tavistock Publication

Royal Anthropological Inst. Of G. Britain & Ireland 1967 'Notes and Queries on Anthropology', Routledge and Kegan Paul Ltd. London.

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N/A

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Shahnavaty



**COURSE WORK FOR Ph. D. IN ANTHROPOLOGY**  
**Course No. II: Review of Concerned Literature, Seminar and Project Work**

Maximum Marks: 100

The course aims at capacity building of the student in taking up independent research programme. The students are required to submit 3 copies of the synopsis based on literature review and pilot study in community/Laboratory as per nature of proposed research topic.

Standard methods of citation of references of bibliography, as applicable in Anthropology, to be followed. Three typed copies of proposed research work will be presented in the form of synopsis / Pilot Proposed report.

Distribution of Marks		
1.	Review of relevant literature	20
2.	Seminar	20
3.	Synopsis / Pilot Project Report	60
Total		100

  
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# SCHOOL OF STUDIES IN BIOTECHNOLOGY

Pt. Ravishankar Shukla University  
Raipur 492 010, Chhattisgarh



## Syllabus

BIOTECHNOLOGY

M. Sc.  
(Semester System)

Session

2019-2020

2020-2021

*Mestalk*  
28/12/18

*P. S. Sahu*  
28/12/18

*S. S. Sahu*  
28/12/18

*Desai*  
28/12/18

*A. M. M. M.*  
28/12/18



<b>SCHEME OF EXAMINATION FOR SESSION 2019-2021</b>				
<b>SCHOOL OF STUDIES IN BIOTECHNOLOGY</b>				
<b>PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR</b>				
<b>M. Sc. BIOTECHNOLOGY (Semester I to IV)</b>				
<b>July 2019 – December 2019</b>				
<b>First Semester</b>	<b>Paper</b>	<b>Title of Paper</b>	<b>Marks</b>	
			<b>(External)</b>	<b>(Internal)**</b>
	<b>1*</b>	Cell Biology	<b>80</b>	<b>20</b>
	<b>2</b>	Genetics	<b>80</b>	<b>20</b>
	<b>3</b>	Microbial Physiology	<b>80</b>	<b>20</b>
	<b>4</b>	Bio-molecules	<b>80</b>	<b>20</b>
	<b>LC-1</b>	Lab Course 1 (Based on paper 1 & 2)	<b>80</b>	<b>20</b>
	<b>LC-2</b>	Lab Course 2 (Based on paper 3 & 4)	<b>80</b>	<b>20</b>
		<b>Total</b>	<b>600</b>	
<b>January 2020 – June 2020</b>				
<b>Second Semester</b>	<b>Paper</b>	<b>Title of Paper</b>	<b>(External)</b>	<b>(Internal)</b>
	<b>5</b>	Biostatistics, Bioinformatics & Computers in Biotechnology	<b>80</b>	<b>20</b>
	<b>6</b>	Molecular Biology	<b>80</b>	<b>20</b>
	<b>7</b>	Plant Biotechnology	<b>80</b>	<b>20</b>
	<b>8</b>	Macromolecules & Enzymology	<b>80</b>	<b>20</b>
	<b>LC-3</b>	Lab Course 3 (Based on paper 5 & 6)	<b>80</b>	<b>20</b>
	<b>LC-4</b>	Lab Course 4 (Based on paper 7 & 8)	<b>80</b>	<b>20</b>
		<b>Total</b>	<b>600</b>	
<b>July 2020 – December 2020</b>				
<b>Third Semester</b>	<b>Paper</b>	<b>Title of Paper</b>	<b>(External)</b>	<b>(Internal)</b>
	<b>9</b>	Genetic Engineering	<b>80</b>	<b>20</b>
	<b>10</b>	Biology of Immune System	<b>80</b>	<b>20</b>
	<b>11</b>	Bioprocess Engineering & Technology	<b>80</b>	<b>20</b>
	<b>12</b>	Environmental Biotechnology	<b>80</b>	<b>20</b>
	<b>LC-5</b>	Lab Course 5 (Based on paper 9 & 10)	<b>80</b>	<b>20</b>
	<b>LC-6</b>	Lab Course 6 (Based on paper 11 & 12)	<b>80</b>	<b>20</b>
		<b>Total</b>	<b>600</b>	
<b>January 2021 – June 2021</b>				
<b>Fourth Semester</b>	<b>Paper</b>	<b>Title of Paper</b>	<b>(External)</b>	<b>(Internal)</b>
	<b>13</b>	IPR, Biosafety, Bioethics and Nanobiotechnology	<b>80</b>	<b>20</b>
	<b>14</b>	Advanced techniques in Biotechnology	<b>80</b>	<b>20</b>
	<b>15</b>	Animal Biotechnology	<b>80</b>	<b>20</b>
	<b>16</b>	Genomics & Proteomics	<b>80</b>	<b>20</b>
	<b>LC-7</b>	Lab Course 7 (Based on paper 13 & 14)	<b>80</b>	<b>20</b>
	<b>LC-8</b>	Lab Course 8 (Based on paper 15 & 16)	<b>80</b>	<b>20</b>
		<b>Total</b>	<b>600</b>	
		<b>OR</b>		
		<b>Project Work***</b>	<b>600</b>	
		Dissertation	<b>240</b>	<b>60</b>
		Seminar based on project	<b>160</b>	<b>40</b>
		Viva-voce	<b>80</b>	<b>20</b>
		<b>Grand total [Semester I + II + III + IV]</b>	<b>2400</b>	

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Reshoo  
Dalk

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\*Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) -type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.

\*\*1. Each student will be evaluated continuously throughout the semester.

2. There will be a class test based on each theory paper. The full marks will be 10 for each paper.

3. There will be a poster/oral presentation based on each theory paper. The full marks will be 10 for each presentation.

4. Each student will be required to submit a brief write-up (not more than 20 pages) on his/her poster/oral presentation.

\*\*\* 1. A student of IV semester will have the option to opt for project work in lieu of four theory papers and two lab courses provided he/she secures at-least 65% or more marks in aggregate in semester I and II.

2. The project has to be carried out in recognized national laboratories or UGC recognized universities. No student will be allowed to carry out project in private laboratories/ college/ institutions, excluding the colleges recognized as research centers by the RDC of Pt. Ravishankar Shukla University, Raipur.

3. The valuation of all the projects will be carried out by the external examiner and HoD of UTD or its nominee at the UTD Centre.

- M.Sc. Students of Biotechnology have to attend one excursion or visit in one academic year (within or outside Chhattisgarh)

*Sharma* *RSahy*

*Meitank*  
28/12/18

*Bobby*

*28/12/18*

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# School of Studies in Biotechnology

## Scheme of Examination: Semester I

Paper Code	Title of Theory/Practical Paper	Marks		
		External	Internal	Total
1	Cell Biology	80	20	100
2	Genetics	80	20	100
3	Microbial Physiology	80	20	100
4	Bio-molecules	80	20	100
Lab Course 1	Based on Theory papers 1, 2	80	20	100
Lab Course 2	Based on Theory papers 3, 4	80	20	100
	<b>Total Marks</b>			<b>600</b>

*Rishav*  
*Prakash*

*Mutak*  
*28/12/18*

*Baby*

*28/12/18*

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# School of Studies in Biotechnology

## Semester I

### Paper 1: Cell Biology

M.M.80

#### Unit-I

1. Cell theory
2. Prokaryotic cells: Structure and function – Cell walls of eubacteria (peptidoglycan) and related molecules: Outer – membrane of Gram negative bacteria; Cell wall and cell membrane synthesis; Cell inclusions like endospores, gas vesicles.
3. Diversity of cell size and shape; diversity in prokaryotic and eukaryotic cells.

#### Unit-II

1. Eukaryotic cells: cell wall; plasma membrane; endoplasmic reticulum; golgi apparatus; lysosome; peroxisome; ribosome; mitochondria; chloroplast; nucleus; nucleolus; chromosome.
2. Transport of nutrients and macromolecules: osmosis; ion channels; ion pumps; active transport; protein diffusion, nuclear transport; transport across membranes; molecular mechanisms of transport; regulation of intracellular transport; intracellular vesicular trafficking.

#### Unit-III

1. Mitosis, meiosis and their regulation; steps in cell cycle; regulation of cell cycle; cell-cell interactions.
2. Cell signalling: cellular receptors; signalling through G-protein coupled receptors; signal transduction pathways; second messengers; regulation of signalling pathways.
3. Cell motility: cilia and flagella of eukaryotes and prokaryotes.

#### Unit-IV

1. Production of gametes; cell surface molecules in sperm-egg interaction in animals; molecular events during fertilization in animals, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis.
2. Development in *Drosophila* and *Arabidopsis*; gene expression and its regulation. Spatial and temporal regulation of Gene Expression

**NOTE:** Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.

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**Books:**

1. Gerald Karp (2007) Cell and Molecular Biology. Fifth Edition.
2. Geoffrey M. Cooper; Robert E. Hausman (2009) The Cell: A Molecular Approach.
3. E. J. Ambrose and Dorothy M. Easty (1977) Cell Biology. Second Edition
4. C.B. Powar (2005) Cell Biology. Third Edition.
5. Tortora, Funke and Case (1998) Microbiology: An introduction. Sixth Edition  
Benjamin/Cummings Publishing Co.
6. Lewis J. Klein smith and Valerie M. Kish (2002) Principles of cell and molecular biology.  
Third Edition.
7. P. K. Gupta (2003) Cell and molecular biology. Second Edition, Rastogi publications.
8. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2008). Molecular  
Biology of the Cell (5th Ed.). New York: Garland Science.
9. Lodish, H. F. (2016). Molecular Cell Biology (8th Ed.). New York: W.H. Freeman.
10. Cooper, G. M., & Hausman, R. E. (2013). The Cell: a Molecular Approach (6th Ed.).  
Washington: ASM ; Sunderland.
11. Watson, J. D. (2008). Molecular Biology of the Gene (5th ed.). Menlo Park, CA:  
Benjamin/Cummings.

**List of Practical's:-**

1. To prepare the temporary stained slide of onion bulb peel to study the structure of plant cell.
2. To prepare the temporary stained slide of cheek squamous epithelial cells of mouth of Human  
Beings.
3. Preparation and Study of slide of mitosis using from onion root tips squash.
4. Schedule for study of mitotic index.
5. To determine the abnormal mitotic index.
6. Preparation and study of slide for meiosis using young anthers of *Allium cepa*.
7. To determine the meiotic index in the flower bud of *Allium cepa*.

# School of Studies in Biotechnology

Semester I

Paper 2: Genetics

M.M. 80

## Unit I

1. Introduction to genetics; Beginning of genetics as a science. Early studies involving genetics
2. Mendel and genetics; Mendel's laws of genetics; Physical and chemical basis of Heredity, Genetic variation.
3. Gene to Phenotype – Interactions between the Alleles of one gene, interfering gene interaction.
4. Fine structure of gene, Eukaryotic genome organization (Structure of chromatin, coding and non – coding sequences, satellite DNA); rearrangement in DNA. Central dogma

## Unit II

1. Regulation of gene expression in Prokaryotes and Eukaryotes; Attenuation and antitermination; Operon concept; DNA methylation.
2. Mutation; Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis. Changes in Chromosome number and structure - Euploidy and Aneuploidy, mutagens – UV and chemical mutagens, Ames test; Dosage compensation; Mutational Assay System.
3. Inheritance: Autosomal and sex linked inheritance, Extrachromosomal inheritance, Inheritance pattern. Inheritance of Organelle genes.

## Unit III

1. Variation; sources of variation; selection; Heritability of variation, Process of speciation; Origin of new genes. Hardyweinberg genetic equilibrium, genetic polymorphism and selection.
2. Genes and Quantitative traits; Genotypes and Phenotypic Distribution; Heritability of Quantitative Character; Quantifying Heritability; Polygenic inheritance, Locating genes, QTL mapping
3. Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

## Unit IV

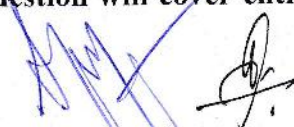
1. Bacterial Genetic system: Transformation, Conjugation, Transduction, Recombination, Plasmids and Transposons. Bacterial Genetic map with reference to *E.coli*.
2. Viruses and their Genetic system: Phage I and its life cycle; RNA phases; RNA viruses; Retroviruses
3. Genetic system of Yeast and Neurospora.
4. Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.

**NOTE: Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.**

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**Books:-**

1. Benjamin Pierce (2017) Genetics: A Conceptual Approach. Sixth Edition, W. H. Freeman
2. Griffiths, William M. Gelbart, Jeffrey H. Miller, Richard C. Lewontin and Anthony J.F. Griffiths (2009) Modern Genetic Analysis. W. H. Freeman
3. D. Peter Snustad, Michael J. Simmons (2007) Principles of Genetics. Wiley India Pvt Ltd.
4. Sandy Primrose and Richard Twyman (2016) Principles of Gene Manipulation and Genomics. Wiley-Blackwell

**List of Practical's:-**

1. Experiments for Mendel's experiments.
2. Studies of prokaryotic & eukaryotic cells.
3. Karyo-type studies.
4. To Performance and study of Mutation in bacteria.
5. To study polyploidy in onion root tips after treatment with colchicine.
6. To demonstrate Barr body in neutrophils by staining human blood smear.
7. Isolation of genetic material from Bacteria.

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# School of Studies in Biotechnology

## Semester I

### Paper 3: Microbial Physiology

M.M. 80

#### Unit I

1. Microbial Evolution, Systematics and Taxonomy –New approaches to bacterial taxonomy classification including ribotyping; Ribosomal RNA sequencing; Characteristics of primary domains; Nomenclature and Bergey's Manual.
2. Microbial Growth – growth curve, measurement of growth and growth yields; Synchronous growth; Continuous culture; Growth as affected by environmental factors like temperature, acidity, alkalinity, water availability and oxygen.

#### Unit II

1. Methods in Microbiology – Pure culture techniques; Theory and practice of sterilization; Principles of microbial nutrition; Types of culture media: defined and undefined media, selective and differential media, minimal and enrichment media; Enrichment culture techniques for isolation of chemoautotrophs, chemoheterotrophs and photosynthetic microorganisms.
2. Metabolic Diversity among Microorganisms – Photosynthesis in microorganisms; Calvin cycle; Chemolithotrophy; oxidizing and reducing bacteria; Methanogenesis and acetogenesis, syntrophy, Nitrogen metabolism; Nitrogen fixation.

#### Unit III

1. Bacteria: Purple and green bacteria; Cyanobacteria; Homoacetogenic bacteria; Acetic acid bacteria; Spirilla; Spirochaetes; Pseudomonads; Lactic and propionic acid bacteria; Endospore forming rods and cocci; Mycobacteria; Chlamydia's and Mycoplasmas.
2. Archaea: Archaea as earliest life forms; Halophiles; Methanogens; Hyperthermophilic Archaea; Thermoplasma.
3. Algae, Fungi, Slime moulds and Protozoa. Viruses: Bacterial, Plant and Animal viruses; Discovery, classification and structure of viruses; Lysogeny; DNA viruses; RNA viruses; Examples of Herpes, Pox, Adenoviruses, Retroviruses.

#### Unit IV

1. Microbial diseases –Infectious disease transmission; Sexually transmitted diseases including AIDS; Diseases transmitted by animals (rabies, plague), insects and ticks (Rickettsias, Lyme disease)
2. Host – Parasite Relationships – Normal microflora of Skin, Oral cavity, Gastrointestinal tract; Types of toxins (Exo -, Endo -, Entero -); Virulence and Pathogenesis.
3. Chemotherapy/Antibiotics – Antibiotics and Antimicrobial agents; Broad-spectrum antibiotics; Antibiotics from prokaryotes; Antifungal antibiotics; Mode of action; Resistance to antibiotics.

**NOTE:** Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.



### Books:

1. Roger Y. Stanier, John L Ingraham, Mark L Wheelis, Rage R Painter (1992) General Microbiology. Fifth edition. The Macmillan Press Ltd.
2. Michael T. Madigan, John Martinko, Jack Parker Brock Biology of Microorganisms. Tenth edition, Prentice-Hall.
3. Pelczar, M.J. Jr., Chan, E.C.S. and Kreig, N.R. (2009) Microbiology. Tata McGraw Hill
4. Maloy, S.R., Cronan, J.E. Jr. and Freifelder, D. Jones (1994) Microbial Genetics. Second edition, Bartlett Publishers.
5. James G. Cappuccino, Natalie Sherman (1996) Microbiology: A Laboratory Manual. Benjamin-Cummings Pub Co.
6. Lansing Prescott, John Harley, and Donald Klein (2001) Microbiology. Fifth edition. McGraw Hill
7. Tortora, Funke and Case (2016) Microbiology. Tenth Edition, Pearson Education.
8. L Y Kun (2003) Microbial Biotechnology: Principles and applications, Microbiology and Environmental Toxicology, Sharad Saxenda, Published by Manglam Publications.
9. Willey, J. M., Sherwood, L., Woolverton, C. J., Prescott, L. M., & Willey, J. M. (2011). Prescott's Microbiology. New York: McGraw-Hill.
10. Matthai, W., Berg, C. Y., & Black, J. G. (2005). Microbiology, Principles and Explorations. Boston, MA: John Wiley & Sons.
11. Lee, Y. K. (2013). Microbial Biotechnology: Principles and Applications. Hackensack, NJ: World Scientific.

### List of Practical's:-

1. Preparation of liquid and solid media for growth of microorganisms.
2. Isolation and maintenance of organisms by plating, streaking and serial dilution methods. Slants and stab cultures. Storage of microorganisms.
3. Isolation of pure culture from soil and water.
4. Growth; Growth curve; Measurement of bacterial population by turbidity and serial dilution methods. Effect of temperature, pH and carbon nitrogen sources on growth.
5. Microscopic examination of bacteria, yeast and molds and study of organisms by Gram stain, Acid fast stain, staining for spores and lactophenol cotton blue mount.
6. Study of mutations by Ames test.
7. Assay of antibiotics and demonstration of antibiotics resistance.
8. Analysis of water for portability and determination of MPN.
9. Bacterial transformation.
10. Biochemical characterization of selected microbes.
11. Transduction
12. One step growth curve of bacteria

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# School of Studies in Biotechnology

Semester I

Paper 4: Bio-molecule

M.M. 80

## Unit I

1. Chemical foundations of Biology – pH, pK, acids, bases, buffers, weak bonds, covalent bonds.
2. Principles of thermodynamics and living system.

## Unit II

1. **Amino acids and peptides** – classification, chemical reactions and physical properties
2. **Sugars** – classification and reactions
3. Heterocyclic compounds and secondary metabolites in living systems – nucleotides, pigments, isoprenoids.

## Unit III

1. **Lipids** – classification, structure and functions.
2. **Proteins** – classification and separation, purification and criteria of homogeneity, end group analysis, hierarchy in structure, Ramachandran map.

## Unit IV

1. **Polysaccharides** – types, structural features, methods for compositional analysis
2. Analytical techniques in biochemistry and biophysics for small molecules and macromolecules for quantization.

**NOTE:** Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.



**Books:**

1. Nelson and Cox (2009) Principles of Biochemistry. Fifth Edition.
2. Albert L. Lehninger (2005) Biochemistry. Second Edition.
3. Todd and Howards Mason (2004) Text book of Biochemistry. Fourth Edition.
4. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer (2007) Biochemistry, Sixth Edition
5. Voet D, Voet JG & Pratt CW (2006) Fundamentals of Biochemistry Second Edition. Wiley.
6. Robert K. Murray, David A Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil (2007) Harper's Illustrated Biochemistry, 28<sup>th</sup> Edition.
7. Buchanan, Gruissemen & Jones (2015) Biochemistry & Molecular Biology of Plant, 2<sup>nd</sup> edition.
8. M. Debnath (2011) Tools and Techniques in Biotechnology.

**List of Practical's:-**

1. Qualitative test for Carbohydrate. (Molisch's test)
2. Qualitative test for Carbohydrate.(Anthrone test)
3. Qualitative test for Carbohydrate.(Benedict's test)
4. Qualitative analysis of Carbohydrate by Barfoed's test.
5. Qualitative test for amino acid by Ninhydrin reaction.
6. Qualitative test for amino acid by Xanthoprotic reaction.
7. Qualitative test for Proteins using Biuret test.
8. Qualitative test for amino acid by Millon's test.

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## Lab. Course 1

### Based on Theory Papers 1 and 2

**Time: 6 hrs.**

**Total Marks – 100**

Q.1 Experiment based on Theory paper 1 (one major & one minor)	30
Q.2 Experiment based on Theory paper 2. (One major & one minor)	30
Q.3 Spotting based on Theory paper 1 and 2	10
Q.4 <i>Viva Voce.</i>	10
Q.5 Sessional	20

## Lab. Course 2

### Based on Theory Papers 3 and 4

**Time: 6 hrs.**

**Total Marks – 100**

Q.1 Experiment based on Theory paper 3 (one major & one minor)	30
Q.2 Experiment based on Theory paper 4 (one major & one minor)	30
Q.3 Spotting based on Theory paper 3 and 4	10
Q.4 <i>Viva Voce.</i>	10
Q.5 Sessional	20

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**School of Studies in Biotechnology**  
**Semester II**

**Scheme of Examination**

Paper Code	Title of Theory/Practical Paper	Marks		
		External	Internal	Total
5	Biostatistics, Bioinformatics & Computers in Biotechnology	80	20	100
6	Molecular Biology	80	20	100
7	Plant Biotechnology	80	20	100
8	Macromolecules & Enzymology	80	20	100
Lab Course 3	Lab Course 3 (Based on paper 5 & 6)	80	20	100
Lab Course 4	Lab Course 4 (Based on paper 7 & 8)	80	20	100
	<b>Total Marks</b>			<b>600</b>

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# School of Studies in Biotechnology

## Semester II

### Paper 5: Biostatistics, Bioinformatics & Computers in Biotechnology

M.M. 80

#### Unit I

1. Brief description and tabulation of data and its graphical representation.
2. Measures of central tendency and dispersion: mean, median, mode, range, standard deviation, variance. Idea of two types of errors and level of significance.

#### Unit II

1. Simple linear regression and correlation.
2. Tests of significance (F & t tests), chi – square test.

#### Unit III

1. Introduction to Word processing, Spreadsheets and Presentation software.
2. Computer – Oriented statistical techniques: Frequency table of single discrete variable, Bubble sort, Computation of mean, variance and standard deviation.

#### Unit IV

1. Bioinformatics basics: Computers in biology and medicine.
2. Protein and nucleic acid databases; Biological background for sequence analysis.
3. Identification of protein sequence from DNA sequence; searching of databases similar sequence; NCBI; publicly available tools; database mining tools.
4. BTIS network in India.

**NOTE:** Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.

**Books:**

1. Animesh K. Dutta (2007) Basic Biostatistics and Its Application. New Central Book Agency (P) Ltd. Kolkata.
2. P.K. Banerjee (2006) Introduction to Biostatistics. 3<sup>rd</sup> edition. S. Chand & Company Ltd.
3. C.S.V. Murthy (2003) Bioinformatics. First Edition, Himalaya Publishing House.
4. S.C. Rastogi, Namita Mendiratta, Parag Rastogi (2003) Bioinformatics: Concepts, Skills and Applications, CBS Publishers and Distributors, New Delhi.
5. C. Subramanian (2004) A Text Book of Bioinformatics. Dominant Publishers and Distributors, New Delhi.
6. David W. Mount (2005) Bioinformatics: sequence and genome analysis. Second edition. CBS Publishers and Distributors, New Delhi, Bangalore (India).
7. David W. Mount (2004) Bioinformatics: sequence and genome analysis; CSHL press
8. C.S.V. Murthy (2003) Bioinformatics. First Edition, Himalaya Publishing House.
9. Johnathan Pevsner (2015) Bioinformatics and Functional, 3<sup>rd</sup> edition.
10. Rosner, B. (2000). Fundamentals of Biostatistics. Boston, MA: Duxbury Press.
11. Lesk, A. M. (2002). Introduction to Bioinformatics. Oxford: Oxford University Press.
12. Mount, D. W. (2001). Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
13. Baxevanis, A. D., & Ouellette, B. F. (2001). Bioinformatics: a Practical Guide to the Analysis of Genes and Proteins. New York: Wiley-Interscience.
14. Pevsner, J. (2015). Bioinformatics and Functional Genomics. Hoboken, NJ.: Wiley-Blackwell.
15. Bourne, P. E., & Gu, J. (2009). Structural Bioinformatics. Hoboken, NJ: Wiley-Liss.

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## List of Practical's:-

### Biostatistics

1. Calculate the mean value of given 20 leaves.
2. Calculate the median of the given sample of 20 leaves.
3. Find out the mode value of given 20 leaves.
4. To complete correlation of leaf length & breadth of a given leaf sample.
5. To perform the t-test for the given data of sample. (Leaves)
6. To perform the Chi- Square test for the given data.
7. To calculate Standard deviation from the data (Sample).

### Computer Application

1. Draw Histogram, Pie, Graph, Line graph.
2. Slide preparation.
3. Use of Internet in Research.
4. Perform spreadsheet application.
5. Compute statistical tools.

### Bioinformatics

1. Search nucleotide sequence of a target gene on NCBI website and BLAST it.
2. Find out amino acid sequence of a particular protein from protein database available on public domain and compare it with other proteins.

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# School of Studies in Biotechnology

## Semester II

### Paper 6: Molecular Biology

M.M.80

#### Unit I

1. Introduction to Molecular Biology
2. DNA Replication – Prokaryotic and eukaryotic DNA replication, Mechanics of DNA replication. Enzymes and accessory proteins involved in DNA replication.
3. DNA Repair and Recombination. Homologous recombination – Holiday junction, gene targeting, FLP/FRT and Cre/Lox recombination, RecA and other recombinases.

#### Unit II

1. Transcription – Prokaryotic transcription: RNA polymerase, Regulatory elements and mechanisms of transcription regulation, Transcription termination.
2. Transcription – Eukaryotic transcription: RNA polymerase, General and specific transcription factors, Regulatory elements and mechanisms of transcription regulation. Modification in RNA - 5' – cap formation, Transcription termination, 3' – end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA, mRNA stability

#### Unit III

1. Translation – Prokaryotic and Eukaryotic translation, the translation machinery, Mechanisms of initiation, elongation and termination, Regulation of translation, co – and post – translational modifications of proteins.
2. Protein Localization – Synthesis of secretory and membrane proteins, Import into nucleus, mitochondria, chloroplast and peroxisomes, receptor mediated endocytosis.

#### Unit IV

1. Oncogenes and Tumor Suppressor Genes – Viral and cellular Oncogenes, tumor suppressor genes from humans, Structure, Function and mechanism of action of pRB and p53 tumor suppressor proteins.
2. Antisense and Ribozyme technology – Molecular mechanism of Antisense molecules, inhibition of splicing, polyadenylation and translation, disruption of RNA structure and capping, Biochemistry of ribozyme; hammer – head, hairpin and other ribozymes, strategies for designing ribozymes, Applications of Antisense and ribozyme technologies.
3. Molecular Mapping of genome – Genetic and physical maps, physical mapping and map – based cloning, Southern and fluorescence *in situ* hybridization for genome analysis, Chromosome micro dissection and micro cloning.

**NOTE:** Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.

**Books:**

1. Gerald Karp (2007) Cell and molecular biology, 5<sup>th</sup> Edition.
2. Lewis J. Klein smith and Valerie M. Kish (2002) Principles of cell and molecular biology, Third Edition.
3. Richard M. Twyman (1998) Advanced Molecular Biology, First South Asian Edition, Viva Books Pvt. Ltd.
4. Benjamin Lewin (2007) Gene IX, 9<sup>th</sup> Edition, Jones and Barlett Publishers.
5. J.D. Watson, N.H. Hopkins, J.W Roberts, J. A. Seitz & A.M. Weiner (2007) Molecular Biology of the Gene, 6<sup>th</sup> Edition, Benjamin Cummings Publishing Company Inc.
6. TA Brown (2002) Genomes 2<sup>nd</sup> Edition; Bios Scientific Publishers.
7. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher, Hidde Ploegh and Paul Matsudaira (2008) Molecular Cell Biology, 6<sup>th</sup> Edition; WH Freeman.
8. Buchanan, Gruissem & Jones (2015) Biochemistry & Molecular Biology of Plant, 2<sup>nd</sup> edition.
9. M. Debnath (2011) Tools and Techniques in Biotechnology.
10. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2008). Molecular Biology of the Cell (5th Ed.). New York: Garland Science.
11. Lodish, H. F. (2016). Molecular Cell Biology (8th Ed.). New York: W.H. Freeman.
12. Cooper, G. M., & Hausman, R. E. (2013). The Cell: a Molecular Approach (6th Ed.). Washington: ASM ; Sunderland.

**List of Practical:-**

1. Extraction of DNA from plant leaves by CTAB methods.
2. Estimation of plant genomic DNA by Spectrophotometer methods.
3. Separation of plant genomic DNA by Agarose gel electrophoresis.
4. Extraction of DNA from animal cells.
5. Estimation of animal genomic DNA by Spectrophotometer methods.
6. Separation of animal genomic DNA by Agarose gel electrophoresis.
7. Separation of Bacterial proteins by vertical SDS-PAGE electrophoresis.
8. Extraction of RNA from Yeast cells.
9. Estimation of Yeast cellular RNA by Spectrophotometer methods.

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# School of Studies in Biotechnology

## Semester II

### Paper 7: Plant Biotechnology

M.M. 80

#### Unit I

1. Introduction to cell and tissue culture, tissue culture as a technique to produce novel plants and hybrids.
2. Tissue culture media (composition and preparation)
3. Initiation and maintenance of callus and suspension culture; single cell clones.
4. Organogenesis; somatic embryogenesis; transfer and establishment of whole plants in soil
5. Shoot – tip culture: Rapid clonal propagation and production of virus free plant

#### Unit II

1. Embryo culture and embryo rescue
2. Anther, pollen and ovary culture for production of haploid plants and homozygous lines
3. Protoplast isolation, culture and fusion; selection of hybrid cells and regeneration of hybrid plants; symmetric and asymmetric hybrids, cybrids.
4. Germplasm conservation – Cryopreservation and slow growth cultures

#### Unit III

1. Plant transformation technology: Basis of tumor formation, Mechanism of DNA transfer, Features of TI and RI plasmids, role of virulence genes, use of Ti and Ri as vectors, binary vectors, markers, use of reporter genes, 35S and other promoters, multiple gene transfers, particle bombardment, electroporation, microinjection.
2. Chloroplast Transformation: Advantages, vectors
3. Application of plant transformation for productivity and performance: herbicide resistance, insect resistance, Bt genes, Non – Bt like protease inhibitors & amylase inhibitors, virus resistance, nucleocapsid gene, disease resistance, PR proteins, nematode resistance, abiotic stress, long shelf-life of fruits and flowers, male sterile lines, bar and barnase systems.

#### Unit IV

1. Metabolic Engineering and Industrial Products: plant secondary metabolites, control mechanisms and manipulation of phenylpropanoid pathway, shikimate pathway, biodegradable plastics, therapeutic proteins, antibodies, edible vaccines.
2. Molecular Marker –RFLP maps, linkage analysis, RAPD markers, STS, microsatellites, SCAR (Sequence characterized amplified regions), SSCP (Single strand conformational polymorphism), AFLP, map based cloning, molecular marker assisted selection.

**NOTE: Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.**

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## Books:-

1. Razdan MK (2010) Introduction to Plant Tissue Culture 2<sup>nd</sup> Edition; Oxford & Ibh Publishing Co. Pvt Ltd.
2. Vasil IK (1994) Plant Cell and Tissue Culture; Springer.
3. Bhojwani SS and Razdan MK(1996) Plant Tissue Culture; Elsevier.
4. TJ Fu, G Singh and WR Curtis (Eds) (1999) Plant Cell and Tissue Culture for the production of Food Ingredient. Kluwer Academic/Plenum Press.
5. J Hammond, P McGarvey & V Yusibov (Eds)(2000) Plant Biotechnology, Springer Verlag.
6. H.S. Chawla (1998) Biotechnology in Crop Improvement, International Book Distributing Company.
7. H.S. Chawla (2000) Introduction to plant biotechnology. Oxford & IBH Publishing Co. (P) Ltd.
8. B.D. Singh, (2004) Biotechnology. Expanding Horizons. First Edition. Kalyani Publishers, Ludhiana.
9. Buchanan, Grissemen & Jones (2015) Biochemistry & Molecular Biology of Plant, 2<sup>nd</sup> edition.
10. M. Debnath (2011) Tools and Techniques in Biotechnology
11. Slater, A., Scott, N. W., & Fowler, M. R. (2008). Plant Biotechnology: an Introduction to Genetic Engineering. Oxford: Oxford University Press.
12. Glick, B. R., & Pasternak, J. J. (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. Washington, D.C.: ASM Press.
13. Brown, T. A. (2006). Gene Cloning and DNA Analysis: an Introduction. Oxford: Blackwell Pub.
14. Primrose, S. B., & Twyman, R. M. (2006). Principles of Gene Manipulation and Genomics. Malden, MA: Blackwell Pub.

## List of Practical's:-

1. Media preparation
2. Meristem / bud culture, shoot multiplication & rooting
3. Callus culture
4. Organogenesis
5. Somatic embryogenesis
6. Plantlet acclimatization
7. Embryo culture
8. Extraction of DNA from plant
9. Estimation of plant DNA by Agarose gel electrophoresis and Spectrophotometer
10. Study of molecular markers

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# School of Studies in Biotechnology

## Semester II

### Paper 8: Macromolecules and Enzymology

M.M. 80

#### Unit I

1. Macromolecules and supra molecules assemblies – Types of macromolecules in biological systems,
2. Molecular assemblies like membranes, ribosomes, extracellular matrix, chromatin
3. Sequencing of proteins and nucleic acids.

#### Unit II

1. Protein – protein and protein – ligand interactions, physical and chemical methods of study.
2. Conformational properties of polynucleotides and polysaccharides – secondary and tertiary structural features and their analysis – theoretical and experimental; protein folding – biophysical and cellular aspects

#### Unit III

1. Enzyme catalysis in solution – kinetics and thermodynamic analysis, effects of organic solvents on enzyme catalysis and structural consequences.
2. Physical and chemical methods for immobilization of enzyme.
3. Glyco and lipoproteins – structure and function

#### Unit IV

1. Protein denaturation
2. Ribozymes and Catalytic antibodies – Functional proteins – structure and drug targets (enzymes and receptors)
3. Nucleic acid hybridization – structural analysis and biological study.

**NOTE:** Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.

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### Books:

1. Nelson and Cox (2009) Principles of Biochemistry, 5<sup>th</sup> Edition.
2. Albert L. Lehninger(2005) Biochemistry, Second Edition.
3. Todd and Howards Mason (2004) Text book of Biochemistry, Fourth Edition.
4. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer (2007) Biochemistry, 6<sup>th</sup> Edition.
5. Voet D, Voet JG & Pratt CW (2006) Fundamentals of Biochemistry, 2<sup>nd</sup> Edition. Wiley
6. Robert K. Murray, David A Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil (2007) Harper's Illustrated Biochemistry, 28<sup>th</sup> Edition
7. M. Debnath (2011) Tools and Techniques in Biotechnology.

### List of Practical's:-

1. Qualitative assay of Protein by the Biuret method.
2. To estimation of Protein Qualitatively by Folin Lowry Method.
3. Estimation of cholesterol by the method of Crawford
4. Determine the activity of Alkalie Protease.
5. Determine the activity of neutral Protease.
6. Effect of temperature on the activity of  $\alpha$ -amylase.
7. Determine the activity of catalase.
8. Determine the activity of urease.
9. Perform protein isolation by SDS PAGE.
10. Enzyme kinetics.

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**Lab. Course 3**

**Based on Theory Papers 5, 6**

**Time: 6 hrs.**

**Total Marks – 100**

Q.1 Experiment based on Theory paper 5 (one major & one minor)	30
Q.2 Experiment based on Theory paper 6 (one major & one minor)	30
Q.3 Spotting based on Theory papers	10
Q.4 <i>Viva Voce</i> .	10
Q.5 Sessional	20

**Lab. Course 4**

**Based on Theory Papers 7 and 8**

**Time: 6 hrs.**

**Total Marks – 100**

Q.1 Experiment based on Theory paper 7 (one major & one minor)	30
Q.2 Experiment based on Theory paper 8 (one major & one minor)	30
Q.3 Spotting based on Theory papers	10
Q.4 <i>Viva Voce</i> .	10
Q.5 Sessional	20

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# School of Studies in Biotechnology

## Semester III

### Scheme of Examination

Paper Code	Title of Theory/Practical Paper	Marks		
		External	Internal	Total
9	Genetic Engineering	80	20	100
10	Biology of Immune System	80	20	100
11	Bioprocess Engineering & Technology	80	20	100
12	Environmental Biotechnology	80	20	100
Lab Course 5	Lab Course 5 (Based on paper 9 & 10)	80	20	100
Lab Course 6	Lab Course 6 (Based on paper 11 & 12)	80	20	100
<b>Total Marks</b>				<b>600</b>

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# School of Studies in Biotechnology

## Semester III

### Paper 9: Genetic Engineering

M.M. 80

#### Unit I

1. Scope of Genetic Engineering.
2. Cloning and patenting of life forms. Genetic engineering guidelines.
3. Molecular tools and their application: Restriction enzymes, modification enzymes, molecular markers.
4. Nucleic acid purification, yield analysis
5. Nucleic acid amplification and its applications

#### Unit II

1. Gene cloning vectors: Plasmids, bacteriophages, phagemids, cosmids, Artificial chromosomes
2. Restriction Mapping of DNA Fragments and Map Construction, Nucleic acid sequencing.
3. cDNA synthesis and cloning: mRNA enrichment, reverse transcription, DNA primers, linkers, adaptors and their chemical synthesis, Library construction and screening.
4. Cloning interacting genes – Two and three hybrid systems. Nucleic acid micro array assay.

#### Unit III

1. Site – directed mutagenesis and protein engineering.
2. DNA Transfection, Southern blot, Northern blot, Western blot, Primer extension, S1 mapping, RNase protection assay, and reporter assays.
3. Expression Strategies for heterologous genes: Vector engineering and codon optimization, host engineering; expression in bacteria, expression in Yeast, expression in insects and insect cells, expression in mammalian cells, expression in plants
4. Phage display: Technique and applications

#### Unit IV

1. Processing of recombinant Proteins: Purification and refolding, characterization of recombinant proteins, stabilization of proteins.
2. T – DNA and transposon tagging: Role of gene tagging in gene analysis, t – DNA and transposon tagging, Identification and isolation of genes through T – DNA or transposon; Targeted gene replacement, Chromosome engineering. Cisgenesis, intragenesis and genome editing by CRISPR-CAS
3. Gene therapy: Vector engineering. Strategies of gene delivery – Viral & non-viral, gene knockout, gene augmentation, gene correction / gene editing, gene regulation and silencing

**NOTE: Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.**

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## Books:

1. Philip M. Gilmaritin (2005) Molecular Plant Biology. Edition Oxford University Press.
2. TA Brown (2005) Gene Cloning and DNA Analysis. 4<sup>th</sup> Edition.
3. Rusell and Peter (2002) Genetics Edition. Pearson Education, Inc, San Francisco.
4. Old and Primrose (2001) Principles of Gene Manipulation. 6<sup>th</sup> Edition.
5. B.D. Singh (2004) Biotechnology: An Expanding Horizons, 1<sup>st</sup> Edition.
6. W:H. Elliott and D. C. Elliott (2001) Biochemical and Molecular Biology. 2<sup>nd</sup> Edition.
7. Eldon John Gardner, Michael J. Simmons and Peter Snustad (1991) Principles of Genetics. Eighth Edition, John Wiley and Sons, INC.
8. Benjamin Lewin (2007) Genes IX. 9<sup>th</sup> Edition Pearson Education International.
9. HD Kumar (2003) Modern Concepts of Biotechnology. Third reprint Edition, Vikas Publishing House. Pvt. Ltd.
10. Brown TA (2006) Genomes, 3rd ed. Garland Science.
11. James D Watson, Richard M. Myers, Amy A. Caudy and Jan A. Witkowski (2007) Recombinant DNA: Genes and Genomes 3<sup>rd</sup> Edition; WH Freeman.
12. Sandy Primrose and Richard Twyman (2006) Principles of Gene Manipulation and Genomics 7<sup>th</sup> Edition; Wiley-Blackwell.
13. Buchanan, Gruissemen & Jones (2015) Biochemistry & Molecular Biology of Plant, 2<sup>nd</sup> edition.
14. Choudhuri, S and DB Carlson (2008) Genomics: Fundamentals and applications, 1st edition.
15. M. Debnath (2011) Tools and Techniques in Biotechnology.
16. Green, M. R., & Sambrook, J. (2012). Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.

## List of Practical's:-

1. Extraction of DNA from *E.coli*. Bacteria.
2. Estimation of bacterial DNA by Spectrophotometer methods.
3. Separation of bacterial genomic DNA by Agarose gel electrophoresis.
4. Hot phenol method for preparation of total cellular RNA from *E.coli*.
5. Estimation of cellular RNA by Spectrophotometer methods.
6. Restriction digestion of DNA with restriction enzymes.
7. Ligation of DNA.
8. Isolation of plasmid DNA from *E.coli*.
9. DNA amplification by PCR.

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# School of Studies in Biotechnology

## Semester III

### Paper 10: Biology of immune system

M.M. 80

#### Unit I

1. Introduction – Phylogeny of immune system, innate and acquired immunity, Clonal nature of immune response.
2. Organization and structure of lymphoid organs.
3. Nature and biology of antigens and super antigens.
4. Antibody structure and function; antibody engineering
5. Antigen – antibody interactions

#### Unit II

1. Major histocompatibility complex
2. BCR & TCR, generation of diversity.
3. Complement system.
4. Cells of immune system – Hematopoiesis and differentiation, Lymphocyte trafficking, B – lymphocyte, T – lymphocyte, Macrophages, Dendritic cells, Natural Killer and lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells.

#### Unit III

1. Regulation of immune response – Antigen processing and presentation, generation of humoral and cell mediated immune responses; Activation of B – and T – lymphocytes; cytokines and their role in immune regulation; T – cell regulation, MHC restriction; Immunological tolerance.
2. Cell – mediated cytotoxicity: Mechanism of T cell and NK cell mediated lysis, Antibody dependent cell mediated cytotoxicity, and macrophage mediated cytotoxicity.
3. Hypersensitivity, Autoimmunity.

#### Unit IV

1. Transplantation: General concept and Application
2. Immunity to infectious agents (intracellular parasites (malaria), helminthes, bacterial (tuberculosis), viruses, (AIDS) infections and other congenital and acquired immunodeficiencies, vaccines.
3. Hybridoma Technology and Monoclonal antibodies

**NOTE:** Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.

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### Books:-

1. Thomas J. Kindt, Barbara A. Osborne and Richard A. Goldsby (2007) Immunology, 6<sup>th</sup> Edition; WH Freeman.
2. Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt (2006) Roitt's Essential Immunology, 11<sup>th</sup> Edition; Wiley-Blackwell.
3. H.D. Kumar (2003) Modern Concepts of Biotechnology 3<sup>rd</sup> Edition, Vikas Publishing House. Pvt. Ltd.
4. K. Banerjee and N. Banerjee (2006) Fundamental of Microbiology and Immunology, First Edition. New Central Book Agency (P) Ltd. Kolkata.
5. Bröstoff J, Seaddin JK, Male D, Roitt IM.( 2002) Clinical Immunology, 6<sup>th</sup> Edition, Gower Medical publishing.
6. Abul K. Abbas, Andrew H. Lichtman, & Shiv Pillai (2007) Cellular and Molecular immunology; Elsevier Inc
7. M. Debnath (2011) Tools and Techniques in Biotechnology.
8. Kindt, T. J., Goldsby, R. A., Osborne, B. A., & Kubly, J. (2006). Kuby Immunology. New York: W.H. Freeman.
9. Murphy, K., Travers, P., Walport, M., & Janeway, C. (2012). Janeway's Immunobiology. New York: Garland Science.
10. Paul, W. E. (2012). Fundamental Immunology. New York: Raven Press.

### List of Practical's:-

1. Enumeration of WBC in blood sample.
2. Preparation of a blood smear and differential blood count.
3. To separate serum from the given blood sample.
4. To determine Albumin Globulin ratio in given serum sample.
5. Estimation of serum protein by Folin Lowry test.
6. Isolation of Immunoglobulin.
7. Separation of serum protein by SDS PAGE.
8. Detection of class specific Antibody by Double Diffusion method.
9. Observe Ag-Ab interaction by Immunoelectrophoresis.
10. Observe Ag-Ab interaction by counter current Immunoelectrophoresis.
11. Study of Agglutination reaction
12. Study of ELISA technique.
13. Immuno diffusion test.
14. Blood group determination by slide agglutination reaction.



**School of Studies in Biotechnology**  
**Semester III**  
**Paper 11: Bioprocess Engineering & Technology**

**M.M. 80**

**Unit I**

1. Introduction to Bioprocess Engineering.
2. Kinetic of microbial growth and death
3. Isolation, Preservation and Maintenance of industrial Microorganisms.
4. Media for industrial fermentation
5. Air and Media Sterilization

**Unit II**

1. Types of fermentation processes: Bioreactors-Analysis of batch, Fed – batch and continuous bioreactors, stability of microbial reactors, analysis of mixed microbial populations, specialized reactors (pulsed, fluidized, photo bioreactors).
2. Measurement and control of bioprocess parameters.






**Unit III**

1. Downstream processing: Introduction, Removal of microbial cells and solid matter, foam reparation, precipitation, filtration, centrifugation, cell disruption, liquid – liquid extraction, chromatography, Membrane process, Drying and crystallization, Effluent treatment: D.O.C. and C.O.D. treatment and disposal of effluents.
2. Whole cell Immobilization and their industrial applications.

**Unit IV**

1. Industrial production of chemicals: Alcohol (ethanol), Acids (citric acetic and gluconic), solvents (glycerol, acetone, butanol), Antibiotics (penicillin, streptomycin, tetracycline), Amino acids (lysine, glutamic acid), Single cell protein. Use of microbes in mineral beneficiation and oil recovery.
2. Introduction to food technology: Elementary idea of canning and packing, Sterilization and pasteurization, of food products, technology of typical food/food products (bread, cheese, idli), Food preservation.

**NOTE: Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.**

### Books:-

1. Shuler ML and Kargi F (2002) Bioprocess Engineering: Basic concepts. 2nd Edition, Prentice Hall, Engelwood Cliffs.
2. Stanbury and Whittaker (1997) Principles of Sterilization techniques, First Indian reprint Edition. Aditya Book (P) Ltd. New Delhi.
3. Michael J. Waites (2008) Industrial microbiology: an introduction 7<sup>th</sup> Edition; Wiley-Blackwell.
4. Damien and Devies (1994) Microbial Technology.
5. LE Casida (1994) Industrial Microbiology
6. H Patel (2003) Industrial Microbiology. 4<sup>th</sup> Edition.
7. KS Bilgrami and AK Pandey (1998) Introduction to Biotechnology. Edition 2<sup>nd</sup>.
8. U Satayanarayan (2005) Biotechnology. First Edition Books and Allied (P) Ltd. Kolkata.
9. Baily JE and Ollis DF. (1986) Biochemical Engineering fundamentals, 2nd Edition, McGraw-Hill Book Co., New York.
10. Mansi EMTEL, Bryle CFA (2007) Fermentation Microbiology and Biotechnology. 2nd Edition, Taylor & Francis Ltd, UK,
11. Shara L. Aranoff, Daniel R. Pearson, Deanna Tanner Okun, Irving A. Williamson, Dean A. Pinkert (2009) Industrial Biotechnology; Nova Science.
12. M. Debnath (2011) Tools and Techniques in Biotechnology.
13. Stanbury, P. F., & Whitaker, A. (2010). Principles of Fermentation Technology. Oxford: Pergamon Press.
14. El-Mansi, M., & Bryce, C. F. (2007). Fermentation Microbiology and Biotechnology. Boca Raton: CRC/Taylor & Francis.
15. Lee, Y. K. (2013). Microbial Biotechnology: Principles and Applications. Hackensack, NJ: World Scientific.

### List of Practical's:-

1. Isolation and identification of microorganisms from industrial waste water.
2. Determination of thermal death point (TDP) and thermal death time (TDT) of microorganism (Bacteria and Fungi).
3. To study the production of citric acid by *Aspergillus niger* and also qualitative and quantitative test.
4. To study the bacterial growth curve.
5. To study the fungal growth curve.
6. Enzyme kinetics.
7. Bio-ethanol production.



# School of Studies in Biotechnology

## Semester III

### Paper 12: Environmental Biotechnology

M.M. 80

#### Unit I

1. Environment: Basic concepts and issues.
2. Environmental Pollution: Types of pollution, Methods for the measurement of pollution; Methodology of environmental management – the problem solving approach, its limitations.
3. Air pollution and its control through Biotechnology

#### Unit II

1. Water pollution and its control: Water as a scarce natural resource, sources of water pollution, Need for water management, Measurement of water pollution, waste water collection, waste water treatment – physical, chemical and biological treatment processes
2. Microbiology of waste water treatments, aerobic process: Activated sludge, oxidation ditches, trickling filter, towers, rotating discs, rotating drums, oxidation ponds.
3. Anaerobic process: Anaerobic digestion, anaerobic filters, Up flow anaerobic sludge blanket reactors.

#### Unit III

1. Treatment schemes for waste waters of dairy, distillery, tannery, sugar, antibiotic industries. Bioremediation
2. Xenobiotics in Environment – Ecological considerations, oil pollution, surfactants, pesticides.

#### Unit IV

1. Biopesticides in integrated pest management.
2. Solid wastes: Sources and management (composting, wormiculture and methane production).
3. Global Environmental Problems: Ozone depletion, UV – B, green house – effect and acid rain, their impact and biotechnological approaches for management.
4. Role of National organization in Biotechnology.

**NOTE: Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.**

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### Books:-

1. Gareth G. Evans, Judy Furlong (2011) Environmental Biotechnology: Theory and Application. 2<sup>nd</sup> Edition; John Wiley and Sons
2. Hans-Joachim Jördening, Josef Winter (2005) Environmental biotechnology: concepts and applications; Wiley-VCH.
3. Indu Shekhar Thakur (2006) Environmental Biotechnology: Basic concepts and Applications. First Edition. I. K. International Pvt. Ltd.
4. A.K. Chatterji (2002) Introduction to Environmental Biotechnology. First Edition. Prentice Hall of India Pvt. Ltd. New Delhi.
5. Manoj Tiwari, Kapil Khulbe and Archana Tiwari (2007) Environmental Studies. First Edition, I. K. International Publishing House Pvt. Ltd.
6. H.D. Kumar (2003) Modern Concepts of Biotechnology. Third reprint Edition, Vikas Publishing House. Pvt. Ltd.
7. B.D. Singh (2004) Biotechnology: Expanding Horizons, 1<sup>st</sup> Edition. Kalyani Publishers.
8. Alan Scragg (2005) Environmental Biotechnology First Edition, reprinted. Oxford University Press.
9. L Y Kun(2003)Microbial Biotechnology: Principles and applications.
10. M. Debnath (2011)Tools and Techniques in Biotechnology.
11. B. Ritmann and P. L. McCarty, (2000), Environmental Biotechnology: Principle & Applications, 2nd Ed., McGraw Hill Science.

### List of Practical's:-

1. To determine the total suspended solids of water.(TSS)
2. To determine the total dissolved solids of water.(TDS)
3. Determination of Dissolved oxygen (DO) of water.
4. Determination of chemical oxygen demand (COD) of water.
5. Determination of biochemical oxygen demand (BOD) of water.
6. To screen the antagonism between *Trichoderma* sp. and *Curvularia* sp.
7. Determination of effect of fungicide on the growth of fungi (*Trichoderma* sp.).
8. Effect of fungicide on the antagonism between *Trichoderma* sp. and *Curvularia* sp.
9. To determine the Most Probable number (MPN) of a given water sample.

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**Lab. Course 5**

**Based on Theory Papers 9, 10**

**Time: 6 hrs.**

**Total Marks – 100**

Q.1 Experiment based on Theory paper 9 (one major & one minor)	30
Q.2 Experiment based on Theory paper 10 (one major & one minor)	30
Q.3 Spotting based on Theory papers	10
Q.4 <i>Viva Voce.</i>	10
Q.5 Sessional	20

**Lab. Course 6**

**Based on Theory Papers 11 and 12**

**Time: 6 hrs.**

**Total Marks – 100**

Q.1 Experiment based on Theory paper 11 (one major & one minor)	30
Q.2 Experiment based on Theory paper 12 (one major & one minor)	30
Q.3 Spotting based on Theory papers	10
Q.4 <i>Viva Voce.</i>	10
Q.5 Sessional	20

**School of Studies in Biotechnology**  
Semester IV

**Scheme of Examination**

Paper Code	Title of Theory/Practical Paper	Marks		
		External	Internal	Total
13	IPR, Biosafety, Bioethics and Nanobiotechnology	80	20	100
14	Advanced techniques in Biotechnology	80	20	100
15	Animal Biotechnology	80	20	100
16	Genomics & Proteomics	80	20	100
Lab Course 7	Based on paper 13 & 14	80	20	100
Lab Course 8	Based on paper 15 & 16	80	20	100
<b>Total Marks</b>				<b>600</b>

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# School of Studies in Biotechnology

Semester IV

Paper 13: IPR, Biosafety, Bioethics and Nanobiotechnology

M.M. 80

## Unit – I

1. **IPR** : Introduction to intellectual property; types of IP: patents, trademarks, copyright & related rights, plagiarism, industrial design, traditional knowledge, geographical indications, protection of new GMOs; International framework for the protection of IP; IP as a factor in R&D.
2. **Entrepreneurship in bio-business** : Introduction and scope in Bio-entrepreneurship, Types of bio-industries Strategy and operations of bio-sector firms; Entrepreneurship development program of public and private agencies (MSME, DBT, BIRAC, Make In India).

## Unit II

1. **Biosafety** - introduction; historical background; introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; GRAS organisms, biosafety levels of pathogenic microorganisms; definition of GMOs; principles of environmental risk assessment and food and feed safety assessment
2. **Bioethics** – cloning and stem cell research, Human, plants, microbes and animal experimentation, animal rights/welfare, Agricultural biotechnology – Genetically engineered food, Protection of environment and biodiversity – biopiracy.

## Unit – III

1. **Nanobiotechnology** Introduction to Nanobiotechnology: Concepts, historical perspective; Different formats of nanomaterials and applications;
2. Cellular Nanostructures; Nanopores; Bimolecular motors; Synthesis and characterization of different nanomaterials.

## Unit – IV,

1. Nanoparticles for diagnostics; concepts of smart stimuli responsive nanoparticles, implications in cancer therapy,
2. Nanodevices for biosensor development
3. Thin films: synthesis and applications.

**NOTE:** Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.



### Books:-

1. Onetti, A., & Zucchella, A. Business Modeling for Life Science and Biotech Companies: Creating Value and Competitive Advantage with the Milestone Bridge. Routledge.
2. Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press.
3. Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management. New Delhi: Himalaya Pub. House.
4. Ganguli, P. (2001). Intellectual Property Rights: Unleashing the Knowledge Economy. New Delhi: Tata McGraw-Hill Pub.
5. National IPR Policy, Department of Industrial Policy & Promotion, Ministry of Commerce, GoI
6. National Portal of India. <http://www.archive.india.gov.in>
7. National Biodiversity Authority. <http://www.nbaindia.org>
8. Recombinant DNA Safety Guidelines (1990) Department of Biotechnology, Ministry of Science and Technology, Govt. of India. Retrieved from-  
<http://www.envfor.nic.in/divisions/csurv/geac/annex-5.pdf>
9. Recombinant DNA Safety Guidelines, 1990 Department of Biotechnology, Ministry of Science and Technology, Govt. of India. Retrieved from-  
<http://www.envfor.nic.in/divisions/csurv/geac/annex-5.pdf>
10. Wolt, J. D., Keese, P., Raybould, A., Fitzpatrick, J. W., Burachik, M., Gray, A., Wu, F. (2009) Problem Formulation in the Environmental Risk Assessment for Genetically Modified Plants. Transgenic Research, 19(3), 425-436. doi:10.1007/s11248-009-9321-9
11. Craig, W., Tepfer, M., Degrassi, G., & Ripandelli, D. (2008) An Overview of General Features of Risk Assessments of Genetically Modified Crops. Euphytica, 164(3), 853-880. doi:10.1007/s10681-007-9643-8
12. Guidelines for Safety Assessment of Foods Derived from Genetically Engineered Plants. 2008.
13. Guidelines and Standard Operating Procedures for Confined Field Trials of Regulated Genetically Engineered Plants. 2008. Retrieved from  
<http://www.igmoris.nic.in/guidelines1.asp>
14. Alonso, G. M. (2013). Safety Assessment of Food and Feed Derived from GM Crops: Using Problem Formulation to Ensure "Fit for Purpose" Risk Assessments. Retrieved from  
<http://biosafety.icgeb.org/inhousepublicationscollectionbiosafetyreviews>
15. Sandra J. Rosenthal, David W. Wright (2005) Nanobiotechnology Protocols. Humana Press Inc. 999 Riverview Drive, Suite, 208, Totowa, New Jersey.
16. PC Trivedi (2008) Nanobiotechnology. Pointer Publishers.
17. GL Hornyak, HF Tibbals, and J Dutta (2008) Fundamentals of Nanotechnology.
18. Rita Khare (2013) Concepts in Nano Biotechnology.
19. Shimasaki, C. D. (2014). Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies. Amsterdam: Elsevier. Academic Press is an imprint of Elsevier.
20. Complete Reference to Intellectual Property Rights Laws. (2007). Snow White Publication Oct.
21. Kuhse, H. (2010). Bioethics: an Anthology. Malden, MA: Blackwell.
22. World Intellectual Property Organisation. <http://www.wipo.int>
23. David S. Goodsell, (2004); Bionanotechnology: Lessons from Nature; Wiley-Liss.




**List of Practical's:-**

1. Synthesis of Nanomaterials.
2. Characterization of Nanomaterials.
3. Plagiarism detection by using different online plagiarism-tools.
4. Write-down guidelines for GMO.
5. Find and list-out bio-safety rules for food & beverage.
6. List out IPR of a researcher.
7. Find and list-out different bio-safety rules to be followed in the laboratories.
8. Find and list-out different bio-safety rules to be considered during management of biohazard materials.

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# School of Studies in Biotechnology

## Semester IV

### Paper 14: Advanced techniques in Biotechnology

M.M. 80

#### Unit I

1. Principles and application of: Centrifugation, Chromatography (Paper, Thin layer, gas and liquid chromatography, LCMS), Electrophoresis.
2. RIA and autoradiography in biology, ELISA.

#### Unit II

1. Principles and application of Thermocycler
2. Microscopy: Light and compound microscopes, Confocal microscopy, Scanning & Electron microscopy, Phase Contrast and fluorescence microscopy.

#### Unit III

1. Principles and application of DNA micro array
2. Principles and application of: Colorimetry, Spectrophotometry, densitometry, Fluorescence spectrophotometry.
3. Molecular structure determination using NMR and X- ray diffraction

#### Unit IV

1. Principles and application of Cytophotometry
2. Flow cytometry
3. Southern, Northern, and Western Blotting.
4. DNA sequencer

**NOTE:** Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.

### Books:-

1. K. Wilson and J. Walker (2018) Principle and Techniques of Biotechnology and Molecular Biotechnology. Cambridge University Press.
2. Upadhyaya and Upadhyaya(2009) Biophysical Chemistry. Mumbai : Himalaya Pub. House.
3. David, L. Nelson and Michael, M. Cox Lehniger (2008) Principal of Biochemistry. 5<sup>th</sup> Edition. W.H. Freeman and Company, New York.
4. Anthony J.F. Griffiths, William M. Gelbart, Richard C. Lewontin and Jeffrey H. Miller; (1999 )Modern Genetic Analysis. Publisher W. H. Freeman.
5. Ralf Pörtner (2013) Animal cell biotechnology: methods and protocols. Humana Press.
6. M. Debnath (2011) Tools and Techniques in Biotechnology.
7. Campbell, I. D. (2012). Biophysical Techniques. Oxford: Oxford University Press.
8. Serdyuk, I. N., Zaccai, N. R., & Zaccai, G. (2007). Methods in Molecular Biophysics: Structure, Dynamics, Function. Cambridge: Cambridge University Press.
9. Rajagopal Vadivambal, Digvir S. Jayas. (2015). Bio-Imaging: Principles, Techniques, and Applications. ISBN 9781466593671 - CAT# K20618.
10. Alberto Diaspro, Marc A. M. J. van Zandvoort. (2016). Super-Resolution Imaging in Biomedicine. ISBN 9781482244342 - CAT# K23483.

### List of Practical's:-

Perform various advance laboratory techniques, like –

1. Centrifugation.
2. Chromatography.
3. Spectrophotometry.
4. Electrophoresis.
5. Perform the advance biotechnological techniques, like – ELISA, PCR, Southern blotting, etc.



# School of Studies in Biotechnology

Semester IV

Paper 15: Animal Biotechnology

M.M. 80

## Unit I

1. Animal cell: Structure and organization
2. Equipment's and materials for animal cell culture
3. Primary and established cell line cultures.
4. Constituents of culture media and their application
5. Application of animal cell culture

## Unit II

1. Biology and characterization of the cultured cells, measuring parameters of growth
2. Basic techniques of mammalian cell culture *in vitro*; disaggregating of tissue and primary culture; maintenance of cell culture; cell separation
3. Scaling - up of animal cell culture.
4. Cell synchronization: Cell growth stages
5. Cell cloning: Basic techniques for cell cloning
6. Cell transformation: Characteristics of transformed cells

## Unit III

1. Stem cell cultures, embryonic stem cells and their applications.
2. Cell culture based vaccines: General introduction, Vaccines for Malaria and AIDS
3. Somatic cell genetics.
4. Ethical issues in relation to animal biotechnology

## Unit IV

1. Transgenic animals: Mice, Sheep, Birds and Fish
2. Apoptosis.
3. Tissue engineering: Elementary idea of tissue engineering, Artificial skin, artificial cartilage

**NOTE: Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.**



**Books:-**

1. RW Masters (2000) Animal Cell Culture Practical Approach: Oxford University Press.
2. Ralf Pörtner (2007) Animal cell biotechnology. Humana Press.
3. M Clynes (2012) Animal Cell Culture Techniques.
4. Nigel Jenkins (1999) Animal Cell Biotechnology methods and Protocols. Humana Press, Totowa, New Jersey.
5. B.D. Singh Biotechnology (2004) Expanding Horizons. First Edition. Kalyani Publishers, Ludhiana.
6. U Satyanarayana (2005) Biotechnology. Books and Allied (P) Ltd., Kolkata.

**List of Practical's:-**

1. Extraction, estimation and separation of DNA from blood
2. Extraction, estimation and separation of DNA from spleen
3. Extraction, estimation and separation of DNA from muscle tissue
4. To perform mechanical disaggregation of soft tissues of chick, for recovery of cells.
5. To perform enzymatic disaggregation of tissue, for recovery of cells.

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# School of Studies in Biotechnology

Semester IV

Paper 16: Genomics & Proteomics

M.M. 80

## UNIT – I

1. Genomics – General introduction, Types of genomics, Structural genomics, Functional genomics, Comparative genomics, Genome sequencing, Genome mapping, Future of genomics
2. Plant Genomics
3. Genomics in medicine: Gene medicine, Disease models, The impact of genomics on medicine

## UNIT – II

1. Human genome project, Methods of gene sequencing: - Random shotgun sequencing, EST. Whole genome shotgun sequencing, Genome prediction and gene counting, Single nucleotide polymorphisms (SNPs)
2. Comparative Genomics: Sequence comparison, Comparative genomics in bacteria, Comparative genomics in Eukaryotes & organelles

## UNIT – III

1. Proteomics – General concept, Gene and Protein, Types of proteomics, Structural proteomics and Functional proteomics
2. Methods of study the protein, Protein arrays, protein chips, System biology, Practical application of proteomics

## UNIT – IV

1. Future of proteomics, Analysis of protein structure,
2. Protein-Protein interactions, Protein database, Global analysis of protein, Expression analysis and characterization of protein

**NOTE:** Questions will be asked as per the new policy of question paper. In which, 20 multiple choice questions (covering entire syllabus of the paper), 8 very short answer (2-3 sentences) type questions (two from each unit), 8 short answer (about 75 words) type questions (two from each unit), and 5 long answer (about 150 words) type questions (at least one from each unit) will be asked. Each question will cover entire (4) units of the paper.

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**Books:-**

1. Primrose & Twyman (2013) Principles of Gene Manipulation and Genomics.
2. TA Brown (2015) Gene cloning and DNA analysis: An introduction.
3. Guido Grandi (2004) Genomics, Proteomics & Vaccines.
4. Primrose & Twyman (2008) Genomics: Application in Human biology.
5. Introduction to molecular Genetics and Genomics; JBH Publication
6. Timothy Palzkill (2002) Proteomics.
7. U Satyanarayana (2005) Biotechnology. Books and Allied (P) Ltd., Kolkata.
8. P.K. Gupta (2004) Biotechnology and Genomics. Rastogi Publication.
9. S Choudhuri and DB Carlson (2008) Genomics: Fundamentals and applications, 1st edition
10. Johathan Pevsnev (2015) Bioinformatics and Functional. 3<sup>rd</sup> edition.

**List of Practical's:-**

1. Find out and study the sequence similarity by BLAST & FASTA.
2. To study the genome map from NCBI resource.
3. To study the basic functionality of genome by genome browser.
4. Study the whole genome of Hepatitis B virus and Human Mitochondrial Genome using genome databases of Gene Bank.
5. Study the single nucleotide polymorphism (SNP) of human genome using SNP databases of NCBI (Example: MTHFR gene)
6. Study the Sequence comparison in bacterial genome using Gene Bank (16S Ribosomal DNA sequence of *Rickettsia* sp.)
7. To study the Multiple Alignment Sequence by using CLUSTAL OMEGA tools.
8. To determine the sequence of database of RNA families by using Rfam.
9. To retrieve the protein sequence by Swiss Prot database
10. Study the Protein protein and Protein nucleotide interaction using Gene Bank databases (Example : Human 40S ribosome)

**Practical References:-**

1. Shui Qing Ye (2007) Bioinformatics: A Practical Approach. Chapman & Hall Taylor & Francis Gen.
2. Mount D. W (2005) Bioinformatics – Sequence & Genome Analysis. CBS Publishers & Distributors (Pvt) Ltd.
3. Bela Tiwari (2007) Introductory Bioinformatics For Users: The Practicals.
4. Griffiths-Jones S, Bateman A, Marshall M, Khanna A, Eddy SR (2003). "Rfam: an RNA family database". Nucleic Acids Res. 31 (1): 439–41.

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**Lab. Course 7**

**Based on Theory Papers 13, 14**

**Time: 6 hrs.**

**Total Marks – 100**

Q.1 Experiment based on Theory paper 13 (one major & one minor)	30
Q.2 Experiment based on Theory paper 14 (one major & one minor)	30
Q.3 Spotting based on Theory papers	10
Q.4 <i>Viva Voce</i> .	10
Q.5 Sessional	20

**Lab. Course 8**

**Based on Theory Papers 15 and 16**

**Time: 6 hrs.**

**Total Marks – 100**

Q.1 Experiment based on Theory paper 15 (one major & one minor)	30
Q.2 Experiment based on Theory paper 16 (one major & one minor)	30
Q.3 Spotting based on Theory papers	10
Q.4 <i>Viva Voce</i> .	10
Q.5 Sessional	20

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## Project

Project Work	External	Internal	Total
Dissertation	240	60	300
Seminar based on project	160	40	200
Viva-voce	80	20	100
<b>Total</b>			<b>600</b>

1. A student of IV semester will have the option to opt for project work in lieu of four theory papers and two lab courses provided he/she secures at-least 65% or more marks in aggregate in semester I and II.
2. The project has to be carried out in recognized national laboratories or UGC recognized universities. No student will be allowed to carry out project in private laboratories/ college/ institutions, excluding the colleges recognized as research centers by the RDC of Pt. Ravishankar Shukla University, Raipur.
3. The valuation of all the projects will be carried out by the external examiner and HoD of UTD or its nominee at the UTD Centre.

The project work should be related to the field of Biotechnology. The project report should include declaration by the candidate, certificate by the supervisor, acknowledgement, title and introduction along with the following points:

1. Introduction
2. Review of Literature
3. Materials and Methods
4. Results & Discussion
5. Summary
6. Bibliography

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# SCHOOL OF STUDIES IN BIOTECHNOLOGY

Pt. Ravishankar Shukla University

Raipur-492 010

## Syllabus

### Choice Based Credit System

in

### Biotechnology

### Session

2020-2021

2021-2022

BoS approved syllabus for CBCS in Biotechnology  
(Academic session 2020-21 and 2021-22)

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## School of Studies in Biotechnology

Course: Choice Based Course,

Semester: Second

### Name of Paper: Paper – I (Basic Biotechnology)

Total Credit: 03 (Three)


M.M.:100

1. Introduction of Biotechnology; aims & scope of biotechnology.
2. Different areas of biotechnology; application of biotechnology & future prospects.
3. Structure of prokaryotic and eukaryotic cells; comparison between plant and animal cell.
4. Function of cell organelles: Nucleus, Mitochondria, Golgi-complex, Endoplasmic reticulum, etc.
5. Macromolecules in biological system: Amino acids; DNA & RNA; structure and function.
6. Carbohydrate; structure, classification, properties and function.
7. Protein; primary, secondary, tertiary & quaternary structure of protein and their importance.
8. Lipid; structure, classification and function.
9. Introduction and scope of microbiology; general account of Bacteria, Fungi and Virus.

**Note:** There will be 5 questions of equal marks.

BoS approved syllabus for CBCS in Biotechnology  
(Academic session 2020-21 and 2021-22)



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**Books:**

1. Pelczar, M.J. Jr., Chan, E.C.S. and Kreig, N.R. (2009) Microbiology, Tata McGraw Hill.
2. Prescott L.M., Harley J., Klein D. (2001) Microbiology, McGraw Hill 5<sup>th</sup> Edition.
3. U Satyanarayana, First Edition: 2005, reprint (2010), Biotechnology, Books and Allied (P) Ltd. Kolkata.
4. Madigan M.T., Martinko J.M., Parker J., Brock Biology of microorganisms, Prentice-Hall.
5. C.B. Powar (2005) Cell Biology, Third edition, reprint Himalaya Publishing House.
6. Nelson and Cox (2009) Principal of Biochemistry, 5<sup>th</sup> edition.
7. Voet D., Voet J.G., Pratt C.W. (2006) Fundamentals of Biochemistry, 2<sup>nd</sup> Edition. Wiley.
8. Gerald Karp (2007) Cell and Molecular Biology, 5<sup>th</sup> edition.
9. Geoffrey M. Copper, Robert E. Hausman (2009) The Cell: A Molecular Approach.

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## School of Studies in Biotechnology

**Course: Choice Based Course,**

**Semester: Third**

**Name of Paper: Paper – II**

**(Applied Biotechnology)**

**Total Credit: 03 (Three)**

**M.M.:100**

1. Introduction of Bioprocess technology; isolation, screening, identification, preservation and maintenance of industrial microorganisms; applications of bioprocess technology.
2. Pharmaceutical biotechnology: Antibiotic production.
3. Plant tissue culture techniques; basic media and nutrients, micro-propagation, multiplication, acclimatization, green house.
4. Genetic engineering: introduction, tools & techniques, transgenic plants.
5. Environmental pollution: air, water and soil pollution; different biotechnological approaches for the prevention & control of environment pollution: bioremediation, phytoremediation, sewage and effluent treatment.
6. Bioinformatics: general introduction, online-website & tools of bioinformatics; application of bioinformatics.
7. Animal biotechnology: general introduction, tools & techniques, applications,
8. Transgenic animal, cloning.

**Note:** There will be 5 questions of equal marks.

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(Academic session 2020-21 and 2021-22)**

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**Books:**

1. Prescott L.M., Harley J., Klein D. (2001) Microbiology, McGraw Hill 5<sup>th</sup> Edition.
2. U Satyanarayana, First Edition: 2005, reprint (2010) Biotechnology, Books and Allied (P) Ltd. Kolkata.
3. Gerald Karp (2007) Cell and Molecular Biology, 5<sup>th</sup> edition.
4. L.E. Casida (1994) Industrial Microbiology edition.
5. H.S. Chawla- Introduction of Plant Biotechnology, Oxford & IBH Publishing Co. (P) Ltd.
6. Razdan M.K. (2010) Introduction of Plant Tissue Culture, 2<sup>nd</sup> edition, Oxford & IBH Publishing Co. (P) Ltd.
7. Bhojwani SS and Razdan MK – Plant Tissue Culture; Elsevier.
8. Geoffrey M. Copper, Robert E. Hausman (2009) The Cell: A Molecular Approach.
9. TA Brown (2005) Gene Cloning and DNA Analysis, 4<sup>th</sup> Edition.
10. Indu Shekher Thakur (2006) Environmental Biotechnology: Basic concepts and Application, first edition, I.K. International Pvt. Ltd.
11. Gareth G. Evans, Judy Furlong (2011) Environmental Biotechnology: Theory and Application, 2<sup>nd</sup> edition, John Wiley and Sons.
12. Stanbury and Whittaker – Principles of Sterilization techniques, first Indian reprint edition (1997), Aditya Book (P) Ltd. New Delhi.
13. C.S.V. Murthy (2003) Bioinformatics. First Edition, Himalaya Publishing House.
14. S.C. Rastogi, Namita Mendiratta, Parag Rastogi (2003) Bioinformatics: Concepts, Skills and Applications, CBS Publishers and Distributors, New Delhi.
15. B.D. Singh (2004) Biotechnology: An Expanding Horizons, 1st Edition.

BoS approved syllabus for CBCS in Biotechnology  
(Academic session 2020-21 and 2021-22)

# SCHOOL OF STUDIES IN BIOTECHNOLOGY

Pt. Ravishankar Shukla University  
Raipur-492 010

## Syllabus

### Entrance Test of M.Phil. & Ph.D. in Biotechnology

Session  
2019-2020

BoS approved syllabus for M.Phil. & Ph.D. Entrance Test in Biotechnology  
(Academic session 2019-20)

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## Syllabus for M.Phil. & Ph.D. Entrance Test

### Subject: Biotechnology

Session: 2019-2020

#### 1. Cell Biology

Cellular organelles – Plasma membrane, cell wall, their structural organization; Mitochondria; Chloroplast; Nucleus and other organelles and their organization.

Cell cycle – molecular events and model systems

Mechanisms of signal transduction.

#### 2. Biomolecules

Amino acids and peptides – classification, physical properties and chemical reactions

Proteins – Protein structure; primary, secondary, tertiary and quaternary structures of proteins, Protein folding, biophysical and cellular aspects.

Enzyme- Kinetics and thermodynamic analysis, enzyme immobilization

Ribozyme: Types and applications

Carbohydrates-classification and reaction: monosaccharide, disaccharides & polysaccharides

Lipids – classification, structure and functions, Simple, compound & derived lipids

#### 3. Microbiology

Microbial Growth – The definition of growth, mathematical expression of growth, growth curve, measurement of growth and growth yields; Synchronous growth; Continuous culture; Growth as affected by environmental factors like temperature, acidity, alkalinity, water availability and oxygen.

Metabolic Diversity among Microorganisms – Photosynthesis in microorganisms; Calvin cycle; Chemolithotrophy; Methanogenesis and acetogenesis; Fermentations – diversity, syntrophy, Nitrogen fixation.

Microbial diseases –Infectious disease transmission; Respiratory infections caused by bacteria and viruses; Tuberculosis; Sexually transmitted diseases including AIDS; Diseases transmitted by animals (rabies, plague), insects and ticks (Rickettsia's, Lime disease, malaria)

Food and water borne diseases

#### 4. Molecular Biology

DNA Replication – Prokaryotic and eukaryotic DNA replication, Mechanics of DNA replication. Enzymes and accessory proteins involved in DNA replication.

DNA Repair and Recombination.

Transcription – Prokaryotic transcription, Eukaryotic transcription, Unit II

Translation – Prokaryotic and Eukaryotic translation, the translation machinery, Mechanisms of initiation, elongation and termination, Regulation of translation, co – and post – translational modifications of proteins, Protein transport and trafficking.

Oncogenes and Tumor Suppressor Genes – Viral and cellular Oncogenes, tumor suppressor genes from humans, Structure, Function and mechanism of action of pRB and p53 tumor suppressor proteins. Antisense and Ribozyme technology.

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Molecular Mapping of genome. Genome Sequencing-Genome sizes, organelle genomes, Genomic libraries, YAC, BAC libraries.

### 5. Immunology

Phylogeny of immune system, innate and acquired immunity, Clonal nature of immune response.

Organization and structure of lymphoid organs.

Nature and biology of antigens and super antigens.

Antibody structure and function; antibody engineering. Antigen – antibody interactions.

Cells of immune system – Hematopoiesis and differentiation, Lymphocyte trafficking, B – lymphocyte, T – lymphocyte, Macrophages, Dendritic cells, Natural Killer and lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells. Hypersensitivity, Autoimmunity. Hybridoma Technology and Monoclonal antibodies.

### 6. Genetic Engineering

Gene cloning vectors: Plasmids, bacteriophages, phagemids, cosmids, Artificial chromosomes

Restriction Mapping of DNA Fragments and Map Construction, Nucleic acid sequencing.

cDNA synthesis and cloning: mRNA enrichment, reverse transcription, DNA primers, linkers, adaptors and their chemical synthesis, Library construction and screening.

Gene therapy: Vector engineering, gene augmentation, gene correction, gene editing, gene regulation and silencing.

### 7. Bioprocess Engineering

Isolation, Preservation and Maintenance of industrial Microorganisms.

Media for industrial fermentation

Types of fermentation processes: Bioreactors-Analysis of batch, Fed – batch and continuous bioreactors,

Downstream processing: Introduction, Removal of microbial cells and solid matter, foam reparation, precipitation, filtration, centrifugation, cell disruption, liquid – liquid extraction, chromatography, Membrane process, Drying and crystallization, Effluent treatment: D.O.C. and C.O.D. treatment and disposal of effluents.

Industrial production of chemicals: Alcohol (ethanol), Acids (citric acetic and gluconic), solvents (glycerol, acetone, butanol), Antibiotics (penicillin, streptomycin, tetracycline), Amino acids (lysine, glutamic acid), Single cell protein. Use of microbes in mineral beneficiation and oil recovery.

### 8. Plant Tissue Culture

Introduction to cell and tissue culture, tissue culture as a technique. Tissue culture media (composition and preparation)

Initiation and maintenance of callus and suspension culture; single cell clones.

Organogenesis; somatic embryogenesis; transfer and establishment of whole plants in soil

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Protoplast isolation, culture and fusion; Cryopreservation DNA banking for germplasm conservation.

Application of plant transformation for productivity and performance: herbicide resistance, insect resistance, Bt genes.

Molecular Marker –RFLP maps, linkage analysis, RAPD markers, STS, microsatellites, SCAR (Sequence characterized amplified regions), SSCP (Single strand conformational polymorphism), AFLP, QTL, map based cloning, molecular marker assisted selection.

### 9. Animal Tissue Culture

Application of animal cell culture

Primary and established cell line cultures.

Stem cell cultures, embryonic stem cells and their applications.

Cell culture based vaccines

Somatic cell genetics.

Transgenic animals: Mice, Sheep, Birds and Fish .Tissue engineering.

### 10.Environmental Biotechnology

Environmental Pollution: Types of pollution, Methods for the measurement of pollution; Methodology of environmental management – the problem solving approach, its limitations.

Treatment schemes for waste waters of dairy, distillery, tannery, sugar, antibiotic industries. Bioremediation of contaminated soils and waste lands.

Microbiology of degradation of Xenobiotics in Environment, Biopesticides in integrated pest management.

Solid wastes: Sources and management (composting, vermi-culture and methane production).

Global Environmental Problems: Ozone depletion, UV – B, green house – effect and acid rain, their impact and biotechnological approaches for management.

BoS approved syllabus for M.Phil. & Ph.D. Entrance Test in Biotechnology  
(Academic session 2019-20)

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# **SYLLABUS**

**2020-2021**

**PT. RAVISHANKAR SHUKLA UNIVERSITY**

**RAIPUR**

**CHHATTISGARH**



# **SYLLABUS**

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CODE 321 & 322

## **M.Sc.CHEMISTRY**

### **SEMESTER EXAMINATION**



**2020-2021**

**PT.RAVISHANKAR SHUKLA UNIVERSITY**  
**RAIPUR-492010, CHHATTISGARH**

## EXAMINATION SCHEME

M.Sc. examination will be conducted in four SEMESTERS. Each semester exam shall consist of FOUR THEORY PAPERS AND TWO LAB COURSES.

### SEMESTER –I (20 CREDIT)

#### THEORY (16 CREDIT)

PAPER Number and Paper Code	COURSE	CREDIT	DURATION	INTERNAL ASSESSMENT	THEORY MARKS	TOTAL MARKS
1 (CH-101)	GROUP THEORY AND CHEMISTRY OF METAL COMPLEXES	4	4 Hrs	20	80	100
2 (CH-102)	CONCEPTS IN ORGANIC CHEMISTRY	4	4 Hrs	20	80	100
3 (CH-103)	QUANTUM CHEMISTRY, THERMODYNAMICS AND CHEMICAL DYNAMICS - I	4	4 Hrs	20	80	100
4 (CH-104)	THEORY AND APPLICATIONS OF SPECTROSCOPY-I	4	4 Hrs	20	80	100

#### PRACTICAL (4 CREDIT)

PAPER Number and paper code	COURSE	CREDIT	DURATION	MARKS
5 (CH-105)	Lab Course - I	2	8 Hrs	100
6 (CH-106)	Lab Course - II	2	8 Hrs	100

### SEMESTER –II (20 CREDIT)

#### THEORY (16 CREDIT)

PAPER Number and paper code	COURSE	CREDIT	DURATION	INTERNAL ASSESSMENT	THEORY MARKS	TOTAL MARKS
1 (CH-201)	TRANSITION METAL COMPLEXES	4	4 Hrs	20	80	100

<b>2 (CH-202)</b>	REACTION MECHANISMS	4	4 Hrs	20	80	100
<b>3 (CH-203)</b>	QUANTUM CHEMISTRY, THERMODYNAMICS AND CHEMICAL DYNAMICS - II	4	4 Hrs	20	80	100
<b>4 (CH-204)</b>	THEORY AND APPLICATIONS OF SPECTROSCOPY-II	4	4 Hrs	20	80	100



**PRACTICAL (4 CREDIT)**

PAPER Number and paper code	COURSE	CREDIT	DURATION	MARKS
5 (CH-205)	Lab Course - III	2	8 Hrs.	100
6 (CH-206)	Lab Course - IV	2	8 Hrs.	100

**SEMESTER –III (20 CREDIT)****THEORY (16 CREDIT)**

PAPER Number and paper code	COURSE	CREDIT	DURATION	INTERNAL ASSESSMENT	THEORY MARKS	TOTAL MARKS
1 (CH-301)	RESONANCE SPECTROSCOPY, PHOTOCHEMISTRY AND ORGANOCATALYSIS	4	4 Hrs	20	80	100
2 (CH-302)	CHEMISTRY OF BIOMOLECULES	4	4 Hrs	20	80	100
3 (CH-303)	CATALYSIS, SOLID STATE AND SURFACE CHEMISTRY	4	4 Hrs	20	80	100
4 (CH-304)	ANALYTICAL TECHNIQUES AND DATA ANALYSIS	4	4 Hrs	20	80	100

**PRACTICAL (4 CREDIT)**

PAPER Number and paper code	COURSE	CREDIT	DURATION	MARKS
5 (CH-305)	Lab Course - V	2	8 Hrs.	100
6 (CH-306)	Lab Course - VI	2	8 Hrs.	100

**SEMESTER –IV (20 CREDIT)****THEORY (16 CREDIT)**

<b>PAPER Number and paper code</b>	<b>COURSE</b>	<b>CREDIT</b>	<b>DURATION</b>	<b>INTERNAL ASSESSMENT</b>	<b>THEORY MARKS</b>	<b>TOTAL MARKS</b>
<b>1 (CH- 401)</b>	INSTRUMENTAL METHODS ANALYSIS OF	4	4 Hrs	20	80	100
<b>2 (CH- 402)</b>	NATURAL PRODUCTS AND MEDICINAL CHEMISTRY	4	4 Hrs	20	80	100
<b>3 (CH- 403)</b>	MATERIAL AND NUCLEAR CHEMISTRY	4	4 Hrs	20	80	100

<b>4 (CH-404)</b>	ENVIRONMENTAL & APPLIED CHEMICAL	4	4 Hrs	20	80	100.
	ANALYSIS					

OR  
**OPTIONAL PAPERS**

CH-404 a	MEDICINAL CHEMISTRY
404 b	CHEMISTRY OF SURFACTANTS
404 c	CHEMISTRY AND APPLICATION OF PESTICIDES
	MOLECULAR SYMMETRY, COORDINATION AND ORGANOMETALLIC CHEMISTRY
404 d	404 d
404 e	NANOCHEMISTRY
404 f	CHEMISTRY OF NATURAL PRODUCTS
404 g	POLYMERS
404 h	FORENSIC CHEMISTRY

**PRACTICAL (4 CREDIT)**

PAPER Number and paper code	COURSE	CREDIT	DURATION	MARKS
5 (CH-405)	Lab course VII or seminar	2	8 Hrs	100
6 (CH-406)	Lab course VIII	2	8 Hrs	100
Or				
7 (CH-407)	Project Work	2	-----	100
8 (CH-408)	Seminar	2	-----	100

**SCHEME FOR LABORATORY EXPERIMENT EXAMINATION**

EXPERIMENT	MARKS
Object-1	30
Object -2	30
Viva-voce	20
Sessional Marks	20
<b>TOTAL MARKS</b>	<b>100</b>



## FIRST SEMESTER

### PAPER NO 1. CH –101

#### GROUP THEORY AND CHEMISTRY OF METAL COMPLEXES

Max. Marks 80

##### UNIT - I

**SYMMETRY AND GROUP THEORY IN CHEMISTRY:** Symmetry elements and symmetry operation, definitions of group, subgroup, relation between orders of a finite group and its subgroup. Conjugacy relation and classes. Point symmetry group. Schoenflies

symbols, representations of groups by matrices (representation for the  $C_n$ ,  $C_{nv}$ ,  $C_{nh}$ ,  $D_{nh}$ , etc. groups to be worked out explicitly). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use in spectroscopy.

##### UNIT - II

**A. METAL-LIGAND BONDING:** Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes, bonding and molecular orbital theory.

**B. METAL-COMPLEXES:** Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand.

##### UNIT –III

**A. METAL-LIGAND EQUILIBRA IN SOLUTION:** Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH-metry and spectrophotometry.

**B. ISOPOLY ACID AND HETEROPOLYACID:** Isopoly and heteropoly acids of Mo and W. Preparation, properties and structure. Classification, Preparation, properties and structures of borides, carbides, nitrides and silicides. Silicates- classification and Structure, Silicones- preparation, properties and application.

##### UNIT – IV

**A. METAL CLUSTERS:** Higher boranes, carboranes, metalloboranes and metallocarboranes. Metal carbonyl and halide cluster, compounds with metal-metal multiple bonds.

**B. CHAINS:** catenation, heterocatenation, intercatenation.

**C. RINGS:** Borazines, phosphazines.

##### BOOK SUGGESTED:

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes and Row.
3. Chemistry of the Elements, N.N. Greenwood and A. Earnshaw, Pergamon.
4. Comprehensive Coordination Chemistry Eds. G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon.

CONCEPTS IN ORGANIC CHEMISTRY

Max. Marks 80

UNIT - I

- A. **NATURE OF BONDING IN ORGANIC MOLECULES:** Localized and Delocalized chemical bond, conjugation and cross-conjugation, Bonding in Fullerenes, Bonds weaker than covalent, addition compounds,  
Crown ether complexes and cryptands. Inclusion compounds, Cyclodextrins, Catenanes and Rotaxanes.
- B. **AROMATICITY:** Aromaticity in benzenoid and non-benzenoid compounds, Huckel anti-aromaticity, homo-aromaticity. PMO approach for Aromaticity, Annulenes.

UNIT - II

- A. **CONFORMATIONAL ANALYSIS:** Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars, steric strain due to unavoidable crowding.
- B. **STEREOCHEMISTRY:** Elements of symmetry, chirality, molecules with more than one chiral center, methods of resolution, optical purity, stereospecific and stereoselective synthesis. Asymmetric synthesis. Optical activity in the absence of chiral carbon - Biphenyls, allenes and spiranes, chirality due to helical shape.

UNIT - III

- A. **REACTION INTERMEDIATES:** Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes. Sandmeyer reaction, Free radical rearrangement and Hunsdiecker reaction.
- B. **ELIMINATION REACTIONS:** The E<sub>2</sub>, E<sub>1</sub> and E<sub>1cB</sub> mechanisms. Orientation of the double bond. Reactivity, effects of substrate structures, attacking base, the leaving group and the medium.

UNIT - IV

**PERICYCLIC REACTIONS:** Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions - conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions - antarafacial and suprafacial additions, 4n and 4n+2 system, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheletropic reactions. Sigmatropic rearrangements - suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3- and 5,5- sigmatropic rearrangements. Claisen, Cope and Aza-Cope rearrangements. Ene reaction.

BOOKS SUGGESTED:

1. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum.
2. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
3. Structures and Mechanism in Organic Chemistry, C. K. Ingold, Cornell University Press.
4. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall.
5. Modern Organic Reactions, H. O. House, Benjamin.
6. Principles of Organic Synthesis, R. O. C. Norman and J. M. Coxon, Blackie Academic and Professional.
7. Pericyclic Reactions, S. M. Mukherji, Macmillan, India.
8. Reaction Mechanism in Organic Chemistry, S. M. Mukherji and S. P. Singh, Macmillan.
9. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
10. Some Modern Methods of Organic Synthesis, W. Carruthers, Cambridge Univ. Press.
11. Rodd's Chemistry of Carbon Compounds, Ed. S. Coff
12. Organic Chemistry, Vol 2, I. L. Finar, ELBS.
13. Stereo selective Synthesis: A Practical Approach, M. Nogradi, and VCH.
14. Organic Chemistry, Paula Yurkanis Bruice, Pearson Education.

QUANTUM CHEMISTRY, THERMODYNAMICS AND CHEMICAL DYNAMICS - I

Max. Marks 80

UNIT - I

**A. MATHEMATICAL CONCEPTS IN QUANTUM CHEMISTRY:**

Vector quantities and their properties. Complex numbers and Coordinate transformation. Differential and Integral Calculus, Basic rules of differentiation and Integration applications.

- B.** The Schrodinger equation and postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to some model systems viz Particle in a box, the harmonic oscillator, the rigid rotator, the hydrogen atom.

UNIT –II

**BASICS OF THERMODYNAMICS:** Maxwell's thermodynamic relations, Vant's Hoff hypothesis. Partial molar volume and partial molar heat content. Chemical potential, Gibbs-Duhem equation, variation of chemical potential with temperature and pressure. Chemical potential of ideal gases, pure solids, liquids and mixture of ideal gases. Activity and Fugacity, Determination of Fugacity, Variation of Fugacity with Temperature and Pressure.

UNIT –III

**ELECTROCHEMISTRY–I:** Electrochemistry of solution. Debye-Huckel Onsager treatment and its extension, ion solvent interactions. Debye-Huckel Limiting Law. Debye-Huckel theory for activity coefficient of electrolytic solutions. Determination of activity and activity coefficient, ionic strength, Thermodynamics of electrified interface equations. Derivation of electro-capillarity, Lippmann equation (surface excess), methods of determination.

UNIT –IV

**CHEMICAL DYNAMICS –I:** Methods of determining rate laws, consecutive reactions, collision theory of reaction rates, steric factor, Activated complex theory, kinetic salt effects, steady state kinetics, and thermodynamic and kinetic control of reactions. Dynamic chain (Hydrogen-bromine and Hydrogen-chlorine reactions) and Oscillatory reactions (Belousov-Zhabotinsky reaction etc.)

BOOKS SUGGESTED :

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Coulson's Valence, R. McWeeny, ELBS.
3. Chemical Kinetics, K. J. Laidler, Pearson.
4. Kinetics and Mechanism of Chemical Transformations, J. Rajaraman and J. Kuriacose, McMillan.
5. Modern Electrochemistry Vol. I and Vol. II, J.O.M. Bockris and A.K.N. Reddy, Plenum.
6. Thermodynamics for Chemists, S. Glasstone EWP.
7. An Introduction to Electrochemistry S. Glasstone EWP.
8. Organic Chemist's Book of Orbitals. L. Salem and W.L. Jorgensen, Academic Press
9. The Physical Basis of Organic Chemistry, H. Maskill, Oxford University Press



**THEORY AND APPLICATIONS OF SPECTROSCOPY- I**

Max. Marks 80

**UNIT - I**

**UNIFYING PRINCIPLES:**

Electromagnetic radiation, interaction of electromagnetic radiation with matter-absorption, emission transmission, reflection, dispersion, polarization and scattering, Uncertainty relation and natural line width and natural line broadening, transition probability, selection rules, intensity of spectral lines, Born-Oppenheimer approximation, rotational, vibrational and electronic energy levels. Region of spectrum, representation of spectra, F.T. spectroscopy, computer averaging, lasers.

**UNIT- II**

**MICROWAVE SPECTROSCOPY:**

Classification of molecules in term of their internal rotation mechanism, determination of rotation energy of diatomic and polyatomic molecules, intensities of rotational spectral lines, effect of isotopic substitution on diatomic and polyatomic molecules, intensities of rotational spectral lines and parameters of rotational energy of linear and the transition frequencies, non-rigid rotators, spectral lines and parameters of rotational energy of linear and symmetric top polyatomic molecules. Application in determination of bond length.

**UNIT- III**

**INFRA RED SPECTROSCOPY:**

Introduction, simple and anharmonic oscillators in vibrational spectroscopy, diatomic-vibrating rotator, Modes of vibration in polyatomic molecules, vibration-coupling, Fourier Transform IR spectroscopy: instrumentation, interferometric spectrophotometer, sample handling, Factors influencing vibrational frequencies, Application of IR spectroscopy: Interpretation of IR spectra of normal alkanes, aromatic hydrocarbons, alcohols, phenols, aldehydes, ketones, ethers, esters, carboxylic acids, amines and amides.

**UNIT- IV**

**RAMAN SPECTROSCOPY:**

Classical and quantum theories of Raman effect, pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, Coherent anti Stokes Raman spectroscopy (CARS), Instrumentation , Application of Raman effect in molecular structures, Raman activity of molecular vibration, structure of CO<sub>2</sub>, H<sub>2</sub>O, N<sub>2</sub>O, SO<sub>2</sub>, NO<sub>3</sub><sup>-</sup>, ClF<sub>3</sub>.

**BOOKS SUGGESTED**

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Fundamentals of Molecular Spectroscopy, C.N. Banwell.
3. Spectroscopy, B.K. Sharma, Goel Publication.
4. Organic Spectroscopy: Principles and Applications, Jag Mohan, Narosa Publication.
5. Spectroscopy Methods in Organic Chemistry, D.H. Williams & I. Fleming, Tata Mcgraw-Hill Publication.
6. Spectrophometric Identification of Organic Compounds, R.M. Silversteion & F. X. Webster, John Wiley Publication.

## PAPER NO 5. CH - 105

### LABORATORY COURSE-I

Max. Marks 100

#### 1. QUALITATIVE ANALYSIS OF MIXTURE CONTAINING EIGHT RADICALS INCLUDING TWO LESS COMMON METAL FROM AMONG THE FOLLOWING BY SEMI MICRO METHOD.

1) *Basic Radicals* :

Ag, Pb, Hg, Bi, Cu, Cd, As, Sb, Sn, Fe, Al, Cr, Zn, Mn, Co, Ni, Ba, Sr, Ca, Mg, Na, K, Ce, Th, Zr, W, Te, Ti, Mo, U, V, Be, Li, Au, Pt.

2) *Acid Radicals* :

Carbonate, Sulphite, Sulphide, Nitrite, Nitrate, Acetate, Fluoride. Chloride, Bromide, Iodide, Sulphate, Borate, Oxalate, Phosphate, Silicate, Thiosulphate, Ferrocyanide, Ferricyanide, Sulphocyanide, Chromate, Arsenate and Permanganate.

#### 2. QUANTITATIVE ANALYSIS:

Involving separation of two of the following in ores, alloys, or mixtures in solution, one by volumetric and the other by gravimetric methods.

#### 3. ESTIMATION OF:

- 1) Phosphoric acid in commercial orthophosphoric acid.
- 2) Boric acid in borax.
- 3) Ammonia in ammonium salts.
- 4) Manganese dioxide in pyrolusite.
- 5) Available chlorine in bleaching powder.
- 6) Hydrogen peroxide in commercial samples.

#### 4. PREPARATIONS:-

Preparation of selected inorganic compound and their studies by I.R. electronic spectra, Mössbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds

- (1) VO (acac)<sub>2</sub>
- (2) TiO(C<sub>9</sub>H<sub>8</sub>NO)<sub>2</sub> · 2H<sub>2</sub>O
- (3) cis-K [Cr(C<sub>2</sub>O<sub>4</sub>)<sub>2</sub> (H<sub>2</sub>O)<sub>2</sub>]
- (4) Na [Cr (NH<sub>3</sub>)<sub>2</sub> (SCN)<sub>4</sub>]
- (5) Mn (acac)<sub>3</sub>
- (6) K<sub>2</sub>[Fe(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>]
- (7) Prussian Blue, Turnbull's Blue.
- (8) [Co (NH<sub>3</sub>)<sub>6</sub>] [Co (NO<sub>2</sub>)<sub>6</sub>]
- (9) cis-[Co(trien) (NO<sub>2</sub>)<sub>2</sub>] Cl · H<sub>2</sub>O
- (10) Hg [Co (SCN)<sub>4</sub>]
- (11) [Co (Py)<sub>2</sub>Cl<sub>2</sub>]
- (12) [Ni (NH<sub>3</sub>)<sub>6</sub>] Cl<sub>2</sub>
- (13) Ni (dmg)<sub>2</sub>
- (14) [Cu (NH<sub>3</sub>)<sub>4</sub>] SO<sub>4</sub> · H<sub>2</sub>O

#### BOOKS SUGGESTED

1. Vogel's Textbook of Quantitative Analysis, rev. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly, Prentice Hall.

**ADSORPTION/SURFACE CHEMISTRY**

1. Surface Tension - Concentration relationship for solutions (Gibbs equation).
2. To verify the Freundlich and Langmuir Adsorption isotherms using acetic acid/Oxalic acid and activated charcoal.
3. Determination of CMC of surfactants.

**PHASE EQUILIBRIA**

1. To Construct the Phase diagram for three component system (e.g., chloroform-acetic acid-water).

**CHEMICAL KINETICS**

1. Determination of the effect of (a) Change of temperature (b) Change of concentration of reactants and catalyst and (c) Ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions.
2. Determination of the velocity constant of hydrolysis of an ester/ionic reaction in micellar media.
3. Determination of the rate constant for the decomposition of hydrogen peroxide by  $\text{Fe}^{3+}$  and  $\text{Cu}^{2+}$  ions.
4. Determination of the primary salt effect on the kinetics of ionic reactions and testing of the Bronsted relationship (iodide ion is oxidized by persulphate ion).

**SOLUTIONS/MOLECULAR WEIGHTS**

1. Determination of molecular weight of non-volatile substances by Landsberger method.
2. Determination of Molar masses of Naphthelene/acetanilide.
3. Molecular weight of polymers by viscosity measurements.

**CONDUCTOMETRY**

1. Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.
2. Determination of solubility and solubility product of sparingly soluble salts (e.g.,  $\text{PbSO}_4$ ,  $\text{BaSO}_4$ ) conductometrically.
3. Determination of  $\text{pK}_a$  of Acetic acid and verification of Ostwald dilution law.

**POTENTIOMETRY/pH METRY**

1. Determination of the strength of strong and weak acids in a given mixture using a potentiometer/pH meter.
2. Determination of the dissociation constant of acetic acid in DMSO, DMF, acetone and dioxane by titrating it with KOH.
3. Determination of the dissociation constant of monobasic/dibasic acid by Albert-Serjeant method.
4. Determination of Redox potential of  $\text{Fe}^{++}/\text{Fe}^{+++}$  system.
5. Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter.
6. Enzyme kinetics –inversion of sucrose.
7. Determine the specific and molecular rotation of optically active substances.

**BOOKS SUGGESTED**

1. Experiments and Techniques in Organic Chemistry, D.Pasto, C. Johnson and M.Miller, Prentice Hall.
2. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Heath.
3. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.  
Handbook of Organic Analysis –Qualitative and Quantitative, H. Clark, Adward Arnold.
4. Vogel's Textbook of Practical Organic Chemistry,
5. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
6. Findley's Practical Physical Chemistry, B.P. Levi  
Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.



## SECOND SEMESTER

### PAPER NO1 . CH - 201

#### TRANSITION METAL COMPLEXES

Max. Marks 80

##### UNIT - I

**REACTION MECHANISM OF TRANSITION METAL COMPLEXES:** Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, anation reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect. Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

##### UNIT - II

###### **ELECTRONIC SPECTRA AND MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES:**

Spectroscopic ground states, Correlation, Orgel and Tanabe-Sugano diagrams for transition metal complexes ( $d^1$ - $d^9$  states), Selection rules, mechanism for break down of the selection rules, intensity of absorption, band width, spectra of d-d metal complexes of the type  $[M(H_2O)]^{n+}$ , spin free and spin paired  $ML_6$  complexes of other geometries, Calculations of  $Dq$ ,  $B$  and parameters, spin forbidden transitions, effect of spin-orbit coupling, Spectrochemical and Nephelauxetic series. Magnetic properties of complexes of various geometries based on crystal field model, spin free-spin paired equilibria in octahedral stereochemistry.

##### UNIT - III

- A. **TRANSITION METAL COMPLEXES:** Transition metal complexes with unsaturated organic molecules, alkanes, allyl, diene dienyl, arene and trienyl complex, preparations, properties, nature of bonding and structure features. Important reaction relating to nucleophilic and electrophilic attack on ligands and organic synthesis.
- B. **TRANSITION METALS COMPOUND WITH BOND TO HYDROGEN:** Transition Metals Compounds with Bond to Hydrogen.

##### UNIT-IV

- A. **ALKYLS AND ARYLS OF TRANSITION METALS:** Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis.
- B. **COMPOUNDS OF TRANSITION METAL - CARBON MULTIPLE BONDS :** Alkylidenes, low valent carbenes, nature of bond and Structural characteristics.
- C. **FLUXIONAL ORGANOMETALLIC COMPOUNDS:** Fluxionality and dynamic equilibria in compounds such as olefin, -allyl and dienyl complexes.

##### BOOKS SUGGESTED :

1. Principles and applications of organotransition metal chemistry, J.P.Collman, L.S.Hegsdus, J. R. Norton and R.G. Finke, University Science Books.
2. The Organometallic chemistry of the Transition metals, R. H. Crabtree, John Wiley.
3. Metallo - organic chemistry, A.J. Pearson, Wiley.
4. Organometallic chemistry, R.C. Mehrotra and A. Singh, New age International.

## PAPER NO 2. CH - 202

### REACTION MECHANISMS

Max. Marks 80

#### UNIT - I

- A. **ALIPHATIC NUCLEOPHILIC SUBSTITUTION:** The  $S_N^2$ ,  $S_N^1$ , mechanisms. The neighbouring group mechanism, neighbouring group participation by  $\pi$  and  $\sigma$  bonds, anchimeric assistance. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, ambident nucleophile and regioselectivity.
- B. **AROMATIC NUCLEOPHILIC SUBSTITUTION:** The  $S_N^1$ ,  $S_N^2$  mechanisms. Reactivity effect of substrate structure, leaving group and attacking nucleophile. The von Richter, Sommelet-Hauser, and Smiles rearrangements.

#### UNIT - II

- A. **ALIPHATIC ELECTROPHILIC SUBSTITUTION:** Mechanisms of  $S_E^2$ ,  $S_E^1$ , electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity.
- B. **AROMATIC ELECTROPHILIC SUBSTITUTION:** The arenium ion mechanism, orientation and reactivity. The ortho/para ratio, ipso attack, orientation in other ring systems.  $\ominus$  Reactivity-Effect of substrates and electrophiles. Vilsmeier reaction and Gattermann-Koch reaction.

#### UNIT - III

**ADDITION TO CARBON-CARBON MULTIPLE BONDS:** Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio- and chemoselectivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings Hydroboration, Michael reaction. Sharpless asymmetric epoxidation.

#### UNIT - IV

**ADDITION TO CARBON-HETERO MULTIPLE BONDS:** Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids esters and nitriles. Addition of Grignard Reagents, Organo-Zinc and Organo-lithium to carbonyls and unsaturated carbonyl compounds, Wittig reaction.

Mechanism of condensation reactions involving enolates - Aldol, Knoevenagel and Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.

#### BOOKS SUGGESTED :

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Modern Organic Reactions, H. O. House, Benjamin.
3. Principles of Organic Synthesis, R. O. C. Norman and J. M. Coxon, Blackie Academic & Professional.
4. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
5. Structures and Mechanism in Organic Chemistry, C. K. Ingold, Cornell University Press.
6. Reaction Mechanism in Organic Chemistry, S. M. Mukherji and S. P. Singh, Macmillan

QUANTUM CHEMISTRY, THERMODYNAMICS AND CHEMICAL DYNAMICS - II

Max. Marks 80

UNIT –I

- A. **APPLICATION OF MATRICES IN QUANTUM CHEMISTRY:** Addition and multiplication, inverse and transpose of matrices. Determinants, in quantum Chemistry.
- B. **ANGULAR MOMENTUM IN QUANTUM CHEMISTRY:** Angular momentum, angular momentum Operators. Eigen functions and Eigen values Angular momentum, ladder operators.
- C. **APPROXIMATE METHODS:** The variation theorem, linear variation principle. Perturbation theory (first order and non-degenerate). Applications of variation method and perturbation theory to the Helium atom.

UNIT –II

**STATISTICAL THERMODYNAMICS:** Probability, permutations and combinations concepts of probability, Maxwell Boltzmann distribution. Different ensembles and Partition functions translational, rotational, vibrational and Electronic. Thermodynamic function using appropriate Partition function. Fermi-Dirac and Bose-Einstein Statistics and statistical basis of entropy. Heat capacity of solids, Debye and Einstein Models.

UNIT –III

**ELECTROCHEMISTRY –II:** Structure of electrified interfaces. Gouy-Chapman, Stern, Over potentials and exchange current density, Derivation of Butler –Volmer equation, Tafel plot. Semiconductor interfaces, Theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interfaces. Electro catalysis influence of various parameters. Hydrogen electrode.

UNIT –IV

**CHEMICAL DYNAMICS –II:** General features of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method. Molecular reaction dynamics, Dynamics of molecular motions, probing the transition state, dynamics of barrierless chemical reactions in solutions, dynamics of unimolecular reaction. [Lindemann –Hinshelwood , RRK and Rice-Ramsperger-Kassel-Marcus {RRKM}] theories of unimolecular reactions.

BOOKS SUGGESTED :

1. The Chemistry Mathematics Book, E. Steiner, Oxford University Press.
2. Mathematics for Chemistry, Doggett and Sutcliffe, Longman.
3. Mathematical Preparation for Physical Chemistry, F. Daniels, McGraw Hill.
4. Chemical Mathematics, D.M, Hirst, Longman.
5. Applied Mathematics for Physical Chemistry, J.R. Barrante, Prentice Hall.
6. Basic Mathematics for Chemists, Tebbutt, Wiley.
7. Physical Chemistry, P.W. Atkins, ELBS.
8. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill.
9. Quantum Chemistry, Ira N. Levine, Prentice Hall.
10. Coulson's Valence, R. McWeeny, ELBS.
11. Chemical Kinetics, K. J. Laidler, Pearson.
12. Kinetics and Mechanism of Chemical Transformations, J. Rajaraman and J. Kuriacose, McMillan.
13. Modern Electrochemistry Vol. I and Vol. II, J.O.M. Bockris and A.K.N. Reddy, Plenum.
14. Thermodynamics for Chemists, S. Glasstone EWP.
15. An Introduction to Electrochemistry S. Glasstone EWP.
16. Physical Chemistry, Ira N. Levine McGraw Hill.
17. Physical Chemistry, Silbey, Alberty, Bawendi, John-Wiley.



THEORY AND APPLICATIONS OF SPECTROSCOPY –II

Max. Marks 80

UNIT - I

**ULTRAVIOLET AND VISIBLE SPECTROSCOPY:**

Introduction, intensity of vibrational-electronic spectra and Frank-Condon principle for dissociation energy, rotational fine structure of electronic-vibrational spectra, Shape of some molecular orbitals viz., H<sub>2</sub>, He<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>. Electronic spectra of organic molecules, chromophores, application of electronic spectroscopy: spectrophotometric studies of complex ions, determination of ligand/metal ratio in a complex, identification of compounds, determination of stability constants.

UNIT -II

**SCATTERING SPECTROSCOPY:**

Principle, instrumentations and application of Auger spectroscopy, Scanning Electron Microscopy, Electron diffraction of gases and vapours, The Wierl equation and co-related method.

Theory, instrumentation and application of turbidimetry, nephelometry, fluorometry. Fluorescence and phosphorescence and factors affecting them.

UNIT - III

**MASS SPECTROMETRY:**

Introduction, basic principles, separation of the ions in the analyzer, resolution, molecular ion peak, mass spectral fragmentation of organic compounds, factors affecting fragmentation, McLafferty rearrangement. Instrumentation, Characteristics of mass spectra of Alkanes, Alkenes, Aromatic hydrocarbons, Alcohols, Amines. Nitrogen rule, ring rule, Molecular weight and formula determination, Gas chromatography-Mass spectrometry.

UNIT - IV

**NUCLEAR RESONANCE SPECTROPHOTOMETRY:**

Theory of NMR spectroscopy, interaction of nuclear spin and magnetic moment, chemical shift, precessional motion of nuclear particles in magnetic field, spin-spin splitting, coupling constants, factor affecting the chemical shift, shielding effect, effect of chemical exchange, hydrogen bonding, instrumentation of Fourier transform NMR spectrophotometer, structure determination of organic compounds, Carbon-13 NMR spectroscopy, Multiplicity-proton (<sup>1</sup>H) decoupling-noise decoupling, off resonance decoupling, selective proton decoupling, chemical shift.

**BOOKS SUGGESTED**

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Fundamentals of Molecular Spectroscopy, C.N. Banwell.
3. Spectroscopy, B.K. Sharma, Goel Publication.
4. Organic Spectroscopy : Principles and Application, Jag Mohan, Narosa Publication.
5. Spectroscopic Methods in Organic Chemistry, D.H. Williams & I. Fleming, Tata Mcgraw-Hill Publication.
6. Spectrophotometric Identification of Organic Compounds, R.M. Silverstein & F.X. Webster, John Wiley Publications.

## PAPER NO 5. CH - 205

### LABORATORY COURSE –III

Max. Marks 100

- 1. GENERAL METHODS OF SEPARATION AND PURIFICATION OF ORGANIC COMPOUNDS WITH SPECIAL REFERENCE TO:**
  - 1) Solvent Extraction
  - 2) Fractional Crystallization
- 2. DISTILLATION TECHNIQUES:**

Simple distillation, steam distillation, Fractional distillation and distillation under reduced pressure.
- 3. ANALYSIS OF ORGANIC BINARY MIXTURE:**

Separation and Identification of organic binary mixtures containing at least one component with two substituents.  
(A student is expected to analyse at least 10 different binary mixtures.)
- 4. PREPARATION OF ORGANIC COMPOUNDS: SINGLE STAGE PREPARATIONS.**
  - 1) **Acetylation:** Synthesis of  $\beta$ -Naphthyl acetate from  $\beta$ -Naphthol / Hydroquinone diacetate from Hydroquinone.
  - 2) **Aldol condensation:** Dibenzal acetone from benzaldehyde.
  - 3) **Bromination:** p-Bromoacetanilide from acetanilide.
  - 4) **Cannizzaro Reaction:** Benzoic acid and Benzyl alcohol from benzaldehyde.
  - 5) **Friedel Crafts Reaction:** o-Benzoyl Benzoic acid from phthalic anhydride.
  - 6) **Grignard Reaction:** Synthesis of triphenylmethanol from benzoic acid,
  - 7) **Oxidation:** Adipic acid by chromic acid oxidation of cyclohexanol.
  - 8) **Perkin's Reaction:** Cinnamic acid from benzaldehyde.
  - 9) **Sandmeyer Reaction:** p-Chlorotoluene from p-toluidine/o-Chlorobenzoic acid from anthranilic acid.
  - 10) **Schotten Baumann Reaction:**  $\beta$ -Naphthyl benzoate from:  $\beta$ -Naphthol / Phenyl benzoate from phenol.
  - 11) **Sulphonation Reaction:** Sulphanilic acid from aniline.

#### BOOK SUGGESTED :

1. Practical Organic chemistry by A. I. Vogel.
2. Practical Organic chemistry by Mann and Saunders.
3. Practical Organic chemistry by Garg and Salija.
4. The Systematic Identification of Organic compounds, R. L. Shriner and D. Y. Curtin.
5. Semimicro Qualitative Organic Analysis, N.D. Cheronis, J. B. Entrikin and E. M. Hodnett.
6. Practical Physical chemistry by Alexander Findlay.
7. Experimental Physical chemistry, D. P. Shoemaker, G. W. Garland and J. W. Niber, Mc Graw Hill Interscience.
8. Findlay's Practical Physical chemistry, revised B

## PAPER NO 6. CH –206

### LABORATORY COURSE –IV

Max. Marks 100

#### I. ERROR ANALYSIS AND STATISTICAL DATA ANALYSIS

1. Linear Regression Analysis
2. Curve Fitting
3. Student “t” Test
4. Data Analysis Using Basic Statistical Parameters
5. Calibration of volumetric Apparatus, Burette, Pipette Weight Box etc.

#### II. USE OF COMPUTER PROGRAMMES

The students will learn how to operate a PC and how to run standard programmes and packages. Execution of linear regression, X-Y plot, numerical integration and differentiation as well as differential equation solution programmes. Monte Carlo and Molecular dynamics. Programmes with data preferably from physical chemistry laboratory. Further, the student will operate one or two or the packages such as MICROSOFT EXCEL, WORLD, POWERPOINT, SPSS, ORIGIN, MATLAB, EASYPLOT.

#### III. A. FLAME PHOTOMETRIC DETERMINATIONS

1. Sodium and potassium when present together.
2. Sodium/potassium in solid samples.
3. Solid Sodium and Potassium in Liquid Samples.
4. Lithium/calcium/barium/strontium.
5. Cadmium and magnesium in tap water.

#### B. NEPHELOMETRIC DETERMINATIONS

1. Sulphate
2. Phosphate
3. Silver

#### IV. ELECTROPHORESIS

1. To separate cations of inorganic salts by paper electrophoresis.
2. Capillary Electrophoresis of water –soluble Vitamines

#### V. SPECTROSCOPY

1. Verification of Beer’s Lambert Law.
2. Determination of stoichiometry and stability constant of inorganic (e.g. ferric –salicylic acid) and organic (e.g. amine-iodine) complexes, thiocyanate.
3. Characterization of the complexes by electronic and IR, UV spectral data.
4. Determination of Indicator constant ( $pK_a$ ) of methyl red.

#### BOOK SUGGESTED :

1. Computer and Common Sense, R. Hunt and J. Shelley, Prentice Hall.
2. Computational Chemistry, A.C. Norris.
3. Microcomputer Quantum Mechanics, J.P. Killngbeck, Adam Hilger.
4. Computer Programming in FORTRAN IV, V. Rajaraman, Prentice Hall.
5. An Introduction to Digital Computer Design, V. Rajaraman and T. Radhakrishnan, Prentice Hall.
6. Experiments in Chemistry, D.V. Jahagirgar.



## THIRD SEMESTER

### PAPER NO 1. CH - 301

#### RESONANCE SPECTROSCOPY, PHOTOCHEMISTRY AND ORGANOCATALYSIS

Max. Marks 80

##### UNIT –I

- A. **ELECTRON SPIN RESONANCE SPECTROSCOPY:** Hyperfine coupling, spin polarization for atoms and transition metal ions, spin-orbit coupling and significance of g-tensors, application to transition metal complexes (having one unpaired electron).
- B. **NUCLEAR QUADRUPOLE RESONANCE SPECTROSCOPY:** Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splitting, applications.

##### UNIT –II

- A. **PHOTOELECTRON SPECTROSCOPY:** Basic principle both for atoms and molecules; Photo-electric effect, ionization process, Koopman's theorem, Spectra of simple molecules, Auger electron spectroscopy, Determination of Dipole moment.
- B. **PHOTOACOUSTIC SPECTROSCOPY:** Basic principle of Photo acoustic Spectroscopy (PAS), PAS – gases and condensed system Chemical and Surface application.

##### UNIT –III

- A. **PHOTOCHEMICAL REACTIONS :** Interaction of electromagnetic radiation with matter, Photophysical processes , Stern Volmer equation, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, Actinometry.
- B. **DETERMINATION OF REACTION MECHANISM:** Classification, rate constants and life times of reactive energy states –determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions.
- C. **MISCELLANEOUS PHOTOCHEMICAL REACTIONS:** Photo-Fries reactions of anilides, Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photodegradation of polymers, Photochemistry of vision.

##### UNIT –IV

###### A. ORGANOCATALYSIS

General Principles: Energetic, Catalytic cycles, catalytic efficiency and life time, selectivity. Type of organometallic reaction: Ligand substitution, Oxidative addition, reductive elimination and insertion and deinsertion. Homogeneous catalysis: Hydrogenation of alkenes, Hydroformylation, Monsanto acetic acid synthesis, Wacker oxidation of alkenes, Alkenes metathesis, Palladium-Catalysed C-C bond forming reactions, asymmetric oxidation. Heterogeneous catalysis: The nature of heterogeneous catalysts, Fischer-Tropsch synthesis, alkene polymerization.

##### BOOK SUGGESTED:

1. Infrared and Raman Spectra: Inorganic and Coordination Compounds, K. Nakamoto, Wiley.
2. Fundamentals of Photochemistry, K.K. Rohtagi-Mukherji, Wiley-Eastern.
3. Essentials of Molecular Photochemistry, A. Gilbert and J. Baggott, Blackwell Scientific Publications.
4. Molecular Photochemistry, N.J. Turro, W.A. Benjamin.
5. Introductory Photochemistry, A. Cox and T. Camp, McGraw-Hill.
6. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
7. Application of Spectroscopy of Organic Compounds, J.R. Dyer, Prentice Hall.
8. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
9. Organic Photochemistry, J. Coxon and B. Halton, Cambridge University Press.
10. Shriver & Atkins Inorganic Chemistry: P. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, Oxford University Press
11. Inorganic Chemistry: C.E. Housecraft, A.G. Sharpe, Pearson Education Limited.
12. Inorganic Chemistry: Principles of Structure and Reactivity: J.E. Huheey, E.A. Keiter, R.L. Keiter, O.K. Medhi, Pearson Education
13. Organometallic Chemistry: A Unified Approach: R.C. Mehrotra, A. Singh, New Age International Publishers.

## CHEMISTRY OF BIOMOLECULES

Max. Marks 80

## UNIT –I

- A. **BIOENERGETICS:** Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.
- B. **ELECTRON TRANSFER IN BIOLOGY:** Structure and function of metalloproteins in electron transport processes –cytochromes and iron-sulphur proteins, synthetic models.
- C. **TRANSPORT AND STORAGE OF DIOXYGEN:** Heme proteins and oxygen uptake, structure and function of haemoglobin, myoglobin, haemocyanins and haemerythrin, model synthetic complexes of iron, cobalt and copper.

## UNIT –II

- A. **METALLOENZYMES:** Zinc enzymes –carboxypeptidase and carbonic anhydrase. Iron enzymes – catalase, peroxidase and cytochrome P-450. copper enzymes- superoxide dismutase. Molybdenum oxotransferase enzymes –xanthine oxidase.
- B. **ENZYME MODELS:** Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality. Biomimetic chemistry, Cyclodextrin-based enzyme models, calixarenes, ionophores, synthetic enzymes or synzymes.

## UNIT –III

- A. **ENZYMES :** Nomenclature and classification of Enzyme. Induced fit hypothesis, concept and identification of active site by the use of inhibitors.
- B. **CO-ENZYME CHEMISTRY:** Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD<sup>+</sup>, NADP<sup>+</sup>, FMN, FAD, lipoic acid, vitamin B<sub>12</sub>.
- C. **BIOTECHNOLOGICAL APPLICATIONS OF ENZYMES:** Techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilization enzymes in medicine and industry. Enzymes and Recombinant DNA Technology.

## UNIT –IV

- A. **BIOPOLYMER INTERACTIONS:** forces involved in biopolymer interaction. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems. Hydrogen ion titration curves.
- B. **THERMODYNAMICS OF BIOPOLYMER SOLUTIONS:** Thermodynamics of biopolymer solution, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical system.
- C. **CELL MEMBRANE AND TRANSPORT OF IONS:** Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport and Nerve conduction.

## BOOK SUGGESTED:

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.L. Lippard and J.S. Valentine, University Science Books.
3. Inorganic Biochemistry vols II and I.Ed G.L. Eichhorn, Elsevier.
4. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
5. Bioinorganic Chemistry, I. Bertini, H.B. Gary, S.J. Lippard and J.S. Valentine, University Science.
6. Inorganic Biochemistry vols I and II ed. G.L. Eichhorn, Elsevier.
7. Bioorganic Chemistry: A Chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer-verlag.
8. Understanding Enzymes, Trevor palmer, Prentice Hall.
9. Enzyme Chemistry : Impact and Applications, Ed. Collin J Suckling, Chapman and Hall.
10. Enzyme Mechanisms Ed, M.I. Page and A. Williams, Royal Society of Chemistry.
11. Fundamentals of Enzymology, N.C. Price and L. Stevens, Oxford University Press.
12. Immobilized Enzymes: An Introduction and Applications in Biotechnology, Michael D. Trevan, and John Wiley.

13. Enzymatic Reaction Mechanisms, C. Walsh, W.H. Freeman.
14. Enzyme Structure and Mechanisms, A Fersht, W.H. Freeman.
15. Biochemistry: The Chemical Reactions of Living Cells, D.E. Metzler, Academic Press.
16. Principles of Biochemistry, A.L. Lehninger, Wroth Publishers.
17. Biochemistry, L. Stryer, W.H. Freeman.
18. Biochemistry, J. David Rawn, Neil Patterson.
19. Biochemistry, Voet and Voet, John Wiley.
20. Outlines of Biochemistry, E.E. Conn and P.K. Stumpf, John Wiley.
21. Bioorganic Chemistry : A Chemistry Approach to Enzyme Action, H. Dugas and C. Penny, Springer-Verlag.
22. Biochemistry and Molecular Biology of Plants, Buchanan, Griseham and Jones, I.K. International Pvt. Ltd.



**CATALYSIS, SOLID STATE AND SURFACE CHEMISTRY**

Max. Marks 80

**UNIT –I**

**ACIDS, BASES, ELECTROPHILES, NUCLEOPHILES AND CATALYSIS:**

Acid-base dissociation, Electronic and structural effects, acidity and basicity. Acidity function and their applications. Hard and soft acids and bases. Nucleophilicity scales. Nucleofugacity. The alpha effect. Ambivalent Nucleophilities. Acid base catalysis-specific and general catalysis. Bronsted catalysis, Enzyme Catalysis.

**UNIT –II**

**MICELLES AND ADSORPTION :**

Micelles : Classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of Surfactants. Thermodynamics of micellization - phase separation and mass action models. Reverse micelles, micro-emulsion. Micellar Catalysis, Surface tension capillary action, pressure difference across curved surface (Laplace equation), vapor pressure of droplets (Kelvin equation), Gibbs adsorption isotherm.

**UNIT –III**

**SOLID STATE CHEMISTRY - I :**

Crystal defects and Non-stoichiometry - Perfect and imperfect crystals, intrinsic and extrinsic defects - point defect, line and plane defects, vacancies - Schottky defects and Frankel defects. Thermodynamics of Schottky and Frenkel defect, formation of color centres, non-stoichiometry and defects. Electronic properties and Band theory of semiconductors.

**UNIT –IV**

**MACROMOLECULES :**

Polymer - Definition types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization.

Molecular mass and average molecular mass. Molecular mass determination (Osmometry, Viscometry, diffusion and light scattering methods), Sedimentation, chain configuration of macromolecules, calculation of average dimensions of various chain structures.

**BOOK SUGGESTED :**

1. G.W. Castellan, "Physical Chemistry", Addison- Lesley Publishing Co.
2. E.A. Moelwyn Hughes, "Physical Chemistry", Pergamon Press.
3. Denbigh, "Chemical Equilibria", D. Van Nostrand.
4. J. Rose, "Dynamic Physical Chemistry" Sir Issac Pitman and Sons.
5. Solid state "Chemistry and its Applications, A.R. West, Plenum.
6. Principle of Solid State H.V. Kar, Wiley Eastern.
7. Solid State Chemists, D.K. Chakrabarty, New Age International (P) Ltd.
8. Micelles, Theoretical and Applied Aspects, V. Moral Plenum.
9. The Chemistry Mathematics Book, E. Steiner, Oxford University Press.
10. Mathematics for Chemistry, Doggett and Sutcliffe, Longman.
11. Mathematical Preparation for Physical Chemistry, F. Daniels, McGraw Hill.
12. Chemical Mathematics, D.M. Hirst, Longman.
13. Applied Mathematics for Physical Chemistry, J.R. Barrante, Prentice Hall.
14. Basic Mathematics for Chemists, Tebbutt, Wiley.
15. Quantum Chemistry, Ira N. Levine, Prentice Hall.
16. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill.

**ANALYTICAL TECHNIQUES AND DATA ANALYSIS**

Max. Marks 80

**UNIT –I**

**SAMPLE PREPARATION, DEGESTION AND STATISTICAL ANALYSIS**

- A. Sampling - Collection, Preservation and preparation of sample, Techniques of sampling of solid, liquid and gaseous samples, Operation of drying and preparing a solution of the analyte.  
Principle, methodology and application of different types of digestions such as acid digestion, base digestion, enzymatic and microwave digestion for liquid and solid materials.
- B. Evolution and procession of Analytical Data, Precision and Accuracy, Types of Errors, Propagation of errors, Normal Distribution Curve, Standard deviation, Confidence limit, Graphical presentation of result-method of average, Method of Linear least square, Significant figures, Statistical aid to hypothesis of testing- t-test, F-test, Correlation coefficient, Rejection of data.

**UNIT –II**

**SEPARATION TECHNIQUES**

- A. Principle of Solvent Extraction, Methods of Extraction, Efficiency of extraction, Selectivity of extraction, applications.
- B. Principle, classification of chromatographic techniques, Technique and applications of paper chromatography, Thin-layer chromatography, HPTLC, Column chromatography.

**UNIT –III**

**THERMAL AND AUTOMATED METHODS**

- A. Principle, Instrumentation, Applications of TGA, DTA and DSC methods.
- B. Automated methods, Principle, instrumentation and application of flow injection analysis.

**UNIT –IV**

**ELECTROCHEMISTRY**

- A. Principles and instrumentation of pH potentiometry, coulometry and conductometry.
- B. Basic principles, Diffusion current, polarized electrode, Micro electrode, Dropping Mercury Electrode Ilkovic equation, Polarographic wave, Qualitative analysis Stripping methods, Cyclic Voltammetry, Amperometric titration :-curves, Differential pulse polarography and Square wave polarography.

**BOOK SUGGESTED :**

1. Fundamental of Analytical Chemistry- Skoog D.A. and West D.M. Saunders, College Publication.
2. Textbook of Quantitative Inorganic Analysis-Vogel A.I.
3. Principles and Practice of Analytical Chemistry-Fifield F.W and Kealey D. Black well Science
4. Instrumental Analysis R. Braun, McGraw Hill, International Edition.
5. Analytical Chemistry, Christian, G.D., WSE/Wiley.
6. Instrumental Analysis, Willard Meritt Dean, CBS.
7. Chemical Analysis, Brawn, McGraw Hill.
8. Fundamental of Analytical Chemistry-Skoog D.A. and West D.M.
9. Principles of instrumental analysis, Skoog Holler - Niemann.
10. Instrumental analysis, Wizard Dean and Merit.
11. Principle and PRACTICAL analytical chemistry, Fifield and Kealey.

## PAPER NO 5. CH - 305

### LABORATORY COURSE –V

Max. Marks 100

1. To calculate the activity with given radioactive source.
2. Determination of the half-life of Radionuclide.
3. Determination of absorption coefficient & half
4. Determination of absorption coefficient & half thickness of lead for gamma radiation.
5. Determination of range and energy of  $\beta$  particle
6. Prove the inverse square law for gamma rays.
7. Measurement of gamma ray energy by gamma ray spectrometry.
8. Determination of the partition coefficient for iodine between carbon tetrachloride & (a) Water, (b) aqueous potassium iodide.
9. Study of kinetics of exchange between ethyl iodide & the iodide ion.
10. Determination of the solubility product of lead iodide.
11. Determination of the dissociation constant of Barium Nitrate.
12. Determination of the concentration of iodine in a given sample (KI), by isotope dilution technique.
13. To study the effect of temperature, concentration of the reactant and catalyst on the rate of a chemical reaction (Hydrolysis/Nucleophilic Substitution).
14. Reaction between Sodium Formate and Iodine by
  - (i) Volumetric Method.
  - (ii) Conductometric Method.
16. Saponification of ethyl acetate
  - (i) Volumetric Method.
  - (ii) Conductometric Method.
17. Reaction between Acetone and Iodine.
18. To study the autocatalytic reaction between  $\text{KMnO}_4$  and Oxalic acid.
19. Reaction between  $\text{K}_2\text{S}_2\text{O}_8$  and Iodine.
20. Determination of pKa by Kinetic Measurement.
21. Evaluation of Equilibrium constants from kinetic data.
22. Determination of rate constant of the decomposition of benzene diazonium chloride at different temperature.
23. To study the photolysis of uranyl oxalate.
24. To study the effect of substrate catalyst etc (i) HCl,  $\text{K}_2\text{S}_2\text{O}_8$  (ii) KOH, NaOH.
25. To study the Activation parameters.
26. To study the solvent effect using some Aprotic & Protic Solvents.
27. To examine the substituent effect (Hammett equation).
28. To study the effect of Electrolyte on the rate hydrolysis (KCl, NaCl,)
29. To study some simple enzyme catalyzed reaction.
30. To study the Micellar Catalyzed Reaction.

**Some advanced level sophisticated instrument based (FTIR, NMR, GC-MS, AAS, FLUORESCENCE SPECTROPHOTOMETER, TENSIO METER etc) experiments may be given to the students.**

#### BOOK SUGGESTED:

1. Basic Experiment with radioisotopes by John, N. Andrews & David J. Hornsey, Pitam Publishing New York.
2. Practical radiochemistry by M.F.C. Ladd & W.H. Lee, Cleaver Hune press Ltd.
3. Practical Physical Chemistry by Alexander Findlay.
4. Experimental Physical Chemistry, D.P. Shoemaker, C.W. Garland and J.W. Niber, Mc Graw Hill Interscience.
5. Findlay's Physical Practical Chemistry, revised B.Phys.Levitt, Longman.



## PAPER NO 6. CH –306

### LABORATORY COURSE –VI

Max. Marks 100

#### A. SPECTROPHOTOMETRIC DETERMINATIONS

- I. Manganese / Chromium, Vanadium in steel sample.
- II. Nickel / Molybdenum / Tungsten / Vanadium / Uranium by extractive spectrophotometric method.
- III. Fluoride / Nitrate / Phosphate.
  
- V. Zirconium –Alizarin Red –S complex: Mole-ratio method.
- VI. Copper –Ethylene diamine complex: Slope-ratio method.

#### B. pH METRY

Stepwise proton-ligand and metal-ligand stability constant of complexes by Leving –Rossoti methods.

#### C. POLAROGRAPHY

Composition and stability constant of complexes.

#### D. FLAME PHOTOMETRIC DETERMINATIONS.

- (i) Sodium and potassium when present together
- (ii) Lithium / calcium / barium / strontium.
- (iii) Cadmium and magnesium in tap water.

#### E. REFRACTOMETRY

1. Determination the specific and molar refraction of a given liquid by abbe Refractometer.
2. Determine the variation of refractive index.
3. To verify law of refraction of mixture (glycerol + water).

#### F. SEPARATION AND QUANTITATIVE ESTIMATION OF BINARY AND TERNARY MIXTURES BY THE USE OF FOLLOWING SEPARATION TECHNIQUES:

1. Paper chromatography –Cadmium and Zinc, Zinc and Magnesium.
2. Thin –layer chromatography –separation of nickel, manganese, cobalt and zinc.
3. Ion-exchange.
4. Solvent extraction.
5. Electrophoretic separation.

**Some advanced level sophisticated instrument based (FTIR, NMR, GC-MS, AAS, FLUORESCENCE SPECTROPHOTOMETER, TENSIO METER etc) experiments may be given to the students**

#### BOOK SUGGESTED :

1. Quantitative Inorganic Analysis, A.I. Vogel.
2. Test book of quantitative chemical analysis, A.I. Vogel.
3. Practical Physical chemistry, A.M. James and F.E. Prichard, Longman.
4. Findley's Practical Physical Chemistry, B.P. Levi
5. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.

## FOURTH SEMESTER

### PAPER NO 1. CH - 401

#### INSTRUMENTAL METHODS OF ANALYSIS

Max. Marks 80

##### UNIT –I

###### ADVANCED CHROMATOGRAPHY:

- A. Ion chromatography: Ion exchange equilibrium, Ion-exchange packing and Inorganic Applications.
- B. Size exclusion chromatography: Column packing, Theory of size of exclusion chromatography and applications.
- C. Supercritical fluid chromatography: Properties of supercritical fluid SFC-Instrumentation and operating variables, comparison with other types of chromatography, applications.
- D. Capillary Electrophoresis and capillary electro chromatography : overviews and applications

##### UNIT –II

###### X-RAY AND PROTON INDUCED SPECTROSCOPY:

- A. X-Ray fluorescent method: Principles-Characteristics x-ray emission. Instrumentation x-ray tube, Radioactive sources. Wavelength dispersive instruments. Energy dispersive instruments. Analytical Applications-Qualitative Analysis.
- B. Proton Induced X-Ray Spectroscopy : Theory, instrumentation and application.

##### UNIT –III

###### ATOMIC EMISSION SPECTROSCOPY

- A. Selectivity, sensitivity and interferences of atomic spectroscopy.
- B. Theory, instrumentation and application of flame photometer, AES, ICP-AES and AFS.

##### UNIT –IV

###### ATOMIC ABSORPTION SPECTROSCOPY AND HYPHENATED TECHNIQUES

- A. Theory instrumentation and application of flame and graphite furnace AAS, cold-vapor and hydride generation AAS.
- B. Theory, instrumentation and application of hyphenated techniques i.e. GC/HPLC/-MS, GC/IC/HPLC-ICP-MS.

##### BOOK SUGGESTED:

1. Instrumental methods of analysis, Willard, Meritt and Dean.
2. Basic concepts of analytical chemistry, S.M. Khopkar, John Wiley & Sons.
3. Metallurgical analysis, S.C. Jain.
4. Material Science and Engineering. An Introduction, W.D. Callister, Wiley.
5. Material Science, J.C. Anderson, K.D. Leaver, J.M. Alexander and R.D. Rawlings, ELBS.
6. Fundamentals of Analytical Chemistry, Skoog, Welt, Holler and Crouch Thomson Learning Inc.

**PAPER NO 2. CH - 402**  
**NATURAL PRODUCT AND MEDICINAL CHEMISTRY**

Max. Marks 80

**UNIT-I**

- A. **Terpenoids and Carotenoids:** Classification, nomenclature, occurrence, isolation, general methods of structure determination of Citral, Geraniol,  $\alpha$ -Terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and  $\beta$  – Carotene.
- B. **Alkaloids:** Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on Nitrogen heterocyclic ring, role of alkaloids in plant. Synthesis and biosynthesis of the following: Ephedrine, (+)- Coline, Nicotine, Atropine, Quinine and Morphine.

**UNIT-II**

- A. **Steroids:** Isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Esterone, Progesterone, Aldostrone and Biosynthesis of cholesterol.
- B. **Plant Pigments:** Occurrence, nomenclature and general method of structure determination. Isolation and synthesis of Apigenin, Luteolin, Quercetin, Myrcetin, Quercetin-3-glucoside, Vitexin, Diadzine, Butein, Aureusin, Cyanidin-7-arebinoside, Cyanidin, Hirsutidin.

**UNIT- III**

**Drug Design**

- A. Development of new drugs procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, Structure-Activity Relationship (SAR), Factors affecting bioactivity, resonance, inductive effect. Theories of drug activity: occupancy theory, rate theory, induced fit theory. Quantitative Structure Activity Relationship (QSAR).
- B. Concepts of drug receptors, lipophilicity, pharmacophore, pharmacological activity and typical range of parameters related to drug likeness.
- C. General introduction of pharmacokinetics and pharmacodynamics.

**UNIT – IV**

- A. **Anteoplastic Agents:** Introduction, Alkylating agents, antimetabolites, carcinolytic antibiotics, mitotic inhibitors.
- B. **Antibiotics:** Constitution and synthesis of penicillins, chloramphenicol, tetracycline and streptomycin.
- C. **Antimalarials:** Synthesis and properties of the following Antimalarial: 8-amino quinolone derivatives-Pamaquine, Primapune, Pentaquinr, Isopentaquine, 4- amino quinolone derivatives-Santoquine, Camaquine, Acridine derivatives-Mepracrine, Azacrin, Pyrimidine and Biguanid derivatives- Paludrine Pyremethamine.

**Book Suggested:**

1. Natural Products: Chemistry and Biological Significance, J. Mann, R. S. Davidson, J. B. Hobbs.
2. D. V. Banthrope and J. B. Harbrone, Longman, Essex., Organic Chemistry, Vol. 2, I. L. Finar, ELBS.
3. Chemistry, Biological and Pharmacological properties of Medicinal Plants from the Americans, Ed. Kurt Hostettmann, M. P. Gupta and A. Marston, Harwood Academic Publishers.
4. Introduction to Flavonoids, B. A. Bhom, Harwood Academic Publishers.
5. New Trends in Natural Product Chemistry, Att-ur-Rahman and M. I. Choudhary, Harwood, Academic Publishers.



6. Insecticides of Natural Origin, Sukh Dev, Harwood Academic Publishers.
7. Introduction to medicinal Chemistry, A Gringuage, Wiley-VCH.
8. Burger's Medicinal Chemistry-1 (Chapter-9 and Ch- 14), Drug Ed. M. E. Discovery, Wolff, John Wiley.

**MATERIAL AND NUCLEAR CHEMISTRY**

Max.Marks 80

**UNIT- I**

**NON EQUILIBRIUM THERMODYNAMICS:** Fundamental concepts, Forces and Fluxes, Entropy production, Phenomenological Laws and Onsager's r for biological systems, coupled reactions.

**UNIT- II****MATERIAL CHEMISTRY:**

Preparation and Properties of Nanoparticles, Materials-Metals, Ceramics (Oxide, carbides, sulphides, nitrides). Physical and chemical Methods, Size and Shape controlled Synthesis, Sol-gel methods, Optical Properties, Electrical and Magnetic Properties, Application of Nanoparticles. Characterization of Nanoparticles (SEM, TEM etc.)

**UNIT-III****SUPRAMOLECULAR CHEMISTRY:**

Properties of covalent bonds, bond length, inter bond angles, Force constant, bond and molecular dipole moment, molecular and bond polarizability.

Intermolecular Forces, hydrophobic effects, Electro static, induction, dispersion and resonance energy, Hydrogen bond, Magnetic interactions. Principles of molecular association and organization Biological macromolecules, Molecular receptors and design principal, cryptands, Cyclophanes, calixarenes and cyclodextrins. Supramolecular reactivity and catalysis.

**UNIT-IV****NUCLEAR AND RADIOCHEMISTRY****NUCLEAR THEORY :**

Nuclear cross section and nuclear radii, nuclear shells and magic numbers, theory of nuclear shell model, nuclear potentials, square well and simple harmonic oscillator potentials, application, liquid drop model, semi-empirical mass equation, application and limitations.

**NUCLEAR FISSION :**

Mass, energy and charge distribution of fission products, decay chains, prompt and neutrons, liquid drop model of nuclear fission.

**NUCLEAR ENERGY :**

Nuclear fission, chain reaction, multiplication factor, nuclear reactors

**APPLIED RADIOCHEMISTRY :**

Radioactive isotopes, purity and strength of radioisotopes. Radiochemical principle in the use of tracers, Application of Tracers in Chemical investigations, Physico-chemical methods, Analytical applications, Age determinations, Medical applications, Agricultural application.

**BOOKS SUGGESTED:**

1. Nuclear and Radiochemistry by G. Friedlander, J.W. Kennedy & J.M. Miller, John Wiley and Sons, New York.
2. Source Book an Atomic Energy – S. Glasstone, Affiliated East –West Press Pvt. Ltd. New Delhi.
3. Nuclear Physics by I. Kaplan, Addison –Wiley Publishing company, London.
4. Nuclear Chemistry and its applications, M. Haissinsky, Addison –Welsley, Publishing Company, London.
5. Essentials of Nuclear chemistry, H.J. Arnikar, Wiley Eatern Ltd, New Delhi.
6. Molecular Mechanics, U. Burkert and N.L. Allinger, ACS Monograph 177, 1982.
7. Mechanism and Theory in Organic Chemistry, T.H. Lowry and K.C. Richardson, Harper and Row.
8. Introduction to Theoretical Organic Chemistry and Molecular Modelling, W.B. Smith, VCH, Weinheim.
9. Physical Organic Chemistry, N.S. Isaacs, ELBS./ Longman.
10. Supramolecular Chemistry: concept and Perspectives, J.M. Lehn, VCH.
11. The Chemistry Mathematics Book, E. Steiner, Oxford University Press.
12. Chemical Mathematics, D.M, Hirst, Longman.
13. Applied Mathematics for Physical Chemistry, J.R. Barrante, Prentice Hall.
14. Quantum Chemistry, Ira N. Levine, Prentice Hall.
15. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill.

ENVIRONMENTAL & APPLIED CHEMICAL ANALYSIS

Max. Marks 80

UNIT –I

**AIR POLLUTION MONITORING AND ANALYSIS**

Classification of air pollution monitoring levels, air quality, standards and index, monitoring and analysis of selected air borne pollutants: SO<sub>2</sub>, NO<sub>x</sub>, SPM, VOC's, Pb, CO<sub>2</sub>, POP's, Hg, carbon and ozone. Air pollution control devices Viz ESP, scrubber technique, baghouse filters etc. Atmospheric chemistry of acid rains, photochemical smog, green house effect, global warming, ozone hole.

UNIT –II

**SOIL AND WATER POLLUTION**

Soil and water quality standards, monitoring and analysis of selected soil water contaminants: COD, pesticides, heavy metals, POPs, fluoride, cyanide, nitrate, phosphate, oil & grease, Geobiochemical impact of municipal solid waste, steel plants effluent, domestic sewage. Control devices of water pollutants.

UNIT –III

**FOOD ANALYSIS**

- A. Introduction to general Constituents of food, Proximate Constituents and their analysis, Additives-Introduction -Types - Study of preservatives colors and Antioxidants and method of estimation, adulteration - Introduction, Types, Test for adulterants.
- B. Introduction standards composition and analysis of following foods : Wheat, Bread, Biscuits, Jam, Jelly, Honey, Milk, Ice Cream, Butter, Cheese, Milk Powder, Oils and Fats, Tea, Coffee, Soft drinks, Alcoholic beverages, Cereal and pulses, Confectionery, Fruits, Vegetables, Egg, Fish, Meat.

UNIT –IV

**COSMETICS, CLINICAL AND DRUG ANALYSIS**

- A. Introduction of Cosmetics, evaluation of cosmetics materials, raw material and additives, Cosmetics colors, Perfumes in cosmetics, Cosmetics formulating, introduction, standards and methods of analysis, Creams, face powders, Make-up, Shaving preparations, Bath preparations.
- B. Concepts and principles of analytic methods commonly used in the clinical species: i.e. ammonia, blood urea Nitrogen, Ca, Cl, CO<sub>2</sub>, Fe, K, Li, Mg, Na, P, urea, glucose.  
Method for analysis of proteins (i.e. albumin, bilirubin, creatinine, cholesterol, HDL-cholesterol, triglycerides, creatinine) and Enzymes (i.e. Alanine Aminotransferase, acid phosphatase, alkaline phosphatase, amylase, aspartate, aminotransferase, cholinesterase, lactate, and lipase).

**BOOK SUGGESTED :**

1. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
2. Environmental chemistry, Sharma and Kaur, Krishna Publishers.
3. Environmental Chemistry, A.K. De, Wiley Eastern.
4. Environmental Chemistry, Analysis, S.M. Khopkar, Wiley Eastern.
5. Standard Method of Chemical Analysis, F.J. Welcher Vol. III, Van Nostrand Reinhold Co.
6. Environmental Toxicology, Ed. J. Rose, Gordon and Breach Science Publication.
7. Environmental Chemistry, C. Baird, W.H. Freeman.
8. Analytical chemistry, G.D. Christian, J. Wiley.
9. Fundamentals of Analytical Chemistry, D.A. Skoog, D.m. West and F.J. Holler, W.B. Saunders.
10. Analytical Chemistry - Principles, J.H. Kennedy, W. Saunders.
11. Analytical Chemistry-Principles, and Techniques, L.G. Hargis, Prentice Hall.
12. Principles of Instrumental Analysis, D.A. Skoog and J.L. Loary, W.B. Saunders.
13. Principles of Instrumental Analysis, D.A. Skoog, W.B. Saunders.
14. Quantitative Analysis, R.A. Day, Jr. and A.L. Underwood, Prentice Hall.
15. Environmental Solution Analysis, S.M. Khopkar, Wiley Eastern.



16. Basic Concepts of Analytical Chemistry, S.M. Khopkar, Wiley Eastern.
17. Handbook of Instrumental Techniques for Analytical Chemistry, F. Settle, Prentice Hall.
18. Environmental Biotechnology, Indushekar Thakur, I.K. International Pvt. Ltd.
19. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, Thompson Learning Inc.
20. APHA, 1977, "Methods of Analysis of air, water and soil" Washington US.

**OPTIONAL PAPERS**  
**CH-404 a**  
**MEDICINAL CHEMISTRY**

**UNIT I**

(a) **DRUG DESIGN:** Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, structure – activity relationship (SAR). Theories of drug activity: Occupancy theory, rate theory, induced fit theory. Quantitative structure activity relationship. History and development of QSAR. Concepts of drug receptors. Lipophilicity and Lipinski Rule of 5.

(b) **PHARMACOKINETICS:** Introduction to drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetics parameters in defining drug disposition and in therapeutics.

(c) **PHARMACODYNAMICS:** Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, membrane active drugs, drug metabolism, biotransformation significance of drug metabolism in medicinal chemistry.

**UNIT II**

(a) **ANTINEOPLASTIC AGENTS:** Introduction, role of alkylating agents and antimetabolites in treatment of cancer. Mention of carcinolytic antibiotics and Mitotic inhibitors. Mechlorethamine, cyclophosphamide, melphalan, uracil, mustards, and 6-mercaptopurine.

(b) **CARDIOVASCULAR DRUGS:** Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function. Direct acting arteriolar dilators. Synthesis of amyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa, atenolo, oxyprenolo.

**UNIT III**

(a) **LOCAL ANTIINFECTIVE DRUGS:** Introduction and general mode of action. Synthesis of sulphonamides, furazolidine, nalidixic acid, ciprofloxacin, norfloxacin, dapson, amino salicylic acid, isoniazid, ethionamide, ethambutal, fluconazole, econozole, griseofulvin, chloroquin and primaquin.

(b) **ANTIBIOTICS:** Cell wall biosynthesis, inhibitors,  $\beta$ -lactam rings, antibiotic inhibiting protein synthesis.

Synthesis of penicillin G, penicillin V, ampicillin, amoxicillin, chloramphenicol, cephalosporin, tetracycline and streptomycin.

**UNIT IV**

**PSYCHOACTIVE DRUGS- THE CHEMOTHERAPY OF MIND :** Introduction, neurotransmitters, CNS depressants, mode of action of hypnotics, sedatives, anti-anxiety drugs, benzodiazepines, buspirone. Antipsychotic drugs – the neuroleptics, antidepressants, butyrophenones, serendipity and drug development, stereochemical aspects of psychotropic drugs. Synthesis of diazepam, oxazepam, chlorazepam, alprazolam, phenytoin, ethosuximide, trimethadione, barbiturates, thiopental sodium, glutethimide.

## Books Suggested

1. Introduction to Medicinal Chemistry, A Gringuage, Wiley-VCH
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F. Dorge
3. An Introduction to Drug Design, S. S. Pandeya and J.R.Dimmock, New Age International.
4. Burgers's Medicinal Chemistry and Drug Discovery, Vol-1(Chapter-9 and Chapter-14), Ed. M.E. Wolff, John Wiley.
5. Goodmann and Gilman's Pharmacological Basis of Therapeutics, Mc-Graw Hill.
6. The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, Academic Press.
7. Strategies for Organic Drug Synthesis and Design, D.Lednicer, John Willey



# CHEMISTRY OF SURFACTANTS

## CH-404 b

### UNIT- I

**OVERVIEW OF SURFACTANTS:** Classification of Surfactants, Physicochemical Properties of Surfactants, Critical Micelle Concentration , Determination, Effect of Additives,Aggregate Shapes , Structure and Morphology, Novel and New Generation Surfactants, Aggregation Behavior.

### UNIT-II

**PRINCIPLES OF SELF-ASSEMBLY:** Closed and Continuous Association , Surfactant MicellizationPseudo-Phase Model , Mass Action Model, Estimation of Micelle Size ,Size Dispersion of Micelles, Concentration Dependence of Micelle Size , Phase Behavior, Aggregation Behavior.

### UNIT-III

**SURFACTANT MIXTURES:** Ideal and Non-Ideal Mixed Micelles ,Regular Solution Model Size and Composition Distribution of Aggregates ,Nonionic –ionic Surfactant Mixtures ,Ionic -Ionic Surfactant Mixtures,Origin of Ideal and Non-Ideal Mixing Behavior, Polymer SurfactantInteraction.

### UNIT-IV

**APPLICATIONS OF SURFACTANTS:** Micellar Catalysis, Quantitative Models ,Micellar Enzymology, Phenomenon of Solubilization , Solubilization in Mixed Micelles, Drug Surfactant Interaction, Protein Surfactant Interactions, Microemulsions and its applications, Industrial Application of Surfactants.

#### **Books:**

1. Surfactants Edited by Th. F. Tadros, Academic Press
2. Micelles : Theoretical and Applied Aspects by Y. Moroi
3. Chemistry and Technology of Surfactants by R. J. Farn Wiley

# **CHEMISTRY AND APPLICATION OF PESTICIDES**

## **CH-404c**

### **UNIT-1**

**INTRODUCTION:** What is pesticides, classification of pesticides, utility of pesticides, categories of toxicity, Threshold limit value, LD 50 value, Effect of pesticides in food, House hold and Human health.

### **UNIT-2**

**CHEMICAL TOXICOLOGY:** Biochemical effects of pesticides, pesticides persistence, bioaccumulation and biomagnifications of pesticides, Toxicology of pesticides, Toxicology of organophosphates, carbamates, organochlorine and Dermal Toxicology of pesticides.

### **UNIT-3**

**INSTUMENTAL TECHNIQUES IN PESTICIDES DETECTION:** Spectrophotometry, paper chromatography, Thin layer chromatography (TLC), GC-MS, indicator tube, High performance (pressure) Liquid chromatography (HPLC).

### **UNIT-4**

**PESTICIDES AND ITS RESIDUE ANALYSIS:** Steps in pesticides residue analysis, clean-up, concentration (evaporation), Analysis, Extent of residue of pesticides in different commodities.

### **References**

- Environmental chemistry. A.K De. New Age International Pvt. Ltd. 6<sup>th</sup> edition.
- Soil Testing and Analysis, plant, water and pesticide residues- Patiram, Bajendra N.S. Azad, Thakur and T.Ramesh. Agricultural, Horticultural, Food and Veterinary Science Book. 2<sup>nd</sup> edition.
- Toxicology of pesticides: Experimental, clinical and regulatory perspectives. Edited by: Lucio G. Costa, Corrado L. Galli Sheldon D. Murphy. Springer, 1<sup>st</sup> edition.
- Persistent Pesticide in the Environment- C.A Edward, CRC Press Inc., Florida 2<sup>nd</sup> edition.
- Agricultural chemicals and chemical mutagens- C.L. Canoria.
- Progress in pesticide Biochemistry and Toxicology- D.H Hutson and T.R Roberts. Willey, 7<sup>th</sup> edition.
- Air pollution from Pesticides and Agricultural process. Lee, R.F., Jr. CRC Press Inc., Florida, 1976, 174.

# MOLECULAR SYMMETRY, COORDINATION AND ORGANOMETALLIC CHEMISTRY CH-404 d

## UNIT – I

**SYMMETRY AND GROUP THEORY IN CHEMISTRY:** Symmetry elements and symmetry operation, definitions of group, subgroup, relation between orders of a finite group and its subgroup. Conjugacy relation and classes. Point symmetry group. Schönflies symbols, representations of groups by matrices (representation for the  $C_n$ ,  $C_{nv}$ ,  $C_{nh}$ ,  $D_{nh}$  etc. groups to be worked out explicitly). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use; spectroscopy.

## UNIT – II

**A. METAL-LIGAND BONDING:** Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes, bonding and molecular orbital theory.

**B. ELECTRONIC SPECTRA AND MAGNETIC PROPERTIES OF TRANSITION METAL**

**COMPLEXES:** Spectroscopic ground states, Correlation, Orgel and Tanabe-Sugano diagrams for transition metal complexes ( $d^1$ - $d^9$  states), Selection rules, mechanism for break down of the selection rules, intensity of absorption, band width, spectra of d-d metal complexes of the type  $[M(H_2O)]^{n+}$ , spin free and spin paired ML<sub>6</sub> complexes of other geometries, Calculations of  $Dq$ ,  $B$  and parameters, spin forbidden transitions, effect of spin-orbit coupling, Spectrochemical and Nephelometric series.

## UNIT – III

**A. REACTION MECHANISM OF TRANSITION METAL COMPLEXES:** Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, anation reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect. Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

**B. METAL-LIGAND EQUILIBRA IN SOLUTION:** Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH-metry and spectrophotometry.

## UNIT – IV

**METAL  $\pi$ -COMPLEXES:** Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand. B. Transition metal complexes with unsaturated organic molecules, alkanes, allyl, dienedienyl, arene and trienyl complex, preparations, properties, nature of bonding and structure features. Important reaction relating to nucleophilic, electrophilic attack on ligands and organic synthesis. Alkylidenes, low valent carbenes nature of bond and Structural characteristics.



# **NANOCHEMISTRY**

## **CH-404 e**

### **UNIT I**

#### **GENERIC METHODOLOGIES FOR NANOCHEMISTRY AND NANOTECHNOLOGY**

Introduction and classification, What is nanotechnology?, Classification of nanostructures, Nanoscale architecture, Summary of the electronic properties of atoms and solids, The isolated atom, Bonding between atoms, Giant molecular solids, The free electron model and energy bands, Crystalline solids, Periodicity of crystal lattices, Electronic conduction, Effects of the nanometre length scale, Changes to the system total energy, Changes to the system structure, How nanoscale dimensions affect properties

### **UNIT -II**

#### **MATERIAL CHEMISTRY**

Preparation and Properties of Nanoparticles, Materials-Metals, Ceramics (Oxide, carbides, sulphides, nitrides).physical and chemical Methods, Size and Shape controlled Synthesis, Sol-gel methods, Optical Properties, Electrical and Magnetic Properties, Application of Nanoparticles.

### **UNIT-III**

#### **CHARACTERIZATION METHODS**

X-ray diffraction, Debye-Scherrer formula, dislocation density, micro strain, Synchrotron Radiation, Principle and Applications, Raman Spectroscopy and its Applications, Dynamic Light Scattering (DLS). Electron microscopes: scanning electron microscope (SEM), transmission electron microscope (TEM), atomic force microscope (AFM), scanning tunneling microscope (STM), XPS, Working Principle, Instrumentation and Applications. Differential scanning calorimeter (DSC), Thermogravimetric/Differential Thermal Analyzer (TG/DTA), UV – Visible Spectrophotometer, FTIR, Principle and Applications, Photoluminescence (PL) Spectroscopy.

### **UNIT-IV**

#### **APPLICATIONS ON NANOCHEMISTRY**

Nanobiology, Introduction, Bio-inspired nanomaterials, Interaction Between Biomolecules and Nanoparticle Surfaces, Different Types of Inorganic Materials Used for the Synthesis of Hybrid Nano-bio Assemblies, Applications of Nano in Biology, Nanoprobes for Analytical Applications, Current Status of Nanobiotechnology, Future Perspectives of Nanobiology; Nanosensors, Electrochemical, Nanobiosensors, Smart Dust; Nanomedicines, Nanodrug Administration Diagnostic and Therapeutic Applications.

#### **References:**

1. Nanoparticles: From Theory to Application Edited by Gu"nter Schmid, @ 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim
2. Nanoparticles and Catalysis Edited by Didier Astruc @ 2008 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim
3. Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, Mike HagermanShriver and Atkin's Inorganic Chemistry, Fifth Edition, Oxford, 2010.
4. Nanoscale Science and Technology, Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan, John Wiley & Sons, Ltd., UK, 2005.
5. Introduction to Nanotechnology, Charles P. Poole Jr and Frank J. Owens, Wiley Interscience, 2003.
6. Nano:The Essentials: Understanding Nanoscience and Nanotechnology, T.Pradeep, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.

# CHEMISTRY OF NATURAL PRODUCTS

## CH-404 f

<b>UNIT-I</b>	<b>Terpenoids and Carotenoids</b>	<b>15 Hrs</b>
	Classification; nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules; Citral, Geraniol, $\alpha$ -Terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and $\beta$ -Carotene.	
<b>UNIT-II</b>	<b>Alkaloids</b>	<b>15 Hrs</b>
	Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry, biosynthesis and synthesis of the following: Ephedrine, (+)- Coniine, Nicotine, Atropine, Quinine and Morphine.	
<b>UNIT-III</b>	<b>Gteroids</b>	
	Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone.	
<b>UNIT -IV</b>	<b>Plant Pigments</b>	<b>7 Hrs</b>
	Occurrence, nomenclature, general methods of structure determination, isolation and synthesis of Apigenin, Luteolin, Quercetin, myrcetin, Quercetin-3-glucoside, Vitexin, Diadzein, Butein, Aureusin, Cyanidin-7-arabinoside, Cyanidin, Hirsutidin. Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway.	
	<b>Porphyrins</b>	
<b>UNIT -V</b>	Structure and synthesis of Haemoglobin and Chlorophyll.	
	<b>Prostaglandins</b>	
<b>UNIT -VI</b>	Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE <sub>2</sub> and PGF <sub>2<math>\alpha</math></sub> .	
	<b>Pyrethroids and Rotenones</b>	
	Synthesis and Reaction of Pyrethroids and Rotenones	
<b>UNIT- VII .</b>	<b>Books Suggested :</b>	
	1. Natural Products : Chemistry and Biological Significance, J. Mann, R.S. Davidson,	
	2. J B Hobbs, D.V. Banthrope and J B Harborne, Longman Organic Chemistry, Vol 2 , IL Finar ELBS	
	3. New Trends in Natural Products Chemistry , A R Rahman and M I Choudhury, Harwood Academic Publishers	
	4. Roods Chemistry of Carbon Compounds, Ed S. Coffey, Elsevier	

# POLYMERS

CH-404 g

8 Hrs

## **UNIT- I Basics**

Importance of polymers. Basic concepts: Monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition, radical chain-ionic and co-ordination and co-polymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous system.

## **UNIT- II Polymer Characterization**

14 Hrs

Polydispersion-average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular weights. End-group, viscosity, light scattering, osmotic and ultracentrifugation methods. Analysis and testing of polymers-chemical analysis of polymers, spectroscopic methods, X-ray diffraction study. Microscopy. Thermal analysis and physical testing-tensile strength. Fatigue, impact. Tear resistance. Hardness and abrasion resistance.

## **UNIT-III Structure and Properties**

14 Hrs

Morphology and order in crystalline polymers-configurations of polymer chains. Crystal structure of polymers. Morphology of crystalline polymers, strain-induced morphology, crystallization and melting. Polymer structure and physical properties-crystalline melting point  $T_m$ - melting point of homogeneous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature,  $T_g$ -Relationship between  $T_m$  and  $T_g$ , effects of molecular weight, diluents, chemical structure, chain topology, branching and cross linking. Property requirements and polymer utilization.

## **UNIT-IV Polymer Processing**

12 Hrs

Plastics, elastomers and fibres. Compounding. Processing techniques: Calendering, die casting, rotational casting, film casting, injection moulding, extrusion moulding, thermoforming, foaming, reinforcing and fibre spinning.

## **UNIT-V Properties of Commercial Polyme**

12 Hrs

Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers- Fire retarding polymers and electrically conducting polymers. Biomedical polymers- contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

### **Books Suggested :**

1. Textbook of Polymer Science, F W . Billmeyer Jr. Wiley
2. Polymer Science, V R Gowarikar, N V Viswanathan and J Sreedhar, Wiley Eastern
3. Contemporary Polymer Chemistry, H R Alcock and F W Lambe, Prentice Hall
4. Physics and Chemistry of Polymers, J M G Cowie, Blackie Academic and Professional



# **FORENSIC CHEMISTRY**

## **Course -404h**

### **Unit-I**

#### **Introduction to Forensic Science**

Forensic science : methodologies and applications used in the forensic context. Organic and inorganic chemical analyses of physical evidence, principles of serology and DNA analysis, ballistics, arson, fingerprint analysis, drug analysis,

### **Unit-II**

#### **Forensic Chemistry**

Chemical aspects of forensic science as it applies to criminal investigation and laboratory preparation. Instrumentation and chemistry associated with crimes. properties of the chemical evidence.. Details of the methods employed for analysis, such as color test, Chromatography (GC, GLC, HPLC), mass spectrometry (MS), GC-MS. Laboratory course. Instrumental Aspects of Liquid Chromatography Solvent delivery systems, sample inlets, temperature control, coupled column systems, detectors, and indirect detection other Separation Techniques

### **Unit-III**

#### **Toxicology**

General principles and fundamentals of forensic toxicology, poisons, action, toxicity, postmortem characteristics, samples required for toxicological analysis and methods of collection, methods of preservation and analysis. Chemical, toxicological and pathological characteristics of commonly abused drugs, including the following: ethanol, barbiturates, narcotics, stimulants, and hallucinogens

### **Unit-IV**

#### **Applications of Forensic Chemistry**

Investigation of crime against society, food adulteration, environmental pollution, use and distribution of unsafe chemicals, career in criminal investigation, in the laboratory analysis of forensic evidence,. Drug Enforcement Administration, Food and Drug Administration, Environmental Protection Agency, and Occupational Safety and Health Administration. environmental sciences, industrial hygiene,.

**(Combination should be- Lab course VII + Lab course VIII OR Seminar + Project work)**

**LABORATORY COURSE-VII**

**Max. Marks 100**

**A. MULTI-STEP SYNTHESIS OF ORGANIC COMPOUNDS**

- (i) Beckmann Rearrangement: Benzanilide from benzene (Benzene Benzophenone Benzophenone oxime Benzanilide).
- (ii) Benzilic Acid Rearrangement: Benzilic acid from Benzoin (Benzoin Benzil Benzilic acid)
- (iii) Skraup's synthesis (Synthesis of heterocyclic Quinoline from o - Amino phenol)
- (iv) p-Bromoaniline from Aniline (Aniline Acetanilide p - Bromoacetanilide p -Bromoaniline)
- (v) p-Nitroacetanilide from Acetanilide (Aniline Acetanilide p - Nitroacetanilide p - Nitroaniline)
- (vi) m Nitroaniline from Benzene (Benzene Nitrobenzene m - dinitrobenzene m- nitroaniline)
- (vii) Acridone from Anthranilic acid (Anthranilic acid o - Chlorobenzoic acid N -Phenylanthranilic acid Acridone)
- (viii) Enzymatic Synthesis Enzymatic reduction : Reduction of ethylace enantiomeric excess of S(+) ethyl - 3 - hydroxybutanone and determine its optical purity.

**B. QUANTITATIVE ORGANIC ANALYSIS**

- (i) Estimation of Sulphur by Messenger's Method.
- (ii) Estimation of Nitrogen by Kjeldahl Method.

**C. ESTIMATION OF FUNCTIONAL GROUP**

- (i) Estimation of Aniline.
- (ii) Estimation of Amino Group By Acetylation Method.
- (iii) Estimation of Hydroxyl Group By Acetylation Method.
- (iv) Estimation of Carbonyl Group By Hydrazone Formation Method.
- (v) Estimation of Carboxyl Group By Titration Method.
- (vi) Determination of Equivalent Weight of Carboxylic Acid By Silver Salt Method.
- (vii) Estimation of Glucose By Fehling Solution Method.
- (viii) Estimation of Glycine By Titration Method.

**D. EXTRACTION OF ORGANIC COMPOUNDS FROM NATURAL SOURCES**

- (i) Isolation of caffeine from leaves.
- (ii) Isolation of Casein from milk.
- (iii) Isolation of lactose from milk.
- (iv) Isolation of nicotine dipicrate from tobacco.
- (v) Isolation of Cinchonine from cinchona bark.
- (vi) Isolation of Piperine from black pepper.
- (vii) Isolation Lycopene from tomatoes.
- (viii) Isolation of  $\beta$ -Carotene from carrots.
- (ix) Isolation of Limonene from citrus rinds.

- (x) Isolation of protein and carbohydrates from seeds –colour test
- (xi) Extraction of Fatty oil from seeds and determination of refractive index of the oil.
- (xii) Isolation of protein and carbohydrate (as reducing sugars) from seed-colour test.

**E. Some advanced level sophisticated instrument based (FTIR, NMR, GC-MS, AAS, FLUORESCENCE SPECTROPHOTOMETER, TENSIOMETER etc) experiments may be given to the students. SUGGESTED BOOKS:**

1. Practical Organic chemistry by A. I. Vogel.
2. Practical Organic chemistry by Mann and Saunders.
3. Practical Organic chemistry by Garg and Saluja.
4. The Systematic Identification of Organic compounds, R. L. Shriner and D. Y. Curtin.
5. Semimicro Qualitative Organic Analysis, N.D. Cheronis, J. B. Entrikin and E. M. Hodnett.
6. Experimental Organic chemistry, M. P. Doyle and W. S. Mungall.
7. Small Scale Organic preparation, P. J. Hill.
8. Experimental Biochemistry, by B.S.Roa and V.Deshpande. I.K. International Pvt.Ltd.
9. Comprehensive Practical Organic Chemistry, Preparation and Qualitative Analysis, V.K.Ahluwalia and Renu Aggarwal, University Press.

**OR**

### **Seminars**

Seminar topics should be related to M. Sc. Syllabus or research oriented topics on recent trends in chemical sciences



**(Combination should be- Lab course VII + Lab course VIII OR Seminar + Project work)**

**LABORATORY COURSE –VIII**

**Max. Marks 100**

**A. TITRIMETRIC/GRAVIMETRIC DETERMINATIONS**

- (i) Manganese in iron / Steel by Bismuthate / Langanane –Karplus/Periodate methods.
- (ii) Manganese in pyrolusite ores.
- (iii) Nickel in steel by dimethylglyoxime method.
- (iv) Lead by dithizone precipitation.

**B. SPECTROPHOTOMETRIC DETERMINATIONS**

- (i) Manganese/Chromium / Vanadium / Copper / Lead in Steel and Environmental / Industrial effluent samples.
- (ii) Nickel / Molybdenum / Tungsten / Vanadium / Uranium by extractive spectrophotometric method.
- (iii) Fluoride / Nitrite / Phosphate in tap / pond / river industrial waste water.
- (iv) Iron in water samples by thiocyanate and phenanthroline methods.

**C. CHROMATOGRAPHIC SEPARATION**

- (i) Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of R<sub>f</sub> values.
- (ii) Thin layer chromatography – separation of nickel, manganese, cobalt and zinc, Determination of R<sub>f</sub> values.

**D. FLOW INJECTION ANALYSIS.**

Determination of the following anions/cations in synthetic/real/ environmental samples.

- (i)  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Cr}^{6+}$ ,  $\text{Fe}^{3+}$
- (j) (ii)  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{PO}_4^{3-}$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{BO}_3^{3-}$ .

**E. ATOMIC ABSORPTION SPECTROPHOTOMETER**

Determination of metal contents (Fe/Pb/As/Zn/Co/Ni etc.) in real and environmental samples.

**F. MISCELLANEOUS**

- (i) Nutrient and micronutrient analysis in plant/soil/sediment.
- (ii) Speciation of toxic metals i.e. As, Hg, Se, etc.
- (iii) Analysis of clinical samples i.e. blood, urine, hair, etc.

**Some advanced level sophisticated instrument based (FTIR, NMR, GC-MS, AAS, FLUORESCENCE SPECTROPHOTOMETER, TENSIO METER etc) experiments may be given to the students.**

**SUGGESTED BOOK:**

1. Quantitative Inorganic Analysis, A.I. Vogel.
2. Standard Methods of Water Analysis.
3. Colorimetric Determination of Traces of Metals, E.B. Sandell.
4. GBC, Manuals on AAS analysis, Austria.

**OR**  
**Projects**

- Recent trends in chemical sciences
- Based on synthesis of organic compounds, characterization
- Kinetic, thermodynamic studies
- Analysis of chemical substances from environmental, biological, food and pharmaceutical samples with analytical techniques
- Ore, rocks, coal, cement analysis

**Note: The Project work will be based on research facilities available in colleges, institutions or university**

# Name of SoS – School of Studies in Chemistry

## Syllabus- Choice Based Syllabus (Second Semester)

### Name of paper- ANALYTICAL TECHNIQUES AND DATA ANALYSIS

Total Credit-03

Total Marks -80+20

#### ANALYTICAL TECHNIQUES AND DATA ANALYSIS

##### Elective Course

##### Choice Based Credit System in Master Course in Chemistry

#### **SAMPLE PREPARATION, DEGESTION AND STATISTICAL ANALYSIS**

- A. Sampling - Collection, Preservation and preparation of sample, Techniques of sampling solids, liquids and gases, Operation of drying and preparing a solution of the analyte.  
Principle, methodology and application of different types of digestions such as acid digestion, base digestion, enzymatic and microwave digestion for liquid and solid materials.
- B. Evolution and procession of Analytical Data, Precision and Accuracy, Types of Errors, Normal Distribution Curve, Standard deviation, Confidence limit, Graphical presentation of result-method of average, Method of Linear regression, Significant figures, Statistical aid to hypothesis testing-t-test, F-test, Correlation coefficient, Rejection of data.

#### **SEPARATION TECHNIQUES**

- A. Efficiency of extraction, Selectivity of extraction, Extraction system, Method of Extraction, applications.
- B. Principles, classification of chromatographic techniques, Technique and applications of paper chromatographic, Thin-layer chromatographic, HPTLC, Column chromatography.

#### **INSTRUMENTATION INVOLVED IN PHYSICAL CHEMISTRY**

- A. UV visible and Tensiometer
- B. Principles, Instrumentation, Application of TGA, DTA and DSC methods.
- C. Automated methods, Principle, instrumentation and application of flow injection analysis.

#### **ELECTROCHEMISTRY**

- A. Principles and instrumentation of pH potentiometry, coulometry and conductometry.
- B. Basic principles, Diffusion current, polarized electrode, Micro electrode, Dropping mercury Electrode Ilkovic equation, Polarographic wave, Qualitative analysis Stripping methods, Cyclic Voltammetry, Amperometric titration :-curves, Differential pulse polarography and Square wave polarography.

#### **BOOK SUGGESTED :**

1. Fundamental of Analytical Chemistry-Skoog D.A. and West D.M.
2. Saunders, College Publication.
3. Textbook of Quantitative Inorganic Analysis-Vogel A.I.
4. Principles and Practice of Analytical Chemistry-Fifield F.W and Kealey
5. D. Black well Science
6. Instrumental Analysis R. Braun, McGraw Hill, International Edition.
7. Analytical Chemistry, Christain, WSE/Wiley.
8. Instrumental Analysis, Willard Merilt, CBS.
9. Chemical Analysis, Brawn, McGraw Hill
10. Fundamental of Analytical Chemistry-Skoog D.A. and West D.M.
11. Principles of instrumental analysis, Skoog Holler - Niemann.
12. Instrumental analysis, Wizard Dean and Merit.
13. Principal and PRACTICAL analytical chemistry, Fifield and Kealey.



# Name of SoS – School of Studies in Chemistry

## Syllabus- Choice Based Syllabus (Second Semester)

### Name of paper- INSTRUMENTAL METHODS OF ANALYSIS

Total Credit-03

Total Marks -80+20

#### INSTRUMENTAL METHODS OF ANALYSIS

Elective Course

Choice Based Credit System in Master Course in Chemistry

##### **ADVANCED CHROMATOGRAPHY:**

- A. Ion chromatography: Ion exchange equilibrium, Ion-exchange packing and Inorganic Applications.
- B. Size exclusion chromatography: Column packing, Theory of size of exclusion chromatography and applications.
- C. Supercritical fluid chromatography: Properties of supercritical fluid SFC-Instrumentation and operating variables, comparison with other types of chromatography, applications.
- D. Capillary Electrophoresis and capillary electro chromatography : overviews and applications

##### **X-RAY AND PROTON INDUCED SPECTROSCOPY:**

- A. X-Ray fluorescent method: Principals-Characteristics x-ray emission. Instrumentation x-ray tube, Radioactive sources. Wavelength dispersive instruments. Energy dispersive instruments. Analytical Applications-Qualitative Analysis.
- B. Proton Induced X-Ray Spectroscopy: Theory, instrumentation and application.

##### **ATOMIC EMISSION SPECTROSCOPY**

- A. Selectivity, sensitivity and interferences of atomic spectroscopy.
- B. Theory, instrumentation and application of flame photometer, AES, ICP-AES and AFS.

##### **ATOMIC ABSORPTION SPECTROSCOPY AND HYPHENATED TECHNIQUES**

- A. Theory instrumentation and application of flame and graphite furnace AAS, cold-vapor and hydride generated AAS.
- B. Theory , instrumentation and application of hyphenated techniques i.e. GC/HPLC/-MS, GC/IC/HPLC-ICP-MS.

#### **BOOK SUGGESTED:**

1. Instrumental methods of analysis, Willard, Meritt and Dean.
2. Basic concepts of analytical chemistry, S.M. Khopkar, John Wiley & Sons.
3. Metallurgical analysis, S.C. Jain.
4. Material Science and Engineering. An Introduction, W.D. Callister, Wiley.
5. Material Science, J.C. Anderson, K.D. Leaver, J.M. Alexander and R.D. Rawlings, ELBS.
6. Fundamentals of Analytical Chemistry, Skoog, Welt, Holler and Crouch Thomson Learning Inc.

# Name of SoS – School of Studies in Chemistry

## Syllabus- Choice Based Syllabus(Third Semester)

### Name of paper- RESONANCE SPECTROSCOPY AND PHOTOCHEMISTRY

Total Credit-03

Total Marks -80+20

#### RESONANCE SPECTROSCOPY,PHOTOCHEMISTRY AND ORGANOCATALYSIS

##### Elective Course

##### Choice Based Credit System in Master Course in Chemistry

- A. ELECTRON SPIN RESONANCE SPECTROSCOPY :** Hyperfine coupling, spin polarization for atoms and transition metal ions, spin-orbit coupling and significance of g-tensors, application to transition metal complexes (having one unpaired electron).
- B. NUCLEAR QUADRUPOLE RESONANCE SPECTROSCOPY:** Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splittings, applications.
- A. PHOTOELECTRON SPECTROSCOPY :** Basic principle both for atoms and molecules; Photo-electric effect, ionization process, extraKoopman'sofsimplemolecules,theorem,Auger p electron spectroscopy, Determination of Dipole moment.
- B. PHOTOACOUSTIC SPECTROSCOPY:** Basic principle of Photo acoustic Spectroscopy (PAS), PAS –gases and condensed system Chemical and Surface application.
- A. PHOTOCHEMICAL REACTIONS :** Interaction of electromagnetic radiation with matter, Stern Volmer equation, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, Actinometry.
- B. DETERMINATION OF REACTION MECHANISM:** Classification, rate constatnts and life times of reactive energy states –determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions.
- C. MISCELLANEOUS PHOTOCHEMICAL REACTIONS :** Photo-Fries reactions of anilides, Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photodegradation of polymers, Photochemistry of vision.
- A. ORGANOCATALYSIS**  
General Principles: Energetic, Catalytic cycles, catalytic efficiency and life time, selectivity. Type of organometallic reaction: Ligand substitution, Oxidative addition, reductive elimination and insertion and deinsertion. Homogeneous catalysis: Hydrogenation of alkenes, Hydroformylation, Monsanto acetic acid synthesis, Wacker oxidation of alkenes, Alkenes metathesis, Palladium-Catalysed C-C bond forming reactions, asymmetric oxidation. Heterogenous catalysis: The nature of heterogenous catalysts, Fischer-Tropsch synthesis, alkene polymerization.

#### BOOK SUGGESTED:

1. Infrared and Raman Spectra: Inorganic and Coordination Compounds, K. Nakamoto, Wiley.
2. Fundamentals of Photochemsitry, K.K. Rohtagi-Mukherji, Wiley-Eastern.
3. Essentials of Molecular Photochemistry, A. Gilbert and J. Baggott, Blackwell Scientific Publications.
4. Molecular Photochemsitry, N.J. Turro, W.A. Benjamin.
5. Introductory Phtochemistry, A. Cox and T. Camp, McGraw-Hill.
6. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
7. Application of Spectroscopy of Organic Compounds, J.R. Dyer, Prentice Hall.
8. Photochemistry , R.P. Kundall and A. Gilbert, Thomson Nelson.
9. Organic Photochemistry, J. coxon and B. Halton, Cambridge University Press.
10. Shriver& Atkins Inorganic Chemistry: P.Atkins, T.Overtone, J. Rourke, M. Weller, F. Armstrong, Oxford University Press
11. Inorganic Chemistry: C.E. Housecraft, A.G. Sharpe, Pearson Education Limited.
12. Inorganic Chemistry: Principles of Structure and Reactivity: J.E. Huheey, E.A. Keiter, R.L.Keiter, O.K. Medhi, Pearson Education

## Name of SoS – School of Studies in Chemistry

### Syllabus- Choice Based Syllabus (Third Semester)

#### Name of paper- CHEMISTRY OF BIOMOLECULES

Total Credit-03

Total Marks -80+20

#### CHEMISTRY OF BIOMOLECULES

##### Elective Course

##### Choice Based Credit System in Master Course in Chemistry

- A. BIOENERGETICS:** Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.
- B. ELECTRON TRANSFER IN BIOLOGY:** Structure and function of metalloproteins in electron transport processes –cytochromes and iron-sulphur proteins, synthetic models.
- C. TRANSPORT AND STORAGE OF DIOXYGEN:** Heme proteins and oxygen uptake, structure and function of haemoglobin, myoglobin, haemocyanins and haemerythrin, model synthetic complexes of iron, cobalt and copper.
- 
- A. METALLOENZYMES:** Zinc enzymes –carboxypeptidase and carbonic anhydrase. Iron enzymes – catalase, peroxidase and cytochrome P-450. copper enzymes- superoxide dismutase. Molybdenum oxatransferase enzymes –xanthine oxidase.
- B. ENZYME MODELS:** Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality. Biomimetic chemistry, Cyclodextrin-based enzyme models, calixarenes, ionophores, synthetic enzymes or synzymes.
- 
- A. ENZYMES:** Nomenclature and classification of induced Enzyme. F<sub>o</sub>F<sub>1</sub> hypothesis, concept and identification of active site by the use of inhibitors.
- B. CO-ENZYME CHEMISTRY:** Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD<sup>+</sup>, NADP<sup>+</sup>, FMN, FAD, lipoic acid, vitamin B<sub>12</sub>.
- C. BIOTECHNOLOGICAL APPLICATIONS OF ENZYMES:** Techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilization of enzymes in medicine and industry. Enzymes and Recombinant DNA Technology.
- 
- A. BIOPOLYMER INTERACTIONS:** forces involved in biopolymer interaction. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems. Hydrogen ion titration curves.
- B. THERMODYNAMICS OF BIOPOLYMER SOLUTIONS:** Thermodynamics of biopolymer solution, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical system.
- C. CELL MEMBRANE AND TRANSPORT OF IONS:** Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport and Nerve conduction.

#### BOOK SUGGESTED:

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.L. Lippard and J.S. Valentine, University Science Books.
3. Inorganic Biochemistry vols II and I. Ed G.L. Eichhorn, Elsevier.
4. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.



5. Bioinorganic Chemistry, I. Bertinin, H.B. Gary, S.J. Lippard and J.S. Valentine, University Science.
6. Inorganic Biochemistry vols I and II ed. G.L. Eichhorn, Elsevier.
7. Bioorganic Chemistry: A Chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer-verlag.
8. Understanding Enzymes, Trevor palmer, Prentice Hall.
9. Enzyme Chemistry : Impact and Applications, Ed. Collin J Suckling, Chapman and Hall.
10. Enzyme Mechanisms Ed, M.I. Page and A. Williams, Royal Society of Chemistry.
11. Fundamentals of Enzymology, N.C. Price and L. Stevens, Oxford University Press.
12. Immobilizaed Enzymes: An Introduction and Applications in Biotechnology, Michael D. Trevan, and John Wiley.
  
13. Enzymatic Reaction Mechanisms, C. Walsh, W.H. Freeman.
14. Biochemistry: The Chemical Reacitons of liging cells, D.E. Metzler, Academic Press.
15. Principles of Biochemistry, A.L. Lehninger, Wroth Publishers.
16. Biochemistry, L. Stryer, W.H. Freeman.
17. Biochemistry, J. David Rawn, Neil Patterson.
18. Biochemistry, Voet and Voet, John Wiley.
19. Outlines of Biochemistry, E.E. Conn and P.K. Stumpf, John Wiley.
20. Bioorganic Chemistry : A Chemistry Approach to Enzyme Action, H. Dugas and C. Penny, Springer-Verlag.
21. Biochemistry and Molecular Biology of Plants, Buchanan, Gruissem and Jones, I.K. International Pvt. Ltd.

**Name of SoS – School of Studies in Chemistry**

**Syllabus- Choice Based Syllabus (Third Semester)**

**Name of paper- NANOCHEMISTRY AND ITS APPLICATIONS**

**Total Credit-03**

**Total Marks -80+20**

**NANOCHEMISTRY AND ITS APPLICATIONS**

**Elective Course**

**Choice Based Credit System in Master Course in Chemistry**

**UNIT I: GENERIC METHODOLOGIES FOR NANOCHEMISTRY AND NANOTECHNOLOGY:**

*Introduction and classification* - What is nanotechnology? - Classification of nanostructures - Nanoscale architecture; Summary of the electronic properties of atoms and solids - The isolated atom - Bonding between atoms - Giant molecular solids - The free electron model and energy bands - Crystalline solids - Periodicity of crystal lattices -Electronic conduction; Effects of the nanometre length scale - Changes to the system total energy - Changes to the system structure - How nanoscale dimensions affect properties?

**UNIT -II. MATERIAL CHEMISTRY :**

Preparation and Properties of Nanoparticles, Materials-Metals, Ceramics (Oxide, carbides, sulphides, nitrides).physical and chemical Methods, Size and Shape controlled Synthesis, Sol-gel methods, Optical Properties, Electrical and Magnetic Properties, Application of Nanoparticles.

**UNIT-III . CHARACTERIZATION METHODS.**

X-ray diffraction - Debye-Scherrer formula – dislocation density – micro strain –Synchrotron Radiation – Principle and Applications –Raman Spectroscopy and its Applications – Dynamic Light Scattering (DLS). Electron microscopes: scanning electron microscope (SEM) – transmission electron microscope (TEM); atomic force microscope(AFM) – scanning tunneling microscope (STM) - XPS – Working Principle, Instrumentation and Applications. Differential

scanning calorimeter (DSC) – Thermogravimetric/Differential Thermal Analyzer (TG/DTA) – UV – Visible Spectrophotometer - FTIR – Principle and Applications – Photoluminescence (PL) Spectroscopy.

#### **UNIT-IV APPLICATIONS ON NANOCHEMISTRY**

Nanobiology - Introduction - Bio-inspired nanomaterials - Interaction Between Biomolecules and Nanoparticle Surfaces - Different Types of Inorganic Materials Used for the Synthesis of Hybrid Nano-bio Assemblies -

#### **UNIT-V APPLICATIONS OF NANO IN BIOLOGY**

Applications of Nano in Biology -Nanoprobes for Analytical Applications - Current Status of Nanobiotechnology - Future Perspectives of Nanobiology; Nanosensors, Electrochemical , Nanobiosensors - Smart Dust; Nanomedicines, Nanodrug Administration Diagnostic and Therapeutic Applications.

#### **References:**

1. Nanoparticles: From Theory to Application Edited by Gu'nter Schmid, @ 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim
2. Nanoparticles and Catalysis Edited by Didier Astruc @ 2008 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim
3. Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, Mike HagermanShriver and Atkin's Inorganic Chemistry, Fifth Edition, Oxford, 2010.
4. Nanoscale Science and Technology, Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan, John Wiley & Sons, Ltd., UK, 2005.
5. Introduction to Nanotechnology, Charles P. Poole Jr and Frank J. Owens, Wiley Interscience, 2003.
6. Nano:The Essentials: Understanding Nanoscience and Nanotechnology, T.Pradeep, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.



# **SYLLABUS**

**PRE - Ph.D. COURSE**

**IN**

**CHEMISTRY**



**2017-2018**

**PT. RAVISHANKAR SHUKLA UNIVERSITY  
RAIPUR - 492 010, CHHATTISGARH**

## PRE - Ph.D. COURSE

DURATION : SIX MONTHS

M.M. : 200

COURSES		MARKS
C O U R S E  I	1. RESEARCH METHODOLOGY	20
	2. LITERATURE SEARCH TECHNIQUE	20
	3. INSTRUMENTATION TECHNIQUES	20
	4. SAMPLING & MODELING	20
	5 STATISTICAL ANALYSIS	20
C O U R S E  II	6. PROJECT BASED ON REVIEW OF RESEARCH WORK	50
	7. SEMINAR	50
	<b>TOTAL</b>	<b>200</b>

# **PRE - Ph.D. COURSE**

## **COURSE – I**

### **RESEARCH METHODOLOGY IN CHEMISTRY**

**M.M. - 100**

#### **UNIT-I RESEARCH METHODOLOGY**

Purpose of research; Research project Conceptualization, choice of methods; Elements of a research proposal, operationalization choices and illustrations. Research design: formulation, pre-testing of research instruments and procedures, units of analysis, time dimension. Experimental design and use of indicators in research. Survey Research: Guidelines for asking question and questionnaires construction, Self-administered questionnaires, Interview and other survey methods; their strength and weaknesses. Sampling: the logic of sampling , concepts and terminologies , population and Sampling frames , types of sampling design .Field studies : steps in the conducting field study ; evaluation research: how to carry out evaluation research , Patent and IPR.

#### **UNIT-II LITERATURE SEARCH TECHNIQUE**

IUPAC rule for nomenclature –Introduction to chemical abstracts –Subject Index, Substance Index, Author Index, Formula Index and other indices-Uses of these indices with examples- current contents –organization –methods of using the titles and index –other similar abstracts for special topics related to chemistry. Use of computer browsing for literature search and downloading –basics of internet services –various sources of abstracts ,articles and papers of browsing and downloading , Techniques of conversion from one format to another Structure drawing programs and their uses –searches through structure . Use of Literature, Knowledge of National and International Journals, Impact Factor, Citation-Index, h Index,SCI Journals, Plagiarism

#### **UNIT-III INSTRUMENTAL TECHNIQUES**

Principle, instrumentation and application of electro-analytical, spectrophotometry, fluorimetry, AAS, AES, XRF and NMR techniques. Principle instrumentation and application of chromatography and MS techniques. Classical Method of Analysis



## **UNIT-IV SAMPLING AND MODELING**

Mesearment and sampling technique of air pollutants using air monitors in selected atmospheric receptors. Statistical approach in environmental monitoring and analysis using selected parameters(correlation and regression analysis, factor analysis etc.) and graph plotting ( Boxplot ,histogram etc.)

## **UNIT-V STATISTICAL ANALYSIS**

Various types of errors – precision and accuracy- significant figures, various statistical tests on the accuracy of results, positive and negative deviation from accurate results the binomial distribution, the Gaussian distribution - the normal distribution of random errors, mean value, variance and standard deviation, reliability interval, deviations, from the Gaussian law of error distribution, student's t-distribution, and t-test- comparison of the mean with the expected value, comparison of the results of two different methods, comparison of the precision of two methods by F-test, Gross errors and elimination of outlying results, graphical methods- Linear regression line, standard deviation, correlation coefficient-Multiple linear regression (one variable with two other variables).

### **COURSE - II**

**M.M. : 100**

#### **I. PROJECT BASED ON REVIEW OF RESEARCH WORK**

**M.M.-50**

#### **II. SEMINARS**

**M.M.-50**

### **BOOK SUGGESTED:**

1. Ahuja & Jespersen, Modern Instrumental Analysis, 1st Edition, Elsevier Science, 2006.
2. Douglas A. Skoog; F. James Holler; Stanley R. Crouch, Principles of instrumental Analysis, Cole Pub Co., 2006.
3. John Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (Hardcover), 2008
4. John W. Creswell, Qualitative Research & Evaluation Methods , 2008
5. Thesis and Assignment Writing – J. Anderson, B.H. Dursten and M.Poole, Wiley Eastern (1977).
6. A Hand Book of Methodology of Research – P. rajamal and P. Devadoss, R.M.M.Vidya Press (1976).
7. instrumental Methods of Analysis – H.H. Willard, L.L.Merritt, J.a.Dean, F.A. Settle, CBS Publishers & Distributors, 1986.
8. Practical Process, Research and Development – Neal G. Anderson, Amazow

## (Semester System)

एम.ए.—एप्लाइड फिलॉसफी एण्ड योग (अनुप्रयुक्त दर्शन एवं योग)

(शिक्षा सत्र 2020–21 से प्रभावी)

प्रथम सेमेस्टर

पूर्णांक : 80

प्रथम प्रश्न पत्र : योग के आधारभूत-तत्व

- इकाई 1— अनुप्रयुक्त दर्शन—अर्थ, स्वरूप एवं महत्व, दर्शन एवं अनुप्रयुक्त दर्शन में संबंध। योग का अर्थ, परिभाषा, महत्व व उद्देश्य, योग का उद्भव एवं विकास, योग में साधक एवं बाधक तत्व, योग कौशल विकास – अर्थ, परिभाषा, आवश्यकता एवं उद्देश्य। योग कौशल विकास के विभिन्न आयाम।
- इकाई 2— वेद एवं उपनिषद, गीता एवं योग वाशिष्ठ, बौद्ध दर्शन तथा जैन दर्शन, सांख्य एवं वेदान्त दर्शन।
- इकाई 3— अष्टांग योग एवं कर्म योग, भक्ति योग एवं ज्ञान योग, हठ योग, मंत्र योग, लय योग एवं क्रिया योग।
- इकाई 4— महर्षि पतंजलि, गुरु गोरक्षनाथ, शंकराचार्य।
- इकाई 5— स्वामी विवेकानन्द, श्री अरविन्द, योगी श्यामाचरण लाहड़ी, स्वामी कुवलयानन्द एवं स्वामी शिवानन्द

सहायक पुस्तकें—

1. भारतीय दर्शन

2. भारतीय दर्शन का सर्वेक्षण

3. हठयोग प्रदीपिका

4. आसन मीमांसा

5. प्राणायाम मीमांसा

6. गोरक्ष संहिता

नंदकिशोर देवराज (संपादक)

संगम लाल पाण्डेय

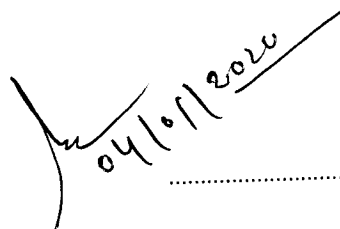
प्रकाशक कैवल्यधाम लोणावाला

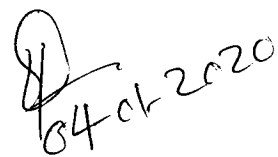
स्वामी कुवलयानन्द

स्वामी कुवलयानन्द

गुरु गोरक्षनाथ

  
04/11/2020

  
04/11/2020

  
04-11-2020

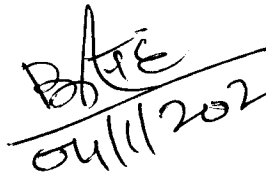
द्वितीय प्रश्न पत्र : योग की दार्शनिक पृष्ठभूमि

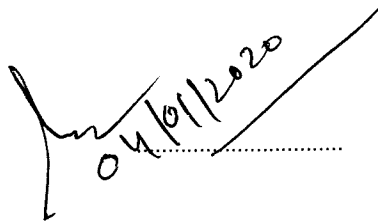
पूर्णांक : 80


- इकाई 1--भारतीय दर्शन की सामान्य विशेषताएँ, भारतीय दर्शन में योग का महत्व।  
इकाई 2--योग की दार्शनिक पृष्ठभूमि, सांख्य -दर्शन, सांख्य और योग में संबंध, पुरुष सिद्धि, बंधन।  
इकाई 3--सांख्य प्रकृति सिद्धि, स्वरूप, विकासवाद एवं कैवल्य।  
इकाई 4--योग सूत्र, अष्टांग योग परिचय।  
इकाई 5--गीता में योग के विविध रूप, भक्ति, ज्ञान एवं कर्म।

सहायक पुस्तकें--

- |                            |                    |
|----------------------------|--------------------|
| 1. योगदर्शन                | सम्पूर्णानंद       |
| 2. पातजल योग-विमर्श        | विजयपाल शास्त्री   |
| 3. भारतीय दर्शन की रूपरेखा | एम हिरियन्ना       |
| 4. सांख्यतत्त्व कौमुदी     | वाचस्पति मिश्र     |
| 5 सरल योगासन               | डॉ. ईश्वर भारद्वाज |

  
04/11/2020

  
04/11/2020

  
04-01-2020



तृतीय प्रश्न पत्र : हठयोग सिद्धांत एवं साधना

पूर्णांक : 80

- इकाई 1—हठयोग की परिभाषा अभ्यास हेतु उचित स्थान, ऋतुकाल।  
साधना में साधक व बाधक तत्व। हठ सिद्धि के लक्षण।  
हठयोग की उपादेयता योगाभ्यास के लिए पथ्यापथ्य निर्देश।
- इकाई 2—हठ योग प्रदीपिका में वर्णित आसनों की विधि व लाभ।  
प्राणायाम की परिभाषा, प्रकार, विधि, प्राणायाम की उपयोगिता।  
षट्कर्म वर्णन, धौति, वस्ति, नेति, नौलि त्राटक, कपाल-भाति की विधि व लाभ।
- इकाई 3—कुंडलिनी का स्वरूप, चक्रों के स्वरूप, जागरण के उपाय।  
बंध.मुद्रा वर्णन, महामुद्रा, महाबंध, महावेध, खेचरी, उडडीयान बंध, जालंधर, मूलबंध  
विपरीतकरणी, बज्रौली, शक्तिचालिनी समाधि का वर्णन नादानुसंधान।
- इकाई 4—घेरण्ड संहिता में वर्णित षट्कर्म—धौति, वस्ति, नेति, नौलि, त्राटक, कपालभाति की विधि  
सावधानियां व लाभ।
- इकाई 5—घेरंड संहिता के आसन, प्राणायाम, मुद्राएँ, प्रत्याहार, ध्यान व समाधि का विवेचन।  
घेरंड संहिता में वर्णित विविध आसनों एवं प्राणायामों की विधि, लाभ एवं सावधानियां।

सहायक पुस्तकें—

- |                           |                            |
|---------------------------|----------------------------|
| 1. हठयोग प्रदीपिका        | प्रकाशक कैवल्यधाम लोणावाला |
| 2. घेरण्ड संहिता          | प्रकाशक कैवल्यधाम लोणावाला |
| 3. योगांक—कल्याण विशेषांक | गीता प्रेस, गोरखपुर        |
| 4. हठयोग                  | स्वामी शिवानंद             |
| 5. योग विज्ञान            | स्वामी विज्ञानानंद सरस्वती |

चतुर्थ प्रश्नपत्र : कियात्मक  
इन्टर्नशिप

पूर्णांक : 75

पूर्णांक : 25

पवनमुक्तासन भाग—एक  
भाग — दो  
भाग — तीन  
सूर्यनमस्कार।

*Patil*  
04/11/2020

*04/11/2020*

*04-11-2020*

## द्वितीय सेमेस्टर

प्रथम प्रश्न पत्र : चेतना का अध्ययन

पूर्णांक : 80

इकाई 1--चेतना का अर्थ, परिभाषा स्वरूप, अध्ययन की आवश्यकता

इकाई 2--उपनिषद, बौद्ध, जैन मतानुसार चेतना

इकाई 3--चेतना का स्वरूप, सांख्य-योग एवं मीमांसा एवं अद्वैत वेदांत मत में, आत्मा, ब्रह्म, पुरुष,

सिद्धि, पुरुष बहुत्व

इकाई 4--चेतना का स्वरूप, हुसर्ल, सार्त्रे, श्री अरविंद, मानव का स्वरूप राधाकृष्णन, रवीन्द्रनाथ टैगोर

इकाई 5--मानव चेतना का स्वरूप, मानव चेतना के अध्ययन की आवश्यकता, मानव चेतना का वर्तमान

संकट तथा सार्थक समाधान के उपाय, मानव चेतना के विविध रहस्य एवं तथ्य – जन्म और

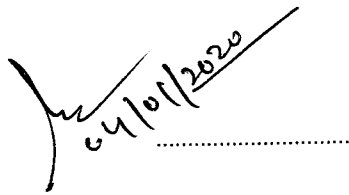
जीवन, भाग्य और पुरुषार्थ, कर्मफल सिद्धांत, संस्कार एवं पुर्नजन्म, भारतीय ऋषियों द्वारा


विकसित मानव चेतना के विकास की विधियां ।

सहायक पुस्तकें--

- |                                     |                       |
|-------------------------------------|-----------------------|
| 1 समकालीन भारतीय दर्शन              | बी के लाल             |
| 2 समकालीन पाश्चात्य दर्शन           | बी के लाल             |
| 3 समकालीन पाश्चात्यदर्शन            | लक्ष्मी सक्सेना       |
| 4. भारतीय दर्शन में चेतना का स्वरूप | डॉ. श्रीकृष्ण सक्सेना |
| 5. मानव चेतना                       | डॉ. ईश्वर भारद्वाज    |

  
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6/11/2020

इकाई 1—योग की परिभाषा, चित्त, चित्त भूमियों, चित्त वृत्तियों।

अभ्यास और वैराग्य, समाधि के भेद, ईश्वरत्व, ईश्वर प्राणिधान, चित्त प्रसादन के उपाय, ऋतंभराप्रज्ञा।

इकाई 2—पंचक्लेश, दुःख का स्वरूप, चतुर्व्यूहवाद, विवेकख्याति, सप्तधाप्रज्ञा।

इकाई 3—योग के आठ अंग — यम, नियमादि : इनकी सिद्धि के फल  
वितर्क—विवेचन, प्राणायाम का फल, प्रत्याहार का फल।

इकाई 4—धारणा, ध्यान और समाधि संयमचित्त का परिणाम, विभूति और उसके भेद, कैवल्य का स्वरूप।

इकाई 5—सिद्धि के पांच भेद, निर्माण चित्त कर्म के भेद, दृष्टा और दृश्य  
धर्ममेध समाधि, आधुनिक जीवन में ध्यान की प्रासंगिकता।

सहायक पुस्तकें—

- |                          |                  |
|--------------------------|------------------|
| 1. योग सूत्रतत्ववैशारदी  | वाचस्पति मिश्र   |
| 2. योग सूत्र योग वर्तिका | विज्ञानभिक्षु    |
| 3. योग सूत्र राज मार्तंड | हरिहरानंद आरण्य  |
| 4. पातंजल योगप्रदीप      | ओमानंद तीर्थ     |
| 5. पातंजल योग विमर्श     | विजयपाल शास्त्री |
| 6. ध्यान योग प्रकाश      | लक्ष्मणानंद      |
| 7. योग दर्शन             | राजवीर शास्त्री  |

*Patil*  
4/11/2020

*04/11/2020*  
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*04-11-2020*

इकाई 1—स्वास्थ्य की परिभाषा, स्वस्थ पुरुष के लक्षण, दिनचर्या—मुखशोधन, व्यायाम की परिभाषा, योग्यायोग्य प्रकार, लाभ, स्नान के लाभ एवं हानि के अनुसार स्नान, संध्योपासना, योगाभ्यास । रात्रिचर्या —निद्रा एवं ब्रह्मचर्य, ऋतुचर्या, ऋतुविभाजन, ऋतु के अनुसार दोषों का संचय, प्रकोप व प्रशमन । सद्वृत्त एवं आचार रसायन ।

इकाई 2—आहार की परिभाषा, आहार के गुण व कर्म । आहार के घटक द्रव्य : कार्बोज, वसा, प्रोटीन, खनिजपदार्थ, जीवनीय तत्व जल । आहार की मात्रा व काल, संतुलित आहार । दुग्धाहार, फलाहार, अपक्वाहार, मिताहार उपवास । शाकाहार व मांसाहार के अवगुण । अंकुरित आहार के लाभ, योगाभ्यासी के लिए निषिद्ध आहार ।

इकाई 3—निम्नलिखित रोगों का लक्षण— कारण व यौगिक उपचार  
अग्निमांद्य, अजीर्ण, पीलिया, कोष्ठबद्धता, अम्लपित्त, कोलाइटिस, दमा, उच्च व निम्न रक्तचाप, साइटिका, आमवात; अर्थराइटिस, वातरक्त; गठियाबद्ध ।

इकाई 4—नाभि टलना, चर्मरोग, कर्णबाधिर्य, नासांकुर वृद्धि, बाल झड़ना, दृष्टिक्षीणता, सर्वाइकल स्पोण्डिलाइटिस, धातुदौर्बल्य, मधुमेह, बौनापन, श्वेतप्रदर, कटिशूल ।

इकाई 5—आधुनिक जीवन शैली में योग की प्रासंगिकता, सावधानियाँ एवं निदान (खानपान व्यवस्था, भविष्य के प्रति अनिश्चितता, मानसिक अवसाद, द्रुत जीवन शैली आदि के विशेष संदर्भ में) ।

सहायक पुस्तकें—

- |                        |              |
|------------------------|--------------|
| 1. स्वस्थवृत्त विज्ञान | रामहर्ष सिंह |
| 2. यौगिक चिकित्सा      | कुवल्यानंद   |
| 3. योग से आरोग्य       | कालिदास      |

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चतुर्थ प्रश्नपत्र : कियात्मक  
इन्टर्नशिप

पूर्णांक : 75  
पूर्णांक : 25

- 1 प्राणायाम, मुद्रा एवं बंध क्रिया
2. पवनमुक्तासन भाग-एक  
भाग - दो  
भाग - तीन
3. सूर्यनमस्कार।

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**प्रथम प्रश्न पत्र : श्रीमद्भगवद गीता दर्शन एवं योग साधना के तत्व**

- इकाई 1—श्रीमद् भगवद गीता का स्वरूप, रचनाकाल, श्रीमद् भगवदगीता का दार्शनिक एवं आध्यात्मिक महत्व। मानवीय चिंतन एवं जीवन पर विश्वव्यापी प्रभाव।
- इकाई 2—श्रीमद् भगवदगीता के कुछ प्रमुख भाष्यकारों का जीवन परिचय उनकी योग साधनाएं एवं भाष्य की विशेषताएं, आचार्य शंकर, आचार्य रामानुज, लोकमान्य तिलक तथा गोंधी के संदर्भ में।
- इकाई 3—श्रीमद् भगवदगीता का तत्व विचार, माया, प्रकृति, पुरुष, ईश्वर तथा अवतार तत्व का स्वरूप, श्रीमद्भगवद गीता का आचार शास्त्र।
- इकाई 4—गीता में योग की प्रवृत्ति व स्वरूप। योग के भेद—कर्मयोग, भक्ति योग, ज्ञानयोग, ध्यान योग का स्वरूप। भक्त, कर्मयोगी व ज्ञानयोगी व ज्ञानी तत्व के लक्षण, स्थितप्रज्ञ का तत्व दर्शन।
- इकाई 5—गीता का निष्काम कर्मयोग, ज्ञान भक्ति एवं कर्म योगों का समन्वय।

सहायक पुस्तकें—

- |                                 |                   |
|---------------------------------|-------------------|
| 1. श्रीमद्भगवदगीता              | रामानुज भाष्य     |
| 2. गीतांक                       | गीताप्रेस गोरखपुर |
| 3. गीतामाता                     | गोंधी             |
| 4. गीता प्रवचन संत              | विनोवाभावे        |
| 5. श्रीमद्भगवदगीता गीतारहस्यद्ध | लोकमान्य तिलक     |
| 6. श्रीमद्भगवदगीता              | शांकरभाष्य        |

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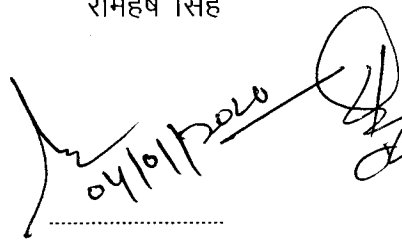
द्वितीय प्रश्न पत्र : आसन और प्राणायाम का वैज्ञानिक अध्ययन पूर्णांक : 80

- इकाई 1—आसन परिभाषा, उद्देश्य, आसनों का वर्गीकरण आसन और व्यायाम में अंतर, बंधो का वैज्ञानिक विवेचन।
- इकाई 2—ध्यानात्मक शरीर—सम्बर्धनात्मक एवं विश्रामात्मक आसनों का वैज्ञानिक विवेचन, शुद्धिक्रियाओं, षठकर्मों का वैज्ञानिक विवेचन।
- इकाई 3—प्राणायाम की परिभाषा प्राणायाम के गुण विशेष प्राणायाम की प्रक्रिया का वैज्ञानिक विवेचन, श्वसन तंत्रकी क्रियाविधि, प्राणायाम के संदर्भ में दीर्घश्वसन एवं प्राणायाम में अंतर।
- इकाई 4—प्राणशक्ति के पाँच स्वरूप, विभिन्न रोगों के निदान में प्राणायाम की उपयोगिता, आधुनिक वैज्ञानिक अध्ययन के संदर्भ में।
- इकाई 5—प्राणायाम में ध्यानात्मक आसनों व बंधोकी अनिवार्यता का वैज्ञानिक विवेचन।

सहायक पुस्तकें—

- |                               |   |
|-------------------------------|---|
| 1. प्राणशक्ति एक दिव्य विभूति | पं. श्री राम शर्मा आचार्य सम्पूर्ण वाङ्मय |
| 2. योगासन और स्वास्थ्य        | लक्ष्मीनारायण अग्रवाल                     |
| 3. आसन प्राणायाम से आधि       | व्याधि निवारण—ब्रम्हवर्चस                 |
| 4. योग दीपिका                 | बी.के.एस. आयंगर                           |
| 5. योग एवं यौगिक चिकित्सा     | रामहर्ष सिंह                              |

  
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इकाई 1—स्वास्थ्य – अर्थ, परिभाषा, लक्षण एवं अंगों की विवेचना ।

स्वस्थवृत्त –अर्थ, परिभाषा, स्वरूप, प्रयोजन, अंग

दिनचर्या – प्रातः कालीन नित्यकर्म, व्यायाम की अवधारणा एवं उपयोगिता

अभ्यंग – अर्थ, परिभाषा एवं विधियां एवं उनके शरीरगत प्रभाव एवं चिकित्सकीय प्रयोग ।

इकाई 2—स्नान – अर्थ एवं परिभाषा, उद्देश्य, स्नान के भेद व समय, संसाधन, निषेधात्मक स्थितियां व लाभ

निद्रा – परिभाषा, उद्देश्य, प्रकार, कारणीय सिद्धांत व लाभ, अनिद्रा के लक्षण व उपाय ।

इकाई 3—ऋतुचर्या – अर्थ, परिभाषा, विभाजन एवं विशेषताएं । ऋतु के अनुसार दोषों का संचय, प्रकोप व प्रशमन – सद्वृत्त एवं आचार रसायन, अर्थ, परिभाषा एवं प्रकार आदि— व्याधि रोकथाम, निवारण एवं दीर्घ आयु के लिए इनकी उपयोगिता ।

इकाई 4—आहार एवं पोषण – अर्थ, परिभाषा, अंग, घटक, गुणवत्ता, मात्रा, समय, बारम्बारता, कार्य एवं उपयोगिता ।

आहार विविधता – दुग्धहार, फलाहार, अपक्वाहार । उपवास की अवधारणा एवं स्वास्थ्य संबंधी उपयोगिता । मांसाहार व शाकाहार की तुलनात्मक विवेचना ।

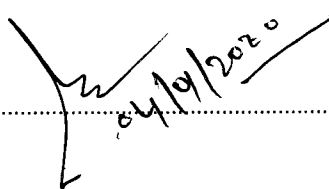
इकाई 5— संतुलित आहार – परिभाषा, घटक एवं वर्गीकरण ।


घटकों का रासायनिक वर्गीकरण –प्रोटीन, कार्बोहाइड्रेड, वसा, खनिज, लवण, विटामिन, जल, वर्गीकरण तथा शरीर में कार्य । आहार –चिकित्सा

**सहायक पुस्तकें—**

1. चरक संहिता महर्षि चरक
2. सुश्रुत संहिता महर्षि सुश्रुत
3. आयुर्वेद सिद्धांत रहस्य आचार्य बालकृष्ण

  
5/11/2020

  
5/11/2020


  
5/11/2020

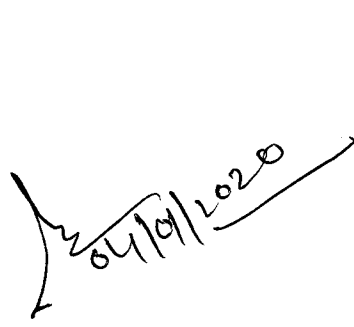


चतुर्थ प्रश्नपत्र : कियात्मक  
इन्टरनशिप

पूर्णांक : 75  
पूर्णांक : 25

1. षटकर्म
2. प्राणायाम, मुद्रा एवं बंध क्रिया
3. पवनमुक्तासन भाग-एक  
भाग - दो  
भाग - तीन
4. सूर्यनमस्कार।

  
4/1/2020

  
04/01/2020

.....

## चतुर्थ सेमेस्टर

प्रथम प्रश्नपत्र : योग—उपचार

पूर्णांक : 80

- इकाई 1—योग चिकित्सा का अर्थ, परिभाषा, प्रयोजन, मूल सिद्धांत, स्वास्थ्य संवर्द्धन, रोकथाम, उपचार एवं दीर्घायु के लिये योग चिकित्सा का महत्व । योग चिकित्सक के गुण, योग चिकित्सा एवं एलोपैथिक चिकित्सा के बीच में अन्तर, योग चिकित्सा की समकालीन पद्धतियां एवं योग चिकित्सा की सीमाएं ।
- इकाई 2—यौगिक विकृति निदान : 1 स्वर विज्ञान 2. प्राण एवं 3. श्वास का शारीरिक, मानसिक एवं मनोदैहिक दैनिक समस्याओं के साथ संबंध । सप्तचक्र का तंत्रिका तंत्र एवं अन्तःस्रावी ग्रंथियों से संबंध । स्वास्थ्य एवं तन्दरुस्ती : अर्थ, परिभाषा, लक्षण एवं अंगों की विवेचना (योग एवं डब्ल्यू. एच.ओ. के संदर्भ में)
- इकाई 3—सामान्य— व्याधियों के लिये योग चिकित्सा, अस्थि एवं मांशपेशी तंत्र के रोग — कमर दर्द, सायटिका, सरवाईकल स्पॉण्डलाइटिस, आमवात के कारण, लक्षण, निदान एवं योग चिकित्सा । श्वसन संबंधी रोग : दमा, निमोनिया, नजला के कारण, लक्षण, निदान एवं योग चिकित्सा ।
- इकाई 4—पाचन तंत्र संबंधी रोग : कब्ज, अजीर्ण, अम्लपित्त, अल्सर, उदरवायु, पीलिया के कारण, लक्षण, निदान एवं योग चिकित्सा । रक्त परिवहन तंत्र संबंधी उच्च रक्तचाप, निम्न रक्तचार, हृदय धमनी अवरोधके कारण, लक्षण, निदान एवं योग चिकित्सा ।
- इकाई 5—अन्तःस्रावी ग्रंथियों संबंधित रोग :- मधुमेह, थायराइड हार्मोन वृद्धि व कमी, मोटापा, डायबिटीज, मानसिक शक्ति हास के कारण, संकेत, लक्षण, निदान एवं योग चिकित्सा । तंत्रिका तंत्र संबंधित रोग — सिर दर्द, अवसाद, चिन्ता, अनिद्रा, माइग्रेन, तनाव, धूम्रपान, मद्यपान के कारण, लक्षण, निदान एवं योग चिकित्सा । मानसिक रोग स्वास्थ्य : अर्थ, परिभाषा, कारण, लक्षण एवं उनका योग चिकित्सा द्वारा निदान

सहायक पुस्तकें—

- |                           |                 |
|---------------------------|-----------------|
| 1 चरक संहिता              | महर्षि चरक      |
| 2 सुश्रुत संहिता          | महर्षि सुश्रुत  |
| 3 आयुर्वेद सिद्धांत रहस्य | आचार्य बालकृष्ण |
| 4 स्वस्थवृत्त विज्ञान     | रामहर्ष सिंह    |

*रामहर्ष सिंह*  
04/11/2020

*04/11/2020*  
04/11/2020

इकाई 1—शरीर रचना का सामान्य परिचय चलन तंत्र रक्त वाहिका तंत्र पाचन तंत्र  
श्वसन तंत्र मूत्र —जनन तंत्र तंत्रिका तंत्र उत्सर्जन तंत्र तथा संतुलित आहार।

इकाई 2—कंकाल तंत्र उर्ध्व शाखा का कंकाल अधःशाखा का कंकाल ।

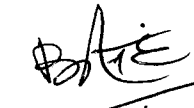
इकाई 3—परिसंचरण तंत्र हृदय हृदयचक्र हृदय संरोध के कारण एवं बचाव के  
उपाय यौगिक सावधानियां एवं निदान रक्त की संरचना।

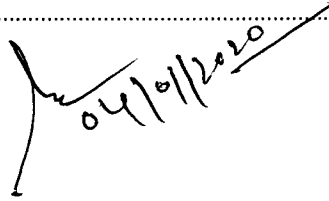
इकाई 4—पाचन तंत्र रक्त वाहिका तंत्र तथा श्वसन तंत्र इनकी कार्य प्रणाली पर  
यौगिक क्रियाओं का प्रभाव।

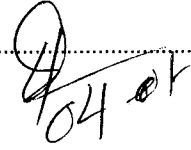
इकाई 5—मूत्रजनन तंत्र, उत्सर्जन तंत्र तथा तंत्रिका तंत्र— इनकी कार्यप्रणाली पर योगिक।

सहायक पुस्तकें—

- |                                      |                     |
|--------------------------------------|---------------------|
| 1. शरीर और शरीर क्रिया विज्ञान       | मन्जु गुप्त         |
| 2. मानव—शरीर—रचना                    | मुकन्द स्वरूप वर्मा |
| 3. मानव शरीर रचना एवं क्रिया विज्ञान | अनन्त प्रकाश गुप्ता |

  
04/11/2020

  
04/11/2020

  
04/11/2020

तृतीय प्रश्नपत्र :

पूर्णांक : 100

यह प्रश्न पत्र दो भागों में विभक्त होगा

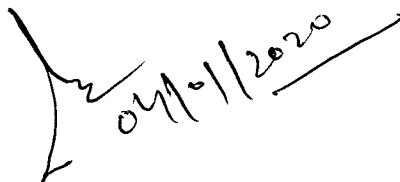
1. परियोजना कार्य 75 अंक
2. शैक्षिक भ्रमण / मौखिकी 25 अंक

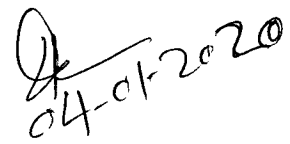
चतुर्थ प्रश्न पत्र : कियात्मक  
इन्टर्नशिप

पूर्णांक : 75  
पूर्णांक : 25

1. उच्च स्तरीय योगिक कियाएं
2. शोधन कियाएं
3. ध्यान
4. षटकर्म
5. प्राणायाम, मुद्रा एवं बंध किया
6. पवनमुक्तासन भाग-एक  
भाग - दो  
भाग - तीन
7. सूर्यनमस्कार।

  
04/11/2020

  
04/11/2020

  
04-01-2020



5

SVM SoS in Comparative Religion, Philosophy & Yoga

Choice Based Credit System (Elective Paper)

दर्शनशास्त्र एवं योग का परिचय : Introduction to Philosophy & Yoga  
भाग-I / Part-I (For Second Semester)

कुल क्रेडिट -03

कुल - 80

खण्ड-1 - भारतीय दर्शन एवं संस्कृति का परिचय, वेद, उपनिषद्, आस्तिक-नास्तिक दर्शन, नीतिशास्त्र का परिचय, नैतिक मूल्य एवं अन्य मूल्य, सदगुण, दण्ड के सिद्धान्त

Section-1- Introduction to Indian Philosophy & Culture.  
Veda, Upanishad, Astika-Nastika Philosophy.  
Introduction to Ethics, Moral values and other values,  
Virtue, Theories of Punishment.

खण्ड-2 - धर्म दर्शन का परिचय, ईश्वर के अस्तित्व के प्रमाण (भारतीय एवं पाश्चात्य) ईश्वर के अनस्तित्व के प्रमाण (भारतीय एवं पाश्चात्य)

Section-2 - Introduction to Philosophy of Religions, Proofs for the existence of God (Indian & Western), Proofs for the non-existence of God (Indian & Western)

खण्ड-3 - भारतीय समाज दर्शन का परिचय, स्वामी विवेकानन्द का वेदान्तिक सिद्धान्त महात्मा गांधी का सर्वधर्म समभाव, पं.दीनदयाल उपाध्याय का एकात्म मानव दर्शन : आधुनिक पाश्चात्य दर्शन का परिचय, बुद्धिवाद, अनुभववाद, कौट का समीक्षावाद

Section-3 - Introduction to Indian Social Philosophy, Vedantic principle of Swami Vivekanand, Sarvadharm Sambhav of Mahatma Gandhi, Integral humanism of Pt. Deen Dayal Upadhyaya Introduction to Modern-Western Philosophy, Rationalism, Empiricism, Theory of criticism of Kant.

Suggested Books-

1. भारतीय दर्शन (Volume-I) - डॉ. राधाकृष्णन
2. धर्म दर्शन - डॉ. लक्ष्मी निधि शर्मा
3. समाज दर्शन - डॉ. शिव भानु सिंह
4. पाश्चात्य दर्शन - डॉ. चन्द्रधर शर्मा

टीप-प्रत्येक भाग में तीन-तीन खण्ड है। प्रत्येक खण्ड एक क्रेडिट का

Swami Vivekanand Memorial  
SOS in Comparative Religion, Philosophy & Yoga  
Pt. Ravishankar Shukla University, Raipur

SVM SoS in Comparative Religion, Philosophy & Yoga

Choice Based Credit System (Elective Paper)

दर्शनशास्त्र एवं योग का परिचय : Introduction to Philosophy & Yoga

भाग-II / Part-II (For Third Semester)

कुल क्रेडिट -03

कुल - 80

खण्ड-1 - योग की परिभाषा, उद्देश्य, आसनों का वर्गीकरण, आसन और व्यायाम में अंतर, बंधों का वैज्ञानिक विवेचन, प्राणायाम की परिभाषा, प्राणायाम के लाभ, प्राणायाम की प्रक्रिया का वैज्ञानिक विवेचन, रवसन तंत्र की क्रिया विधि प्राणायाम के संदर्भ में, दीर्घ रवसन एवं प्राणायाम में अंतर।

Section-1- Definition of Yoga, Aims, Classification of Asanas, Difference between Asana and exercise, scientific explanation of Bandhas, Definition of Pranayama, Benefits of Pranayama, Scientific explanation of process of Pranayama, Process of respiratory system-with reference to Pranayama, Difference between long breathing & Pranayama.

खण्ड-2 - प्राण शक्ति के पाँच स्वरूप, विभिन्न रोगों के निदान में प्राणायाम की उपयोगिता-आधुनिक वैज्ञानिक अध्ययन के संदर्भ में।

Sectoin-2 - Five aspects of Prana shakti, Utility of Pranayama in curing different diseases-with reference to modern scientific study.


इकाई -3 - स्वास्थ्य की परिभाषा, स्वस्थ व्यक्ति के लक्षण, दिनचर्या, कर्मयोग, सांध्योपासना, ब्रह्मचर्य, विभिन्न रोगों के लक्षण, कारण एवं यौगिक उपचार।  
आधुनिक जीवन शैली में योग की प्रासंगिकता-सावधानियों एवं निदान

UNIT-3 - Definition of Health, Characteristics of healthy person, Daily routine, Karma-Yoga, Evening prayer, Celibacy; Symptoms, Causes and Yogic treatment of different diseases.  
Relevance of Yoga in modern life style- Precautions & treatment.

**Suggested Books-**

- |                                    |   |                   |
|------------------------------------|---|-------------------|
| 1. स्वस्थवृत्त विज्ञान             | - | डॉ. रामहर्ष सिंह  |
| 2. योगिक चिकित्सा                  | - | स्वामी कुपल्यानंद |
| 3. प्राण शक्ति : एक द्विष्य विभूति | - | पं. श्रीराम शर्मा |
| 4. योग दीपिका                      | - | बी. के. एस. अयंगर |
| 5. योग एवं यौगिक चिकित्सा          | - | डॉ. रामहर्ष सिंह  |

टीप-प्रत्येक भाग में तीन-तीन खण्ड है। प्रत्येक खण्ड एक क्रेडिट का है।

  
HEAD  
Sri Sri Vivekanand Memorial  
SoS in Comparative Religion, Philosophy & Yoga  
Ravishankar Shukla University, Raipur

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**P.G.Diploma in Yoga Education and Philosophy  
Syllabus. (Effective from 2018-19 (Exam.2019.)**

There shall be two theory papers and one Practical (Three parts) in each semester.

**SEMESTER -I**

**Paper -1 Theoretical Yoga Vijnan**

**M.M.-50.**

Unit-I : Introductio to Yoga : The concept,meaning ,definition and tradition of Yoga, Guru-Shishya ( types and meaning )

Unit-II : Basic texts of Yoga --Yoga Sutra(Samadhi and Sadhana Padas), Hathyoga Pradipika.

Unit-III : Kinds of yoga : Bhakti yoga ,Karma yoga, Mantra yoga and Raj yoga.

Unit-IV : Study of Ida,Pingala, Sushumna,Seven Chakras ,Five Koshas, and Five Pranas.

Unit-V : Contemporary Yogis --Shri Aurobindo,Satyananda and Shivananda.

**Paper -2. Applied Yoga Vijnan.**

**M.M. 50.**

Unit-I : Meaning ,definition and importance of Yoga and Health in life. Theories of Health,Various exercises benefits of Yoga- asanas and their values vis-a-vis other systems.

Unit -2 : Practice of Yoga - Preparation . Food , Dress, Sequence , Climatic Changes daily routine Vratas for health,positive and negative factors.

Unit -3 : Life pattern and Yoga --Effects of yoga upon bodily functions,Role of yoga asanas in modern living.

Unit - 4 : Physiology- Constitution Nervous system , Respiratory system, Circulatory system and ESndocrine glands

Unit- 5 : Aspects of Mind ( Topograficals and Dynamic ) Id,Ego and Super Ego, Conciuous , Sub-conciuous and Un-conciuous . Yogic concept of mind and mental process.

**Practicals**

**(A) Practice Teaching (Indoor)**

**M.M. 50.**

Asanas, Kriyas, Pranayamas  
Class arrangement, Meditation

**(B) Practical (1-6)**

**M.M. 50.**

1. Pawanmuktasana Part-1,2 &3
2. Asanas :,Relaxation,Pre-meditative,backward and forward bending, Spinal Cord Twisting and balancing, Asanas of Vajrasana group & Standing pose
3. Nadishodhan and Pranayamas : Sheetal Pranayama, Sheetakari Pranayama, Ujjayi Pranayama & Bhramari Pranayama.
4. Mudra : Hastmudra, Manmudra and Kayamudra.
- 5 Bandha : Moolbandha & Jalandhar Bandha.
6. Shawaasana.

**(C) Practical record**

**M.M. 25**

**Viva-Voce**

**MM 25**

.....  
**Total Marks of I sem :**

**250.**

## SEMESTER-II.

### Paper -I Yoga Philosophy.

Max.Marks : 50

- Unit-I The subject matter of Yoga philosophy-  
Samkhya: Prakriti,Purusha and Cosmology.  
Vedanta :Brahman Soul and Maya.
- Unit-II Different systems of philosophy :  
Pancha Mahavrata -- Jainism.  
Ashtang Marg -- Buddhism  
Integral Yoiga -- Shri Aurobindo
- Unit-III Yoga Sutra : Nature of Chitta, Chitta vrittis and Bhoomis
- Unit-IV Kinds of Yoga : Hatha Yoga, Kundalini, Jnana,Laya.
- Unit-V Psychosomatic disorders(meaning and types) their  
management through Yoga, Aging --Its problems  
and management through Yoga.

### Paper II. Hatha Yoga.

M.M. - 50

- Unit-I Introduction to the HathPradipika and Gherand Samhita.
- Unit-II Pranayama--Its meaning methods,kinds,Precaution and benifits.
- Unit-III Shuddhi kriya--Shatkarma,its method and utility.
- Unit-IV Bandha and Mudras --methods and benifits.
- Unit-V Samadhi , Different systems of Meditation.

### Practicals.

#### (A) Practice Teaching (Indoor)

M.M. - 50

Asanas, Kriyas, Pranayamas,  
Class arrangement & Meditation.

#### (B) Practical (1-8)

M.M.- 50

1. Balancing Asanas.
2. Asanas of Higher group.
3. Surya Namaskar.
4. Pranayama : Suryabheda Pranayama, Bhastrika Pranayama, Kapalabhati Pranayama & Moorchha Pranayama.
5. Bandha : Uddiyaan Bandha & Mahaabandha.
6. Mudra : Bandha Mudrayen & Aadhaar Mudrayen.
7. Shatkarma.
8. Dhaayana & Yoganidra.

#### (C) Practical records

M.M. 25

#### Viva-voce

M.M. 25

#### Total Marks of II Semester

250

=====  
Grand Total of I & II Semester -----

500



## Certificate Course in Yoga Education & Philosophy

Note : Duration of this course shall be of 01 Semester (six months).  
There shall be 02 papers of 50 marks each - 01 Theory &  
01 Yogic Practices

### PAPER - I

Unit- (I) Introduction to Philosophy & Yoga- Meaning and Definition of  
Philosophy & Yoga;  
Basics of Indian & Western Philosophy.

Unit- (II) Introduction to Yogic Texts :-  
(i) Patanjāl Yoga Sutra (ii) Hath Pradeepika  
(iii) Bhagavat Geeta (iv) Gherand Sanhita

Unit-(III) Introduction to Different Types of Yoga :-  
(i) Janana Yoga (ii) Bhakti Yoga (iii) Karma Yoga.  
(iv) Raja Yoga (v) Mantra Yoga

Unit-(IV) Introduction to Yoga Therapy  
(i) Yogic life style and diet  
(ii) Asana & Pranayama & their Physiological effects  
(iii) Satkarma - Benifits & Precautions

Unit-(V) Development of Yoga through Yoga Gurus & their contributions :  
(i) Sri Aurobindo  
(ii) Swami Vivekananda  
(iii) Shriram Sharma Acharya  
(iv) S. Kuvalayanand  
(v) B.K.S. Iyengar  
(vi) Swami Satyanand Saraswati

### Reference Books :-

योग विज्ञान	-	स्वामी विद्यानंद सरस्वती
हठ प्रदीपिका	-	कैवल्यधाम लोनावाला
घेरण्ड संहिता	-	बिहार स्कूल ऑफ मुंगेर
पातंजल योग सूत्र	-	गीता प्रेस, गोरखपुर
भारतीय दर्शन की रूपरेखा	-	हरेन्द्र प्रसाद सिन्हा
Integrated Yoga Therapy	-	H.R. Nagendra

*P. Singh*  
05/08/19

*Sharma*  
05/08/19

*Rajendra*  
5-8-19

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05/08/19

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05-8-19

प्रमाण पत्र पाठ्यक्रम :- योग शिक्षा एवं दर्शन

द्वितीय प्रश्न पत्र – किर्यात्मक योग (Yogic Practices)

1. पवन मुक्त आसन – भाग एक  
गठिया निरोधक समूह (Anti - Rheumatic Group)
  - पादांगुलि नमन एवं गुल्फ नमन
  - गुल्फ चक
  - जानु नमन एवं ज्ञानु चक
  - अर्द्ध तितली आसन एवं पूर्ण तितली आसन
  - मुष्टिका बंध एवं मणिबंध नमन, मणिबंध चक
  - कोहनी नमन, कोहनी चक, स्कंध चक
  - ग्रीवा संचालन आसन
2. पवन मुक्त आसन – भाग दो  
वात निरोधक समूह (Digestive / Abdominal Group)
  - पादोत्थान आसन, पाद संचालन आसन, पाद चक आसन
  - सुप्त पवन मुक्त आसन
  - सुप्त उदराकर्षण आसन, शव उदराकर्षण आसन
  - नौका आसन
3. पवन मुक्त आसन – भाग तीन  
शक्तिबंध समूह (Energy Block Postures)
  - रज्जू कर्षण आसन
  - चक्की चालन आसन
  - नौका संचालन आसन
  - काष्ठातक्ष आसन
  - कौआ चालन आसन
  - उदराकर्षण आसन
4. सूर्य नमस्कार
5. षट्कर्म - जलनेती, कपालभाति, कुन्जल क्रिया
6. प्राणायाम - नाडी शोधन (अनुलोम-विलोम), भ्रामरी
7. योग निद्रा - शवासन

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**Swami Vivekananda Memorial  
SOS in Comparative Religion, Philosophy and Yoga**

**Course Work for Ph. D. in Philosophy.**

S. No.	Paper	Marks
1	Theory Paper	100
2	Practical	
	a. Review / Project Work	50
	b. Seminar	50
	Total	100
	Grand Total	200

**Theory Paper : Research methodology :**

The candidate must be aware of the following topics --

- i. Definition, Aim and Nature of Research.
- ii. Selection of topic and preparation of Synopsis.
- iii. Formation of Hypothesis, Types of Research.
- iv. Matter/data collection, classification and its use.
- v. Different methods--Dialectical, Analytical, Synthetic, Inductive, Deductive and Pragmatic.
- vi. Preparation of Bibliography, Footnotes and References.
- vii. Computer application

Recommended books.

1. Anusandhan Pravidhi Aur Prakiya--  
Vinay Pathak, Bhavana Prakashan Delhi.
2. Studies in Philosophical Methods--Chhaya Rai  
University of Jabalpur.

The candidate shall prepare a project/Review and shall present the summary in written form in seminar as per instructions given in revised Ordinance 45 of the University.

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**Course Title:**

- **Research and Publication Ethics (RPE)-Course** for awareness about the publication ethics and publication misconducts.

**Course Level:**

- 2 Credit course (30 hrs.)

**Eligibility:**

- M.Phil., Ph.D. students and interested faculty members (It will be made available to post graduate students at later date)

**Fees:**

- As per University Rules

**Faculty:**

- Interdisciplinary Studies

**Qualifications of faculty members of the course:**

- Ph.D. in relevant subject areas having more than 10 years' of teaching experience

**About the course**

**Course Code: CPE- RPE**

**Overview**

- This course has total 6 units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. Hands-on-sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, h-index, Impact Factor, etc.) and plagiarism tools will be introduced in this course.

**Pedagogy:**

- Class room teaching, guest lectures, group discussions, and practical sessions.

**Evaluation**

- Continuous assessment will be done through tutorials, assignments, quizzes, and group discussions. Weightage will be given for active participation. Final written examination will be conducted at the end of the course.



## Course structure

- The course comprises of six modules listed in table below. Each module has 4-5 units.

Modules	Unit title	Teaching hours
<b>Theory</b>		
RPE 01	Philosophy and Ethics	4
RPE 02	Scientific Conduct	4
RPE 03	Publication Ethics	7
<b>Practice</b>		
RPE 04	Open Access Publishing	4
RPE 05	Publication Misconduct	4
RPE 06	Databases and Research Metrics	7
	<b>Total</b>	<b>30</b>

## Syllabus in detail

### THEORY

- RPE 01: PHILOSOPHY AND ETHICS (3 hrs.)**
  - Introduction to philosophy: definition, nature and scope, concept, branches
  - Ethics: definition, moral philosophy, nature of moral judgements and reactions
- RPE 02: SCIENTIFIC CONDUCT (5hrs.)**
  - Ethics with respect to science and research
  - Intellectual honesty and research integrity
  - Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
  - Redundant publications: duplicate and overlapping publications, salami slicing
  - Selective reporting and misrepresentation of data
- RPE 03: PUBLICATION ETHICS (7 hrs.)**
  - Publication ethics: definition, introduction and importance
  - Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
  - Conflicts of interest
  - Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
  - Violation of publication ethics, authorship and contributorship
  - Identification of publication misconduct, complaints and appeals
  - Predatory publishers and journals

### PRACTICE

- RPE 04: OPEN ACCESS PUBLISHING(4 hrs.)**

1. Open access publications and initiatives
  2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
  3. Software tool to identify predatory publications developed by SPPU
  4. Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.
- **RPE 05: PUBLICATION MISCONDUCT (4hrs.)**
    - A. Group Discussions (2 hrs.)**
      1. Subject specific ethical issues, FFP, authorship
      2. Conflicts of interest
      3. Complaints and appeals: examples and fraud from India and abroad
    - B. Software tools (2 hrs.)**  
Use of plagiarism software like Turnitin, Urkund and other open source software tools
  - **RPE 06: DATABASES AND RESEARCH METRICS (7hrs.)**
    - A. Databases (4 hrs.)**
      1. Indexing databases
      2. Citation databases: Web of Science, Scopus, etc.
    - B. Research Metrics (3 hrs.)**
      1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
      2. Metrics: h-index, g index, i10 index, altmetrics

## References

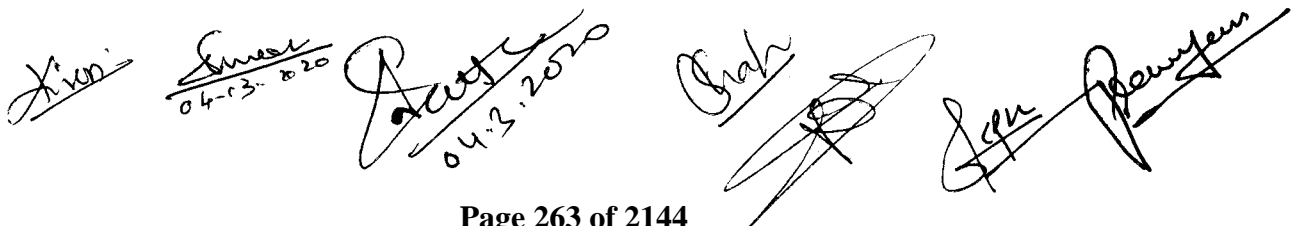
- Bird, A. (2006). *Philosophy of Science*. Routledge.
- MacIntyre, Alasdair (1967) *A Short History of Ethics*. London.
- P. Chaddah, (2018) *Ethics in Competitive Research: Do not get scooped; do not get plagiarized*, ISBN:978-9387480865
- National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). *On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition*. National Academies Press.
- Resnik, D. B. (2011). What is ethics in research & why is it important. *National Institute of Environmental Health Sciences*, 1–10. Retrieved from <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>
- Beall, J. (2012). Predatory publishers are corrupting open access. *Nature*, 489(7415), 179–179. <https://doi.org/10.1038/489179a>
- Indian National Science Academy (INSA), *Ethics in Science Education, Research and Governance*(2019), ISBN:978-81-939482-1-7. [http://www.insaindia.res.in/pdf/Ethics\\_Book.pdf](http://www.insaindia.res.in/pdf/Ethics_Book.pdf)



**PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR [C.G.]  
ORDINANCE NO.**

**MASTER OF COMPUTER APPLICATIONS (TWO YEARS)**

1.	The degree of Master of Computer Applications shall be of two academic years divided into four semesters.
2.	The eligibility for admission shall be as per AICTE Norms or as follows; a. Passed BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree. <p style="text-align: center;">OR</p> Passed B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University). b. Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination.
3.	The admission procedure shall be as decided by University/Directorate of Technical Education (DTE) Govt. of Chhattisgarh, from time to time.
4.	The medium of instructions and examination will be English.
5.	The examination shall comprise of Theory Examination, Practical Examination and Sessionals, as per the "Scheme of Examination" recommended by the Board of Studies from time to time.
6.	Details of subjects to be taught in four semester curriculum pattern and examination scheme for each year course shall be formed and implemented as per recommendation of Board of Studies from time to time.
7.	Requirement for examination: i) Examination will be conducted by Pt. Ravishankar Shukla University, Raipur; ii) Examination shall be in Theory, Practical and Sessional as stipulated; iii) A candidate will be permitted to appear for the examination only if the candidate has put up a minimum attendance of 75% of the lectures and practical classes. University may condone shortfall as required by rules.
8.	The provisions of this course in respect of examination, results and grades are subject to alternation by the Board of studies from time to time and shall also conform to guidelines of AICTE/UGC/MHRD/Govt. of India / Statutes and Ordinance of this University.
9.	In case of an examinee for Master of Computer Applications, who is not a regular student of the department/college, the sessional marks obtained during the period in which the candidate pursued the course for the examination in the department/college shall be taken into account for the purpose of determining their result at the examination.
10.	The minimum passing marks which an examinee shall have to obtain in each subject shall be (i) 40% in each theory paper (ii) 60% in each sessional and (iii) 50% in each practical/project examination.
11.	A candidate shall be eligible to be promoted and appear in the succeeding semester examination only if he/she fails in not more than two (theory/practical/project/seminar) papers in any one semester examination.
12.	A candidate failing in not more than two (theory/practical/project/seminar) papers of any semester shall be eligible to take examination of the paper in which he has failed along with the current semester examination.
13.	If a candidate fails in more than two (theory/practical/project/seminar) papers in any one

  
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	semester examination he/she will be year back and he/she will be appearing in the failing papers only.										
14.	A candidate will be permitted to appear in the examination of the course for a maximum period of 5 years including the year of admission. If he/she fails to clear the course within the period of 5 years, he/she will be dropped out of the course.										
15.	A candidate, who fails to obtain minimum marks in sessional of any subject, will be treated as failed and will have to repeat the whole semester. He/she will have to attend the classes of all the subjects of the respective semester to earn requisite sessional marks and again appear in all theory and practical/project/seminar papers in the next year examination.										
16.	The result of the Fourth semester shall not be declared until the candidate has passed all theory and practical/project/seminar papers of all semesters (First, Second, Third and Fourth).										
17.	The weightage of marks in each semester will be as follows: <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Semester</th> <th>Weightage of Marks</th> </tr> </thead> <tbody> <tr> <td>First Semester</td> <td>20%</td> </tr> <tr> <td>Second Semester</td> <td>20%</td> </tr> <tr> <td>Third Semester</td> <td>30%</td> </tr> <tr> <td>Fourth Semester</td> <td>30%</td> </tr> </tbody> </table>	Semester	Weightage of Marks	First Semester	20%	Second Semester	20%	Third Semester	30%	Fourth Semester	30%
Semester	Weightage of Marks										
First Semester	20%										
Second Semester	20%										
Third Semester	30%										
Fourth Semester	30%										
18.	<p>(a) There shall be no classification of the examinees successful in each semester of the examination.</p> <p>(b) Division shall be awarded only after the fourth semester examination, based on the performance of the candidate for all the four semesters according to the weightage table given above.</p> <p>(i) The examinees who have obtained 75% or more marks in the aggregate considering all the examination taken together shall be placed in First Division with Honours.</p> <p>(ii) The examinees who have obtained 65% or more marks but less than 75% in the aggregate considering all the examination taken together shall be placed in the First Division.</p> <p>(iii) The examinees who have obtained less than 65% marks and more than or equal to 48% in the aggregate considering all the examination taken together shall be placed in the Second Division.</p> <p>(iv) An examinee must secure minimum 48% of the total aggregate to be declared successful in any examination, otherwise he/she will be declared "FAIL"</p>										
19.	Recalculation, Revaluation and any matter related to examination not covered in this ordinance will be covered as per University Ordinance no. 5 and 6.										
20.	For the rules not defined here or in case of any conflict the Board of Studies shall be empowered to take the decision accordingly. The final decision shall be taken by the Hon'ble Vice-Chancellor based on the recommendations of the Board of Studies.										
21.	On the report of the Principal of the College / Head, School of Study, the Executive Council may refuse admission to, or exclude any candidate from the examination at any stage, if it is satisfied that such candidate is not fit to be admitted or not fit to appear in the examination. The reason for such exclusion shall be recorded.										

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प्रपत्र-दो

1. विश्वविद्यालय का नाम : पं. रविशंकर शुक्ल विश्वविद्यालय, रायपुर
2. अधिनियम /अध्यादेश/परिनियम क्रमांक : REVISED ORDINANCE No. 85
3. अधिनियम /अध्यादेश/परिनियम का नाम : MASTER COMPUTER APPLICATIONS
4. अनुशांसा के प्राधिकारी का नाम एवं  
अनुशांसा की तिथि धारा 52 (4) की  
स्थिति में कुलपति द्वारा अनुशांसा की  
तिथि : विद्यापरिषद् की स्थायी समिति की बैठक दिनांक में अनुशांसित एवं कार्यपरिषद् की बैठक में अनुमोदित

अधिनियम /अध्यादेश/ परिनियम क्रमांक	वर्तमान प्रावधान	प्रस्तावित संशोधन	औचित्य	Remarks
<b>85.</b>	<p>1. There shall be the following six examinations for the Degree of Master in Computer Applications as stated below :-</p> <p>Master of Computer Applications ( First Semester )</p> <p>Master of Computer Applications ( Second Semester )</p> <p>Master of Computer Applications ( Third Semester )</p> <p>Master of Computer Applications ( Fourth Semester )</p> <p>Master of Computer Applications ( Fifth Semester )</p> <p>Master of Computer Applications ( Sixth Semester )</p>	<p>1. The degree of Master of Computer Applications shall be of two academic years divided into four semesters.</p>	<p>Modified in accordance with the new guidelines of the AICTE in which the duration has been updated to two years.</p>	
	2. i) MCA First, Second, Third, Fourth and Fifth			

	<p>Semester Examination will comprise of (a) Written Papers (b) Sessional Work and (c) Laboratory Work.</p> <p>ii) MCA Sixth Semester Examination will comprise of (a) Written papers (b) Sessional Work and (c) Project Work.</p> <p>iii) The examination in written papers shall be held at the end of each semester according to the schemes of Examination given in the appendix 'A'. The detailed scheme of examination and syllabus as may be in force from time to time, shall be published by the University.</p>	Removed	Covered in point 5 of the revised ordinance.	
	<p>3. (a) The duration of the academic years of MCA will be divided into six semesters as follows :-</p> <p>First, Third and i) 1st July to 30th November Fifth Semester ii) Examination for written papers at the end of the Semester : 11th December to 30th December.2</p> <p>Second and i) 1st January to 30th April Fourth Semester ii) Examination for written papers at the end of the Semester : 11th June to 30th June.</p> <p>Sixth semester i) 1st January to 30th June ii) Project Evaluation at the end of the Semester : 11th June to 30th June.</p>	Removed	The duration of the course has been changed to two years.	
	<p>3. (b) After the semester Examination, a candidate may be provisionally admitted to the higher semester till the declaration of the lower semester result. He/She will be permitted to continuing the higher semester only if</p>	Removed	Covered in point 11 of revised ordinance.	

	<p>He/She fulfill the provision of Para 13.</p>			
	<p>4. A candidate seeking admission to the Master of Computer Applications (MCA) Course should be Graduate of any recognized Indian University or Foreign University or Institute recognized by the concerned University as equivalent thereto. Bachelor's Degree must be of minimum three year duration in any discipline with Mathematics as compulsory or additional subject at (10+2) level. The admission procedure shall be as decided by University from time to time.</p>	<p>Removed</p>	<p>Covered in point 2 of the revised ordinance.</p>	
	<p>5. A student of college seeking admission to the examination shall : a) Apply for the admission to the examination through the principal of College / Head, School of Study. b) Produce the following certificates from the principal of the college / Head, School of study viz. Certificate. 1) Of Good Conduct. 2) Of fitness to present himself at the Examination. 3) Of having persecuted a regular courses of study and 4) Of possessing the minimum academic qualification prescribed for appearing in the examination.</p> <p>ii) For the purpose of this paragraph, the fitness of a student to present himself at the examination shall be judged by the principal of the College / Head, School of Study :-</p> <p>a) The record of his / her academic work in the college. b) His/her intellectual capacity and c) The time at his disposal before the commencement of the examination for making up the deficiencies of</p>	<p>Removed</p>	<p>Admission process is taken care of by Directorate of Technical Education (DTE) Govt. of Chhattisgarh</p>	

	<p>any, in his studies.</p> <p>iii) The certificates required by this paragraph shall reach the Registrar not later than the date preceding by two weeks the date of commencement of the written examination.</p>			
	<p>6. Any deficiency in attendance at the course of study for the examination may be condoned subject to a maximum of 15% in accordance with the provisions of the Ordinance No. 6 relating to condonation of deficiency in attendance.</p>	<p>Removed</p>	<p>Covered in point 7 or the revised ordinance.</p>	
	<p>7. On the report of the Principal of the College / Head, School of Study, the Executive Council may refuse admission to, or exclude any candidate from the examination at any stage, if it is satisfied that such candidate is not fit person to be admitted thereto. The reason for such exclusion shall be regarded.</p>	<p>Removed</p>	<p>Covered in point 21 or the revised ordinance.</p>	
	<p>8. The candidates disobeying the instructions of the Center Superintendent in the Examination Centre of resorting to any sort of unfair means at the examination shall be dealt with according to the provisions of Ordinance No. 5 and 6 of the University.</p>	<p>Removed</p>	<p>Covered in point 19 or the revised ordinance.</p>	
	<p>9. i) Every application for admission to the Master of Computer Applications (First, Second, Third, Fourth, Fifth, sixth Semester) Examination shall be in the form prescribed by the Academic Council and shall reach the Registrar not less than four weeks &amp; before the commencement of the examination. It shall be accompanied by such examination and other fee for each semester as may be prescribed by the University from time to</p>	<p>Removed</p>	<p>By default applicable</p>	



	<p>time.</p> <p>ii) Every Application of a candidate other than a student of a college seeking readmission to the examination shall be made in the form prescribed by the Academic Council and shall together with the fee as stated in paragraph (i) and such additional fee as may be prescribed by the Academic Council in this behalf, before the commencement of the examination.</p> <p>iii) A candidate who fails to pass or to present himself at the examination shall be entitled to a refund of the fees, but in genuine and hard cases of sickness etc. a part of the fee can be adjusted towards to immediate next examination, if such an application is sent so as to reach the Registrar not later than 30 days from the date of commencement of examination at which the candidate was to appear.</p>			
	<p>10. The scheme of examination for Master of Computer Applications will be prescribed by the University from time to time.</p>	<p>Removed</p>	<p>Covered in point 6 or the revised ordinance.</p>	
	<p>11. In case of an examine for Master of Computer Applications, who is not a regular student of the college, the sessional marks obtained during the period in which he prosecuted the course for the examination in a college shall be taken into account for the purpose of determining his result at the examination.</p>	<p>Removed</p>	<p>Covered in point 9 or the revised ordinance.</p>	
	<p>12. The minimum passing marks which an examinee shall obtain in each subject shall be (i) 40% in each theory paper (ii) 60% in each</p>	<p>Removed</p>	<p>Covered in point 10 or the</p>	

<p>sessional and (iii) 50% in each laboratory test/viva examination/project evaluation and (iv) 50% of the total aggregate.</p>		<p>revised ordinance.</p>	
<p>13. A candidate shall be eligible to appear in the succeeding semester examination only after having passed the preceding semester examination provided that if a candidate fails in not more than two (theory/practical) papers in any one-semester examination, he will be promoted to the next semester course. A candidate failing in not more than two (theory/practical) paper of any semester shall be eligible to take examination of the paper in which he has failed along with the current semester examination. He/She shall be eligible to carry the backlog of maximum two papers of each semester but in any case he/she shall not be permitted to carry backlog of more than four papers (theory/practical) at a time. The candidate will be required to clear the complete backlog of ATKT before appearing in Sixth Semester Examination.</p>	<p>Removed</p>	<p>Divided into 6 points (11 – 16) of the revised ordinance to improve clarity and comprehension</p>	
<p>14. In each semester examination, at least 50% theory papers shall be internal.</p>	<p>Removed</p>	<p>Ambiguous.</p>	
<p>15. (a) There shall be no classification of the examinees successful in each semester of the examination. (b) The classification of examinees after having</p>	<p>Removed</p>	<p>Covered in point 18 or the revised ordinance.</p>	

	<p>passed all the six semester examinations shall be made as follows</p> <p>i) The examinees who have obtained 75% or more marks in the aggregate considering all the six semester taken together shall be placed in First Division with Honours.</p> <p>ii) The examinees who have obtained 65% or more marks but less than 75% in the aggregate considering in all the six semester taken together shall be placed in the First Division.</p> <p>iii) The examinees who have obtained less than 65% marks and more than 50% in the aggregate considering all the six semester taken together shall be placed in the Second Division.</p> <p>iv) An examinee must secure 50% of the total aggregate to be declared successful in any semester examination.</p>			
	<p>16. (a) As soon as possible after the examination the Executive Council shall publish a list of successful examinee arranged in the three divisions. The names of the examinee who obtain the first ten places in First Division being arranged in order of Merit.</p>	<p>Removed</p>	<p>Covered in point 16 or the revised ordinance.</p>	
	<p>16. (b) A candidate who is successful at the sixth semester of the MCA examination shall be awarded the MCA Degree I the form prescribed by the Academic Council in this behalf. Weightage of marks in each semester are as follows :</p>	<p>Removed</p>	<p>Covered in point 17 or the revised ordinance.</p>	

Semester	Weightage of Marks			
First Semester	5%			
Second Semester	5%			
Third Semester	15%			
Fourth Semester	15%			
Fifth Semester	30%			
Sixth Semester	30%			
<p>17. SCRUTINY OF MARKS EVALUATION : A candidate whose result has been declared, may apply to the Registrar for the scrutiny of his/her marks in written papers and the rechecking of his result, or for revaluation of his answer books but not more than two within 30 days of declaration of the result. According to the provisions laid down in Ordinance No 5 &amp; 6. The fee for scrutiny of marks and for revaluation shall be as per University rules.</p>			Removed	Covered in point 19 or the revised ordinance.
			<p>2. The eligibility for admission shall be as per AICTE Norms or as follows;</p> <p>a. Passed BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree.</p> <p style="text-align: center;">OR</p> <p>Passed B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).</p> <p>b. Obtained at least 50% marks (45%</p>	Similar to point 4 of the old ordinance. Modified to conform to AICTE norms of eligibility.



		marks in case of candidates belonging to reserved category) in the qualifying Examination.	
	New Point	3. The admission procedure shall be as decided by University/Directorate of Technical Education (DTE) Govt. of Chhattisgarh, from time to time.	There was no point related to the admission procedure in the old ordinance.
	New Point	4. The medium of instructions and examination will be English.	There was no point related to the medium(language) of instructions and examination in the old ordinance.
	—	5. The examination shall comprise of Theory Examination, Practical Examination and Sessionals, as per the “Scheme of Examination” recommended by the Board of Studies from time to time.	Similar to point 2 of the old ordinance.
	—	6. Details of subjects to be taught in four semester curriculum pattern and examination scheme for each year course shall be formed and implemented as per recommendation of Board of Studies from time to time.	Similar to point 10 of the old ordinance.
	New Point	7. Requirement for examination: i) Examination will be conducted by Pt. Ravishankar Shukla University, Raipur; ii) Examination shall be in Theory, Practical	To clarify conditions related to the

		and Sessional as stipulated; iii) A candidate will be permitted to appear for the examination only if the candidate has put up a minimum attendance of 75% of the lectures and practical classes. University may condone shortfall as required by rules.	organization of the examination and eligibility of a candidate to appear in the examination.	
	New Point	8. The provisions of this course in respect of examination, results and grades are subject to alternation by the Board of studies from time to time and shall also conform to guidelines of AICTE/UGC/MHRD/Govt. of India / Statutes and Ordinance of this University.	There was no point related to alterations of provisions and the body authorized to do so.	
	—	9. In case of an examinee for Master of Computer Applications, who is not a regular student of the department/college, the sessional marks obtained during the period in which the candidate pursued the course for the examination in the department/college shall be taken into account for the purpose of determining their result at the examination.	Similar to point 11 of the old ordinance.	
	—	10. The minimum passing marks which an examinee shall have to obtain in each subject shall be (i) 40% in each theory paper (ii) 60% in each sessional and (iii) 50% in each practical/project examination.	Similar to point 12 of the old ordinance.	
	—	11. A candidate shall be eligible to be promoted and appear in the succeeding semester examination only if he/she fails in not more than two (theory/practical/project/seminar) papers in any one semester examination.	Covers some aspect of the point 13 of the old ordinance.	

	—	12. A candidate failing in not more than two (theory/practical/project/seminar) papers of any semester shall be eligible to take examination of the paper in which he has failed along with the current semester examination.	Covers some aspect of the point 13 of the old ordinance.	
	—	13. If a candidate fails in more than two (theory/practical/project/seminar) papers in any one semester examination he/she will be year back and he/she will be appearing in the failing papers only.	Covers some aspect of the point 13 of the old ordinance.	
	New Point	14. A candidate will be permitted to appear in the examination of the course for a maximum period of 5 years including the years of admission. If he / she fails to clear the course within the period of 5 years, he /she will be dropped out of the course.	Maximum period of course duration specified .	
	New Point	15. A candidate, who fails to obtain minimum marks in sessional of any subject, will be treated as failed and will have to repeat the whole semester. He/she will have to attend the classes of all the subjects of the respective semester to earn requisite sessional marks and again appear in all theory and practical/project/seminar papers in the next year examination.	There was no point in the old ordinance clarifying what happens if a candidate fails to obtain minimum required marks in sessional of any subject.	
	—	16. The result of the Fourth semester shall not be declared until the candidate has passed all theory and practical/project/seminar papers of all semesters (First, Second, Third and Fourth).	Covers some aspect of the point 13 of the old ordinance.	
	—	17. The weightage of marks in each semester will be	Similar to	

		<p>as follows:</p> <table border="1"> <thead> <tr> <th>Semester</th> <th>Weightage of Marks</th> </tr> </thead> <tbody> <tr> <td>First Semester</td> <td>20%</td> </tr> <tr> <td>Second Semester</td> <td>20%</td> </tr> <tr> <td>Third Semester</td> <td>30%</td> </tr> <tr> <td>Fourth Semester</td> <td>30%</td> </tr> </tbody> </table>	Semester	Weightage of Marks	First Semester	20%	Second Semester	20%	Third Semester	30%	Fourth Semester	30%	<p>point 16(b) of the old ordinance. Updated in accordance with the new guidelines of AICTE.</p>	
Semester	Weightage of Marks													
First Semester	20%													
Second Semester	20%													
Third Semester	30%													
Fourth Semester	30%													
	<p>—</p>	<p>18. (a) There shall be no classification of the examinees successful in each semester of the examination.</p> <p>(b) Division shall be awarded only after the fourth semester examination, based on the performance of the candidate for all the four semesters according to the weightage table given above.</p> <p>(i) The examinees who have obtained 75% or more marks in the aggregate considering all the examination taken together shall be placed in First Division with Honours.</p> <p>(ii) The examinees who have obtained 65% or more marks but less than 75% in the aggregate considering all the examination taken together shall be placed in the First Division.</p> <p>(iii) The examinees who have obtained less than 65% marks and more than or equal to 48% in the aggregate considering all the examination taken together shall be placed in the Second Division.</p> <p>(iv) An examinee must secure minimum</p>	<p>Similar to point 15 of the old ordinance.</p>											



		48% of the total aggregate to be declared successful in any examination, otherwise he/she will be declared "FAIL"		
	—	19. Recalculation, Revaluation and any matter related to examination not covered in this ordinance will be covered as per University Ordinance no. 5 and 6.	Similar to point 17 of the old ordinance.	
	New Point	20. For the rules not defined here or in case of any conflict the Board of Studies shall be empowered to take the decision accordingly. The final decision shall be taken by the Hon'ble Vice-Chancellor based on the recommendations of the Board of Studies.	To clarify what can be done in any unforeseen circumstances.	
	New Point	21. On the report of the Principal of the College / Head, School of Study, the Executive Council may refuse admission to, or exclude any candidate from the examination at any stage, if it is satisfied that such candidate is not fit to be admitted or not fit to appear in the examination. The reason for such exclusion shall be recorded.	To clarify what can be done in any unforeseen circumstances	

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कुलसचिव

**SCHEME OF TEACHING AND EXAMINATIONS 2020-21  
MASTER OF COMPUTER APPLICATIONS (2 Years)**

**FIRST SEMESTER**

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
		L	T	P		Max. Marks				Min. Marks			
						Th	Ses	Pr	Total	Th	Ses	Pr	Total
MCA101	Object Oriented Programming With 'C++'	3	2	-	4	100	25	-	125	40	15	-	55
MCA102	RDBMS (SQL and PL/SQL)	3	2	-	4	100	25	-	125	40	15	-	55
MCA103	Operating System with Case Study of Linux	3	2	-	4	100	25	-	125	40	15	-	55
MCA104	Computer System Architecture	3	2	-	4	100	25	-	125	40	15	-	55
MCA105	Software Engineering	3	2	-	4	100	25	-	125	40	15	-	55
MCA106	Lab-I : Programming in C++	-	-	3x2	3	-	50	100	150	-	30	50	80
MCA107	Lab-II : Programming in SQL and PL/SQL	-	-	2	1	-	50	50	100	-	30	25	55
MCA108	Lab-III : Programming in Linux	-	-	2	1	-	50	50	100	-	30	25	55
MCA109	Personality Development / Mock Interviews	-	-	2	1	-	25	-	25	-	15	-	15
	<b>TOTAL</b>	15	10	12	26	500	300	200	<b>1000</b>	200	180	100	<b>480</b>

*SK*

*Pate*

*Ranjana*

*Khin*

*Chah*

*04/03/2020*

# Object Oriented Programming with 'C++'

Subject Code - MCA101

Max Marks : 100

Min Marks : 40

## UNIT - I: Language Fundamental

**Overview of OOP:** The Object Oriented paradigm, Basic concepts of OOP, Benefits of OOP, Object oriented languages, Application of OOP **Overview of C++:** History of C++, **Data Types:** Built-in data types, User-defined data types, Derived data types. **Constants and Variables:** Symbolic constants, Dynamic initialization of variable, Reference variable. **Operators in C++:** **Control Structures:** if-else, nested if-else, while, do-while, for, break, continue, switch, goto statement.

## UNIT - II: Structure & Function

**Structures:** A simple structure, defining a structure variable, accessing structures member, enumeration data type. **Function:** Function declaration, calling function, function definition, **Passing Arguments to function:** Passing constant, Passing value, Reference Argument, Structure as argument, Default argument. **Returning values from function:** return statement, returning structure variable, return by reference. Overloaded functions, Inline functions and Templates.

## UNIT - III: Object Classes and Inheritance

Object and Class, Defining the class and its member, Making an outside function inline, nesting of member function, array as class member, structure and classes. **Memory allocation:** memory allocation for objects, new and delete operator, static data member, static member functions, object as function argument. **Constructor & Destructor:** Null and default constructor. Parameterized constructor, Constructor with default argument, copy constructor, class destructors, **Inheritance:** Introduction to inheritance, Types of inheritance, function overriding, Constructor in Derived class. **Access specifiers:** public, private, protected.

## UNIT - IV: Pointers, Virtual Function and Operator Overloading

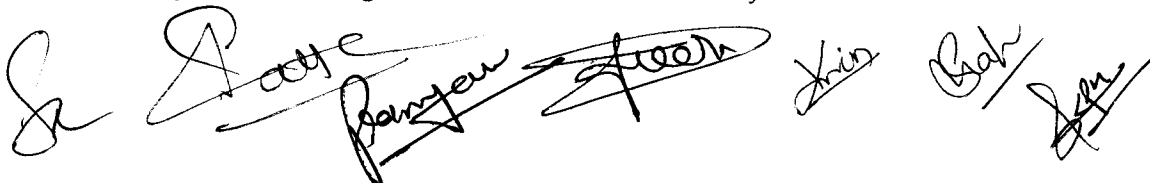
**Pointers:** Introduction, & and \* operator, pointer to object, this pointer, pointer to derived class. **Dynamic polymorphism:** Virtual function, Pure Virtual Function, Abstract class. **Static Polymorphism:** Operator keyword, overloading unary operator (++ (pre increment and post increment),--) using operator function, overloading binary operators (+,-,==,>=,<=, +=,<,>,[ ]), Friend function, Friend class, overloading binary operators using friend function.

## UNIT - V: File & Stream

**File and Stream:** C++ Stream class, unformatted I/O operations, formatted console I/O, manipulators, opening and closing a file, detecting eof, file modes, get(), put(), reading and writing a class object, Updating a file random access.

## RECOMMENDED BOOKS:

1. C++: The Complete Reference, Herbert Schildt, Tata McGraw-Hill
2. Object Oriented Programming with C++, E. Balagurusamy, Tata McGraw-Hill
3. The C++ Programming Language, Bjarne Stroustrup, Addison-Wesley.
4. Object Oriented Programming in C++, Robert Lafore, Galgotia Publications.
5. Introduction to Object Oriented Programming, K V Witt, Galgotia Publications.
6. Object Oriented Programming, G Blaschek, Springer Verlag
7. Object Data Management, R Cattell, Addison Wesley.



# RDBMS (SQL and PL/SQL)

## Subject Code - MCA102

Max Marks : 100

Min Marks : 40

### UNIT - I: Overview of Database Management

Data, Information and knowledge, Increasing use of data as a corporate resource, data processing verses data management, file oriented approach verses database oriented approach to data management; data independence, database administration roles, DBMS architecture, different kinds of DBMS users, importance of data dictionary, contents of data dictionary, types of database languages. Data models: network, hierarchical, relational. Introduction to distributed databases, Client/Server databases, Object-oriented databases, Object-relational databases, Introduction to ODBC concept.

### UNIT - II: Relational Model & Relational Algebra

Entity - Relationship model as a tool for conceptual design-entities, attributes and relationships. ER diagrams; Concept of keys; Case studies of ER modeling Generalization; specialization and aggregation. Converting an ER model into relational Schema. Extended ER features. **Relational Algebra:** select, project, cross product different types of joins (inner join, outer joins, self-join); set operations, Tuple relational calculus, Domain relational calculus, Simple and complex queries using relational algebra.

### UNIT - III: SQL and Relational Database Design

Introduction to SQL constructs (SELECT...FROM, WHERE... GROUP BY... HAVING... ORDERBY...), INSERT, DELETE, UPDATE, DROP, VIEW definition and use, Temporary tables, Nested queries, and correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreign key, references. Embedded SQL and Application Programming Interfaces. Normalization concept in logical model; Pitfalls in database design, update anomalies: Functional dependencies, Join dependencies, Normal forms (1NF, 2NF, 3NF). Boyce-Codd Normal form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF. Denormalization.

### UNIT - IV: PL/SQL

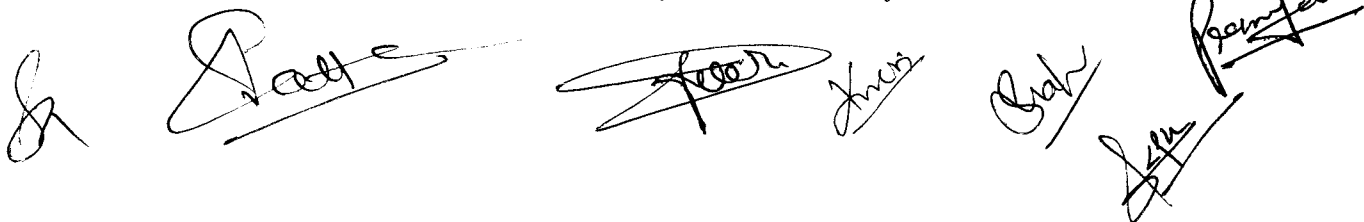
Introduction to PL/SQL variables - literals - data types - advantages of PL/SQL; Control statements : if ; iterative control - loop, while, for , goto ; exit when; Cursors : Types -implicit, explicit - parameterized cursors - cursor attributes; Exceptions: Types - internal , user-defined , handling exceptions - raise statement; PL/SQL tables and records: Declaring PL/SQL tables - referring PL/SQL tables, inserting and fetching rows using PL/SQL table, deleting rows; records - declaration of records - deleting records; Sub programs: Functions -procedures - in, out, inout parameters; purity functions - packages - package specification -advantages of packages - private and public items - cursors in packages.

### UNIT - V: Query Processing and Optimization

Query Processing, Protecting Database and Data Organization -Parsing, translation, optimization, evaluation and overview of Query Processing. Protecting the Data Base - Integrity, Security and Recovery. Domain Constraints, Referential Integrity, Assertion, Triggers, Security & Authorization in SQL. **Data Organization-File Organization:** Fixed length records, variable length records, Organization of records in files.

### BOOKS RECOMMENDED:

1. **Database System Concept:** A. Silberschatz , H.F. Korth and S. Sudarshan, TMH
2. **Fundamentals of Database Systems:** Elmasri & Nawathe, Pearson Education
3. **An Introduction to Database Systems:** C. J. Date, AWL Publishing Company
4. **SQL, PL/SQL:** Ivan Bayross, BPB Publication
5. **An Introduction to database systems:** Bipin Desai, Galgotia Publication.
6. **Database Management System:** A. K. Majumdar & P. Bhattacharya, TMH





# Operating System with Case Study of Linux

## Subject Code - MCA103

Max. Marks: 100

Min Marks : 40

### UNIT - I: Introduction

Defining operating system, History and Evolution of operating system, **Basic Concepts:** batch processing, spooling, multiprogramming, multiprocessor system, time sharing, real time systems, Functions and Goals of operating system, Operating system as resource manager, Operating system as an abstract machine.

### UNIT - II: Process Management

Process concept, Process Control Block, **Process State:** State Transition Diagram, **Scheduling Queues:** Queuing Diagram, Types of schedulers-context switching and dispatcher, various types of CPU scheduling algorithms and their evaluation, multilevel queues and multilevel feedback queues, Thread life cycle, multithreading,

### UNIT - III: IPC and Dead Locks

**Inter Process Communication:** competing and co-operating processes, Introduction to concurrent processing, Precedence graphs, Critical section problem, Semaphore concept, Study of classical process synchronization problems: Producer-Consumer, Dining Philosophers. **Deadlocks:** The dead lock problem, dead lock definition, **Deadlock Characterization:** necessary condition, resource allocation graph, **Deadlocks handling:** Deadlock prevention, Deadlock avoidance, Banker's algorithm, Deadlock detection, Recovery from Deadlock.

### UNIT - IV: Memory Management

Preliminaries of memory management, Contiguous memory allocation, partitioned allocation MFT, fragmentation, MVT, partition allocation policies, compaction, Non-Contiguous memory allocation, Paging, Structure of page table, Segmentation, **Virtual Memory:** Concepts, demand paging, Swapping, **Page replacement policies:** FIFO, Optimal, LRU, MRU, Thrashing. **Secondary Storage:** Hierarchy, physical characteristics, evaluation of disk access time and data transfer rate, **Scheduling algorithms:** FCFS, SCAN etc.

### UNIT - V: File and Device Management

**File concept:** file types, file directory maintenance, File sharing, Basic file system structure, access methods-sequential and direct access, free space management contiguous, linked allocation and indexed allocation and their performances. **Protection and Security:** principle of protection, domain structure, access matrix, access control, the security problems. **Distributed systems:** Introduction & Features, Types of distributed OS.

### BOOKS RECOMMENDED:

1. **Operating System Concepts**, Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Wiley India
2. **Modern Operating System**, Andrew .S. Tanenbaum, PHI
3. **Operating System Concepts**, James L. Peterson and Abraham Silberschatz, Addison-Wesley
4. **Operating System Concepts & Design**, Milan Milenkovic, MGH
5. **An Introduction to Operating Systems**, Harvey M. Dietel, Addison Wesley

# Computer System Architecture

## Subject Code - MCA104

Max Marks : 100

Min Marks : 40

### UNIT - I Boolean algebra and H/w component:

Introduction to Boolean Algebra, Logic Gates, Map simplification: K-Map, **Combinational Circuit:** Half and Full Adder, Decoder and Multiplexer; **Sequential Circuit:** Flip-Flop (SR, D, JK, Master-Slave, T), 4 bit Register, Register with parallel load, Shift register, Binary ripple Counter, Binary synchronous counter.

### UNIT - II Register transfer language and micro operations

Register Transfer Language (RTL), Concepts of bus, Bus and Memory transfers, **Micro-operation:** Arithmetic, Logic and Shift micro operation, Instruction code, Computer registers, Computer instructions, Timing and control, Instruction Cycle and Interrupt Cycle, Memory reference instructions, Input-output and interrupt, Design of basic computer

### UNIT - III Programming Computers and CPU

Machine Language, Assembly Language, Assembler, Program Loops, Input /Output, Programming, General register organization, Stack organization, Instruction format, Addressing modes, Data transfer and manipulation language, Micro-programmed and Hardwired control, RISC Vs. CISC, **Pipelining in CPU design:**, Parallel Processing, Arithmetic and RISC pipelining.

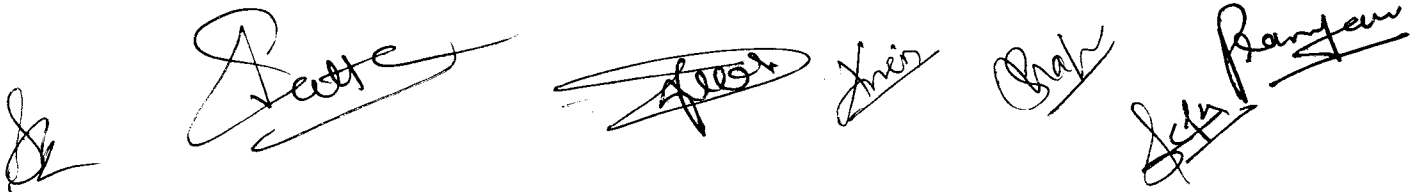
**UNIT - IV Computer Arithmetic and I/O Techniques:** Addition, Subtraction, Division and Multiplication Algorithm, Input-Output Interface, asynchronous data transfer; **Modes of transfer:** Programmed I/O, Interrupt Mechanism, Direct Memory Access (DMA), I/O Processor. Memory Organization: Cache Memory Organization, Virtual Memory.

### UNIT - V Introduction to Parallel Processing

Types of parallelism, Degree of parallelism (DOP), Application of parallel processing, Flynn's Classification: SISD, SIMD, MISD, and MIMD.

### BOOKS RECOMMENDED:

1. **Computer System Architecture**, *Morris Mano*, PHI
2. **Computer Organization and Architecture**, *William Stalling*, PHI
3. **Computer organization and Architecture**, *J.P.Hayes*, TMH
4. **Digital Computer Logic Design**, *Morris Mano*, PHI
5. **Fundamentals of Microprocessors**, *B. Ram*
6. **Computer System Architecture and organization**, *Dr.M. Usha, T. S. Shrikant*, Wiley publication.
7. **Digital Computer Electronics**, *Malvino*.
8. **Structured Computer Organization**, *Andrew M. Tanenbanm*, PHI
9. **Modern Digital Electronics**, *R.P.Jain*, Tata McGrawHill



# Software Engineering

## Subject Code - MCA105

Max Marks : 100

Min Marks : 40

### UNIT - I Software Engineering Fundamentals:

Introduction to Software Engineering; Software Engineering Principles(Layers); Software Process - Process Framework, Umbrella Activities, Process Adaptation; Software Crisis; Process Models-Waterfall Model, Prototype Model, Incremental Model, Spiral Model, RAD Model; Agile Process.

### UNIT - II Software Analysis and Design:

Requirement Engineering; Analysis Model-Data Flow Diagram, Data Dictionary, E-R Diagram, Decision Table; Software Requirements Specification(SRS), Structure of SRS; Pseudo code; Software Design; Design Process; Design Concepts-Abstraction, Partitioning, Modularity, Information Hiding, Refinement, Refactoring; Function Oriented Design; Object Oriented Design; Cohesion and Coupling.

### UNIT - III Software Quality and Case Tools:

Software Metrics, Categories of Metrics, Function Point Metric; Software Quality; McCall's Quality Factors; Software Maturity Model-CMM,CMMI; Software Quality Assurance; ISO Standards-9000, 9001 and 9126; Software Reliability; Case Tools and its Scope; Case Objectives; Architecture of Case Tools; Case Classification.

### UNIT - IV Coding and Testing:

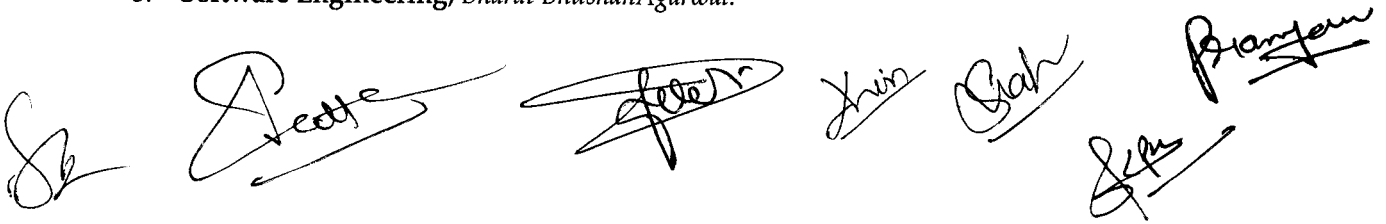
Programming Style; Structured Programming; Coding Standard; Internal Documentation; Software Testing-Verification and Validation; Alpha and Beta Testing; Levels of Testing-Unit, Integration and System Testing; Testing Techniques- White Box, Black Box; Cyclomatic Complexity; Test Plan; Debugging-Debugging Process, Debugging Strategies(Approaches).

### UNIT - V Software Maintenance and Project Management:

Risk Management - Software Risk, Risk Identification; Introduction to Software Maintenance, Categories of Maintenance; Belady and Lehman Model; Boehm Model; Project Management Concept - People, Product, Process, Project; Software Team; Software Project Planning; Software Project Estimation; Cost Estimation Model(COCOMO, COCOMO II, Putnam-SLIM, Walston and Felix); Software Reengineering.

### RECOMENDED BOOKS:

1. **Software Engineering: A Practitioner's Approach**, Roger S. Pressman, TMH
2. **An Integrated approach to Software Engineering**, Pankaj Jalote, Narosa Publications
3. **Software Engineering**, Bharat Bhushan Agarwal.

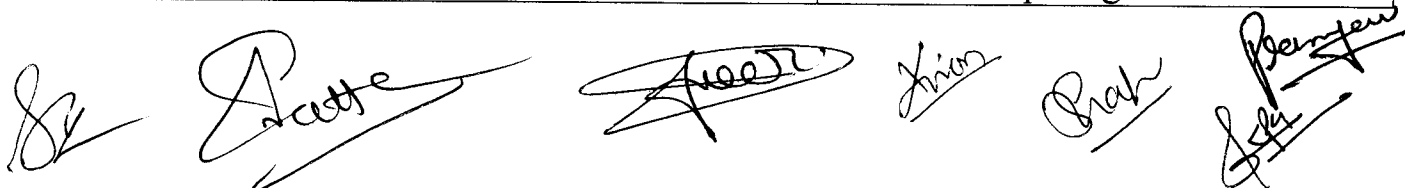


**SCHEME OF TEACHING AND EXAMINATIONS 2020-21**  
**MASTER OF COMPUTER APPLICATIONS (2 Years)**

**SECOND SEMESTER**

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
		L	T	P		Max. Marks				Min. Marks			
						Th	Ses	Pr	Total	Th	Ses	Pr	Total
MCA201	Programming in Python	3	2	-	4	100	25	-	125	40	15	-	55
MCA202	JAVA Programming	3	2	-	4	100	25	-	125	40	15	-	55
MCA203	Data Structure and Algorithms	3	2	-	4	100	25	-	125	40	15	-	55
MCA204	Elective – I	3	2	-	4	100	25	-	125	40	15	-	55
MCA205	Elective – II	3	2	-	4	100	25	-	125	40	15	-	55
MCA206	Lab-IV : Programming in Python	-	-	3x2	3	-	50	100	150	-	30	50	80
MCA207	Lab-V : Programming in JAVA	-	-	2	1	-	50	50	100	-	30	25	55
MCA208	Lab-VI : Programming Based on MCA203	-	-	2	1	-	50	50	100	-	30	25	55
MCA209	Group Discussion	-	-	2	1	-	25	-	25	-	15	-	15
	<b>TOTAL</b>	15	10	12	26	500	300	200	1000	200	180	100	480

Sr. No.	Elective –I	Elective -II
1.	Theory of Computations	Data Ware Housing And Mining
2.	Advanced Computer Architecture	Internet of Things
3.	Computer Graphics	Mobile Computing





# Programming in Python

## Subject Code - MCA201

Max. Marks: 100

Min Marks : 40

### UNIT - I

**Introduction to Python Programming:** What is a Program, Formal and Natural Languages, Why use Python, Uses of python, Strengths & Drawbacks, The Python Interpreter, Running Python, The IDLE User Interface, The Interactive Prompt, Script Mode, Dynamic Typing , Debugging. **Types, Operators, Expressions & Statements:** Values and Types, Assignment Statement, Variable Names, Expressions & Statements, Order of Operations, String Operations, Comments.

### UNIT - II

**Conditionals:** Boolean Expressions, Logical operators, Conditional & Alternative Execution, Chained and Nested Conditions. **Iterations:** Reassignment, Updating Variables, The "for" and "while" statements, break. **Strings:** String is a sequence, len, Traversal with a for loop, String Slices, Searching, Looping and Counting, String Methods, the "in" operator, String Comparison.

### UNIT - III:

**Lists:** List is a Sequence, Traversing and other Operations, List Slices, List Methods, Map Filter and Reduce, Deleting Elements, Lists and Strings, Objects and Values, Aliasing, List Arguments. **Tuples:** Tuple Assignments, Tuples as Return Values, Variable Length Argument Tuples, Lists and Tuples, Dictionaries and Tuples, Sequence of Sequences. **Dictionaries:** A Mapping and as a Collection of Counters, Looping and Dictionaries, Reverse Lookup, Dictionaries and Lists, Memos, Global Variables. **Sets:** Properties & Operations, Frozen Sets.

### UNIT - IV:

**Functions:** Function Calls, Math Functions, Composition, Adding New Functions, Definitions & Uses, Flow of Execution, Parameters and Arguments, Why Functions, Stack Diagrams, Void and Fruitful Functions, Return Values, Incremental Development, Composition, Boolean Functions, Checking Types. **Recursion:** Stack Diagram for Recursive Functions, Infinite Recursion, Taking Input from Keyboard, More Recursion.

### UNIT - V:

**Files:** Files & Persistence, Reading and Writing, Format Operator, Filenames and Paths. **Miscellaneous Topics:** Catching Exceptions, Databases, Pickling, Pipes, Modules. **Object-Oriented Programming:** Programmer defined Types, Attributes, Instances as Return Values, Classes and Functions, Classes and Methods, Inheritance and Polymorphism.

### BOOKS RECOMMENDED:

1. **Learning Python** 5<sup>th</sup> Edition, *Mark Lutz*, O'Reilly Publications
2. **Core Python Programming**, *R. Nageshwara Rao*, Dreamtech Publications
3. **Think Python** 2<sup>nd</sup> Edition, *Allen B. Downey*, O'Reilly Publications
4. **Beginning Python: Using Python 2.6 and Python 3.1**, *James Payne*, Wiley
5. **Python Essentials Reference**, 4<sup>th</sup> Edition, *David M. Beazley*, Addison - Wesley
6. **Practical Programming: An Introduction to Computer Science Using Python 3**, *Paul Gries et al.*, Pragmatic Programmers

# JAVA Programming

## Subject Code - MCA202

Max. Marks: 100

Min Marks : 40

### UNIT - I: Introduction to Java Programming

**An overview of Java:** Object Oriented Programming, Features of Java, Java Virtual Machine, Java Environment: Java Development Kit, Java Standard Library, Data Types, **Variables:** Declaring a variable, Dynamic Initialization, The scope and life time of variable, Type conversion and Casting: Narrowing and Widening Conversions, Numeric Promotions, Type Conversion Contexts; **Operators:** Arithmetic Operators, Relational Operators, Logical Operators, Bit wise Operators, Conditional Operators, new operator, [ ] and instance of operator. **Control Statements:** Java's Selection statement, Iteration Statement, Jump Statement. **Arrays:** Declaring Array variables, constructing an Array, Initializing an Array, Multidimensional Arrays, Anonymous Arrays.

### UNIT - II: Define the Class and interface

**Introducing Classes:** Class Fundamentals, Declaring Object, Assigning Object Reference Variables, Defining **Methods:** method overloading and overriding, Using objects as parameter, Constructors, Garbage collection, finalize () method. **Inheritance:** Inheritance basic, method overloading, object reference this and super, Chaining constructor using this () and super (), Member accessibility modifier: public, protected, default accessibility of member, private protected, private, **Package:** Define package, CLASSPATH, importing package, Interface: Define an interface, implementing interface, extending interface, variable in interface, **Overview of nested class:** Top level nested class and interface, Non static inner class, Local class, Anonymous class.

### UNIT - III: Exception handling and Multithreading

**Exception Handling:** Exception types, Uncaught Exception, Using try and catch, multiple catch, nested try block, throw, throws, and finally. **Multithreading:** Creating Thread, Thread Priority, Synchronization, Thread Scheduler, Running & Yielding, Sleeping & Waking Up, Waiting & Notifying, Suspending & Resuming; miscellaneous methods in thread class.

### UNIT - IV: Fundamental Library Classes of Java and Input / Output

Object class, String class, String Buffer class, Wrapper class, Math class, Collection: Collection interface, List interface, Set interface sorted interface, Array List class, Linked List class, Tree Set, Comparator, Vector, Stack. **I/O Classes and Interfaces:** File, Buffer Stream, Character Stream, and Random Access for files, Object Sterilization.

**UNIT - V: Event Handling:** Overview of Event Handling, Event Hierarchy, The Delegation Event Model, Event Classes, KeyEventClass, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Event Adapters. **GUI Programming:** Introduction to Swing, History, Features, Components and Containers, Swing Packages, Painting, Swing Component Classes: JLabel, JTextField, Swing Buttons, JTabbedPane, JScrollBar, JList, JComboBox, Trees, JTable, Swing Menus: < Main Menu, PopUp Menu, ToolBar. **JDBC:** Introduction to JDBC, JDBC Drivers Type, Connection, JDBC URLs, Driver Manager, Statement - Creating, Executing, Closing, Result Set - Data Types and Conversions. Prepared Statement, Callable Statement, Mapping SQL and Java Types.

### BOOKS RECOMMENDED:

1. Java: The Complete Reference, Herbert Schildt, Oracle Press.
2. Core Java: Volume-I & Volume 2, Cay S. Horstmann & Gary Cornell, PEARSON
3. Programming with Java, E. Balagurusamy, McGraw Hill Education
4. Core Java, R. Nageshwara Rao, Dreamtech Press

# Data Structure and Algorithms

## Subject Code - MCA203

Max. Marks: 100

Min Marks : 40

### UNIT - I Array and Linked Lists

Introduction to data structure, Primitive data structure, Introduction to Algorithm analysis for time and space requirement, Rate of growth and Order notation, Basic time and space analysis of an algorithm. Linear Array, Representations of Array in Memory, Traversing, Insertion and Deletion in Linear Array, Multidimensional Array. Linked list, Representation of linked lists in memory, Traversing a linked list, Searching a linked list, Memory Allocation, Insertion into a linked List, Deletion from a Linked List, Header Linked List, Two- Way Linked Lists, Circular Linked List.

### UNIT - II Stack and Queues

Stacks Definition, concepts, operation and application of Stacks, Recursion and Polish notations, Quick sort, tower of Hanoi, Queue, Priority Queue: definition concepts, operation and application of Queue, circular queue and Dequeue. Linked representation of stack and queue.

### UNIT - III Trees and their Representations:

Terminologies related to trees, Binary Tree, complete binary tree, almost complete binary tree; Tree Traversals-preorder, in order and post order traversals, their recursive and non-recursive implementations, Expression tree-evaluation, Linked representations of binary tree, operations. Header nodes; threads, **Binary Search Tree**: searching, Inserting and deleting in BST, Heap; Path Lengths; Huffman's Algorithms. Basic idea of AVL Tree.

### UNIT - IV Graphs:

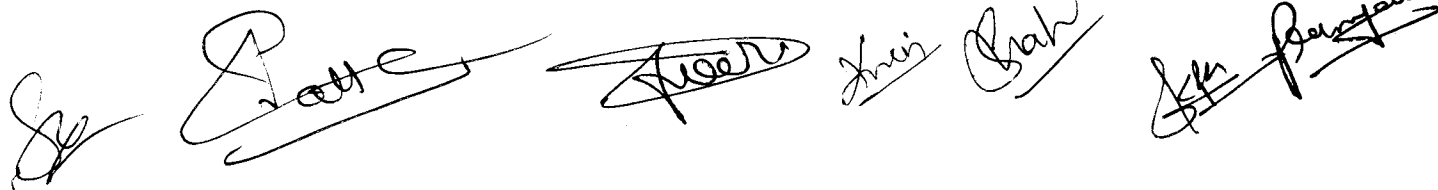
Related definitions; Graph representations- adjacency matrix, adjacency list, adjacency multi-list; Traversal schemes - depth first search, breadth first search; Minimum spanning tree; Shortest path algorithm; Kruskal and Dijkstra's algorithms.

### UNIT - V Searching, Hashing and Sorting:

Searching : Linear Search, Binary Search, Searching and data modification Hashing- Basics, methods, collision, resolution of collision, chaining; Internal Sorting, External sorting - Bubble Sort, Insertion Sort, Selection Sort, Merge sort, Radix sort, heap sort.

### BOOKS RECOMMENDED:

1. **Data Structures and Program Design in C**, Kruse R.L, PHI.
2. **Data Structures using C and C++**, Tanenbaum, PHI.
3. **Fundamental of Data Structures**, Horowitz and Sahani, Galgotia Publishers.
4. **Data Structures**, Schaum Series.
5. **Data Structures**, Bhagat Singh.
6. **Data Structures**, Trembley and Sorenson.



## Elective I: Theory of Computation Subject Code - MCA204

Max. Marks: 100

Min Marks : 40

### UNIT - I:

Alphabet, String and language, Finite state Machines, finite automata with  $\epsilon$ -moves, Conversion of N DFA to DFA, Removal of  $\epsilon$ -transition from N DFA, Two way finite automata, finite automata with output, Mealy & Moore machines, Applications of finite automata, minimization of finite automata.

### UNIT - II:

Chomsky classification of Languages , Regular Expression and Language, Properties of Regular languages, Pumping lemma for regular sets, Closure properties of regular sets, Decision algorithms for Regular sets, Myhill-Nerode theorem.

### UNIT - III:

Context free grammars and their properties, derivation tree, simplifying CFG, ambiguity in CFG, Chomsky Normal form, Greibach Normal form, Pumping lemma for CFL, Closure properties of CFL.

### UNIT - IV:

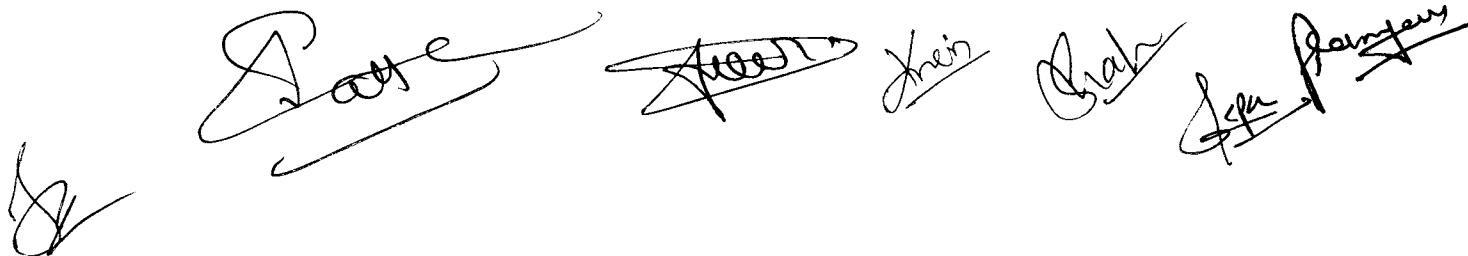
Pushdown automata: Informal description, Definition, Determinism and Non determinism in PDA, Equivalence of PDA's and CFL's. Two way PDA, Concept of Linear Bounded Automata, context sensitive grammars and their equivalence, Turning machine construction, determinism and non-determinism in TM, Multi tape, multi-track TM.

### UNIT - V:

Undecidability, Universal turning machine and an undecidable problem, recursive function theory, Recursively enumerable sets, recursive sets, partial recursive sets, Church's hypothesis, post correspondence problem, Russell's paradox.

### RECOMMENDED BOOKS:

1. **Theory of Computer Science, Automata Languages & computation**, K.L.P. Mishra, N. Chandrashekharan, PHI.
2. **Introduction to Automata Theory Language and Computation**, John E. Hopcraft and Jeffary D. Ullman, Narosa Publication house.
3. **Introduction to Formal Languages, Automata Theory and Computation**, Kamala Krithivasan and Rama. R, Pearson.
4. **Introduction to Automata Theory Languages and Computation**, John E. Hopcraft, Jeffary, D. Ullman and Rajeev Motwani.





**Elective I: Advanced Computer Architecture**  
**Subject Code - MCA204**

**Max. Marks: 100**

**Min Marks : 40**

**UNIT I:**

Introduction - Feng's and Flynn's classification scheme, Multiprocessor and Multicomputer, UMA, NUMA, COMA, NORMA, memory models, parallel computer and its type. Applications of Parallel Computers.

**UNIT II:**

System Interconnect Architecture - Static and Dynamic, Hypercube Interconnection network, multistage interconnection networks-architecture and routing, design consideration, throughput delay, blocking and non-blocking properties. Performance Metrics and Benchmarks.

**UNIT III:**

Principle of pipelining-overlapped parallelism, Linear and non-linear pipelining, reservation table, calculation of MAL. Types of Instruction Pipeline. Arithmetic pipeline designs example -Floating point adder, pipelined multiplier.

**UNIT IV:**

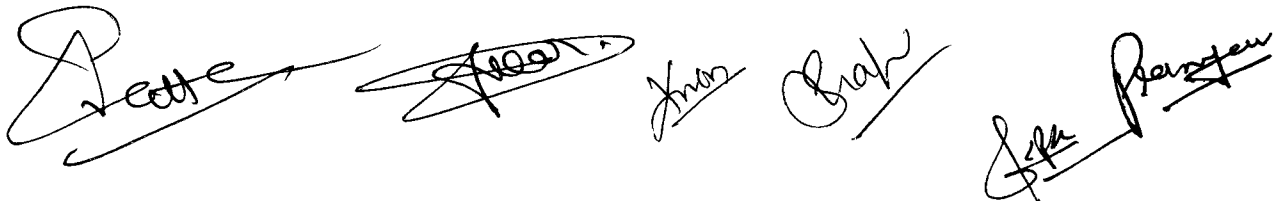
Advanced processor Technology - RISC, CISC, VLIW architectures, Hazard detection and resolution, functional organization of instruction in IBM 360/91.

**UNIT V:**

Exploring parallelism in program- multidimensional arrays. Parallel Algorithm-Matrix addition, subtraction, multiplication -block and SIMD. Bitonic sort, sorting on linear array processors. Bernstein's condition, ISO efficiency concept.

**BOOKS RECOMMENDED:**

- 1 **Computer Architecture & Parallel Processing**, Kai Hwang and F.A. Briggs, McGraw Hill.
- 2 **Advanced Computer Architecture**, Kai Hwang, McGraw Hill.
- 3 **Parallel Computing**, M.R. Bhujade, New Age Publication.
- 4 **Parallel Computing Theory and Practice**, Michael J. Quinn, Tata McGraw Hill



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# Elective I: Computer Graphics

## Subject Code - MCA204

Max Marks : 100

Min Marks : 40

### UNIT - I: Display Devices

Refresh Cathode-Ray tubes, Random Scan and Raster Scan Display, Color CRT Monitors, Color display techniques: shadow masking and Beam penetration, Direct view storage tubes, Flat Panel display: plasma panel displays, LED & LCD devices. **Interactive Graphics:** Physical Input devices, logical classification, input function, interactive picture construction techniques.

### UNIT - II: Output Primitives

Points and Lines, Line drawing Algorithms: DDA Algorithm and Bresenham's Line Algorithm, Antialiasing. Circle generating Algorithms: Bresenham's Circle Algorithms, Midpoint Circle Algorithm, Ellipse Generating Algorithm: Midpoint, Character generation and text display. Output command for various geometrical shapes, Filled Area Primitive: Scan line polygon fill algorithm, Boundary fill algorithm, Flood fill algorithm. Attribute of outputs primitives: line attribute, Area-fill Attribute, Text attribute, Bundled attributes, Area-Fill.

### UNIT -III: Two Dimensional Transformation and Viewing

**Transformation:** Translation, Scaling, Rotation, Reflection, Shearing. Matrix representations of Transformation and Homogenous Coordinates, Composite Transformations and Concatenation of transformation. **Two-Dimensional Viewing Coordinate system:** World/user coordinates, Device coordinate, Normalized device coordinates, Viewing pipeline: windows and viewports, Viewing transformation pipeling, Window-to-Viewport coordinate transformation, Clipping algorithm: point, line clipping algorithm: Cohen-Sutherland, Liang Barsky, Nicholl-Lee-Nicholl, Line Clipping, polygon clipping algorithm : Sutherland-Hodgman, Weiler-Atherton, text clipping.

### UNIT - IV: 3-D Transformation and Viewing

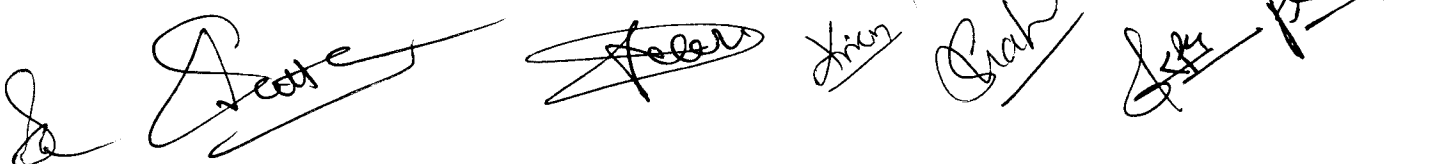
**3-D Transformation:** Translation, Scaling, Rotation about standard and arbitrary axis, Other Transformation: Reflections and shears, Transformation commands. **Viewing:** Viewing Pipeline, Viewing Coordinates: transformation from world to viewing coordinates.

### UNIT - V: 3-D Projection

**Projection:** Parallel Projection, Perspective Projection, Normalized view volume, viewport Clipping, Clipping in Homogeneous Coordinate. **Visible-Surface detection algorithms:** Back-Face removal, Depth Buffer method, Scan line method, Depth sorting method, Area subdivision and Octree method.

### RECOMMENDED BOOKS:

1. *Computer Graphics, Hearn D. & Baker P.M.*
2. *Computer Graphics: A Programming Approach, Harrington S.*
3. *Procedural Elements for Computer Graphics, Rogers D.F.*



**Elective II: Data Warehousing and Mining**  
**Subject Code - MCA205**

**Max. Marks: 100**

**Min Marks : 40**

**UNIT - I: Introduction to Data Warehousing and OLAP Technology for Data Mining**

What is Data Mining?, Data Mining: On what kind of data?, KDD Process, Data Mining Functionality, Are all the patterns interesting?, Attribute Types, What is Data Warehouse?, Data Cube: A multi-dimensional data model, Data Warehouse Architecture, Data Warehouse Implementation, Data Warehouse Usage(Applications), OLAP Operations, Concept of Transaction, Transactional Database, Distributed Database, Commit Protocols.

**UNIT - II: Data Preprocessing, Data Mining Primitive, Languages and System Architecture**

Why preprocess the data?, Data Cleaning, Data Integration, Data Transformation, Data Reduction, Concept Hierarchy Generation, Data Mining Primitive, Data Mining Query Language, Architecture of Data Mining System.

**UNIT - III: Mining Association Rules in Large Databases**

Association Rule Mining, Mining Single-dimensional Boolean Association Rules from Transactional Databases (Apriori algorithm, FP-Tree growth algorithm), Mining Multilevel Association Rules from Transactional Databases, Mining Multi-dimensional Association Rules from Transactional Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-based Association Mining.

**UNIT - IV: Classification, Prediction and Cluster Analysis**

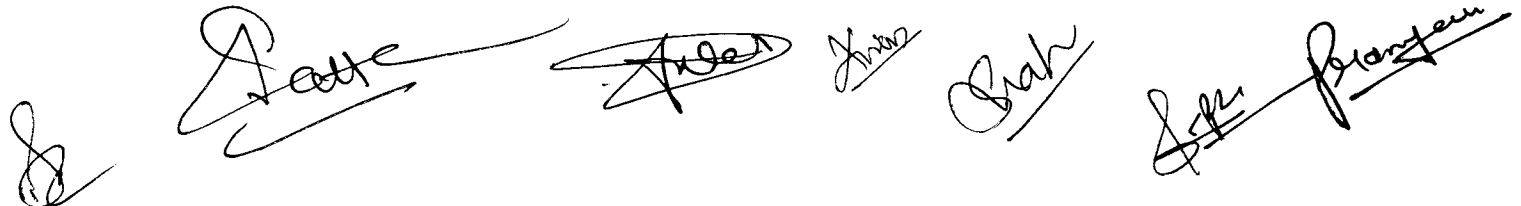
What is Classification?, What is Prediction?, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back Propagation, Classification based on Association, Other Classification Methods, Prediction, Classification Accuracy, What is Cluster Analysis?, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis.

**UNIT - V: Mining Complex Types of Data & Applications and Trends in Data Mining**

Mining Time-series and Sequence Data, Mining Spatial Databases, Mining Multimedia Databases, Mining Text Databases, Mining World Wide Web, Data Mining Applications, Social Impact of Data Mining, Trends in Data Mining.

**RECOMENDED BOOKS:**

1. **Data Mining: Concepts and Techniques**, Jiawei Han and Micheline Kamber
3. **Data Mining Techniques**, Arun K Pujari,
4. **Data Mining Introductory and Advanced Topics**, Margaret H Dunham, Pearson

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## Elective II: Internet of Things

### Subject Code - MCA205

Max Marks : 100

Min Marks : 40

#### Unit – I OVERVIEW:

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

#### Unit – II REFERENCE ARCHITECTURE:

**IoT Architecture** – State of the Art – Introduction, State of the art, Reference Model and architecture, **IoT reference Model** – IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints** – Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

#### Unit – III IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS:

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

#### Unit – IV TRANSPORT & SESSION LAYER PROTOCOLS:

**Transport Layer** Transmission Control Protocol (TCP), Multipath Transmission Control Protocol (MPTCP), User Datagram Protocol (UDP), Datagram Congestion Control Protocol (DCCP) , Stream Control Transmission Protocol (SCTP), Transport Layer Security (TLS), Datagram Transport Layer Security (DTLS))

**Session Layer-** Hyper Text Transfer Protocol (HTTP), Constrained Application Protocol (CoAP), Extensible Messaging and Presence Protocol (XMPP), Advanced Message Queuing Protocol (AMQP), Message Queue Telemetry Transport (MQTT)

#### Unit – V SERVICE LAYER PROTOCOLS & SECURITY:

**Service Layer** – oneM2M, European Telecommunications Standards Institute (ETSI) M2M (Machine-to-Machine), OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, Routing Protocol for Low-Power and Lossy Networks (RPL), Application Layer

#### RECOMMENDED BOOKS:

1. **From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence**, Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, Academic Press, 2014
2. **Learning Internet of Things**, Peter Waher, PACKT publishing
3. **Architecting the Internet of Things**, Bernd Scholz-Reiter, Florian Michahelles, Springer
4. **Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications**, Daniel Minoli, Willy Publications
5. **Internet of Things (A Hands-onApproach)**, Vijay Madiseti and ArshdeepBahga, VPT, 2014.



## Elective II: Mobile Computing

Subject Code: MCA205

Max. Marks: 100

Min Marks : 40

### UNIT I: Introduction

Introduction to Mobile Communication, Evolution of modern Mobile wireless communication systems, Applications of mobile communication, Need and Requirements of Mobile communication, satellite systems and Applications, Type of satellite systems, characteristics of satellite systems, Global Positioning system (GPS) and Applications, some open research topics in mobile communication

### UNIT II: Mobile Communication Systems

Introduction, Cellular System Infrastructure, Registration, Handoff Parameters and Underlying support, Roaming Support Using System Backbone, to Mobile IP, Functions of Mobile IP, Mobile Node, Corresponding Node, Home Network, Foreign Network, Home Agent , Foreign Agent, Care-of Address, IP Packet Delivery, Agent Discovery, Agent Solicitation , Registration, Tunneling , Dynamic host configuration protocol

### UNIT III: Mobility and Frequency Management

Mobility management in wireless Networks, Handoff Techniques, Handoff detection and Assignment, Types of Handoff, channel Reservation for Handoff calls, WLAN transmission technology, Frequency hopping, Direct Sequence Modulation, Frequency division, Orthogonal Frequency Division, Spectrum utilization.

### UNIT IV: Wireless LANs and PANs

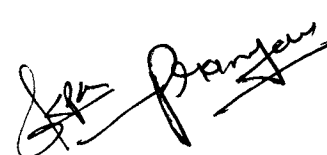
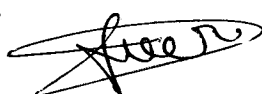
Introduction to IEEE 802.11, Ricochet, Ricochet Wireless Modem, Services Provided by Ricochet, Home RF, Home RF Technology, Hiper LAN, Bluetooth , Advantages and disadvantages of Wireless LAN, Infra redvs radio transmission , introduction to MAC. Technologies influence WLANs / WPANs in future.

### UNIT V: Mobile Adhoc Network

Introduction to Mobile Adhoc Network (MANET), Characteristics of MANET, Applications of MANET, Routing, Need for Routing, Routing Classification, Table-Driven Routing Protocol - Destination Sequenced Distance Vector Routing Protocol, Cluster-Head Gateway Switch Routing, Wireless Routing Protocol. Source initiated On-demand Routing- Adhoc On Demand Distance Vector Routing, Dynamic Source Routing, Temporarily Ordered Routing Algorithms, Hybric Protocol - Zone Routing Protocol.

### RECOMMENDED BOOKS:

1. **Mobile Communication:** Jochen H. Schiller, Pearson Education Publication
2. **Introduction to Wireless and Mobile Systems:** D.P. Agrawal, Qing-An Zing, Vikas Publishing House.
3. **Wireless Communication and Networks:** ItiSahaMisra, McGraw Hill education.
4. **Wireless and mobile Communication:** T.G. Palanivelu, R. Nakkeeran, PHI Publication.
5. **Mobile Commerce:** KarabiBandyopadhyay, PHI Publication.



**SCHEME OF TEACHING AND EXAMINATIONS 2020-21  
MASTER OF COMPUTER APPLICATIONS (2 Years)**

**THIRD SEMESTER**

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
		L	T	P		Max. Marks				Min. Marks			
						Th	Ses	Pr	Total	Th	Ses	Pr	Total
MCA301	.Net Technology	3	2	-	4	100	25	-	125	40	15	-	55
MCA302	Computer Network & Data Communication	3	2	-	4	100	25	-	125	40	15	-	55
MCA303	Artificial Intelligence	3	2	-	4	100	25	-	125	40	15	-	55
MCA304	Elective – III	3	2	-	4	100	25	-	125	40	15	-	55
MCA305	Elective – IV	3	2	-	4	100	25	-	125	40	15	-	55
MCA306	Lab-VII : Programming in .Net Technology	-	-	3x2	3	-	50	100	150	-	30	50	80
MCA307	Lab-V III: Networking	-	-	2	1	-	50	50	100	-	30	25	55
MCA308	Lab-IX : Mini Project	-	-	2	1	-	50	50	100	-	30	25	55
MCA309	Seminar	-	-	2	1	-	25	-	25	-	15	-	15
	<b>TOTAL</b>	15	10	12	26	500	300	200	1000	200	180	100	480

Sr. No.	Elective –III	Elective -IV
1.	Compiler Design	Big Data Analytics
2.	Soft Computing	Cloud Computing
3.	Digital Image Processing	Cyber Security

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**.Net Technology**  
**Subject Code - MCA301**

**Max. Marks: 100**

**Min Marks : 40**

**UNIT - I : Inside the .NET framework :**

Overview of .net framework, Managed Execution process, CLR, common language specification, JIT Compilation , MSIL, Namespaces, Assemblies, metadata, Common Type System, cross language, interoperability, Garbage collection.

**UNIT - II : Programming with .NET Framework**

Windows form : working with Visual Studio IDE, creating a .NET solution, MDI application, components and controls, Data types, variables, Type conversions, Operators, Control Structures : conditional statements, loops, arrays, types of methods, method data, Introduction to exception handling-exception statements.

**UNIT - III : XML, Windows process and File Handling**

Types, structures, Enumerations, classes, Interfaces, Working with files-Files and directories, streams, Readers and writers, Reading and writing XML files, XML serialization, processing Transaction, Monitoring and Managing Windows Process, retrieving information about process.

**UNIT - IV : Building .NET Framework Applications**

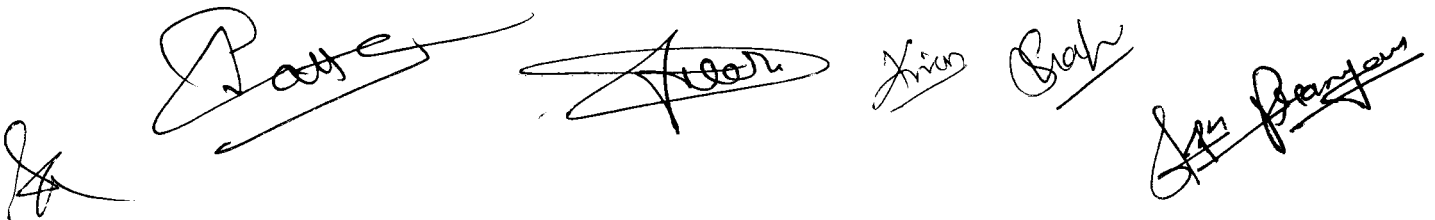
Introduction to ASP .NET, Differentiate classic ASP and ASP .NET, Web application, Web forms, Form validations – Client side, Server side, controls in web forms, Events in Web form.

**UNIT - V : Advanced concepts and Database Programming**

Delegates, ADO .NET Architecture, .NET data provider, dataset components, creating database applications using Window forms and web forms (Database connectivity through ADO .NET), Introduction to web services, web services for Mobile application, Remote overview.

**BOOKS RECOMMENDED**

1. MSDN online – by Microsoft
2. Visual Basic .NET Complete - By BPB Publications, New Delhi.
3. The Complete Reference VB .NET – By Jeffery R. Shapiro, Tata Mcgraw Hill.
4. Professional VB .NET 2003 – by bill Evjen & others, Wiley Dreamtech India (P) Ltd. New Delhi.

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# Computer Networks & Data Communication

## Subject Code - MCA302

Max Marks : 100

Min Marks : 40

### UNIT - I

**Introduction to Computer Networking:** The Concept of Networking, Data Communication, Required network elements, The Role of Standards Organization. Line Configuration-Point to Point and Multipoint, Various Topologies- Star, Bus, Ring etc., Transmission Mode- Simplex, Half-duplex and Full-duplex, Categories of Networks- LAN, MAN, WAN. The benefits of a Computer Networks. The OSI and TCP/IP Reference Model.

### UNIT - II

**Transmission of Digital Data:** Shannon's and Nyquist theorems for maximum data rate of a channel, Sampling Theorem. Transmission media- Guided Media-Twisted Pair, Coaxial Cable, Fibre Optic. Unguided Media. Analog and digital data Transmission- parallel and serial transmission. Switching- Circuit, Message, Packet switching. Multiplexing- TDM, FDM, WDM and CDM. Modulation- brief overview of classification of modulation. Connectors - RJ45, BNC-T Connector.

### UNIT - III

**Data Link Layer and Routing Algorithms:** Line Discipline- ENQ/ACK & Poll/Select, Flow Control- stop and wait, sliding window, Error Detection and Correction- Parity, Checksum, CRC, Hamming Code. Multiple access protocols- ALOHA, Slotted ALOHA, CSMA/CD, CSMA/CA. IP address classes and subnet mask. IPv4 and IPv6 header format, Classes of Network, Subnet mask, Routing algorithms- Distance Vector and Link State Routing.

### UNIT - IV

**Transport Layer, Application Layer, ATM and Congestion Control:** TCP and UDP header format, Email- SMTP and POP. Domain Name System, HTTP, WWW  
ATM- ATM Cell, ATM Switch, Multistage Switch, ATM Reference Model. Congestion control algorithm- Leaky bucket and token bucket.

### UNIT - V

**Network Security:** Cryptography- Symmetric Key and Asymmetric Key, Components of Network Security- Confidentiality, Authentication, Integrity and Non Repudiation. DES, RSA, Diffie Hellman algorithm, Virus, Worms, Trojan, Digital signature, SSL, IPsec.

### BOOKS RECOMMENDED:

1. Computer Networks - A S Tanenbaum
2. Data Communication and Networking - B A Forouzan
3. Data and Computer Communications - William Stallings
4. Computer Networks and Internets - Douglas E. Comer

*Shiver*  
04-03-2020

*Patel*  
04.3.2020

*Kumar*  
*Prakash*  
*Sharma*  
04-03-20

*Dr. Prakash*



# Artificial Intelligence

## Subject Code - MCA303

Max. Marks: 100

Min Marks : 40

### UNIT - I

**Introduction to AI:** Foundations of AI, Philosophy and History; the AI problems, AI technique; The Turing Test. **Intelligent Agents:** Agents and Environments, the Concept of Rationality, the Nature of Environments and the Structure of Agents. **Problem solving & State Space Search:** General problem solving; defining problems as State Space Search, Problem Characteristics; Production Systems & their characteristics.

### UNIT - II

**Exhaustive Searches:** Generate and Test, Breadth First Search, Depth First Search and DFID **Heuristic Search Techniques:** Best first search; A\* algorithm; Problem Reduction AND/OR Graphs and AO\* algorithm. **Local Searches & Optimizations:** Hill climbing and its variants; Branch and Bound technique. **Constraint Satisfaction Problems:** Definition; Constraint Propagation and Backtracking. **Game Playing:** Mini-Max Search Procedure; Alpha-Beta Cutoffs; Additional Refinements.

### UNIT - III

**Knowledge Representation:** Types of Knowledge; Knowledge Representation Issues; **Logic:** First order Predicate Logic; Representation of facts in FOL; Inference in FOL; Resolution Principle, Clausal Form and Unification; **Inference Mechanisms:** Forward and Backward Chaining; **Slot and Filler Structures:** Semantic Networks; Frame Systems and value inheritance; Conceptual Dependency; Scripts;

### UNIT - IV

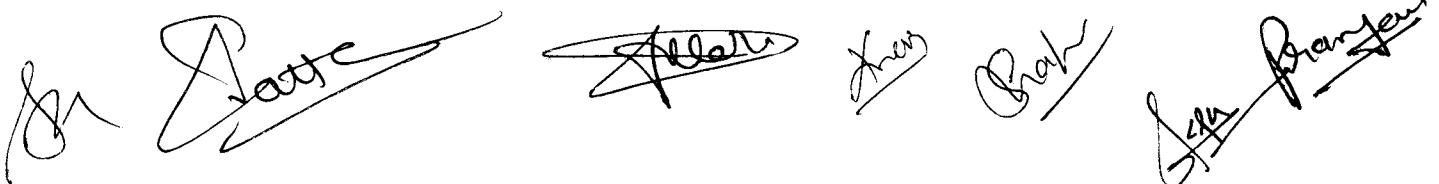
**Reasoning under Uncertainty:** Non-monotonic Reasoning, Probabilistic Reasoning and Uncertainty; Probability Theory; Baye's Theorem and Bayesian networks; Certainty Factor; Dempster-Shafer Theory. **Planning:** Overview; The Blocks World; Component of a Planning System: Goal Stack Planning; Nonlinear Planning; **Natural Language Processing:** Introduction, Overview of Linguistics, Grammars and Languages: context sensitive and context free grammar; Chomsky Hierarchy, Parsing techniques: Recursive Transition Nets, Augmented Transition Nets, Semantic Analysis: Case, Logic and Semantic grammars;

### UNIT - V

**Expert Systems:** Introduction, Characteristics, History and Applications of expert systems; Expert System Shells; Rule Based Systems Architectures, Non Production System Architectures; Knowledge Acquisition and Validation; Case Studies: MYCIN& DENDRAL. **Learning:** Rote learning; Learning by Taking Advise; Learning in Problem Solving; Induction; Explanation based learning; Discovery; Analogy.

### BOOKS RECOMMENDED:

1. **Artificial Intelligence 3<sup>rd</sup> Edition**, Rich E., Knight K. and Nair S. B., McGraw Hill Education
2. **Artificial Intelligence: A Modern Approach 3<sup>rd</sup> Edition**, Russell S. J. and Norvig P., Pearson Education
3. **Introduction to Artificial Intelligence and Expert Systems**, Patterson D. W., PHI
4. **Principles Of Artificial Intelligence**, Nilson N. J., Narosa Publications
5. **Artificial Intelligence 3<sup>rd</sup> Edition**, Winston P. H., Pearson Education
6. **A First Course in Artificial Intelligence**, Khemani D., McGraw Hill Education



## Elective III: Compiler Design

### Subject Code - MCA304

Max. Marks: 100

Min Marks : 40

#### UNIT - I

##### Introduction to Compiling and one pass compiler:

Compilers & translators, Phases of compilers, Compiler writing tools, Bootstrapping; overview of one pass compiler.

##### Finite Automata and Lexical Analysis:

Role of Lexical Analyzer; specification of tokens, Recognition of tokens, Regular expression, Finite automata, from regular expression to finite automata, DFA and NFA, Implementation of lexical analyzer; tools for lexical analyzer -LEX.

#### UNIT - II

##### Syntax analysis & Parsing Technique:

Context free grammars; Bottom up parsing, Shift reduce parsing, Operator Precedence parsing, Top down parsing, elimination of left recursion; recursive descent parsing, Predictive parsing.

##### Automatic Construction of Efficient parsers:

LR parser, construction of SLR and canonical LR parser table, Using ambiguous grammar, An automatic parser the generator, YACC, Using YACC with ambiguous grammar, creating YACC lexical analyzer with LEX, Error recovery in YACC.

#### UNIT - III

##### Syntax Directed Translation:

Syntax directed schema, Construction of syntax tree, Translation with top down parser.

##### Run Time Environment:

Source Language issues, Storage organization and allocation strategies, Parameter passing, Implementation of block-structured language.

#### UNIT - IV

##### Intermediate Code Generation:

Intermediate languages; Postfix notation, Three-address code, Quadruples and triples, Translation of assignment statements, Boolean expression, and Procedure call.

##### Error Detection & recover:

Lexical & syntactic phase error, semantics error.

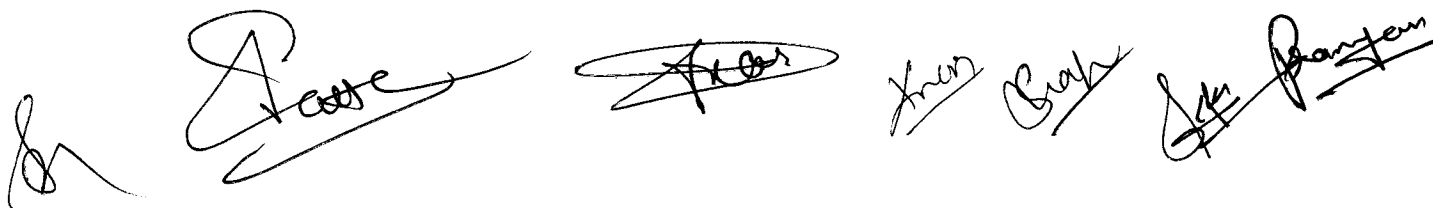
#### UNIT - V

##### Code Optimization:

Optimization of basic block, Loop optimization global data flow analysis, Loop in variant computation. **Code Generation:** Issue and design of code generator, the target machine, a simple code generator.

#### BOOKS RECOMMENDED:

- Principles of Compiler Designing - Alfred V. Aho and J.D. Ullman.
- Principles of Compiler-Principles, Technique and Tools - Alfred V. Aho, Ravi Sethi



## Elective III: Soft Computing Subject Code - MCA304

Max. Marks: 100

Min Marks : 40

### UNIT - I: Introduction to Fuzzy Logic System

Fuzzy Sets Operation Of Fuzzy Sets, Properties Of Fuzzy Sets, Fuzzy Relations, Fuzzy Arithmetic, Membership Functions, Fuzzy To Crisp Conversion. Fuzzy Logic, Fuzzy Rule Based Systems, Fuzzy Decision Making, Fuzzy Database, Fuzzy Intelligent System.

### UNIT - II: Introduction to Artificial Neural Networks

Introduction to Artificial Neural Network, Artificial Neuron, Classification of Artificial Neural Network, Architecture of a Artificial Neural Network, Activation Function, Training an Artificial Neural Network, Application of Artificial Neural Network.

### UNIT - III: Perceptron and Associative Memories

Amari General Learning Rule, HEBB Learning Rule, ADLINE, Perceptron Layer Network, Associative memory: Auto associative Memory, Bi-directional memory, Back-propagation Network: Architecture, Training Algorithm Application of Back-propagation algorithm

### UNIT - IV: Evolutionary Computing

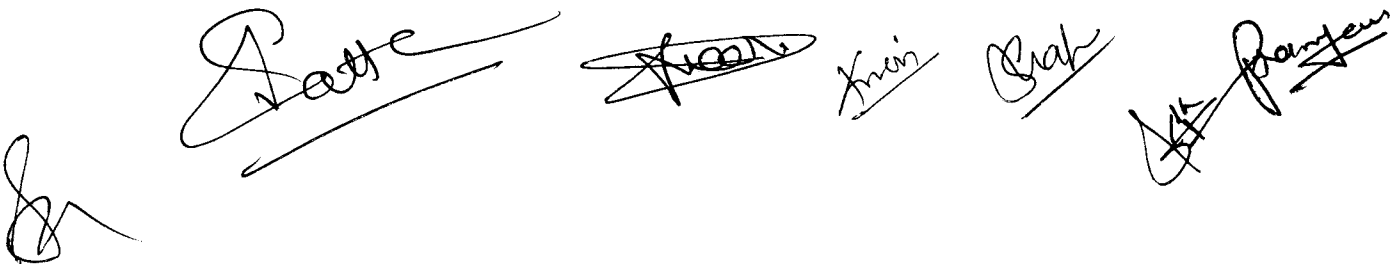
Introduction, overview of evolutionary computing, Genetic algorithms and optimization, The schema theorem: the fundamental theorem of genetic algorithms, Genetic algorithm operators, Integration of genetic algorithms with neural networks, Integration of genetic algorithms with fuzzy logic, Known issues in GAs.

### UNIT - V: Soft Computing Tools

Introduction to MATLAB, Features, Matrix Operations, Curve Plotting, Toolbox Introduction, Introduction to Simulink.

### RECOMMENDED BOOKS:

1. **Soft Computing**, SarojKaushik, TMH Publications.
2. **Fuzzy systems and Fuzzy Logic**, *Klir and Uuna*, PHI Publications.
3. **Introduction to Artificial Neural Networks**, *S. N. Sivanandam and M. Paulraj*, Vikas publication.
4. **Soft Computing and Intelligent systems Design**, *Fakhreddine O. Karry and Clarence de Silva*
5. **Neural Network Design**, *Hagan & Demuth*, Vikas Pub. Comp.
6. **Fundamentals of Artificial Neural Networks**, *M.A.Hassaoun*.
7. **Fuzzy sets, uncertainty and information**, *George J. Kir, & TA Folger*.
8. **Fuzzy sets, Decision making and Expert system**, *HJ Zimmerman*, Kluwer, Boston.
9. **Fuzzy set theory and its applications**, *H. J. Zimmerman*, Kluwer, Boston.

The image shows five handwritten signatures in black ink, arranged horizontally. From left to right: a stylized signature, a signature that appears to be 'Datta', a signature that appears to be 'Kumar', a signature that appears to be 'Bhak', and a signature that appears to be 'Ramesh'.

## Elective III: Digital Image Processing Subject Code - MCA304

Max. Marks: 100

Min Marks : 40

**Unit – I: Introduction:** Digital Image Fundamentals Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sensing and acquisition Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

**Unit – II: Image Enhancement Spatial Domain:** Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods; **Frequency Domain:** Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering

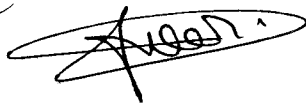
**Unit – III: Image Restoration** A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.

**Unit – IV: Image Compression:** Fundamentals, Image Compression Models, Error-Free Compression, Lossy Compression, Image Compression Standards. **Morphological Image Processing:** Dilation and Erosion, Opening and Closing, Hit-or-Miss Transformations, Some Morphological Algorithms.

**Unit – V: Segmentation** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation. **Representation and Description:** Representation, Boundary Description and Regional Descriptor.

### RECOMMENDED BOOKS:

1. **Digital Image Processing**, *Rafel C Gonzalez and Richard E. Woods*, PHI 2nd Edition
2. **Computer Vision and Image Processing**, *Scott.E.Umbaugh*, Prentice Hall





**Elective IV: Big Data Analytics**  
**Subject Code – MCA305**

**Max Marks : 100**

**Min Marks : 40**

**UNIT – I: Introduction to Data Warehousing and OLAP Technology for Data Mining**

What is Data Mining?, KDD(Knowledge Discovery from Databases) Process, What Kinds of Data Can Be Mined?, Data Mining Functionality, Are all the patterns interesting?, Attribute Types, What is Data Warehouse?, Data Warehouse Architecture, Data Cube: A multi-dimensional data model, Schemas for Multidimensional Data Models, OLAP Operations, Data Warehouse Usage(Applications). , Data Mining Primitive, Architecture of Data Mining System.

**UNIT – II: Introduction Concept of Big Data**

Big Data- Define Data, Web Data, Classification of Data- Structured, Semi-Structured, and Unstructured. Big Data Definitions, Challenges of Conventional system, Why We Need Big Data, Difference between Big Data and Small Data, Importance of Big Data. Big Data Characteristics (4V's Volume, Velocity, Variety, and Veracity), Big Data Types, Big Data Handling Techniques. Complexity of Big Data, Big Data Processing Architectures, Big Data Technologies, Big Data Business Value. Big Data Analytics Application. Big Data Challenges and Future Scope.

**UNIT – III: INTRODUCTION TO HADOOP AND HADOOP ARCHITECTURE**

**Big Data** – Apache Hadoop & Hadoop EcoSystem: Hadoop Core Component, Features of Hadoop, The Hadoop Distributed File System: HDFS data Storage, Hadoop Physical Organization, HDFS Commands, MapReduce Framework, MapReduce Programming Model, MapReduce Map task, Reduce Task and MapReduce Execution, Hadoop YARN, Hadoop2 Execution Model, Hadoop Ecosystem Tools, Hadoop Ecosystem.

**UNIT – IV: NoSQL Big Data Management, Mongo DB**

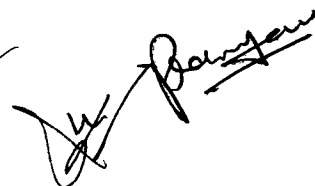
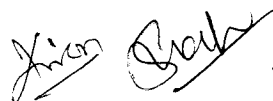
**NoSQL:** What is it?, Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NoSQL DataStore, NoSQL Data Architecture pattern, NOSQL to Manage Big Data. **Data Base for the Modern Web:** Introduction to MongoDB, features of MongoDB, Data Types, Mongo DB Query Language and Database Command.

**UNIT – V: Hive and Pig:**

**Pig:** Apache Pig, Application of Apache Pig, Feature, Pig Architecture, Pig- Grunt Shell, Installing Pig, Pig Latin Data Model, Pig Latin and Developing Pig Latin Scripts: Apache Pig Execution, Commands. **HIVE AND HIVEQL. Hive:** Introduction, Characteristics, limitation, Hive Architecture and Installation, Comparison with Traditional Database (RDBMS), Hive Datatype and File Formats, Hive Data Model, Hive Integration and Workflow Steps, Hive Built-in Functions, HiveQL.

**RECOMMENDED BOOKS:**

1. **Big Data Analytics**, Raj Kamal and Preeti Saxena, McGraw Hill Education
2. **Big Data: Black Book**, DT Educational Services, Dreamtech Press
3. **Big Data Analytics**, Seema Acharya & Shubhashini Chellappan, Wiley India
4. **Big Data Analytics**, M. Vijayalakshmi & Radha Shankarmani, Wiley India



## Elective IV: Cloud Computing

### Subject Code – MCA305

Max Marks : 100

Min Marks : 40

#### Unit – I

**Introduction:** Cloud Computing: Vision, Definition, Reference Model, Characteristics, Benefits and Challenges, Historical Developments, Cloud Computing Environments, Cloud Platforms and Technologies; The Evolution of Cloud Computing: Parallel Computing vs. Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for Distributed Computing, Introduction of Grid Computing.

#### Unit – II

**Virtualization:** Introduction, Characteristics, Taxonomy of Virtualization, Levels of Virtualization, Structure and Mechanism of Virtualization, Virtualization and Cloud Computing, Advantages and Disadvantages, Virtualization Technology Examples: Xen, VMware, Microsoft Hyper-V.

#### Unit – III

**Cloud Computing Architecture:** Service Oriented Architecture, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Data Storage as a Service (DSaaS). Types of Clouds; Economics of the Cloud and Open Challenges; **Security and Organizational aspects:** Host Security and Data Security.

#### Unit – IV

**Migration to the Cloud:** Adoption and use of Cloud by Businesses (Small and Enterprise), Pace of Adoption, Benefits and Phases of Adoption, Cloud Service Provider's Capabilities and Liabilities, Success factors and Issues. **Migrating Applications:** Key Aspects, Migration Techniques, Phases of Migration. **Service Level Agreement (SLA):** Aspects and Requirements, Availability and Outages, Credit Calculations, SLA Samples.

#### Unit – V

**Industry Platforms:** Amazon Web Services, Google AppEngine, Microsoft Azure; **Cloud Applications:** Scientific Applications, Business and Consumer Applications; **Advanced Topics:** Energy Efficiency in Clouds, Market Based Management, Federated Clouds / InterCloud, Third Party Cloud Services.

#### RECOMMENDED BOOKS:

1. **Mastering Cloud Computing**, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education
2. **Cloud Computing: Black Book**, Kailash Jayaswal et al., Kogent Learning Solutions, Dreamtech Press
3. **Cloud Computing: Principals and Paradigms**, Rajkumar Buyya et al., Wiley India
4. **Cloud Computing: Concepts, Technology & Architecture**, Erl, Pearson Education India
5. **Cloud Computing Bible**, Barrie Sosinsky, O'Reilly Media
6. **Cloud Computing: A Practical Approach**, Toby Velt, Anthony Vote and Robert Elsenpeter, McGraw Hill
7. **Cloud Application Architectures: Building Applications and Infrastructures in the Cloud**, George Reese, O'Reilly Media.
8. **Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance**, Tim Mathern Subra Kumaraswamy and Shahed Latif, O'Reilly Media.

## Elective IV: Cyber Security

### Subject Code – MCA305

Max. Marks: 100

Min Marks : 40

#### UNIT – I: INTRODUCTION

Computer Security Concepts, The Challenges of Computer Security, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, A model for network Security, **Symmetric Encryption Principal:** Cryptography, Cryptanalysis, Feistel Cipher Structure, DES, Random and Pseudorandom Numbers, Symmetric Block Modes of Operation (ECB, CBC, CFB, CTR).

#### UNIT – II PUBLIC KEY CRYPTOGRAPHY

Approaches to Message Authentication, **Hash Functions:** Hash Functions Requirement, Security of Hash Functions, The SHA Secure Hash Function, **Public Key Cryptography:** Public –Key Encryption Structure, Applications for Public Key Cryptosystem, RSA, Attacks on RSA, OAEP.

#### UNIT – III MESSAGE INTEGRITY AND MESSAGE AUTHENTICATION

**Message Integrity:** Document and Finger Printing, Message and Message Digest, Cryptographic Hash Function Criteria Random Oracle Model, Birthday Problems and Summary of solutions, **Message Authentication:** Modification Detection Code, Message Authentication Code, Introduction of HMAC & CMAC, **Digital Signature:** Comparison, Process, Services, Attacks on Digital Signature.

#### UNIT – IV MALICIOUS SOFTWARE

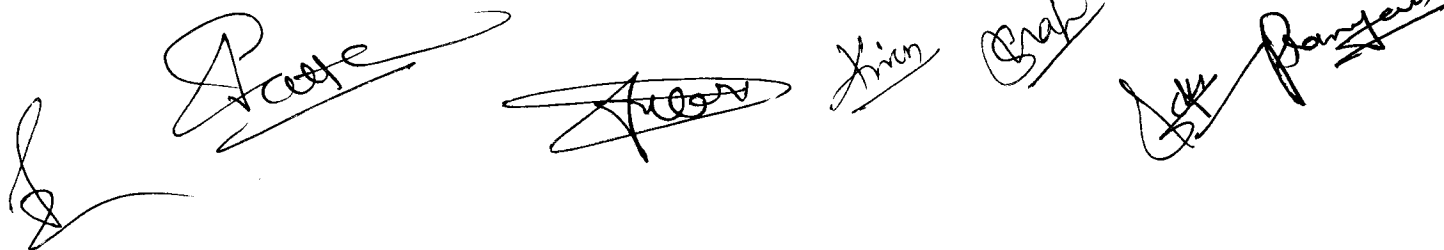
**Intruders:** Intruder Behavior Patterns, Intrusion Techniques, Intrusion Detection by Audit Records, Statistical Intrusion Detection, Distributed Intrusion Detection, Honeypot Types of Malicious Software, Nature of Viruses, Virus Classification, Antivirus Approaches, Worms and its Propagation model, DDoS Attack.

#### UNIT – V FIREWALL & SECURITY TOOLS

**Firewall:** Need & Characteristics of Firewall, Types of Firewall, Firewall Basing, Firewall Location and Configuration, Introduction to Kali Linux ,Tools Available in Kali Linux and Its Usage. WireShark Packet Analyzer and Its Features. Cyber Security Policy, Domain of Cyber Security Policies.

#### RECOMMENDED BOOKS:

1. **Network Security Essentials**, *William Stallings*, PEARSON
2. **Cryptography and Network Security**, *William Stallings*, PHI.
3. **Cryptography and Network Security**, *Atul Kahate*, Tata McGraw Hill
4. **Cryptography and Network Security**, *B.A. FOROUZAN*, TMH
5. **Cyber Security policy Guidebook**, *Jennifer Jason Paul, Marcus Jeffery Joseph*. Wiley Publication,2012.
6. **Network Security: The Complete Reference**, *Robertra Bragg*, Tata McGraw Hill.
7. **Cyber Security Essentials**, *James Graham, Richard Ryan*, CRC press

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**SCHEME OF TEACHING AND EXAMINATIONS 2020-21**  
**MASTER OF COMPUTER APPLICATIONS (2 Years)**  
**FOURTH SEMESTER**

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
		L	T	P		Max. Marks				Min. Marks			
						Sessional Marks of Project Work	Project Viva-Voce	Pr	Total	Sessional Marks of Project Work	Project Viva-Voce	Pr	Total
MCA401	System Development Project (System Design & Implementation) / Research Project.	5	-	30	20	200	200	-	400	120	100	-	220
	<b>TOTAL</b>	5	-	30	20	200	200	-	400	120	100	-	220

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**SCHEME OF TEACHING AND EXAMINATIONS 2020-2021**  
**MASTER OF SCIENCE IN INFORMATION TECHNOLOGY**

**FIRST SEMESTER**

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+((T+P) / 2)	Examination Marks							
		L	T	P		Max. Marks				Min. Marks			
						Th	Ses	Pr	Total	Th	Ses	Pr	Total
MSc(IT)101	Object Oriented Programming with C++	3	2	-	4	100	50	-	150	40	30	-	70
MSc(IT)102	RDBMS and SQL	3	2	-	4	100	50	-	150	40	30	-	70
MSc(IT)103	Mathematical Foundations of Computer Science	3	2	-	4	100	50	-	150	40	30	-	70
MSc(IT)104	Computer System Architecture	3	2	-	4	100	50	-	150	40	30	-	70
MSc(IT)105	Internet and Web Technology	3	2	-	4	100	50	-	150	40	30	-	70
MSc(IT)106	Programming Lab C++	-	-	3x2	3	-	25	100	125	-	15	50	65
MSc(IT)107	RDBMS & SQL Lab	-	-	3x2	3	-	25	100	125	-	15	50	65
	<b>TOTAL</b>	15	10	12	26	500	300	200	<b>1000</b>	200	180	100	<b>480</b>

# Object Oriented Programming with 'C++'

## MSc(IT)101

Max Marks : 100

Min Marks : 40

### UNIT – I: Language Fundamental

**Overview of OOP:** The Object Oriented paradigm, Basic concepts of OOP, Benefits of OOP, Object oriented languages, Application of OOP. **Overview of C++:** History of C++, **Data Types:** Built-in data types, User-defined data types, Derived data types. **Constants and Variables:** symbolic constants, Dynamic initialization of variable, Reference variable. Operators in C++. **Control Structures:** if-else, nested if-else, while, do-while, for, break, continue, switch, goto statement.

### UNIT – II: Structure & Function

**Structures:** A Simple structure, Defining a structure variable, Accessing structures member, Enumeration data type. **Function:** Function Declaration, Calling Function, Function Definition, **Passing Arguments to function:** Passing Constant, Passing Value, Reference Argument, Structure as argument, Default Argument. **Returning values from function:** return statement, Returning structure variable, Return by reference. Overloaded Function, Inline Function, Templates.

### UNIT – III: Object Classes and Inheritance

Object and Class, Defining the class and its member, Making an outside function inline, nesting of member function, array as class member, structure and classes. **Memory allocation:** memory allocation for objects, new and delete operator, static data member, static member functions, object as function argument. **Constructor & Destructor:** Null and default constructor. Parameterized constructor, Constructor with default argument, copy constructor, class destructors, **Inheritance:** Introduction to inheritance, Types of inheritance ,function overriding, Constructor in Derived class. **Access specifiers:** public, private, protected.

### UNIT – IV: Pointers, Virtual Function and Operator Overloading

**Pointers:** Introduction, & and \* operator, pointer to object, this pointer, pointer to derived class. **Dynamic polymorphism:** Virtual function, Pure Virtual Function, Abstract class. **Static Polymorphism:** Operator keyword, overloading unary operator (++(pre increment and post increment),--) using operator function, overloading binary operators (+,-,==,>,<=, +=,<,>,[ ] ), Friend function, Friend class, overloading binary operators using friend function.

### UNIT – V: File & Stream

**File and Stream:** C++ Stream class, unformatted I/O operations, formatted console I/O, manipulators, opening and closing a file, detecting eof, file modes, get(), put(),reading and writing a class object, Updating a file random access.

### RECOMMENDED BOOKS:

- **Object Oriented Programming with C++ :** E. Balagurusamy, The McGraw-Hill
- **The C++ Programming Language:** Bjarne Stroustrup, Addison Wasley.
- **Object Oriented Programming in C++:** Robert Lafore, Galgotia Publications.
- **Introduction to Object Oriented Programming:** K V Witt, Galgotia Publications.
- **Object Oriented Programming:** G Blaschek, Springer Verlag
- **Object Data Management:** R Cattell, Addison Wasley.

# RDBMS and SQL

## MSc(IT)102

Max Marks : 100

Min Marks : 40

### UNIT – I: Overview of Database Management

Data, Information and knowledge, file oriented approach versus database oriented approach to data management; data independence, database administration roles, DBMS architecture, different kinds of DBMS users, importance of data dictionary, contents of data dictionary, types of database languages. Data models: network, hierarchical, relational. Introduction to distributed databases, Client/Server databases, Object-oriented databases, Object-relational databases.

### UNIT – II: Relational Model & Relational Algebra

Entity - Relationship model as a tool for conceptual design-entities, attributes and relationships. ER diagrams; Extended ER features Generalization, specialization and aggregation; Case studies of ER modeling, Concept of keys; Converting an ER model into relational Schema.

**Relational Algebra:** select, project, cross product different types of joins (inner join, outer joins, self-join); set operations, Tuple relational calculus, Domain relational calculus, Simple and complex queries using relational algebra.

### UNIT – III: SQL and Relational Database Design

Introduction to SQL constructs (SELECT...FROM, WHERE... GROUP BY... HAVING... ORDERBY...), INSERT, DELETE, UPDATE, DROP, VIEW definition and use, Temporary tables, Nested queries, and correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreign key, references, Triggers. Embedded SQL and Application Programming Interfaces. Normalization concept in logical model; Pitfalls in database design, update anomalies: Functional dependencies, Join dependencies, Normal forms (1NF, 2NF, 3NF). Boyce Codd Normal form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF. Denormalization.

### UNIT – IV: PL/SQL

Introduction to PL/SQL variables – literals – data types – advantages of PL/SQL; Control statements : if ; iterative control – loop, while, for , goto ; exit when; Cursors : Types –implicit, explicit – parameterized cursors – cursor attributes; Exceptions: Types – internal , user-defined , handling exceptions – raise statement; PL/SQL tables and records: Declaring PL/SQL tables - referring PL/SQL tables, inserting and fetching rows using PL/SQL table, deleting rows; records - declaration of records - deleting records; Sub programs: Functions -procedures - in, out, inout parameters; purity functions - packages - package specification -advantages of packages - private and public items - cursors in packages.

### UNIT – V: Query Processing and Optimization

Query Processing, Protecting Database and Data Organization -Parsing, translation, optimization, evaluation and overview of Query Processing. Protecting the Data Base - Integrity, Security and Recovery. Domain Constraints, Referential Integrity,

Assertion, Triggers, Security & Authorization in SQL. **Data Organization -File Organization:** Issues in physical design;, File organization for relational tables. Fixed length records, variable length records, Organization of records in files, **Indexing:** Concepts of indexes, indexed files -B-tree, B+-tree, and Hashing Techniques.

### BOOKS RECOMMENDED:

- **Database System Concept:** A. Silberschatz, H.F. Korth and S. Sudarshan, TMH
- **Fundamentals of Database Systems:** Elmasri & Nawathe, Pearson Education
- **An Introduction to Database Systems:** C. J. Date, AWL Publishing Company
- **SQL, PL/SQL:** Ivan Bayross, BPB Publication
- **An Introduction to database systems:** Bipin Desai, Galgotia Publication.
- **Database Management System:** A. K. Majumdar & P. Bhattacharya, TMH

# Mathematical Foundations of Computer Science

## MSc(IT)103

Max Marks : 100

Min Marks : 40

### UNIT – I: Mathematical Logic, Sets Relations and functions

**Mathematical Logic:** Notations, Algebra of Propositions & Propositional functions, logical connectives, Truth values & Truth table Tautologies & Contradictions, Normal Forms, Predicate Calculus, Quantifiers. **Set Theory:** Sets, Subsets, Power sets, Complement, Union and Intersection, De-Morgan's law Cardinality. **Relations:** Cartesian Products, relational Matrices, properties of relations. **Equivalence relation functions:** Injection, Surjection, Bijection, Composition, of Functions, Permutations, Cardinality, the characteristic functions recursive definitions, finite induction.

### UNIT – II: Lattices & Boolean Algebra

**Lattices:** Lattices as Algebraic System, Sub lattices, some special Lattices (Complement, Distributive, Modular). **Boolean algebra:** Axiomatic definitions of Boolean algebra as algebraic structures with two Operations, Switching Circuits.

### UNIT – III: Groups Fields & Ring

**Groups:** Groups, axioms, permutation groups, subgroups, co-sets, normal subgroups, free subgroups, grammars, language. **Fields & Rings:** Definition, Structure, Minimal Polynomials, Irreducible Polynomials, Polynomial roots & its Applications.

### UNIT – IV: Graphs

**Graphs:** Simple Graph, Multigraph & Psuedograph, Degree of a Vertex, Types of Graphs, Sub Graphs and Isomorphic Graphs, Operations of Graphs, Path, Cycles and Connectivity, Euler and Hamilton Graph, Shortest Path Problems BFS(Breadth First Search), Dijkstra's Algorithm, Representation of Graphs, Planar Graphs, Applications of Graph Theory.

### UNIT – V: Trees

**Trees:** Trees, Properties of trees, pendant vertices in a tree, center of tree, Spanning tree, Binary tree, Tree Traversal, Applications of trees in computer science.

### BOOKS RECOMMENDED:

- **A text book of Discrete Mathematics:** *Swapan Kumar Sarkar*. S.Chand & company Ltd.
- **Discrete Mathematical structure with applications to computer science:** *J.P Trembly & R. Manohar*. TMH
- **Discrete Mathematics:** *K.A Ross and C.R.B Wriht*.
- **Discrete Mathematics Structures for computer science:** *Bernard Kohman & Robert C. Bushy*.
- **Discrete Mathematics:** *Seymour Lipschutz Mare Lipson*. TMH Edition.



# Computer System Architecture

## MSc(IT)104

Max Marks : 100

Min Marks : 40

### UNIT – I Representation of Information and H/w component

Number system (decimal, BCD, octal, hexadecimal) and conversions,  $r$  and  $r-1$ 's complement, Fixed and Floating point representation, Binary codes: Excess-3, ASCII, EBCDIC, Error detection codes. Boolean Algebra, Map simplification K-Map, Logic Gates, **Combinational Circuit:** Half and Full Adder, Decoder and Multiplexer; **Sequential Circuit:** Flip-Flop (SR, D, JK, Master-Slave,T), 4 bit Register, Register with parallel load, Shift register, Binary ripple Counter, Binary synchronous counter.

### UNIT – II Register transfer language and micro operations

Register Transfer Language (RTL), Concepts of bus, Bus and Memory transfers, **Micro-operation:** Arithmetic, Logic and Shift micro operation, Instruction code, Computer registers, Computer instructions, Timing and control, Instruction Cycle and Interrupt Cycle, Memory reference instructions, Input-output and interrupt, Design of basic computer

### UNIT – III Programming Computers and CPU

Machine Language, Assembly Language, Assembler, Program Loops, Input /Output, Programming, General register organization, Stack organization, Instruction format, Addressing modes, Data transfer and manipulation language, Micro-programmed and Hardwired control, RISC Vs. CISC, **Pipelining in CPU design:** , Parallel Processing ,Arithmetic and RISC pipelining.

### UNIT – IV Computer Arithmetic and I/O Techniques

Addition, Subtraction, Division and Multiplication Algorithm, Input-Output Interface, asynchronous data transfer; **Modes of transfer:** Programmed I/O, Interrupt Mechanism, Direct Memory Access (DMA), I/O Processor.

### UNIT – V Memory Organization

**Memory hierarchy:** Static and Dynamic RAM, ROM; Building large memory using chips, Associative Memory: associative mapping, Direct mapping, set associative mapping; Cache Memory Organization, Virtual Memory.

### BOOKS RECOMMENDED:

- **Computer System Architecture**, *Morris Mano*, PHI, 3rd Edition)
- **Computer Organization and Architecture**, *William Stalling*, PHI
- **Computer organization and Architecture**, *J.P.Hayes*, TMH.
- **Digital Computer Logic Design**, *Morris Mano* ,PHI
- **Computer System Architecture and organization**, *Dr. M. Usha, and T. S. Shrikant*, Wiley publication.
- **Digital Computer Electronics**, *Malvino*.
- **Structured Computer Organization**, *Andrew S. Tanenbanm*, PHI
- **Modern Digital Electronics**, *R.P.Jain*, TMH
- **Fundamental of microprocessors**, *B. Ram*

# Internet and Web Technology

## MSc(IT)105

Max Marks : 100

Min Marks : 40

### UNIT – I

**Introduction to Computer and Hardware:** Introduction of Information Technology, History of Computers, Organization of computers, Number Systems, Programming language and types, Public domain software, Applications of Information Technology in business, industry, entertainment, science, engineering and medicine.

### UNIT – II

**Internet and its Application:** Evolution of internet, Internet applications, TCP/IP, Addressing in Internet (IP), Domains, Internet service providers, Connectivity such as dial up, leased line, VSAT. E-mail protocols (X-400, SMTP, UUCP), Description of E-Mail headers, Email routing, e-mail client, POP-3, IMAP- 4.

### UNIT – III

**FTP and Telnet:** Introduction to File Transfer Protocol (FTP), Types of FTP servers (including anonymous), Telnet protocol, Telnet client, Terminal emulation. Usenet and Internet relay chat, Web publishing tool, Website planning, Website Hosting , Multiple sites on one server, Maintaining a web site, WWW servers, HTTP & URLs, Registration of website on search engines , maintenance of website.

### UNIT – IV

**Dynamic HTML and Web Designing:** HTML Basic concepts, Web designing issue, Structure of HTML documents, HTML Elements: Core attributes, Language attributes, Core Events, Block Level Events, Text Level Events, Linking Basics, Linking in HTML, Images and Anchors, Anchor Attributes, Image Maps, Semantic Linking Meta Information, Image Preliminaries, Image Download issues, Images as Buttons, Introduction to Layout: Backgrounds, Colors and Text, Fonts, Layout with Tables, Introduction to CSS.

### UNIT – V

**Internet Security:** Internet security vulnerability and threats, Firewalls, Introduction to AAA, Malwares.  
**E-Commerce:** Introduction, Concepts & technology, Advantages, Limitations, Various electronics payment system, Payment Gateways, Introduction to EDI.

### BOOKS RECOMMENDED:

- **Computers Today**, *S.K.Basadra*, Galgotia Publication..
- **Internet for Every One**, *Alexis Leon and Mathews Leon*, Tech World.2008 print.
- **Introduction to Computers**, *P.K.Sinha*, BPB Publication.
- **Fundamentals of Computers**, V. Rajaraman, Prentice Hall of India.
- **HTML Complete Reference**, *Thomas A. Powell*, TMH
- **Frontiers of Electronics of Commerce** , *Ravi kalakota & Andrew B. Whinston*, Addison Wesley

**SCHEME OF TEACHING AND EXAMINATIONS 2020-2021**  
**MASTER OF SCIENCE IN INFORMATION TECHNOLOGY**

**SECOND SEMESTER**

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+((T+P) / 2)	Examination Marks							
		L	T	P		Max. Marks				Min. Marks			
						Th	Ses	Pr	Total	Th	Ses	Pr	Total
MSc(IT)201	.NET Technology	3	2	-	4	100	25	-	125	40	15	-	55
MSc(IT)202	Data Structures	3	2	-	4	100	25	-	125	40	15	-	55
MSc(IT)203	Computer Networks & Data Communication	3	2	-	4	100	25		125	40	15	-	55
MSc(IT)204	Operating System (with Linux as case Study)	3	2	-	4	100	25	-	125	40	15	-	55
MSc(IT)205	AI & Expert Systems	3	2	-	4	100	25	-	125	40	15	-	55
MSc(IT)206	Programming Lab – Based on 201	-	-	3x2	3	-	50	100	150	-	30	50	80
MSc(IT)207	Programming Practice - Based on 202	-	-	2	1	-	50	50	100	-	30	25	55
MSc(IT)208	Common Software - Based on 203/204	-	-	2	1	-	50	50	100	-	30	25	55
MSc(IT)209	Personality Development / Group Discussion	-	-	2	1	-	25	-	25	-	15	-	15
	<b>TOTAL</b>	15	10	12	26	500	300	200	<b>1000</b>	200	180	100	<b>480</b>

## **.NET Technology MSc(IT)201**

**Max Marks : 100**

**Min Marks : 40**

### **UNIT – I: Inside the .NET framework:**

Overview of .net framework, Managed Execution process, CLR, common language specification, JIT Compilation , MSIL, Namespaces, Assemblies, metadata, Common Type System, cross language, interoperability, Garbage collection.

### **UNIT – II: Programming with .NET Framework**

**Windows form:** working with Visual Studio IDE, creating a .NET solution, MDI application, components and controls, Data types, variables, Type conversions, Operators, Control **Structures:** conditional statements, loops, arrays, types of methods, method data, Introduction to exception handling-exception statements.

### **UNIT – III: XML, Windows process and File Handling**

Types, structures, Enumerations, classes, Interfaces, Working with files-Files and directories, streams, Readers and writers, Reading and writing XML files, XML serialization, processing Transaction, Monitoring and Managing Windows Process, retrieving information about process.

### **UNIT – IV: Building .NET Framework Applications**

Introduction to ASP .NET, Differentiate classic ASP and ASP .NET, Web application, Web forms, Form validations – Client side, Server side, controls in web forms, Events in Web form.

### **UNIT – V: Advanced concepts and Database Programming**

Delegates, ADO .NET Architecture, .NET data provider, dataset components, creating database applications using Window forms and web forms (Database connectivity through ADO .NET), Introduction to web services, web services for Mobile application, Remote overview.

### **BOOKS RECOMMENDED:**

- **MSDN online – by Microsoft**
- **Visual Basic .NET Complete -** BPB Publications, New Delhi.
- **The Complete Reference VB .NET,** *Jeffery R. Shapiro*, Tata McGraw Hill.
- **Professional VB .NET 2003,** *Bill Evjen & others*, Wiley India (P) Ltd.



# Data Structures

## MSc(IT)202

**Max Marks: 100**

**Min Marks : 40**

### **UNIT – I Array and Linked Lists**

Introduction to data structure, Primitive data structure, Introduction to Algorithm analysis for time and space requirement, Rate of growth and Order notation, Basic time and space analysis of an algorithm. Linear Array, Representations of Array in Memory, Traversing, Insertion and Deletion in Linear Array, Multidimensional Array. Linked list, Representation of linked lists in memory, Traversing a linked list, Searching a linked list, Memory Allocation, Insertion into a linked List, Deletion from a Linked List, Header Linked List, Two- Way Linked Lists, Circular Linked List.

### **UNIT – II Stack and Queues**

Stacks Definition, concepts, operation and application of Stacks, Recursion and Polish notations, Quick sort, tower of Hanoi, Queue, Priority Queue: definition concepts, operation and application of Queue, circular queue and Dequeue. Linked representation of stack and queue.

### **UNIT – III Trees and Its Representation:**

Terminologies related to trees, Binary Tree, complete binary tree, almost complete binary tree; Tree Traversals- preorder, in order and post order traversals, their recursive and non-recursive implementations, Expression tree-evaluation, Linked representations of binary tree, operations. header nodes; threads, **Binary Search Tree:** searching, Inserting and deleting in BST, Heap; Path Lengths; Huffman's Algorithms. Basic idea of AVL Tree.

### **UNIT – IV Graphs:**

Related definitions; Graph representations- adjacency matrix, adjacency list, adjacency multi-list; Traversal schemes - depth first search, breadth first search; Minimum spanning tree; Shortest path algorithm; Kruskal and Dijkstra's algorithms.

### **UNIT – V Searching, Hashing and Sorting:**

Searching : Linear Search, Binary Search, Searching and data modification Hashing- Basics, methods, collision, resolution of collision, chaining; Internal Sorting, External sorting - Bubble Sort, Insertion Sort, Selection Sort, Merge sort, Radix sort, heap sort.

### **BOOKS RECOMMENDED:**

- **Fundamental of Data Structures**, *Horowitz and Sahani*, Galgotia Publishers.
- **Data Structures and Program Design in C**, *Kruse R.L*, PHI.
- **Data Structures using C and C++**, *Tanenbaum*, PHI.
- **Data Structures**, Schaum Series.
- **Data Structures**, *Bhagat Singh*.
- **Data Structures - Trembley and Sorenson**.

# Computer Networks & Data Communication

## MSc(IT)203

Max Marks : 100

Min Marks : 40

### UNIT – I

**Introduction to Computer Networking:** The Concept of Networking, Data Communication, Required network elements, The role of Standards Organization. Line Configuration, Various Topologies, Transmission Mode, Categories of Networks- LAN, MAN, WAN. The benefits of a Computer Networks. **The OSI and TCP/IP Reference Model:** The Concept of Layered Architecture, Design Issues for the Layers. Interfaces and services, Detailed Functions of the Layers. Comparison between OSI and TCP/IP Reference model.

### UNIT – II

**Transmission of Digital Data:** Shannon's and Nyquist theorems for maximum data rate of a channel. Transmission media- Co-axial, UTP, Fiber optic and wireless. Analog and digital data Transmission- parallel and serial transmission. DTE-DCE interface using RS-232C. Study of modems- 56k and Cable Modem. Modem standards. **Multiplexing and Switching:** The Concept of Multiplexing- FDM, TDM, WDM. The Concept of Switching- Circuiting, Message switching, Packet switching.

### UNIT – III

**Data Link Layer and Routing Algorithms:** Line Discipline, Flow Control- stop and wait, sliding window, Go back N, Error Control- ARQ stop and wait, sliding window ARQ. HDLC, SLIP, PPP. Multiple access protocols- ALOHA, Slotted ALOHA, CSMA/CD. IEEE standards for LAN's and MAN's. The IP protocol, and its header. IP address classes and subnet mask. **The concept of ICMP, ARP, RARP, RSVP, CIDR and Ipv6:** Routing algorithms- shorted path first, Distance Vector, Link State. Congestion Control-The leaky bucket and Token bucket Algorithms.

### UNIT – IV

**Transport Layer:** The Concept of client and Server in terms of Socket addressing in Transport layer. Two way and three-way handshaking. TCP header. Network Performance Issues. The Concept of Domain Name System, Various Resource Records. Architecture and services of E-mail (RFC-822 and MIME). The Concept of World Wide Web- server side and client side. **ATM:** The concept of ATM, ATM Adoption layers- AAL1, AAL2, AAL3/4, AAL5, Comparison of AAL protocols. Cell formats for UNI and NNI. Service Categories, Quality of service, Congestion Control in ATM.

### UNIT – V

**Comparative study of Networking Technologies:** X.25, Frame Relay, ATM, SONET, SMDS, ISDN. **Network Security:** The Importance of Security in Networking. Traditional Cryptography, Data Encryption Standards, RSA algorithm.

### BOOKS RECOMMENDED:

- **Computer Networks** - A S Tanenbaum
- **Data Communication and Networking** - B A Forouzan

# Operating Systems (with Linux as case study)

MSc(IT)204

Max Marks : 100

Min Marks : 40

## UNIT – I: Introduction

Defining operating system, History and Evolution of operating system, **Basic Concepts:** batch processing, spooling, multiprogramming, multiprocessor system, time sharing, real time systems, Functions and Goals of operating system, Operating system as resource manager, Operating system as an abstract machine.

## UNIT – II: Processor Management

Process concept, Process Control Block, **Process State:** State Transition Diagram, **Scheduling Queues:** Queuing Diagram, Types of schedulers-context switching and dispatcher, various types of CPU scheduling algorithms and their evaluation, multilevel queues and multilevel feedback queues, Thread life cycle, multithreading,

## UNIT – III: IPC and Dead Locks

**Inter Process Communication:** competing and co-operating processes, Introduction to concurrent processing, Precedence graphs, Critical section problem, Semaphore concept, Study of classical process synchronization problems: Producer–Consumer, Dining Philosophers. **Deadlocks:** The dead lock problem, dead lock definition, **Deadlock Characterization:** necessary condition, resource allocation graph, **Deadlocks handling:** Deadlock prevention, Deadlock avoidance, Banker’s algorithm, Deadlock detection, Recovery from Deadlock.

## UNIT – IV: Memory Management

Preliminaries of memory management, Contiguous memory allocation, partitioned allocation MFT, fragmentation, MVT, partition allocation policies, compaction, Non-Contiguous memory allocation, Paging, Structure of page table, Segmentation, **Virtual Memory:** Concepts, demand paging, Swapping, **Page replacement policies:** FIFO, Optimal, LRU, MRU, Thrashing. **Secondary Storage:** Hierarchy, physical characteristics, evaluation of disk access time and data transfer rate, **Scheduling algorithms:** FCFS, SCAN etc.

## UNIT – V: File and Device Management

**File concept:** file types, file directory maintenance, file sharing, basic file system structure, access methods-sequential and direct access, free space management contiguous, linked allocation and indexed allocation and their performances. **Protection and Security:** principle of protection, domain structure, access matrix, access control, the security problems. **Distributed systems:** Introduction & Features, Types of distributed OS.

## BOOKS RECOMMENDED:

- **Operating System Concepts**, Abraham Silberschatz, Peter B. Galvin and Greg Gagne (Wiley India Edition)
- **Modern Operating System**, Andrew .S. Tanenbaum, (PHI)
- **Operating System Concepts**, James L. Peterson and Abraham Silberschatz (Addison-Wesley)
- **Operating System Concepts & Design**, Milan Milenkovic (MGH)
- **An Introduction to Operating Systems**, Harvey M. Dietel(Addison Wesley)

# Artificial Intelligence & Expert Systems

## MSc(IT)205

Max Marks : 100

Min Marks : 40

### UNIT – I

**Introduction to AI:** Foundations of AI, Philosophy and History; AI problems, AI technique; The Turing Test. **Intelligent Agents:** Agents and Environments, the Concept of Rationality, the Nature of Environments and the Structure of Agents. **Problem solving & State Space Search:** General problem solving: defining problems as State Space Search, Problem Characteristics; Production Systems & their characteristics.

### UNIT – II

**Exhaustive Searches:** Generate and Test, Breadth First Search, Depth First Search and DFID  
**Heuristic Search Techniques:** Branch and Bound technique; Best first search; A\* algorithm; Problem Reduction AND/OR Graphs and AO\* algorithm. **Local Searches & Optimizations:** Hill climbing and its variants. **Constraint Satisfaction Problems:** Definition; Constraint Propagation and Backtracking. **Game Playing:** Mini-Max Search Procedure; Alpha-Beta Cutoffs; Additional Refinements.

### UNIT – III

**Knowledge Representation:** Types of Knowledge; Knowledge Representation Issues; **Logic:** First order Predicate Logic; Representation of facts in FOL; Inference in FOL; Resolution Principle, Clausal Form and Unification; **Inference Mechanisms:** Forward and Backward Chaining; **Slot and Filler Structures:** Semantic Networks; Frame Systems and value inheritance; Conceptual Dependency; Scripts;

### UNIT – IV

**Reasoning under Uncertainty:** Non-monotonic Reasoning, Probabilistic Reasoning and Uncertainty; Probability Theory; Bayes Theorem and Bayesian networks; Certainty Factor; Dempster-Shafer Theory. **Planning:** Overview; The Blocks World; Component of a Planning System: Goal Stack Planning; Nonlinear Planning; **Natural Language Processing:** Introduction, Overview of Linguistics, Grammars and Languages: context sensitive and context free grammar; Chomsky Hierarchy, Parsing techniques: Recursive Transition Nets, Augmented Transition Nets, Semantic Analysis: Case, Logic and Semantic grammars;

### UNIT – V

**Expert Systems:** Introduction, Characteristics, History and Applications of expert systems; Expert System Shells; Rule Based Systems Architectures, Non Production System Architectures; Knowledge Acquisition and Validation; Case Studies: MYCIN & DENDRAL. **Learning:** Rote learning; Learning by Taking Advice; Induction; Explanation based learning; Discovery; Analogy.

### BOOKS RECOMMENDED:

- **Artificial Intelligence**, Rich E., Knight K. and Nair S. B., McGraw Hill Education
- **Artificial Intelligence: A Modern Approach**, Russell S. J. and Norvig P., Pearson Education
- **Introduction to Artificial Intelligence and Expert Systems**, Patterson D. W., PHI
- **Principles Of Artificial Intelligence**, Nilson N. J., Narosa Publications
- **Artificial Intelligence**, Winston P. H., Pearson Education



**SCHEME OF TEACHING AND EXAMINATIONS 2020-2021**  
**MASTER OF SCIENCE IN INFORMATION TECHNOLOGY**

**THIRD SEMESTER**

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+ ((T+P) /2)	Examination Marks							
		L	T	P		Max. Marks				Min. Marks			
						Th	Ses	Pr	Total	Th	Ses	Pr	Total
MSc(IT) 301	Java Programming Language	3	2	-	4	100	25	-	125	40	15	-	55
MSc(IT) 302	Python Programming Language	3	2	-	4	100	25	-	125	40	15	-	55
MSc(IT) 303	Software Engineering	3	2	-	4	100	25	-	125	40	15	-	55
MSc(IT) 304	<b>Electives :</b> 1. Advanced Computer Architecture 2. Data Mining & Warehousing 3. Cloud Computing 4. Digital Image Processing	3	2	-	4	100	25	-	125	40	15	-	55
MSc(IT) 305	<b>Electives :</b> 1. Mobile Communication 2. Theory of Computations 3. Internet of Things 4. Analysis and Design of Algorithms	3	2	-	4	100	25	-	125	40	15	-	55
MSc(IT) 306	Programming Lab - Based on 301	-	-	3x2	3	-	50	100	150	-	30	50	80
MSc(IT) 307	Programming Practice - Based on 302	-	-	2	1	-	50	50	100	-	30	25	55
MSc(IT) 308	Common Software/Mini-Project	-	-	2	1	-	50	50	100	-	30	25	55
MSc(IT) 309	Managerial Skills / Seminar	-	-	2	1	-	25	-	25	-	15	-	15
	<b>TOTAL</b>	15	10	12	26	500	300	200	<b>1000</b>	200	180	100	<b>480</b>

# Java Programming Language

## MSc(IT)301

Max Marks : 100

Min Marks : 40

### UNIT – I: Introduction to Java Programming

**An overview of Java:** Object Oriented Programming, Features of Java, Java Virtual Machine, Java Environment: Java Development Kit, Java Standard Library, Data Types, **Variables:** Declaring a variable, Dynamic Initialization, The scope and life time of variable, Type conversion and Casting: Narrowing and Widening Conversions, Numeric Promotions, Type Conversion Contexts; **Operators:** Arithmetic Operators, Relational Operators, Logical Operators, Bit wise Operators, Conditional Operators, new operator, [ ] and instance of operator. **Control Statements:** Java's Selection statement, Iteration Statement, Jump Statement. **Arrays:** Declaring Array variables, constructing an Array, Initializing an Array, Multidimensional Arrays, Anonymous Arrays.

### UNIT – II: Classes and Interface

**Introducing Classes:** Class Fundamentals, Declaring Object, Assigning Object Reference Variables, Defining **Methods:** method overloading and overriding, Using objects as parameter, Constructors, Garbage collection, finalize () method. **Inheritance:** Inheritance basic, method overloading, object reference this and super, Chaining constructor using this () and super (), Member accessibility modifier: public, protected, default accessibility of member, private protected, private, **Package:** Define package, CLASSPATH, importing package, **Interface:** Define an interface, implementing interface, extending interface, variable in interface, **Overview of Nested Class:** Top level nested class and interface, Non static inner class, Local class, Anonymous class.

### UNIT – III: Exception handling and Multithreading

**Exception Handling:** Exception types, Uncaught Exception, Using try and catch, multiple catch, nested try block, throw, throws, and finally. **Multithreading:** Creating Thread, Thread Priority, Synchronization, Thread Scheduler, Running & Yielding, Sleeping & Waking Up, Waiting & Notifying, Suspending & Resuming; miscellaneous methods in thread class.

### UNIT – IV: Fundamental Library Classes of Java and Input / Output

Object class, String class, String Buffer class, Wrapper class, Math class, Collection: Collection interface, List interface, Set interface sorted interface, Array List class, Linked List class, Tree Set, Comparator, Vector, Stack. **I/O Classes and Interfaces:** File, Buffer Stream, Character Stream, and Random Access for files, Object Sterilization.

### UNIT – V: Events, GUI and JDBC

**Event Handling:** Overview of Event Handling, Event Hierarchy, The Delegation Event Model, Event Classes, KeyEventClass, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Event Adapters. **GUI Programming:** Introduction to Swing, History, Features, Components and Containers, Swing Packages, Painting, Swing Component Classes; **JDBC:** Introduction to JDBC, JDBC Drivers Type, Connection, JDBC URLs, Driver Manager, Statement – Creating, Executing, Closing, Result Set – Data Types and Conversions. Prepared Statement, Callable Statement, Mapping SQL and Java Types.

### BOOKS RECOMMENDED:

1. **Java: The Complete Reference**, *Herbert Schildt*, Oracle Press.
2. **Core Java: Volume-I & Volume 2**, *Cay S. Horstmann & Gary Cornell*, PEARSON
3. **Programming with Java**, *E. Balagurusamy*, McGraw Hill Education
4. **Core Java**, *R. Nageshwara Rao*, Dreamtech Press

# Python Programming Language

## MSc(IT)302

Max Marks : 100

Min Marks : 40

### UNIT – I

**Introduction to Python Programming:** What is a Program, Formal and Natural Languages, Why use Python, Uses of python, Strengths & Drawbacks, The Python Interpreter, Running Python, The IDLE User Interface, The Interactive Prompt, Script Mode, Dynamic Typing , Debugging. **Types, Operators, Expressions & Statements:** Values and Types, Assignment Statement, Variable Names, Expressions & Statements, Order of Operations, String Operations, Comments.

### UNIT – II

**Conditionals:** Boolean Expressions, Logical operators, Conditional & Alternative Execution, Chained and Nested Conditions. **Iterations:** Reassignment, Updating Variables, The “for” and “while” statements, break. **Strings:** String is a sequence, len, Traversal with a for loop, String Slices, Searching, Looping and Counting, String Methods, the “in” operator, String Comparison.

### UNIT – III

**Lists:** List is a Sequence, Traversing and other Operations, List Slices, List Methods, Map Filter and Reduce, Deleting Elements, Lists and Strings, Objects and Values, Aliasing, List Arguments. **Dictionaries:** A Mapping and as a Collection of Counters, Looping and Dictionaries, Reverse Lookup, Dictionaries and Lists, Memos, Global Variables. **Tuples:** Tuple Assignments, Tuples as Return Values, Variable Length Argument Tuples, Lists and Tuples, Dictionaries and Tuples, Sequence of Sequences.

### UNIT – IV

**Functions:** Function Calls, Math Functions, Composition, Adding New Functions, Definitions & Uses, Flow of Execution, Parameters and Arguments, Why Functions, Stack Diagrams, Void and Fruitful Functions, Return Values, Incremental Development, Composition, Boolean Functions, Checking Types. **Recursion:** Stack Diagram for Recursive Functions, Infinite Recursion, Taking Input from Keyboard, More Recursion.

### UNIT – V

**Files:** Files & Persistence, Reading and Writing, Format Operator, Filenames and Paths. **Miscellaneous Topics:** Catching Exceptions, Databases, Pickling, Pipes, Modules. **Object-Oriented Programming:** Programmer defined Types, Attributes, Instances as Return Values, Classes and Functions, Classes and Methods, Inheritance and Polymorphism.

### BOOKS RECOMMENDED:

1. **Learning Python** 5<sup>th</sup> Edition, *Mark Lutz*, O'Reilly Publications
2. **Core Python Programming**, *R. Nageshwara Rao*, Dreamtech Publications
3. **Think Python** 2<sup>nd</sup> Edition, *Allen B. Downey*, O'Reilly Publications
4. **Beginning Python: Using Python 2.6 and Python 3.1**, *James Payne*, Wiley
5. **Python Essentials Reference**, 4<sup>th</sup> Edition, *David M. Beazley*, Addison – Wesley
6. **Practical Programming: An Introduction to Computer Science Using Python 3**, *Paul Gries et al.*, Pragmatic Programmers
7. **Python Complete Reference**, Tata McGraw Hill

# Software Engineering

## MSc(IT)303

**Max Marks : 100**

**Min Marks : 40**

### **UNIT – I: Software Engineering Fundamentals:**

Introduction to Software Engineering; Software Engineering Principles(Layers); Software Process – Process Framework, Umbrella Activities, Process Adaptation; Software Crisis; Process Models-Waterfall Model, Prototype Model, Incremental Model, Spiral Model, RAD Model; Agile Process.

### **UNIT – II: Software Analysis and Design:**

Requirement Engineering; Analysis Model-Data Flow Diagram, Data Dictionary, E-R Diagram, Decision Table; Software Requirements Specification(SRS), Structure of SRS; Pseudo code; Software Design; Design Process; Design Concepts-Abstraction, Partitioning, Modularity, Information Hiding, Refinement, Refactoring; Function Oriented Design; Object Oriented Design; Cohesion and Coupling.

### **UNIT – III: Software Quality and Case Tools:**

Software Metrics, Categories of Metrics, Function Point Metric; Software Quality; McCall's Quality Factors; Software Maturity Model-CMM,CMMI; Software Quality Assurance; ISO Standards-9000, 9001 and 9126; Software Reliability; Case Tools and its Scope; Case Objectives; Architecture of Case Tools; Case Classification.

### **UNIT – IV: Coding and Testing:**

Programming Style; Structured Programming; Coding Standard; Internal Documentation; Software Testing-Verification and Validation; Alpha and Beta Testing; Levels of Testing-Unit, Integration and System Testing; Testing Techniques- White Box, Black Box; Cyclomatic Complexity; Test Plan; Debugging-Debugging Process, Debugging Strategies(Approaches).

### **UNIT – V: Software Maintenance and Project Management:**

Risk Management – Software Risk, Risk Identification; Introduction to Software Maintenance, Categories of Maintenance; Belady and Lehman Model; Boehm Model; Project Management Concept – People, Product, Process, Project; Software Team; Software Project Planning; Software Project Estimation; Cost Estimation Model(COCOMO, COCOMO II, Putnam-SLIM, Walston and Felix); Software Reengineering.

### **RECOMENDED BOOKS:**

1. **Software Engineering: A Practitioner's Approach**, Roger S. Pressman, TMH
2. **An Integrated approach to Software Engineering**, Pankaj Jalote, Narosa Publications
3. **Software Engineering**, Bharat Bhushan Agarwal.



# **Advanced Computer Architecture**

## **MSc(IT)304- Elective 1**

**Max Marks : 100**

**Min Marks : 40**

### **UNIT – I**

Introduction - Feng's and Flynn's classification scheme, Multiprocessor and Multicomputer, UMA, NUMA, COMA, NORMA, memory models, parallel computer and its type. Applications of Parallel Computers.

### **UNIT – II**

System Interconnect Architecture – Static and Dynamic, Hypercube Interconnection network, multistage interconnection networks-architecture and routing, design consideration, throughput delay, blocking and non-blocking properties. Performance Metrics and Benchmarks.

### **UNIT – III**

Principle of pipelining-overlapped parallelism, Linear and non-linear pipelining, reservation table, calculation of MAL. Types of Instruction Pipeline. Arithmetic pipeline designs example –Floating point adder, pipelined multiplier.

### **UNIT – IV**

Advanced processor Technology – RISC, CISC, VLIW architectures, Hazard detection and resolution, functional organization of instruction in IBM 360/91.

### **UNIT – V**

Exploring parallelism in program- multidimensional arrays. Parallel Algorithm-Matrix addition, subtraction, multiplication –block and SIMD. Bitonic sort, sorting on linear array processors. Bernstein's condition, ISO efficiency concept.

### **BOOKS RECOMMENDED:**

- 1 **Computer Architecture & Parallel Processing**, *Kai Hwang and F.A. Briggs*, McGraw Hill.
- 2 **Advanced Computer Architecture**, *Kai Hwang*, McGraw Hill.
- 3 **Parallel Computing**, *M.R. Bhujade*, New Age Publication.
- 4 **Parallel Computing Theory and Practice**, *Michael J. Quinn*, Tata McGraw Hill

## **Data Mining & Warehousing** **MSc(IT)304- Elective 2**

**Max Marks : 100**

**Min Marks : 40**

### **UNIT – I**

Introduction: KDD (Knowledge Discovery from Databases), Fundamentals of data mining, Data Mining Functionalities, Major issues in Data Mining, Data Warehouse and OLAP Technology, Multidimensional Data Model, Data Warehouse Architecture, OLAP operations, Warehouse schema.

### **UNIT – II**

Data Preprocessing & Data Mining Languages: Need of Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation, Data Mining Primitives, Data Mining Query Languages, Architectures of Data Mining Systems, Concepts Description: Characterization and Comparison, Analytical Characterization.

### **UNIT – III**

Association Rule Mining, Classification and Prediction: Association Rule Mining, Market Basket Analysis, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Apriori algorithm, FP-Tree growth algorithm, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation.

### **UNIT – IV**

Cluster Analysis: Types of Data in Cluster Analysis, Outlier Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods.

### **UNIT – V**

Mining Complex Types of Data: Web Mining, Text Mining, Multimedia Mining, Temporal and Spatial Data Mining, Trends in Data Mining, Data Mining Applications.

### **RECOMENDED BOOKS:**

1. **Data Mining: Concepts and Techniques**, *Jiawei Han and Micheline Kamber*
3. **Data Mining Techniques**, *Arun K Pujari*,
4. **Data Mining Introductory and Advanced Topics**, *Margaret H Dunham*, Pearson

# Cloud Computing

## MSc(IT)304- Elective 3

Max Marks : 100

Min Marks : 40

### Unit – I

**Introduction:** Cloud Computing: Vision, Definition, Reference Model, Characteristics, Benefits and Challenges, Historical Developments, Cloud Computing Environments, Cloud Platforms and Technologies; The Evolution of Cloud Computing: Parallel Computing vs. Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for Distributed Computing, Introduction of Grid Computing.

### Unit – II

**Virtualization:** Introduction, Characteristics, Taxonomy of Virtualization, Levels of Virtualization, Structure and Mechanism of Virtualization, Virtualization and Cloud Computing, Advantages and Disadvantages, Virtualization Technology Examples: Xen, VMware, Microsoft Hyper-V.

### Unit – III

**Cloud Computing Architecture:** Service Oriented Architecture, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Data Storage as a Service (DSaaS). Types of Clouds; Economics of the Cloud and Open Challenges; **Security and Organizational aspects:** Host Security and Data Security.

### Unit – IV

**Migration to the Cloud:** Adoption and use of Cloud by Businesses (Small and Enterprise), Pace of Adoption, Benefits and Phases of Adoption, Cloud Service Provider's Capabilities and Liabilities, Success factors and Issues. **Migrating Applications:** Key Aspects, Migration Techniques, Phases of Migration. **Service Level Agreement (SLA):** Aspects and Requirements, Availability and Outages, Credit Calculations, SLA Samples.

### Unit – V

**Industry Platforms:** Amazon Web Services, Google AppEngine, Microsoft Azure; **Cloud Applications:** Scientific Applications, Business and Consumer Applications; Advanced Topics: Energy Efficiency in Clouds, Market Based Management, Federated Clouds / InterCloud, Third Party Cloud Services.

### RECOMMENDED BOOKS:

1. **Mastering Cloud Computing**, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education
2. **Cloud Computing: Black Book**, Kailash Jayaswal et al., Kogent Learning Solutions, Dreamtech Press
3. **Cloud Computing: Principals and Paradigms**, Rajkumar Buyya et al., Wiley India
4. **Cloud Computing: Concepts, Technology & Architecture**, Erl, Pearson Education India
5. **Cloud Computing Bible**, Barrie Sosinsky, O'Reilly Media
6. **Cloud Computing: A Practical Approach**, Toby Velté, Anthony Vote and Robert Elsenpeter, McGraw Hill
7. **Cloud Application Architectures: Building Applications and Infrastructures in the Cloud**, George Reese, O'Reilly Media.
8. **Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance**, Tim Mathern Subra Kumaraswamy and Shahed Latif, O'Reilly Media.

# Digital Image Processing

## MSc(IT)304 - Elective 4

Max Marks : 100

Min Marks : 40

### Unit – I

**Introduction:** Digital Image Fundamentals Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sensing and acquisition Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

### Unit – II

**Image Enhancement Spatial Domain:** Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods, **Frequency Domain:** Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering

### Unit – III

**Image Restoration** A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.

### Unit – IV

**Image Compression:** Fundamentals, Image Compression Models, Error-Free Compression, Lossy Compression, Image Compression Standards. **Morphological Image Processing:** Dilation and Erosion, Opening and Closing, Hit-or-Miss Transformations, Some Morphological Algorithms.

### Unit – V

**Segmentation** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation. **Representation and Description:** Representation, Boundary Description and Regional Descriptor.

### RECOMMENDED BOOKS:

1. **Digital Image Processing**, *Rafel C Gonzalez and Richard E. Woods*, Pearson
2. **Fundamentals of DIP**, *A.K. Jain*, PHI.
3. **Digital Image Processing Using MATLAB**, *Gonzalez, Woods and Eddins*, *McGraw Hill Education*



# Mobile Communication

## MSc(IT)305 - Elective 1

Max Marks : 100

Min Marks : 40

### UNIT – I: Introduction.

Introduction to Mobile Communication, Short history of wireless communication, Applications, Vehicles, Emergency, Business, Replacement of wired network, Location dependent services, infotainment, Mobile and Wireless devices, A Simplified reference model, some open research topics in mobile communication.

### UNIT – II: Satellite Systems

History of satellite system, Applications of satellite systems, Type of satellite systems, characteristics of satellite systems, satellite system infrastructure, satellite system architecture, Global Positioning system (GPS), Limitations of GPS. Beneficiaries of GPS, Applications of GPS

### UNIT – III: Mobile Communication Systems

Introduction, Cellular System Infrastructure,, Registration, Handoff Parameters and Underlying support, Roaming Support Using System Backbone, to Mobile IP, Functions of Mobile IP, Mobile Node, Corresponding Node, Home Network, Foreign Network, Home Agent, Foreign Agent, Care-of Address, IP Packet Delivery, Agent Discovery, Agent Solicitation, Registration, Tunneling, Dynamic host configuration protocol.

### UNIT – IV: Wireless LANs and PANs

Introduction to IEEE 802.11, Ricochet, Ricochet Wireless Modem, Services Provided by Ricochet , Home RF, Home RF Technology, Hiper LAN, Blue tooth , Advantages and disadvantages of Wireless LAN, Infra red vs radio transmission , introduction to MAC. Technologies influence WLANs / WPANs in future.

### UNIT – V: Mobile Adhoc Network

Introduction to Mobile Adhoc Network(MANET), Characteristics of MANET, Applications of MANET, Routing, Need for Routing, Routing Classification, Table-Driven Routing Protocol – Destination Sequenced Distance Vector Routing Protocol, Cluster-Head Gateway Switch Routing, Wireless Routing Protocol. Source initiated On-demand Routing- Adhoc on Demand Distance Vector Routing, Dynamic Source Routing, Temporarily Ordered Routing Algorithms, Hybrid Protocol – Zone Routing Protocol.

### RECOMMENDED BOOKS:

1. **Mobile Communication:** *Jochen H. Schiller*, Pearson Education Publication
2. **Introduction to Wireless and Mobile Systems:** *D.P. Agrawal, Qing-An Zing*, Vikas Publishing House

# Theory of Computations

## MSc(IT)305- Elective 2

**Max Marks : 100**

**Min Marks : 40**

### **UNIT – I**

Alphabet, String and language, Finite state Machines, finite automata with  $\epsilon$ -moves, Conversion of N DFA to DFA, Removal of  $\epsilon$ -transition from N DFA, Two way finite automata, finite automata with output, Mealy & Moore machines, Applications of finite automata, minimization of finite automata.

### **UNIT – II**

Chomsky classification of Languages, Regular Expression and Language, Properties of Regular languages, Pumping lemma for regular sets, Closure properties of regular sets, Decision algorithms for Regular sets, Myhill-Nerode theorem.

### **UNIT – III**

Context free grammars and their properties, derivation tree, simplifying CFG, ambiguity in CFG, Chomsky Normal form, Greibach Normal form, Pumping lemma for CFL, Closure properties of CFL.

### **UNIT – IV**

Pushdown automata: Informal description, Definition, Determinism and Non determinism in PDA, Equivalence of PDA's and CFL's. Two way PDA, Concept of Linear Bounded Automata, context sensitive grammars and their equivalence, Turning machine construction, determinism and non-determinism in TM, Multi tape, multi-track TM.

### **UNIT – V**

Decidability, Universal turning machine and decidable problem, recursive function theory, Recursively enumerable sets, recursive sets, partial recursive sets, Church's hypothesis, post correspondence problem, Russell's paradox.

### **RECOMMENDED BOOKS:**

1. **Theory of Computer Science, Automata Languages & computation**, *K.L.P. Mishra, N. Chandrashekhara*, PHI.
2. **Introduction to Automata Theory Language and Computation**, *John E. Hopcraft and Jeffery D. Ullman*, Narosa.
3. **Introduction to Formal Languages, Automata Theory and Computation**, *Kamala Krithivasan and Rama. R.*, Pearson.
4. **Theory of Computation**, *Lewish Papadimitra*, PHI
5. **Introduction to Automata Theory Languages and Computation**, *John E. Hopcraft, Jeffery, D. Ullman and Rajeev Motwani*.
6. **Introduction to languages and theory of computation**, *Matin, J.C*, McGraw-Hill
7. **Theory of Computation**, *Rajesh .K. Shukla*, Cenage Learning

# Internet of Things

## MSc(IT)305 - Elective 3

Max Marks : 100

Min Marks : 40

### Unit – I OVERVIEW:

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

### Unit – II REFERENCE ARCHITECTURE:

**IoT Architecture** – State of the Art – Introduction, State of the art, Reference Model and architecture, **IoT reference Model** – IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints** – Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

### Unit – III IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS:

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

### Unit – IV TRANSPORT & SESSION LAYER PROTOCOLS:

**Transport Layer** Transmission Control Protocol (TCP), Multipath Transmission Control Protocol (MPTCP), User Datagram Protocol (UDP), Datagram Congestion Control Protocol (DCCP) , Stream Control Transmission Protocol (SCTP), Transport Layer Security (TLS), Datagram Transport Layer Security (DTLS))  
**Session Layer-** Hyper Text Transfer Protocol (HTTP), Constrained Application Protocol (CoAP), Extensible Messaging and Presence Protocol (XMPP), Advanced Message Queuing Protocol (AMQP), Message Queue Telemetry Transport (MQTT)

### Unit – V SERVICE LAYER PROTOCOLS & SECURITY:

**Service Layer** – oneM2M, European Telecommunications Standards Institute (ETSI) M2M (Machine-to-Machine), OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, Routing Protocol for Low-Power and Lossy Networks (RPL), Application Layer

### RECOMMENDED BOOKS:

1. **From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence**, Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, Academic Press, 2014
2. **Learning Internet of Things**, Peter Waher, PACKT publishing
3. **Architecting the Internet of Things**, Bernd Scholz-Reiter, Florian Michahelles, Springer
4. **Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications**, Daniel Minoli, Willy Publications
5. **Internet of Things (A Hands-onApproach)**, Vijay Madisetti and ArshdeepBahga, VPT, 2014.

# Analysis and Design of Algorithms

## MSc(IT)305 - Elective 4

**Max Marks : 100**

**Min Marks : 40**

### **UNIT – I INTRODUCTION & ANALYSIS:**

Analyzing algorithms, Algorithm types, Recurrence Equations, Growth function: Asymptotic notation, Standard notation & common functions, Recurrence relation, different methods of solution of recurrence equations with examples.

### **UNIT – II DYNAMIC PROGRAMMING & GREEDY PARADIGM:**

The basic dynamic programming paradigm, Dynamic programming solution to the optimal matrix chain multiplication and the longest common subsequence problems, Top down recursive algorithms, Greedy Paradigm: The basic greedy strategy & computing minimum spanning trees, Algorithms of Kruskal and Prim, Union to Find Algorithm & their applications, Disjoint Set, The relationship in Dijkstra's and Prim's algorithms, Use of greedy strategy in algorithms for the Knapsack problem and Huffman trees.

### **UNIT – III DIVIDE AND CONQUER & BACKTRACKING PARADIGM:**

Introduction to Divide and Conquer paradigm, Quick and merge sorting techniques, Linear time selection algorithm, the basic divide and conquer algorithm for matrix multiplication, Backtracking & Recursive backtracking, Applications of backtracking paradigm. heaps, Representation of heaps, Red Black tree, Binary Search tree , heap sort, shell & bucket sort, Amortized Analysis.

### **UNIT – IV GRAPH ALGORITHMS & STRING MATCHING ALGORITHMS:**

Representational issues in graphs, Depth first search & Breath first search on graphs, Computation of biconnected components and strongly connected components using DFS, Topological sorting of nodes of an acyclic graph & applications, Shortest Path Algorithms on Graphs: Bellman-Ford algorithm, Dijkstra's algorithm & Analysis of Dijkstra's algorithm using heaps, Floyd-Warshall's all pairs shortest path algorithm and its refinement for computing the transitive closure of a graph.

### **UNIT – V NP-COMPLETE PROBLEMS:**

Solvable problems, Types of problems, The notion of a non-deterministic algorithm and its basic relationship to backtracking. Polynomial time non deterministic algorithms for problems like satisfiability, clique problem, Hamiltonian path problems, The definition of NP-hardness and NP-completeness, The notion of polynomial transformation and reductions, Reductions to show that the clique problem, vertex cover, subset sum and Hamiltonian cycle problems are NP-complete.

### **RECOMENDED BOOKS:**

1. **Introduction to Algorithms**; *Cormen, Leiserson, Rivest, Stein*; PHI.
2. **Fundamentals of Algorithms**, Horowitz and Sahni; Galgotia.
3. **The Design & Analysis of Computer Algorithms**, *Hopcroft – Aho – Ullman*, AWL.
4. **Handbook of Algorithms & Data Structures**, *G.H.Gonnet*, AWL.
5. **Introduction to Design & Analysis of Algorithms**, *Levitin*, PE-LPE.



**SCHEME OF TEACHING AND EXAMINATIONS 2020-2021**  
**MASTER OF SCIENCE IN INFORMATION TECHNOLOGY**  
**FOURTH SEMESTER**

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+ ((T+P) / 2)	Examination Marks							
		L	T	P		Max. Marks				Min. Marks			
						Th	Ses	Pr	Total	Th	Ses	Pr	Total
MSc(IT) 401	Cyber Security	3	2	-	4	100	50	-	150	40	30	-	70
MSc(IT) 402	Soft Computing	3	2	-	4	100	50	-	150	40	30	-	70
MSc(IT) 403	Big Data Analytics	3	2	-	4	100	50	-	150	40	30	-	70
MSc(IT) 404	Project Based Seminar	-	-	1x2	1	-	50	-	50	-	30	-	30
MSc(IT) 405	Major Project	-	-	5x2	5	-	100	200	300	-	60	100	160
<b>Total</b>					<b>18</b>	<b>300</b>	<b>300</b>	<b>200</b>	<b>800</b>	<b>120</b>	<b>180</b>	<b>100</b>	<b>400</b>

**Note:**

- Major Project may be a Research Project also.
- Participating in Workshops, Conferences and Seminars or publishing Research Papers will be given weightage in the research project.

# Cyber Security

## MSc(IT)401

Max Marks : 100

Min Marks : 40

### UNIT – I: INTRODUCTION

Computer Security Concepts, The Challenges of Computer Security, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, A model for network Security, **Symmetric Encryption**  
**Principal:** Cryptography, Crypt analysis, Feistel Cipher Structure, DES, Random and Pseudorandom Numbers, Symmetric Block Modes of Operation (ECB, CBC, CFB, CTR).

### UNIT – II PUBLIC KEY CRYPTOGRAPHY

Approaches to Message Authentication, **Hash Functions:** Hash Functions Requirement, Security of Hash Functions, The SHA Secure Hash Function, **Public Key Cryptography:** Public –Key Encryption Structure, Applications for Public Key Cryptosystem, RSA, Attacks on RSA, OAEP.

### UNIT – III MESSAGE INTEGRITY AND MESSAGE AUTHENTICATION

**Message Integrity:** Document and Finger Printing, Message and Message Digest, Cryptographic Hash Function Criteria Random Oracle Model, Birthday Problems and Summary of solutions, **Message Authentication:** Modification Detection Code, Message Authentication Code, Introduction of HMAC & CMAC, **Digital Signature:** Comparison, Process, Services, Attacks on Digital Signature.

### UNIT – IV MALICIOUS SOFTWARE

**Intruders:** Intruder Behavior Patterns, Intrusion Techniques, Intrusion Detection by Audit Records, Statistical Intrusion Detection, Distributed Intrusion Detection, Honeypots. Types of Malicious Software, Nature of Viruses, Virus Classification, Antivirus Approaches, Worms and its Propagation model, DDoS Attack.

### UNIT – V FIREWALL & SECURITY TOOLS

**Firewall:** Need & Characteristics of Firewall, Types of Firewall, Firewall Basing, Firewall Location and Configuration, Introduction to Kali Linux ,Tools Available in Kali Linux and Its Usage. WireShark Packet Analyzer and Its Features. Cyber Security Policy, Domain of Cyber Security Policies.

### RECOMMENDED BOOKS:

1. **Network Security Essentials**, *William Stallings*, PEARSON
2. **Cryptography and Network Security**, *William Stallings*, PHI.
3. **Cryptography and Network Security**, *Atul Kahate*, Tata McGraw Hill
4. **Cryptography and Network Security**, *B.A. FOROUZAN*, TMH
5. **Cyber Security policy Guidebook**, *Jennifer Jason Paul, Marcus Jeffery Joseph*. Wiley Publication, 2012.
6. **Network Security: The Complete Reference**, *Robertra Bragg*, Tata McGraw Hill.
7. **Cyber Security Essentials**, *James Graham, Richard Ryan*, CRC press

# Soft Computing

## MSc(IT)402

Max Marks : 100

Min Marks : 40

### UNIT – I: Introduction to Fuzzy Logic System

Fuzzy Sets Operation Of Fuzzy Sets, Properties Of Fuzzy Sets, Fuzzy Relations, Fuzzy Arithmetic, Membership Functions, Fuzzy To Crisp Conversion. Fuzzy Logic, Fuzzy Rule Based Systems, Fuzzy Decision Making, Fuzzy Database, Fuzzy Intelligent System.

### UNIT – II: Introduction to Artificial Neural Networks

Introduction to Artificial Neural Network, Artificial Neuron, Classification of Artificial Neural Network, Architecture of a Artificial Neural Network, Activation Function, Training an Artificial Neural Network, Application of Artificial Neural Network.

### UNIT – III: Perceptron and Associative Memories

Amari General Learning Rule, HEBB Learning Rule, ADLINE, Perceptron Layer Network, Associative memory: Auto associative Memory, Bi-directional memory, Back-propagation Network: Architecture, Training Algorithm Application of Back-propagation algorithm

### UNIT – IV: Evolutionary Computing

Introduction, overview of evolutionary computing, Genetic algorithms and optimization, The schema theorem: the fundamental theorem of genetic algorithms, Genetic algorithm operators, Integration of genetic algorithms with neural networks, Integration of genetic algorithms with fuzzy logic, Known issues in GAs.

### UNIT – V: Soft Computing Tools

Introduction to MATLAB, Features, Matrix Operations, Curve Plotting, Toolbox Introduction, Introduction to Simulink.

### RECOMMENDED BOOKS:

1. **Fuzzy systems and Fuzzy Logic**, *Klir and Uuna*, PHI Publications.
2. **Introduction to Artificial Neural Networks**, *S. N. Sivanandam and M. Paulraj*, Vikas publication.
3. **Soft Computing and Intelligent systems Design**, *Fakhreddine O. Karry and Clarence de Silva*
4. **Neural Network Design**, *Hagan & Demuth*, Vikas Pub. Comp.
5. **Fundamentals of Artificial Neural Networks**, *M.A.Hassaoun*.
6. **Fuzzy sets, uncertainty and information** *George J. Kir, & TA Folger*.
7. **Fuzzy sets, Decision making and Expert system**, *HJ Zimmerman*, Kluwer, Boston.
8. **Fuzzy set theory and its applications**, *H. J. Zimmerman*, Kluwer, Boston.

# Big Data Analytics

## MSc(IT)403

Max Marks : 100

Min Marks : 40

### UNIT – I: Introduction to Data Warehousing and OLAP Technology for Data Mining

What is Data Mining?, KDD(Knowledge Discovery from Databases) Process, What Kinds of Data Can Be Mined?, Data Mining Functionality, Are all the patterns interesting?, Attribute Types, What is Data Warehouse?, Data Warehouse Architecture, Data Cube: A multi-dimensional data model, Schemas for Multidimensional Data Models, OLAP Operations, Data Warehouse Usage(Applications). , Data Mining Primitive, Architecture of Data Mining System.

### UNIT – II: Introduction Concept of Big Data

Big Data- Define Data, Web Data, Classification of Data- Structured, Semi-Structured, and Unstructured. Big Data Definitions, Challenges of Conventional system, Why We Need Big Data, Difference between Big Data and Small Data, Importance of Big Data. Big Data Characteristics (4V's Volume, Velocity, Variety, and Veracity), Big Data Types, Big Data Handling Techniques. Complexity of Big Data, Big Data Processing Architectures, Big Data Technologies, Big Data Business Value. Big Data Analytics Application. Big Data Challenges and Future Scope.

### UNIT – III: INTRODUCTION TO HADOOP AND HADOOP ARCHITECTURE

**Big Data** – Apache Hadoop & Hadoop EcoSystem: Hadoop Core Component, Features of Hadoop, The Hadoop Distributed File System: HDFS data Storage, Hadoop Physical Organization, HDFS Commands, MapReduce Framework, MapReduce Programming Model, MapReduce Map task,Reduce Task and MapReduce Execution, Hadoop YARN, Hadoop2 Execution Model, Hadoop Ecosystem Tools, Hadoop Ecosystem.

### UNIT – IV: NoSQL Big Data Management, Mongo DB

**NoSQL:** What is it?, Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NoSQL DataStore, NoSQL Data Architecture pattern, NOSQL to Manage Big Data. **Data Base for the Modern Web:** Introduction to MongoDB, features of MongoDB, Data Types,Mongo DB Query Language and Database Command.

### UNIT – V: Hive and Pig:

**Pig:** Apache Pig, Application of Apache Pig, Feature, Pig Architecture, Pig- Grunt Shell, Installing Pig, Pig Latin Data Model, Pig Latin and Developing Pig Latin Scripts: Apache Pig Execution, Commands. **HIVE AND HIVEQL.** **Hive:** Introduction, Characteristics, limitation, Hive Architecture and Installation, Comparison with Traditional Database (RDBMS), Hive Datatype and File Formats, Hive Data Model, Hive Integration and Workflow Steps, Hive Built-in Functions, HiveQL.

### RECOMMENDED BOOKS:

1. **Big Data Analytics**, Raj Kamal and Preeti Saxena, McGraw Hill Education
2. **Big Data: Black Book**, DT Educational Services, Dreamtech Press
3. **Big Data Analytics**, Seema Acharya & Shubhashini Chellappan, Wiley India
4. **Big Data Analytics**, M. Vijayalakshmi & Radha Shankarmani, Wiley India



# Pt. Ravishankar Shukla University, Raipur

Course work for Ph.D. in Computer Science

Sr. No	Paper	Name of Papers
1.	Paper-I	Research Methodology, Communication System and Parallel Computing
2.	Paper-II	Review of Research Paper.

Research Methodology, Communication System and Parallel Computing

## Unit- I

**Research Methodology and Measurement**– Introduction, meaning, motivation, approaches, research proposal, research ethics, research problem, research design, sampling design. Measurement in research, sources of errors, error calculation and handling with examples. Uncertainty analysis, Hypothesis, Performance Metrics and evaluation with examples.

## Unit- II

**Communication System**- Wired and Unwired Networks, Modulation and Multiplexing, OSI and TCP/IP Models, Switches and Switching, ATM, Network Security. Protocols like Aloha, S-Aloha etc. Header Formats. Interconnection Networks.

## Unit- III

**Parallel Computing**- Types of Parallelism, Classification Schemes, Multiprocessor and Multicomputer, Memory Models and Organizations, Cache Coherence, Pipelining, MAL calculation, Hazard and Collision, Dependence Analysis, Data Flow and Vector Computers, DAG, Multi threading, Case Studies.

## Unit- IV

**Study and Implementation of Algorithms**- Complexity, Routing and Congestion Control algorithms, Parallel Algorithms for sorting, matrix handling etc. Table Driven, Source Initiated on Demand and Hybrid Protocols, Code Optimization.

## Unit- V

**Modelling and Simulation**- Introduction to Modelling, Queuing Analysis, Mathematical Modelling of Communication System, Monte-Carlo Simulation Technique, Simulation of Communication System through C Language, Study of different Simulators. Environment setup and Trace File generation in Network Simulator.

### Recommended books –

1. System Simulation with Digital Computer by N.Deo, IIT Kanpur, PHI.
2. Computer Architecture & Parallel Processing by Kai Hwang and F.A. Briggs-Mc Graw Hill.
3. Research Methodology C.R. Kothari, New Age international Publishers
4. Advanced Computer Architecture By Kai Hwang –Mc Graw Hill.
5. Parallel Computing Theory and practice by Michael J. Quinn –Tata Mc-Graw Hill.
6. Computer Network by A.S. Tanenbaum, Pearson Education.
7. Data Communications and Networking by B.A. Forouzan, TMH.

**SYLLABUS FOR UNIVERSITY TEACHING DEPARTMENT AND  
AFFILIATED COLLEGES IN POST GRADUATE (PG) CLASSES**

**M.A. in Economics: Semester Examination 2020-21**

At post graduate level, candidates are required to study 15 papers in First, Second and Third semester (5 papers in each semester) and 04 papers in fourth semester examination. This is to be treated as the nineteen papers of the course structure. So there shall be 19 papers in the post graduate examination in Economics. Viva - voce examination be treated as a compulsory paper for M.A. fourth semester examination. Each paper shall carry 100 marks out of which 80 marks will be for theory paper and 20 marks for internal assessment. There shall be 2000 marks in M.A. in economics and students shall have secure 36 percent marks in aggregate of all papers in order to pass the M.A. Examination. Examination and result shall be treated according to rules and regulations of ordinance no. 13.

<b>M. A. I and II SEMESTER</b>						
<b>Paper</b>	<b>Semester-I</b>	<b>Marks</b>		<b>Semester-II</b>	<b>Marks</b>	
		<b>Theory</b>	<b>Internal</b>		<b>Theory</b>	<b>Internal</b>
<b>I</b>	Micro Economics-I	80	20	Micro Economics-II	80	20
<b>II</b>	Macro Economics-I	80	20	Macro Economics-II	80	20
<b>III</b>	Quantitative Methods	80	20	Research Methods & Computer Application	80	20
<b>IV</b>	Indian Economy	80	20	Indian Economic Policy	80	20
<b>V</b>	Industrial Economics	80	20	Labour Economics	80	20
<b>M. A. III and IV SEMESTER</b>						
<b>I</b>	Economics of Growth	80	20	Economics of Development & Planning	80	20
<b>II</b>	International Trade	80	20	International Economics	80	20
<b>III</b>	Public Finance	80	20	Public Economics	80	20
<b>IV</b>	Environmental Economics	80	20	Economics of Social Sector	80	20
<b>V</b>	Demography	80	20	Viva-voce	100	--

**SEMESTER – I**  
**Micro Economics -1**  
**Paper - I**

- Unit - I Introduction: - Concept of Equilibrium, Economic Models, Neo Classical Demand Analysis. Elasticity of Demand (Price, Income & Cross), Elasticity of supply.
- Unit - II Indifference curve, Marginal Rate of Substitution, Income & substitution effect, Hicks and Slutsky theorem, Revealed preference theory, Hicks's Revision of Demand, Hicksian Consumer surplus.
- Unit – III Theory of Production – Production function, the short period & long period production function, the law of variable proportion (Iso-quant approach) Marginal rate of Technical Substitutions, Returns to a factor and returns to scale. Expansion path, Cobb Douglas Production function, CES production function.
- Unit - IV Theory of cost and Revenue analysis, Perfect Competition- equilibrium of firm in Perfect Competition. Monopoly- short run and long run equilibriums, price discrimination under monopoly competition, monopoly control and regulation. Comparison between monopoly and perfect competition.
- Unit – V Monopolistic Competition– price and output determination under monopolistic competition, Group equilibrium, theory of excess capacity. Oligopoly, non- collusive oligopoly model: The kinked demand curve. The collusive oligopoly – Cartels: joint profit maximization or perfect cartels, price leadership: the low cost price leadership model.

**Text Books**

1. Jhingan M. L. (2014), Advanced Economic Theory, Vrinda Publication, New Delhi
2. Jhingan M. L. (2014), Micro Economics , Vrinda Publication, New Delhi
3. Agarwal , A (2014), Micro Economic analysis , Sahitya Bhawan Publication, New Delhi

**Reference Books**

1. Kraps, David M. (1990) a course in micro economics theory, Princeton university press, Princeton.
2. Kout sayiannis; A (1979) modern Microeconomics (2nd Edition), macmillan press,London.
3. Layard, PRG and P.W. Watters (1978), Micro economic theory, McGraw Hill, New York.
4. San A (1999) Micro economics theory and Applications, Oxford University Press, New Delhi;
5. Stigler, G. (1996) theory of Price (4th edition), Princeton Hall of India, New Delhi.
6. Varian, H (2000) Micro economics Analysis, W.W. Norton, New York.
7. Baumol W.J., (1982) Economic theory and operations Analysis, Princeton Hall of India, New Delhi.
8. Handersan, J.M. and R.E. Quandt (1980) Micro economics theory - A Mathematical approach, Mc Graw Hill New Delhi.
9. Hirshleifer, J. And A Glazer (1997), Price theory and Application, Prentise Hall of India, New Delhi.

**SEMESTER – I**  
**MACRO ECONOMICS-I**  
**Paper – II**

- Unit - I National Income and Accounts – Concept of National Income and National Product, Problems of Measurement, , Different forms of National Income Accounting – Social Accounting, Input Out-put Accounting, Flow of Funds, Balance of Payment – Accounting. Circular flow of Income – Two, Three and Four Sector Economy
- Unit - II Classical Theory of Employment, Say's Law of Market , Principle of Effective Demand, Keynesian & Pigou Theory of Employment, Comparison of Classical and Keynesian Models. National Income Determination of Keynesian Model - Two, Three and Four Sector Economy.
- Unit – III Consumption Function- Keynesian Psychological Law of Consumption, Short Run and Long Run Consumption Function. Theory of Consumption Function – Absolute Income Hypothesis, Duesanbery’s Relative Hypothesis, Life Cycle and Permanent Income Hypothesis.
- Unit - IV Investment Function,, Marginal Efficiency of Capital and Investment. Saving and Investment Equality, Multiplier and its working, Accelerator and its working, Super-Multiplier. Supply of Money, Determinants of Money Supply, Measurement of Money supply, Control of Money Supply. High Powered Money, Money Multiplier.
- Unit – V Demand for Money –Fisher and Cash Balance (Cambridge) Approach, Fundamental Equation of Keynes. Friedman, re-formulation of the quantity theory of money, Post Keynesian Approach to Demand for Money- Patinkin, Bamuls, James Tobin, Friedman, and Gurley & Shaw's Approaches.

**Text books**

1. Sethi, T.T. (2008) Macro Economics , Laxminarayan Agrawal , Agra.
2. Jhingan, M.L. (2010) Monetary Economics, vrinda publications pvt.ltd.
3. Jhingan, M.L. (2000) Macro Economic theory, vrinda publications pvt ltd.
4. Shinghai G.C & Mishra J.P. (2013) Macroeconomic Analysis, Sahitya bhawan publication Agra.

**Reference**

1. Blackhouse, R. and A. Salansi (Eds.) (2000), Macroeconomics and the Real World (2 vol.) Oxford University Press, London.
2. Branson, W.A. (1989), Macroeconomics Theory and Policy, (3<sup>rd</sup> Edition), Harper and Row, New York.
3. Aornbusch, R and F. Stanley (1997), Macroeconomics, McGraw Hill, inc., New York
4. Hall, R.E. and J.B. Taylor (1986), Macroeconomics, W.W>Norton, New York.
5. Heijdra, B.J. and V.P. Frederick (2001), Foundations of Modern Macroeconomics, Oxford University Press, New Delhi.
6. Jha, R. (1991), Contemporary Macroeconomic Theory and Policy, Wiley Eastern Ltd. New Delhi.
7. Romer, D.L. (1996), Advanced macroeconomics, McGraw Hill Company Ltd., New York.
8. Scarte, B.L. (1997), Cycles, Growth and inflation, McGraw Hill, New York.
9. Markeley, G. (1978), Macroeconomics Theory and Policy, macmillan, New York.



**SEMESTER- I**  
**QUANTITATIVE METHODS**  
**Paper – III**

- Unit - I Skewness – Symmetrical and asymmetrical distribution, Measurement of skewness – Karl Pearson's coefficient of skewness, Bowley coefficient of skewness, Test of skewness. Coefficient of correlation : Types and degree of correlation, Simple correlation - Measurement of correlation by the methods of Karl Pearson's coefficient of correlation and Spearman's rank correlation, Calculation of coefficient of correlation in a bivariate frequency distribution, Coefficient of correlation by the method of least square, Probable error and standard error in correlation, Coefficient of determination of correlation. Multiple correlation
- Unit - II Regression analysis – regression and correlation, types of regression, regression lines and correlation, Regression equations. Simple regression analysis, regression equation through least squares, Determination of correlation by regression coefficients, Multiple regression analysis (up to three variables only). Standard error of the estimates of simple and multiple regression analysis. Interpolation and extrapolation: Method of fitting a parabolic curve, Newton's advancing difference method, Direct binomial expansion method and Lagrange's method
- Unit – III Association of Attributes – Meaning, classification and types of association, difference between association and correlation, Consistency of data, Methods of determining association – Method of comparison of proportion, Coefficient of association using Yule's method. Probability: Meaning and definition, Possibility chart, Permutation and combination, Types of events, Measurement of probability– Addition and multiplication theorem, Conditional probability
- Unit - IV Index Number: Meaning and characteristics of Index number, Fisher's ideal index number, Reversibility Test – Time reversibility test & factor reversibility test. Time series Analysis – Components of time series, Measurement of long term trend- semi-average method, Moving average method and method of least squares.
- Unit – V Functions: Meaning and types of functions, Differentiation: Meaning and rules of differentiation, Integration: Meaning and rules of integration, Problems related to differentiation and integration, Auto correlation.

**Reference:**

1. Shukla, S.M. and S.P. Sahay – "Quantitative Methods", Sahitya Bhawan Publications, Agra.
2. Agrawal, D.R., "Quantitative methods". Vrinda Publications (P) Ltd, Delhi.
3. Sancheti, D.C., "Quantitative methods" Sultanchand and Sons, New Delhi.
4. Gupta, S.P. and others, "Quantitative Techniques" Sultanchand and Sons, New Delhi.
5. मेहता एवं मदनानी, 'अर्थशास्त्र में प्रारंभिक गणित', लक्ष्मीनारायण अग्रवाल, आगरा-3.
6. Gujarati, Damodar N, "Basic Econometrics", McGraw Hill Education Pvt. Ltd. , Chennai.

**SEMESTER- I**  
**INDIAN ECONOMY**  
**Paper –IV**

- Unit - I Indian Economy: Meaning, basic characteristics and major issues of development of Indian Economy, GDP and National Income of India – Components and Structure of GDP, Role of Primary, Secondary and Tertiary Sectors in GDP, National Income and Per Capita Income, Growth Rates of GDP and Per Capita Income
- Unit - II Demographic Features of India – Size, Growth Rate, Sex Ratio, Age-Composition, Literacy and Density of Population, Migration, Rural-Urban Migration, Urbanization and Civic Amenities, Occupational Structure, National Population Policy, Demographic Features of Chhattisgarh State
- Unit – III Agricultural Development in Indian Economy – Agricultural Growth and Productivity, Causes of Low Productivity and Measures to Increase it, Agricultural Marketing and Warehousing, Institutional Structure- Land Reforms in India, The Green Revolution, National Agricultural Policy and Food Security in India, Rural credit in India, NABARD and its role in rural credit
- Unit - IV Industrial Development in India, Industrial Policies of 1956 and 1991, Public Sector Enterprises and their Performance, Privatization and Disinvestment, Small Scale Sector and Minor Medium Enterprises, Unorganized Sector and Informalisation of the Indian Economy and Knowledge Economy
- Unit – V Infrastructure- Infrastructure and Economic Development, Energy, Power, Transportation- Road, Railway, Water and Civil Aviation in India, Private Investment in Infrastructure: Outlook and Prospect, Concept of Social Sector and Social Infrastructure, Education, Health and Family Welfare

**Reference:-**

1. Ahulwalia, I. J. and I. M. E. Litle (Eds.) 1999): India's Economic Reforms and Development (Essay honor of Manohar Singh), Oxford University Press, New Delhi
2. .Bardhan, P. K. (9<sup>th</sup> Edition) (1998): The Political Economy of Development India, Oxford University Press, New Delhi.
3. Bawa, R.S. and Raikhy (Ed.) (1997): Structural Change in Indian Economy, Guru Nanak Dev University Press. Amritsar (PB).
4. Brahmananda, P. R. and V. R. Panchmukhi (9<sup>th</sup> Eds.) (2001): Development Experience in the Indian Economy: Interstate Perspectives, Bookwell, Delhi.
5. Chakravarty, S. (1987): Development Planning: The Indian Experience, Oxford University Press, New Delhi.
6. Dantwala, M. L. (1996): Dilemmas of Growth: the Indian Experience, Sage Publication, New Delhi.

**SEMESTER- I**  
**INDUSTRIAL ECONOMICS**  
**Paper –V**

- Unit - I      Concept and Organization of a Firm-Ownership, Control and Objectives of the Firm. Rationale of Industrialization: - Agriculture and Industrialization – patterns, process, speed, Implications of Industrialization. Theories of Industrial location, Alfred Weber and Sergeant Florence Theory. Factors Affecting Industrial Localization.
- Unit - II      Industrial Productivity, Efficiency and Capacity. Industrial Policy in India, Role of Public and Private Sector industries in India. Recent Trends in Industrial Growth. Strategies for Industrial Growth, Regional Development of Industries.
- Unit – III    Owned, External and Other Components of Funds, Nature, Volume and Types of Institutional Finance – IDBI, IFCI, SFCs, SIDC, Commercial Bank.
- Unit - IV     Structure of Industrial Labour, Employment Dimensions of Indian Industry. Industrial Legislation, Industrial Relations, Exit policy and Social Security.
- Unit – V      Large Scale Industries:- Iron and Steel, Cement, Jute, Sugar, paper industries, Development of Small Scale and Cottage Industries in India.

**Text books**

1. Ahluwalia, I.J. (1985), Industrial Growth in India, Oxford University Press, New Delhi.
2. Barthwal, R.R. (1985) : Industrial Economics, Wiley Eastern Ltd., New Delhi.
3. Chernilam, F (1994) : Industrial Economics : Indian Perspective (3<sup>rd</sup> Edition), Himalaya Publishing House, Mumbai.
4. Desai, B. (1999), Industrial Economic in India (3<sup>rd</sup> Edition), Himalaya Publishing house Mumbai.
5. Kuchhal .S.C , the industrial economy of India , Chaitanya publishing house.

**Reference**

1. Divine, P.J. and R.M. Jones et. At. (1976) : An Introduction to industrial economics, George Allen and Unwin Ltd., London.
2. Government of India, Economic Survey (Annual)
3. Hay, D. and D.J. Morries (1979), Industrial Economics: Theory and Evidence, Oxford University Press, New Delhi.
4. Kuchhal, S.C. (1980) :Industrial Economy of India, Chaitanya Publishing House, Allahabad.
5. Reserve Bank of India Report on Currency and Finance (Annual).
6. Singh, A. and A. Sadhu (1988) : Industrial Economics, Himalaya Publishing House

**SEMESTER- II**  
**MICRO ECONOMICS-II**  
**Paper –I**

- Unit - I Sales maximization model: Baumol's model (price-output determination of a product without advertisement and optimal advertising outlay), Managerial theories of the firm: Williamson's model of managerial discretion, Marris theory of the firm. Theory of limit pricing: Bains model.
- Unit - II Theory of distribution: marginal productivity theory of distribution (Marshall– Hicks version), Product Exhaustion theorem. NEO-Classical Approach of Distribution: relative share of labor and capital, technological progress and factor shares in income, Determinants of rent, wages, interest and profit (Only modern Theory).
- Unit – III Linear programming & Game Theory - Linear programming Introduction, & meaning, Conditions and Generalization, Application to the theory of firm, Limitations of Linear Programming, Graphical & Mathematical Solution. Game Theory and Price Determination- Introduction, Two Person Zero Sum game, Non Constant sum game- Prisoner's Dilemma, Limitations of the Game Theory, importance of the Game Theory.
- Unit - IV Concept of Equilibrium: static and dynamic equilibrium, partial and general equilibrium, Excess Demand.
- Unit – V Welfare economics Walrasian– introduction, value judgment, classical welfare economics, Pigovian Welfare economics, Pareto optimal conditions. New welfare economics: compensation principle of Kaldor - Hicks. Social welfare function: Bergson – Samuelsons social welfare function, Arrow's impossibility theorem.

**Text Books**

1. Jhingan M. L. (2014), Advanced Economic Theory, Vrinda Publication, New Delhi
2. Jhingan M. L. (2014), Micro Economics, Vrinda Publication, New Delhi
3. Agarwal , A (2014), Micro Economic analysis, Sahitya Bhawan Publication, New Delhi

**Reference Books**

1. Mansfield, E. (1997), Microeconomics (9<sup>th</sup> Edition), W.W. Norton and Company, New York.
2. Ray, N.C. (1975), An Introduction to Microeconomics, Macmillan Company of India Ltd., Delhi.
3. Ryan, W.J.L. (1962), Price Theory, Macmillan and Co. Limited, London.
4. Samuelson, P.A. and W.D. Nordhaus (1998), Economics, Tata McGraw Hill, New Delhi.
5. Stonier, A.W. and D.C. Hague (1972), A Textbook of Economic Theory, ELBS and Longman Group, London.



**SEMESTER- II**  
**MACRO ECONOMICS-II**  
**Paper –II**

- Unit - I Theory of Inflation – Classical, Keynesian and Monetarist Approaches to Inflation, Semi And Full inflation, Theory of Structural Inflation, Stagflation, Control of Inflation. Philips Curve Analysis– Short Run and Long Run Philip’s Curve. The Natural Rate of Unemployment Hypothesis, Tobin’s Modified Philip Curve.
- Unit - II Business Cycles, Main Features of Business Cycles, Types of Business Cycle, measures to control business cycle. Theories of Business Cycles - Hawtrey’s Monetary Theory of Trade Cycle, Schumpeter’s, Keynes, Hicks, Samuelson’s, Friedman, Kaldor Model of Trade Cycle.
- Unit – III Monetary Policy-Meaning of Monetary Policy, Instrument of Monetary Policy, Objective of Monetary policy, Limitations of Monetary Policy, Monetary Policy and Economic Development. Fiscal Policy– Meaning of Fiscal Policy, Instruments of Fiscal Policy, Objectives of Fiscal Policy, Fiscal Policy and Economic Growth, Effectiveness of Fiscal Policy, Monetarism Vs Fiscalism– The Debate, Similarities between Monetary Policies and Fiscal Policies.
- Unit - IV IS-LM Model, The Product Market Equilibrium, The Money Market Equilibrium, Equilibrium of Product and Money Market, Merits and Demerits of IS-LM Curve, Extension of IS-LM Models With Flexible Prices and Labour Market.
- Unit – V Banking, meaning and function of commercial bank, Credit creation of Commercial bank, Organisation and Structure of Commercial banking ,Policies and Principles of Commercial bank ,Central banking, Function and Credit Control.

**Text books**

1. Sethi, T.T. (2009-10) Macro economics ,Laxminarayan Agrawal ,Agra.
2. Jhingan, M. L. (2008) Monetary Economics,vrinda publications pvt.ltd.
3. Jhingan, M. L. (2010) Macroeconomic theory,vrinda publications pvt ltd.
4. Singhai, G. C. & Mishra J. P. (2013) Macro Economic Analysis, Sahitya Bhawan Publication Agra.

**Reference**

1. Blackhouse, R. and A. Salansi (Eds.) (2000), Macroeconomics and the Real World (2 vols) Oxford University Press, London.
2. Branson, W.A. (1989), Macroeconomics Theory and Policy, (3<sup>rd</sup> Edition), Harper and Row, New York.
3. Aornbusch, R and F. Stanley (1997), Macroeconomics, McGraw Hill, inc., New York
4. Hall, R.E. and J.B. Taylor (1986), Macroeconomics, W.W>Norton, New York.
5. Heijdra, B.J. and V.P. Frederick (2001), Foundations of Modern Macroeconomics, Oxford University Press, New Delhi.
6. Jha, R. (1991), Contemporary Macroeconomic Theory and Policy, Wiley Eastern Ltd. New Delhi.
7. Romer, DL. (1996), Advanced macroeconomics, McGraw Hill Company Ltd., New York.
8. Scarte, B.L. (1997), Cycles, Growth and inflation, McGraw Hill, New York.
9. Markeley, G. (1978), Macroeconomics Theory and Policy, macmillan, New York.

**SEMESTER - II**  
**RESEARCH METHODOLOGY AND COMPUTER APPLICATION**  
**Paper –III**

- Unit - I      Research methodology and research methods, Research : meaning and motivational factors of research, Types of research: Census and sample research, qualitative and quantitative research, Descriptive and analytical research, Open and confidential research and Original and repetitive research. Main stages of statistical research, Primary and secondary data, Different methods of collecting primary data, secondary data -different sources, precautions while constructing questionnaire/schedule, Difference between schedule and questionnaire.
- Unit - II      Sampling- Meaning and need for sampling, size of sampling- What should be the size of sample, Slovin's Formula for determining the size of sample, Merits and limitations of sampling, Sampling and non- sampling errors, Sampling frame, how to judge the reliability of samples. Methods of sampling : different methods of Probability sampling and non-probability sampling.
- Unit – III    Hypothesis- Meaning types and characteristics of hypothesis, Basic concepts concerning testing of hypothesis, Procedure for test of significance. Test of significance of large samples: Test of significance in attributes- standard error of the number of successor, standard error and size of sample, standard error of the difference between proportion of two samples. Test of significance in variables: Standard error of the mean.
- Unit - IV      Test of significance of small samples: Test of significance based on t-distribution- Student's T- test, Paired T- test, F- ratio test and Fisher's Z test. Practical problems related to student's t test, Chi-square test, F ratio test, paired T test and Fisher's Z test. Test of significance of correlation coefficient.
- Unit – V      Computer- Meaning and important characteristics of a computer, History of computer, Different parts of a computer, Various types of computer, Elementary knowledge of INTERNET, Role of computer in economic research.

**Reference Books**

1. Kothari, C.R. "Research Methodology- Methods and Techniques", New Age International (P) Ltd. Publication, New Delhi.
2. Sharma, Dr. Ramnath, " Methods and Techniques of Social Survey and Research," A Rajhans Publication.
3. Bajpai, Dr. S.R., "Methods of Social Survey and Research," Kitab Ghar, Kanpur-3
4. मुखर्जी, रविन्द्रनाथ, सामाजिक शोध एवं सांख्यिकी, विवेक प्रकाशन, जवाहर नगर, दिल्ली – 7
5. शुक्ला एवं सहाय, सांख्यिकीय, साहित्य भवन पब्लिकेशंस, आगरा.

**SEMESTER- II**  
**INDIAN ECONOMIC POLICY**  
**Paper – IV**

- Unit - I Planning in India– Objectives and Strategies of Planning, Development Strategy, LPG Model of Development, NITI Ayog, PURA- a Neo Gandhian Approach to Development, Developing Grass-root Organization: Panchayats, NGO'S.
- Unit - II Problem of Poverty and Inequality – The Concept of Poverty, Measurement and Estimation of Poverty in India, International Comparison of Poverty and Inequality of Incomes, Poverty Eradication Programmes, Causes of Failure to Remove Poverty. Problem of Unemployment in India- Nature of Unemployment, Various Schemes to Reduce the Unemployment, Balanced Regional Development- Indicators, Causes, Changing Scenario and Policy Measures to remove Regional Disparity.
- Unit – III Indian Finance System – An overview, Functions of the Reserve Bank of India, Commercial Banking system, Progress of Banking since 1969, RRBs, DFIs and NBFCs, Financial Sector Reforms in India, Stock Exchange in India, Composition of Indian Capital Market, SEBI and Capital market reform.
- Unit - IV Foreign Trade of India- Importance of Foreign Trade for a developing Economy, Foreign Trade since 1991, Structure and Direction of Foreign Trade, Balance of Payments of India, Issues in Export Import Policies, External value of the Rupee and Foreign Exchange Reserves, FEMA, SEZs, Trade Reforms in India.
- Unit – V WTO and its Impact on the Different Sector of Economy, Economic Reforms – Rational of Internal and External Reforms, Cooperative movement in India- Organization, Structure and Development of different types of Cooperatives in India.

**Reference:-**

1. Ahulwalia, I. J. and I. M. E. Litle (Eds.) 1999): India's Economic Reforms and Development (Essay honor of Manohar Singh), Oxford University Press, New Delhi,.
2. Bardhan, P. K. (9<sup>th</sup> Edition) (1998): The Political Economy of Development India, Oxford University Press, New Delhi.
3. Bawa, R.S. and Raikhy (Ed.) (1997): Structural Change in Indian Economy, Guru Nanak Dev University Press. Amritsar (PB).
4. Brahmananda, P. R. and V. R. Panchmukhi (9<sup>th</sup> Eds.) (2001): Development Experience in the Indian Economy : Interstate Perspectives, Bookwell, Delhi.
5. Chakravarty, S. (1987): Development Planning: The Indian Experience, Oxford University Press, New Delhi.
6. Dantwala, M. L. (1996): Dilemmas of Growth: the Indian Experience, Sage Publication, New Delhi.

**SEMESTER- II**  
**LABOUR ECONOMICS**  
**Paper – V**

- Unit - I     Labour Economics - Definition, Nature, Scope & Importance, Labour Market – Nature and Characteristics of Labour Markets in India .Supply of Labour - Labour force, Factors affecting Law of Labour Supply. Demand for Labour – Labour productivity, Demand for Labour by Industrialist.
- Unit - II     Theories of labour market: - Classical Theory of labour, Marginal productivity theory of Labour Concept of wages – Real Wages , Nominal Wages, Factors Affecting Real wages , Theories of Wage Determination - Classical Theory, New Theory, The theory of Collective Bargaining.
- Unit – III    Theories of Labour Movement - Labour Unions in India, Rise and Growth of Labour Union, Achievements of Labour Unions. Structure and Pattern of Trade Union - Objectives, Growth, Achievements and Failures.
- Unit - IV     Labour Legislation in Indian Labour, Laws and Practices in Relation to International Labour Standards. State and Labour , State and Social Security of Labour, Concept of Social Security and its Evolution.
- Unit – V     Labour Welfare in India, Rural and Agricultural Labour in India, Child Labour, Female Labour, Concept of Industrial Peace, Settlement of Industrial Dispute, Second National Labour Commission.

**Text books**

1. Goyal, Sunil & Goyal, M. L. (2008): Labour Economics, R.B.S.A. Publications, Jaipur.
2. Saxena, R.C. (2010): Labour Problems & Social Welfare, K. Nath and Company Publication, Meerut.
3. Singh, Dilip Kumar, (2008): Workers Participation in Management and Industrial Relation, Rawat Publication, Jaipur & Delhi.
4. Singh, Usha & Singh, H. P. (2011): Child Labour in India : Problem and Solutions, Classical Publication, New Delhi
5. Gupta, P. K., Labour Economics, Vrinda publications, New Delhi.



**SEMESTER – III**  
**ECONOMICS OF GROWTH**  
**PAPER – I**

- Unit - I Economic Growth: Economic Growth and Development, Measurement of Economic Growth, Vicious Circle of poverty, Pre Condition of Economic Development, Factors of Economic Growth: Economic and Non Economic, Meaning and characteristics of an Underdeveloped Country, Obstacles of Economic Development.
- Unit - II Meaning and Characteristics of Modern Economic Growth, Structural Changes under Development, Human development Index, Gender Development index, Gender empowerment measure, UNDP - Human Development Report 2015, Multidimensional index.
- Unit – III Theories of Growth: Classical Theory .Adam Smith Theory of growth, The Ricardian Theory of growth, Mills theory of growth, Malthysian theory of development, Harrod - Domar model of growth.
- Unit - IV Meads Neo-Classical Model of growth, Solow Long- Run model growth, Approaches to Growth: -. Kaldor model of Growth, The Models of Technical Chang, Joan Robinson model of growth.
- Unit – V The Mahalanobis Four Sector Model. The Concept of Capital Output Ratio, Input-Output Analysis, Project Evaluation and its methods and Cost-Benefit Analysis, Economic Growth and Income Distribution: The Kuznets Hypothesis.

**Text Books**

1. Jhingan, M. L. (2008), 31<sup>st</sup> edition, The economics of development and planning, vrinda publication pvt.Ltd.
2. Shinghai, G. C. & Mishra J. P. (2013) Macroeconomic Analysis, Sahitya bhawan publication Agra.
3. Mishra, J. P. (2012) Economics of Growth and development, Sahitya bhawan publication, Agra.

**Reference Books**

1. Hajela P. D. (1998), Labour Restructuring in India : A Critique of the New Economic Policies, Common wealth Publishers, New Delhi.
2. Jhabvala, R. and R.K. Subrahmanya (Eds.) (2000). The Unorganized Sector : Work Security and Social Protection. Sage Publication, New Delhi.
3. Lester, R.A. (1964). Economics of Labour. (2<sup>nd</sup> Edition), Macmilan, New York.
4. Mc Connell, C.R. and S.L. Brue (1986). Contemporary Labour Economics, Mc Graw-Hill New York.
5. Papola, T.S.P.P. Ghosh and A.N. Sharma (Eds.) 1993, Labour, Employment and industrial Relations in India, B.R. Publishing Corporation New Delhi.
6. Rosenberh M.R. (1998), Labour Markets I Low Income Countries in Chenery, H.B. and T.N. Srinivasan, (Eds.) The Handbook of Development Economics, North-Holland, New York.
7. Venkata Ratnam, C.S. (2001), Globlization and Labour- Management Relations Dynamics of change, Sage publications/ Response Books, New Delhi.

**SEMESTER- III**  
**INTERNATIONAL TRADE**  
**Paper – II**

- Unit - I Theory of International Trade – Meaning and Distinguishing Features of Inter- regional and International Trade, The Comparative Cost Theory, Refinements of the Comparative Cost Theory, Opportunity Cost Theory, Theory of Reciprocal Demand.
- Unit - II Modern Theory of International Trade, Factor Price Equalization, Theorem of International Trade, Stolper Samuelson and Rybczynski Theorems. The Terms of Trade – Concepts, Determination of Terms of Trade, Factors Affecting Terms of Trade, Terms of Trade & Economic Development, Its Empirical Relevance and Policy Implications for Less Developed Countries, Terms of Trade & Welfare Implications.
- Unit - III The Theory of Intervention – Tariffs, Quotas, and Non-tariff Barriers, Economic Effects of Tariff and Quotas on National Income, Output, Consumption, Price, Employment, Terms of Trade & Income Distribution, The Stolper – Samuelson Theorem of Tariff on Income Distribution, The Learner's Paradox.
- Unit - IV Balance of Payments – Meaning and components, Equilibrium and Disequilibrium in the BoP, Measures to Correct the Adverse BoP, Adjustment Mechanisms of BoP, Devaluation- The J-curve effect, Marshall-Lerner's Conditions under Devaluation, Expenditure Reducing and Expenditure Switching Policies and Direct Control.
- Unit - V Income Adjustment- Foreign Trade Multiplier, Foreign Repercussion or Back-Wash Effect, Foreign Exchange Rate-Spot and Forward Exchanges Rates, Fixed and Flexible Exchange Rates, their Merits and Demerits, Hybrid Exchange Rate, Floating Rate of Exchange, Managed Floating System.

**Reference:-**

1. Bhagwati, J. (Ed). (1981): International Trade, Selected readings, Cambridge, University Press, Massachusetts.
2. Carbough, R.J. (1999), International Economics, International Thompson Publishing, New York.
3. Chacholiades, M. (1990), International Trade: Theory and Policy, McGraw Hill, Kogakusha, Japan.
4. Dana, D. S. (2000), International Economics: Study Guide and Work Book, (5<sup>th</sup> Edition), Routledge Publishers, London.
5. Dunn, R. M., and J. H. Mutti (2000), International Economics, Routledge, London.
6. Kenen, P.B. (1994), The International Economy, Cambridge University Press, London.
7. Kindleberger, C. P. (1973), International Economics and International Economic Policy A Ready, McGraw Hill International, Singapore.
8. Krugman, P. R. and M. Obstfeld (1994), International Economics: Theory and Policy, Glenview, Foresman.

**SEMESTER- III**  
**PUBLIC FINANCE**  
**Paper – III**

- Unit - I Definition, Nature and scope of Public Finance, Role of Public Finance in Developing Countries, Principles of Maximum Social Advantages. Taxation – features of good tax system, Objectives of Taxation, Principles of Taxation, canons of Taxation, Shifting, Effects and Incidence of Taxation. Impact of Tax under Laws of Returns and Perfect Competition.
- Unit - II Public Expenditure: - Meaning and Scope, Different Forms of Expenditure, Canons of Public expenditure, Structure and Growth of Public Expenditure in India. Trends in Central Government Expenditure. Economic Effects of Public Expenditure on Production and Distribution. Public Expenditure and Economic Growth.
- Unit – III Public Revenue: - Meaning, classification, sources, principles and effects of public revenue. Classification of taxation: - Indirect & Direct Tax, Goods and Service Tax (GST) New Direct tax, Central Excise, Custom Duties, Taxes on Land and Agriculture, Value Added Tax, Modvat, Service Tax, Taxable Capacity.
- Unit - IV Public Debt – Meaning and Objectives of public debt, Different Sources of Public Debt, Redemption of Public Debt. Principle of Public Debt Management, Growth of Public Debt in India, Burden of Public Debt.
- Unit – V Budget – Meaning, Objectives , Different forms of Budget, Budgetary Process in India, Kinds of Budget – traditional Budget, Performance Budget, Zero Based Budget, Outcome Budget, Gender Budget. Budget Theory – Classical Viewpoint (Balance Budget), Modern View Point (Imbalanced Budget.)

**Text Book**

1. Lekhi, R.K.,(2014), Public Finance, Kalyani Publication Ludhiana New Delhi
2. S.K., Singh, (2013) Principal of Public Finance Sahitya Bhavan Publication, Agra.
3. Pant, K.C., (2012) Public Finance
4. Sinha, V.C.,(2013) Public Finance and Economic, Sahitya Bhavan Publication.

**Reference Books**

1. Atkinson, A.B. and J.E. Siglitz (1980), Lectures on Public Economics, Tata McGraw Hill, New York.
2. Government of India (1992), Reports of the Tax Reforms Committee – Interim and Final (Chairman: Raja J. Chelliah).
3. Chelliah, Raja J. et. Al (1981), Trends and issues in India’s Federal Finance, NIPFP. New Delhi.
4. Peacock, A. and G.K. Shaw (1976), The Economic Theory of Fiscal Policy, George Alen and Unwin, London.
5. Sahni, B.S. (Ed.) (1972), Public Expenditure Analysis: Selected Readings, Rotherdam University Press.
6. Musgrave, R.A. and P.B. Musgrave (1976), Public Finance in Theory and Practice, McGraw Hill, Kogakusha, Tokyo.
7. 14th Finance commission Report-2015
8. Central Govt. and Stat Govt. Budget.

**SEMESTER- III**  
**ENVIRONMENTAL ECONOMICS**  
**Paper – IV**

- Unit - I The Economics of Environment - Environmental Micro Economics and Macro Economics, The Circular Flow Model. Theory of Resources Environment and Economic Development - Economic Growth and The Environment, Future of Economic Growth and The Environment. Criterion of Social Welfare- Bentham Criteria, Pareto Optimality Criteria, Kaldor-Hicks Compensation Criterion.
- Unit - II Economic Theory of Environmental Issues - The Theory of Environmental Externalities, Accounting for Environmental Cost, Internalizing Environmental Cost, Positive Externalities. Welfare Analysis of Externalities - Property Rights and The Environment. Common Property Resources and Public Goods - Common Property, Open Excess and Property Rights, Market Failure and Public Goods, Social choice of optimum pollution, Pigovian Taxes and subsidies, Maximization of Social Welfare Under Perfect Competition.
- Unit – III Population, Agriculture and The Environment - Population and the Environment- Demographic Transition and Environment, Population Growth and Economic Growth, Population Policy for the 21st Century, Agriculture, Food and Environment, Sustainable Agriculture for the Future, Environment and Neo-Classical Modal of Natural Resources, Energy and Resources.
- Unit - IV Ecological Economics, National Income and Environmental Accounting - Ecological Economics Basic Concept, Natural Capital and Accounting for Changes in Natural Capital, Macro Economic Scale, Model of Economic and Ecological System. National Income and Accounting - Natural Capital, System of Environment and Economic Accounts (SEEA).
- Unit – V Environmental Value and Methods - Use Value, Option Value and Non Use Value, Cost Benefit Analysis, Methods of environmental valuation- Hedonic Pricing. Household Production Function, Travel Cost Method, Averting Behavior Approach, Contingent Valuation Method, International Carbon Tax. Environment and W.T.O.

**Reference**

1. Madhu Raj – Environmental Economics.
2. Steve Baker – Environmental Economics.
3. D.W. Pearce – Environmental Economics.
4. Bauriol, W.J. and W.E. Oates. (1988): The Theory of Environmental Policy, (2nd Edition), Cambridge University Press, Cambridge.
5. Thomas and Callan (2009): Environmental Economics.
6. Charles D. Kolasted (2005): Environmental Economics, Oxford University Press.
7. Brian Roach, Jonathan M. Harries and Anne Marie codur (2015): Microeconomics and the environment, Global Development and Environment Institute, Tufts University, Medford.
8. Jonathan M. Harries and Anne-Marie codur (2004): Macroeconomics and the environment, Global Development and Environment Institute, Tufts University, Medford.

**SEMESTER- III**  
**DEMOGRAPHY**  
**Paper – V**

- Unit - I Demography – Meaning and Importance, Theories of Population – Theory of Optimum Population and Theory of Demographic Transition. Measures of Population Change and Distribution – Rate of Population Change and Distribution, Measures of Degree of Concentration of Population – Lorenz Curve and Gini Concentration Ratio.
- Unit - II Migration – Kinds and Factor Affecting of Migration, Hurdles of Migration, Measurement of Internal Migration, Migration Rates and Ratio. Urbanization- Factors Influencing Urbanization and Effects of Urbanization, Population and Economic Development. Human Resource Development in India.
- Unit – III Mortality – Meaning and Sources of Mortality Data, Causes of High Death Rate in India, Trends in Death Rate in India, Measurement of Mortality Based on Death Statistics, Crude Death, Specific Death Rate, Infant Mortality Rate and Standardized Death Rate, Child Mortality Rate, Maternal Mortality Rate, Life Table – Functions and Construction of Life Table. Problems Related to Death Rates and Life Table.
- Unit - IV Fertility– Meaning, Causes of High Birth Rate in India, Trends in Birth Rate in India, Measurement of Fertility and Reproduction – Crude Birth Rate, General Fertility Rate, Age-Specific Fertility Rate, Total Fertility Rate. Gross Reproduction Rate and Net Reproduction Rate. Problems Related to Fertility and Reproduction Rates.
- Unit – V Women Empowerment - Economic Status, Women in Decision Making, Women and Labour Market; Women Work Participation: Concept and Analysis of Women’s Work Participation, Structure or Wages across Regions and Economic Sector’s, Determinants of wage Differentials, Gender and Education.

**Text Books**

1. Agrawal, S. N. „India's population Problems, Tata Mc-Graw Hill co. Bombay.
2. Bogue, D. J. Principles of Demography, Honwiley, New York.
3. Sinha, V. C. and Pushpa Sinha, Principles of Demography, Mayur Paper backs.
4. Mishra, Jai Prakash, Demography, Sahitya Bhawan Publications, Agra.
5. Pathak, K. B. and F. Ram, „Techniques of Demographic Analysis“, Himalaya Publishing House.
6. Jhingan, M. L. and others, „Demography, Vrinda Publications (P) Ltd.
7. Srinivasan, K., Basic Demographic Techniques and Applications, Sage Publication.

**Reference Books**

1. Census India SRS Bulletins, Registrar General of India, Govt. of India, 2011
2. Rural-Urban distribution *Census of India: Census Data 2001: India at a glance >> Rural-Urban Distribution*. Office of the Registrar General and Census Commissioner, India. Retrieved on 2008-11-26.
3. Number of Villages *Census of India: Number of Villages* Office of the Registrar General and Census Commissioner, India. Retrieved on 2008-11-26.



4. Urban Agglomerations and Towns *Census of India: Urban Agglomerations and Towns*. Office of the Registrar General and Census Commissioner, India. Retrieved on 2008-11-26.
5. Preston, S.H. (1976). Family Sizes of Children and Family Sizes of Women. *Demography* 13(1): 105-114.
6. Pritchett, L.H. (1994). Desired Fertility and the Impact of Population Policies. *Population and Development Review* 20(1): 1-55.

**SEMESTER - IV**  
**ECONOMICS OF DEVELOPMENT AND PLANNING**  
**Paper – I**

- Unit - I      Achievement and failures of Indian Plans, Resource Mobilization in Indian Plans, Strategy of Indian Plan. Saving, Capital Formation and Overall Growth Rate, Twelfth Five Year Plan (2012-17) Achievement of Eleventh Five Year Plan, NITI Aayog.
- Unit - II      Theories of Development: - The Marxian Model, The Schumpeterian Model, Keynesian Theory of Development, Rostow's Stages of Economic Growth. Marx Stages of Growth, Disguised unemployment as saving potential.
- Unit – III    Approaches to Development- Arther Lewis Model of Unlimited Supply of Labour, Ranis & Fie Model, Leibenstein's Critical Minimum Effort thesis , The Big push theory, Nelson's theory of low level of equilibrium.
- Unit - IV    Development Models: - Theory of Balanced Growth, External Economics, Industrialization and Balanced Growth ,The concept of Unbalanced Growth, Dualistic Theory , The Limits to Growth Model, Myrdal's Theory of Circular Causation.
- Unit – V    Investment Criteria in Economic Development; The social Marginal Productivity Criteria, The capital Turnover Criteria, The Re-investment Criterion, Time Series Criterion, the Choice of Techniques, The Harris –Todaro model of Migration and Unemployment.

**Text books**

1. Jhingan, M.L. (2003), *The Economics of development and planning*, Vrinda publication pvt. Ltd.
2. Shinghai, G.C. & Mishra, J.P. (2013) *Macro Economic Analysis*, Sahitya bhawan publication Agra.
3. Mishra, J.P. (2012) *Economics of Growth and Development*, Sahitya bhawan publication Agra.

**Reference Books**

1. Todaro, M.P. (1996) (6<sup>th</sup> edition) *Economic Development*, Longman London.
2. Solow, R.M. (2000), *Growth Theory An Exposition*, Oxford University Press, Oxford.

3. United Nations, Human development Department report 2005.
4. Behrman, S. and T.N. Shrinivasan (1995), Hand book of Development Economics, Vol 1, 2 & 3, Elsevier; Amsterdam.
5. Ghatak,s (1986), An introduction to development Economics, Allen & elnein, London.
6. Sen, A.K. (Ed.) 1990 growth Economics, Penguin, Harmondsworth.
7. Dasgupta, P.A.K. Sen and S. Marglin (1972), Guidelines for project Evaluation, UNIDO, Vienna,
8. Mehrotra, S. and J. Richard (1998), Development with a Human Face, Oxford University Press New Delhi.

**SEMESTER- IV**  
**INTERNATIONAL ECONOMICS**  
**Paper – II**

- Unit - I Foreign Trade and Economic Development, The Theory of Regional Blocks- Customs Union, Static and Dynamic Effects of a Customs Union and Free Trade Area, Rational of Economic Progress of SAARC, ASEAN, IBSA and BRICS.
- Unit - II Regionalism of European Union, The Euro-Dollar Market, NIEO,WTO- Functions of WTO, Multilateralism and WTO, TRIPS, TRIMS, Agriculture, Market- Access, Textile Clothing, Patent Rights, Ministerial Conferences of WTO, UNCTAD.
- Unit – III Theory of Short Term & Long Term Capital Movement and International Trade– Port Folio Investment and International trade, FDI and International Trade, Merits & Demerits of Long Term Capital Movement in International Trade, Factors Affecting International Capital Movement, The Transfer Problem, Optimum Currency Area, Global Financial Crises.
- Unit - IV International Monetary System, International Liquidity, IMF, World Bank, The World Bank Group, ADB, Foreign Capital in India.
- Unit – V International Organisations- G-20, G-15, BIMSTEC, OPEC, NAFTA, OECD, Working and Regulations of MNCs in India.

**Reference:-**

1. Bhagwati, J. (Ed). (1981): International Trade, Selected Readings, Cambridge, University press, Massachusetts.
2. Carbough, R. J. (1999), International Economics, International Thompson Publishing, New York.
3. Chacholiades, M. (1990), International Trade: Theory and Policy, McGraw Hill, Kogakusha, Japan.
4. Dana, M.S. (2000), International Economics: Study Guide and Work Book, (5<sup>th</sup> Edition), Routledge Publishers, London.
5. Dunn, R. M. And J. H. Mutti (2000), International Economics, Routledge, London.
6. Kenen, P. B. (1994), The International Economy, Cambridge University Press, London.
7. Kindleberger, C. P. (1973), International Economics and International Economic Policy A Reader, McGraw Hill International, Singapore.
8. Krugman, P. R. and M. Obstfeld (1994), International Economics: Theory and Policy, Glenview, Foresman.

**SEMESTER- IV**  
**PUBLIC ECONOMICS**  
**Paper – III**

- Unit - I     Role of Public Finance in Economic Development, Major Fiscal Function, Concept of Social Goods. Fiscal Federalism in India, Principles of Fiscal Federalism, Vertical and Horizontal Imbalances.
- Unit - II     Federal Finance – Principle of Federal Finance in India, Centre – State Financial Relation, Resource Transfer From Centre to States, Godgil's Formula. Fourteen Finance Commission.
- Unit – III    Indian Tax System: - Salient Features, Merits, Demerits, Measures for improvement of Indian Tax system Government measures for improvement: - Taxation enquiry Commission (1953-54), Wanchoo committee, Jha Committee, Kelkar Committee Report , Chelliah Committee Recommendations for reforming the taxation system.
- Unit - IV    Analysis of Centre & Chhattisgarh Govt. Budget, taxable and non taxable income of Chhattisgarh. Performance of the Chhattisgarh government budget.
- Unit – V     Financial Responsibilities and Budget Management Act, Structure and growth of public expenditure in Chhattisgarh, Revenue Expenditure and Capital Expenditure, Plan & Non Plan expenditure in Chhattisgarh.

**Text Books**

1. Lekhi, R.K.,(2014), Public Finance, Kalyani Publication, Ludhiana New Delhi.
2. S.K., Sing, (2013) Principal of Public Finance Sahitya Bhavan Publication, Agra.
3. Pant, K.C., (2012) Public Finance
4. Sinha, V.C., (2013) Public Finance and Economic, Sahitya Bhavan Publication.

**Reference Books**

1. Government of India (1992), reports of the Tax Reforms Committee – Interim and Final (Chairman : Raja J. Chelliah).
2. Chelliah, Raja J. et. Al (1981)., trends and issues in India's Federal Finance, NIPFP. New Delhi.
3. Peacock, A and G.K. Shaw (1976), The Economic Theory of Fiscal Policy, George Allen and Unwin, London.
4. Sahni, B.S. (Ed.) (1972), Public Expenditure Analysis : Selected Readings, Rotherdam University Press.
5. Jha, R. (1998), Modern Public Economics, Routledge, London.
6. Musgrave, R.A. and P.B. Musgrave (1976), Public Finance in Theory and Practice, McGraw Hill, Kogakusha, Tokyo.
7. Cornes, R. and T. Sandler (1986). The Theory of Externalities, Public Goods and Club Goods, Cambridge University Press. Cambridge.
8. Economic Survey Centre and State (2014-15)
9. 14<sup>th</sup> Finance commission Report- 2015
10. Central Govt. and Stat Govt. Budget- 2015

**SEMESTER- IV**  
**ECONOMICS OF SOCIAL SECTOR**  
**Paper – IV**

- Unit - I      Pollution- classification of pollution, Air, Water and Land Pollution, Cause & Effects of pollutant. Problem of solid waste management, Pollution control strategies, Equi-Marginal law of pollution, Global environmental issues- Climate change, Global warming, Green House Effect, Ozone depletion.
- Unit - II      Development and Environment: Relation between development & environmental stress, The Environmental Kuznets Curve, The concept of Sustainable Development, Indicators of sustainability, Measuring sustainable development, Green Economy.
- Unit – III    Economics of Resources- Classification of resources, Renewable & Non-renewable resources, Optimum use of resources. Land resources, Forest resources, Social forestry, Peoples participation in the management of Common & forest land. Energy- Sources of energy, energy efficiency & environment, Alternative sources of energy.
- Unit - IV    Economics of Education- Expenditure on education, Productive expenditure on education, Productivity of education, the return of education, Human capital, Human capital Vs Physical capital, Educational reforms and Right to Education Act.
- Unit – V    Health Economics- Determinants of health care, Malnutrition. The concept of Human life, Inequalities in health- class & gender, Perspective HDI, GDI, GEM and HPI.

**Reference**

1. Bauriol, W.J. and W.E. Oates (1988): The Theory of Environmental Policy, (2nd Edition), Cambridge University Press, Cambridge.
2. Berman, P. (Ed.) (1995): Health Sector reform in Developing Countries: Making health development sustainable, Boston: Harvard Series on Population and International health.
3. Blaug, M. (1972) : Introduction to Economics of Education J Penguin, London.
4. Bromely, D.W. (Ed.) (1995) : Handbook of Environmental Economics, Blackwell, London.
5. Cohn, E. and T. Gaske (1989) : Economics of Education, Pergamon Press, London.
6. Fisher, A.C. (1981): resource and Environmental Economics, Cambridge University Press, Cambridge.
7. Hanley, N.J.F. Shogern and B. White (1997): Environmental Economics in Theory and Practice, Macmillan.
8. Hussen, A.M. (1999) : Principles of Environmental Economics, Routledge. London.
9. Jeroen, C.J.M. van den Bergh (1999): Handbook of Environmental and Resource Economics, Edward Elgar Publishing Ltd. U.K.
10. Thomas and Callan (2009): Environmental Economics.



**Department- School of Studies in Economics**  
**Syllabus - Choice Based Syllabus Second Semester**  
**Name of Subject- Basic Economic Concepts**  
**Total Credit- 3, Total Marks- 100**

- Unit 1-** Basic Economic Problems, Scope of Economics and its nature, Equilibrium Analysis, Demand, Elasticity of Demand, Law of Diminishing Marginal Utility. Consumer Surplus, Supply- Elasticity of Supply, Production Function, The Concept of Cost and its Nature, The Concept of Revenue,
- Unit 2-** The Concept of Market and its Kinds. Perfect Market imperfect Market, Monopoly, Marginal Theory of Distribution, Macro Economics- National Income Definition, Types and methods of Measurement, Consumption Function, Saving and Investment, Inflation, Monetary and Fiscal Policy.
- Unit 3-** Development and Growth -Meaning and Definition, Obstacle, Features of Developed and Developing Countries, HDI, Sustainable Development, WTO, International Trade and Balance of Payment in India.

Text Books

1. Jhingan, M. L. (2014), Advanced Economic Theory, Vrinda Publication, New Delhi
2. Ahuja, H. L. (2014), Advanced Economic Theory, S. Chand Publication, New Delhi
3. Jhingan, M. L. (2014), Macro Economic analysis, Vrinda Publication, New Delhi.
4. Ahuja, H. L. (2014), Macro Economic Theory, S. Chand Publication, New Delhi
5. Jhingan, M. L. (2008) 31<sup>ST</sup> edition, The Economics of Development and Planning, Vrinda publication New Delhi.
6. Mishra, J.P. (2012) Economics of Growth and Development, Sahitya bhawan publication Agra.
7. Vaish, M. C. and Sudama Singh, (2011) International Economics, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

**Department- School of Studies in Economics**  
**Syllabus - Choice Based Syllabus Third Semester**  
**Name of Subject- Indian Economy**  
**Total Credit- 3, Total Marks- 100**

- Unit – I GDP and National Income of India, Role of Primary, Secondary & Tertiary Sectors in GDP of India, National Income and Per Capita Income, Planning in India – Objectives and strategies of planning, NITI Aayog, Demographic Features of India and Chhattisgarh, National Population Policy.
- Unit – II Agricultural Development in Indian Economy – Agricultural Growth and Productivity, Green Revolution, Food Security in India, Poverty and Inequality in India, Industrial Development in India, Industrial Policies of 1956 and 1991, Public sector Enterprises and their performance, MSMEs.
- Unit – III External Sector Behavior of Indian Economy - Structure and Direction of Foreign Trade, Public Finance in Indian Economy – Fiscal Federation, Central-State Financial Relationship, Fourteenth Report of Finance Commission.

**Text Books :-**

1. Ahulwalia, I. J. and I. M. E. Litle (Eds.) 1999), India's Economic Reforms and Development (Essay honor of Manohar Singh), Oxford University Press, New Delhi.
2. Bardhan, P. K. (9<sup>th</sup> Edition) (1998), The Political Economy of Development India, Oxford University Press, New Delhi.
3. Bawa, R.S. and Raikhy (Ed.) (1997), Structural change in Indian Economy, Guru Nanak Dev University Press. Amritsar.
4. Brahmananda, P. R. and V. R. Panchmukhi, Development Experience in the Indian Economy: Interstate Perspectives, Bookwell, Delhi (9<sup>th</sup> Eds.) 2001.
5. Chakravarty, S. (1987): Development Planning: The Indian Experience, Oxford University Press, New Delhi.
6. Dantwala, M.L. (1996): Dilemmas of Growth: the Indian Experience, Sage Publication, New Delhi.
7. Dutta, Gourav and Ashwini Mahajan, (2014) Indian Economy, S. Chand Publications, New Delhi, 71<sup>st</sup> Edition.
8. Mishra, S. K. and V. K. Puri, (2014) Indian Economy, Himalaya Publishing House Pvt. Ltd., New Delhi, 32<sup>nd</sup> Edition.

# Certificate Course in GST

## Syllabus

<b>Paper 1: Fundamentals of Goods and Services Tax</b> <b>Paper code: ECO/ GST-0204-24</b>	<b>Total marks for Evaluation :200</b>	
	Papers	Marks
	Paper 1	100
<b>Paper 2 : Project Report &amp; Viva – Voce</b> <b>Paper code: ECO/ GST-0204-25</b>	Paper 2	100

**Course Objective:** This Course will cover highlights of the Goods & Services Tax which include 5 units.

### **Paper 1: Goods and Service Tax**

**Course code: Eco/GST-0240-24**

#### **Unit 1: Overview of Goods and Services Tax, Levy of an Exemption from Tax and Registration**

Overview of GST, Implementation of GST, Liability of the Tax Payer, GST Network, GST Council, Levy of GST – Introduction, Composition Scheme, Remission of Tax/Duty, Registration Procedure, Important Points, Special Persons, Amendments/Cancellation, Self-Examination Questions

#### **Unit 2: Meaning and Scope of Supply, time of supply and valuation in GST**

Taxable Supply, Supply of Goods and Supply of Services, Course or Furtherance of Business, Special Transactions, Time of Supply – Goods, Time of Supply – Services, Other Points, Transaction Value, Valuation Rules, Self-Examination Questions

#### **Unit 3: Payment of GST, Electronic Commerce & Job Work**

Introduction, Time of GST Payment, How to make payment, Challan Generation & CPIN, TDS & TCS, Introduction to Electronic Commerce, Tax Collected at Source (TCS)

Procedures for E-commerce Operator, Introduction to Job work, self-Examination Questions

**Unit 4:** Input Tax Credit, Input Service Distributors & Matching of Input Tax Credit, Introduction, Important Points, Job Worker, Case Studies–Part I, Case Studies–Part II, Concept of Input Service Distributor, Legal Formalities for an ISD, Distribution of Credit, Returns, GSTR-2, Other Taxable Persons, Annual Return, Self-Examination Questions

**Unit 5:** Overview of the IGST Act, Place of Supply of Goods & Services, GST Portal, Overview, Other Provisions, Introduction, Registered and Unregistered Persons, Case Studies–Part I, Case Studies–Part II, Introduction to GST portal GST Eco-system, GST Suvidha Provider (GSP), Uploading Invoices, Self-Examination Questions

**Paper 2: Project Work Report (70 marks) and Viva- Voce (30 marks)**

**Paper code: ECO/ GST-0204-25**

**Project-Report and Viva- Voce**

The students are required to submit a Project Report. The project would enable them to learn the applications of GST for preparing project reports. The project report should be 25-30 pages and consists of the statement of the problem, review of literature, theoretical and empirical methodology, sources and nature of data, method and analysis, inferences, conclusions, and references.

**School of Studies in Economics**  
**Pt. Ravishankar Shukla University, Raipur (C.G)**

**Certificate Course in Econometrics and Mathematical Economics**

**Scheme of the Examination**

Paper	Name of papers	Marks
First	Fundamentals of Econometrics and Mathematical Economics	100
Second	Project work	
	Project report writing	50
	Project work presentation	30
	Project work viva-voce	20
	Total marks	200

**Paper I: Fundamentals of Econometrics and Mathematical Economics**  
(Code: Eco/E and M-0204-22)

**Course Objectives:** The objective of this course is to provide the basic knowledge of econometrics and mathematical economics that is essential equipment for any serious economist or social scientist. The course will enable the students to compete in competitive exam like NET-JRF, GATE-ECONOMICS and others.

**Unit-I**

Introduction to Econometrics and Econometric Analysis, Steps involved in Econometric Analysis

Introduction to Classical Linear Regression Model- Two variable classical linear regression model

Assumption of Classical Linear Regression Model-Multicollinearity, Heteroscedasticity and Autocorrelation





## Unit-2

Classical Linear Regression Model assumptions. Estimation of the regression model. Properties of Ordinary Least Square estimators, Regression analysis: Objective, Statistical Analysis, and Interpretation of results, Hypothesis Testing-Types of Hypotheses, Test statistic, Critical Region.

## Unit-3

Hypothesis testing: Level of significance and confidence interval approach; Goodness of Fit( $R^2$ ): Concepts of Explained Sum of Squares (ESS)-Residual Sum of Squares -Total Sum of Squares

Multiple Linear Regression Model: Interpretation of the model, Statistical Analysis. Interpretation of the results, Model misspecification:  $R^2$  vs Adjusted  $R^2$ .

## Unit-4

F statistics-Application of F Statistics-Overall significance of the model-Equality between two regression coefficients- Testing the validity of linear restricted and Unrestricted models

Introduction to Dummy Variable, Statistical Analysis of the Dummy variable models. Simultaneous equation model - specification - identification - rank and order conditions - problems. Introduction to Time Series Analysis, Forecasting Time Series. Concept of stationarity Forecasting with ARIMA Modelling.

## Unit-5

Sets, functions and continuity, sequence, series, Differential Calculus and its Applications. Difference and Differential equations with application, Linear Algebra- Matrices, Vector Spaces

## Paper II: Project-Report and Viva- Voce (Code: Eco/E and M-0204-23)

The students are required to submit a Project Report. The project would enable them to learn the applications of the econometric techniques for preparing project reports. The project report should be 25-30 pages and consists of the statement of the problem, review of literature, theoretical and empirical methodology, sources and nature of data, econometric method and analysis, economic/statistical inferences, conclusions, and references.

## Textbooks

1. Basic Econometrics, D N Gujarati
2. Introductory Econometrics: A modern approach Wooldridge
3. Fundamentals of Mathematical Economics, S.C. Gupta & V.K Kapoor
4. Mathematics for Economists, Mehta & Madhani



**SYLLABUS FOR UNIVERSITY TEACHING DEPARTMENT AND  
AFFILIATED COLLEGES IN Ph. D. COURSES WORK CLASSES**

**COURSES WORK FOR THE Ph.D. STUDENTS IN ECONOMICS**

**Session 2020-21**

<b>S.N.</b>	<b>Name of Papers</b>	<b>MARKS</b>
1.	Methodological Aspect of Economic Research	100
2.	Project Work	100
	a. Project Work Viva-Voce : (Marks-20)	
	b. Project Work Presentation : (Marks-30)	
	c. Project work Report (marks-50)	
<b>TOTAL MARKS</b>		<b>200</b>

**PAPER – I : Methodological Aspect of Economic Research**

**Unit- I**     Research – meaning and types.

    Motivation of research

    Criteria of a good research

**Unit- II**    Research Methodology

    Scientific Method

    Research Design

    Sampling

**Unit- III**    Formulation of research Problem

    Data Collection – Method, Tool, Technique

    Data Processing

**Unit- IV**    Computer application in Social Research

Statistical Tool  
Statistical Software  
Data entry and Commands for Analysis

**Unit- V** Research Writing Method

**Paper – II: Practical (Max. Marks - 100)**

**Part – I Project work Report (marks-50)**

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.

- Research Topic
- Review of Literature
- Gaps in earlier Studies
- Statement of Problem
- Objectives
- Hypotheses
- Methodology
- Plan of the Study

**Part – II Project Work Presentation : (Marks-30)**

The candidate shall present a seminar 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.

**Part- III Project Work Viva-Voce : (Marks-20)**

**PT. RAVISHANKAR SHUKLA UNIVERSITY**  
**RAIPUR - 492 010, CHHATTISGARH**

## **M Sc Environmental Science**

### **SYLLABUS**

### **SEMESTER EXAMINATION**



**2020-2021**

## M.Sc. ENVIRONMENTAL SCIENCE COURSES

The Environmental Science is a multidisciplinary subject includes chemistry, physics, geology, geography & biology. The teaching and research in the environmental science is urgently required for understanding and controlling the complex environmental issues arising at the local, regional and global scales.

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### Semester-I (Credit: 24)

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PAPER	COURSE	DURATION	INTERNAL ASSESSMENT	THEORY MARKS	TOTAL MARKS
ENV-01	Fundamental of Ecology	3 Hrs	20	80	100
ENV-02	Instrumental Techniques: Principle and Application	3 Hrs	20	80	100
ENV-03	Analytical Methods in Environmental Sciences	3 Hrs	20	80	100
ENV-04	Renewable, Nonrenewable and Perpetual Resources	3 Hrs	20	80	100
ENV-05	Lab work-1	8 Hrs.			100
ENV-06	Lab work-2	8 Hrs.			100

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### Semester-II(Credit: 24)

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ENV-07	Meteorology and Climatology	3 Hrs	20	80	100
ENV-08	Environmental Pollution and Control : Air and Water	3 Hrs	20	80	100
ENV-09	Environnemental Pollution and Control: Soil, Solid Waste, Radiation and Noise	3 Hrs	20	80	100
ENV-10	Environmental Geosciences	3 Hrs	20	80	100
ENV-11	Lab work-3	8 Hrs.			100
ENV-12	Lab work-4	8 Hrs.			100

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**Semester-III(Credit: 24)**

ENV-13	Environmental Toxicology	3 Hrs	20	80	100
ENV-14	Environmental Microbiology	3 Hrs	20	80	100
ENV-15	Environmental Biotechnology	3 Hrs	20	80	100
ENV-16	Data Analysis in Environmental Sciences	3 Hrs	20	80	100
ENV-17	Lab work-5	8 Hrs.			100
ENV-18	Lab work-6	8 Hrs.			100

**Semester-IV(Credit: 24)**

ENV-19	Remote Sensing and GIS	3 Hrs	20	80	100
ENV-20	Environmental Disaster and Risk	3 Hrs	20	80	100
ENV-21	Environmental Impact Assessment, Environmental Audit and Environmental Management System Standards (EIA, EA and EMSS)	3 Hrs	20	80	100
ENV-22	Environmental Law, Policies and Society	3 Hrs	20	80	100
ENV-23	Dissertation	8 Hrs.			200

**Internal elective paper (Credit: 4)**

- (i) Food adulteration
- (ii) Waste management

**External elective paper (Credit: 4)**

- (i) Renewable, Nonrenewable and Perpetual Resources
- (ii) Environmental Disaster and Risk
- (iii) Environmental Law, Policies and Society

## **Semester-I (24 Cr)**

### **Course-1: Fundamentals of Ecology ( 4 Cr)**

#### **Unit-I: Concept of Ecology (1 Cr)**

History and scope of ecology: autecology, synecology, population, community, ecosystem, biome, tolerance range and limiting factors; Component parts of an ecosystem; Classification of ecosystems; Ecological factors: temperature, light, water; Bio-geo-chemical cycles: Carbon cycle, nitrogen cycle, sulfur cycle, phosphorous cycle; Functional attributes of an Ecosystem :Biological diversity and stability; Biodiversity: Index of diversity and dominance, Biological indices, relationship between species diversity, dominance and stability; Food chain: Trophic levels & ecological pyramid concept; Types of food chain & significance of food chains, pyramid of number, biomass & energy.

#### **Unit-II: Primary and Secondary Production and Ecosystem Energy Flow (1 Cr)**

Concept of Primary Production; Factors affecting primary production; Method for measuring primary production; Relationship between GPP & NPP, atmospheric respiration, primary productivity of different world sites; Secondary production: concept of secondary production and secondary productivity, maintenance cost, production-assimilation efficiency and secondary productivity; Relationship of secondary production to net primary production, Energy flow in Ecosystems, Concept of Energy, Energy source in Ecosystem, Laws governing energy transformation, concept of free energy, Enthalpy and Entropy, Energy flow in producers and consumers, Lindeman's Trophic-Dynamic concept, Ecological efficiencies, Energy flow models.

#### **Unit-III: Population Attributes, Population Fluctuation and Population Interaction (1 Cr)**

Biotic potential and natality, mortality, survivorship curves, life table, age structure, population growth forms, concept of carrying capacity and environmental resistance; Life history strategies, r and k selection, extrinsic and intrinsic abiotic, biotic, density dependent and independent factors associated with population fluctuation; Population interaction like symbiosis, commensalism, parasitism, predation, competition etc.; Models for single and interacting population, social behavior in animals. Factors affecting change in size of human population: death rate and net population change, migration, fertility, age structure, Human population control; economic development and demography transition, family planning method of birth control, socio-economic methods of controlling human population growth.

#### **Unit-IV: Biotic Community and Ecological Succession (1 Cr)**

Concept of habitat and niche, types of niches: spatial, trophic and hyper volume niche; ecological equivalents, community organization, types of communities, community structure (analytical and synthetic), qualitative features of community (Composition, stratification, Physiognomy, dispersion, sociability, vitality, etc. ), quantitative characteristics of community (frequency, density, cover dominance and diversity, important value index),

Ecotone and edge effect. Ecological succession and kind of succession, succession process, concept of climax, monocl意思, and polyclimax theories, examples of succession (hydrosere, lithosere and xerosere) and vegetation of India.

### **Books & References**

- 1 E. P. Odum, Fundamental of ecology, W.B Sounders, 1971.
- 2 M. Dash and S. Dash, Fundamentals of ecology, Mc Graw Hill Education, India, 2009.
- 3 R. T. Wright and B. J. Nebel, Environmental science: Toward A sustainable future, Prentice Hall, 2002.
- 4 P. Stiling, Ecology: Theories and Applications, Prentice Hall, 2001.
- 5 C. Faurie, Ecology: Science and Practice, Oxford & IBH, 2001.
- 6 G. T. Miller, Living in the environment: An introduction to environmental science, Wadsworth Publishers, 1998.
- 7 J. Turk, Introduction to Environmental Studies, Saunders, 1980.
- 8 E. J. Kormondy, Concepts of ecology, Prentice Hall, 1996.
- 9 M. M. Saxena, Applied Environmental Biology, Agrobios, 1990.
- 10 E. Odum and G. W. Barrett, Fundamentals of Ecology, Brooks Cole, 2004

## **Course-2 : Instrumental Techniques: Principale & Application (4 Cr)**

### **Unit-I: Electrochemical Techniques (1 Cr)**

Idea of pH and buffer, Buffer capacity and ionic strength; Principle and application of pH-metry, potentiometry, conductometry, coulometry, polarography, voltammetry (cyclic and anode stripping), amperometry and ion selective electrodes.

### **Unit-II: Spectroscopic Techniques (1 Cr)**

The principle, instrumentation and application of the infrared, FTIR, visible, ultraviolet and Raman and fluorescence spectrometry, nephelometry and turbidimetry.

### **Unit-III: Atomic Spectroscopic Techniques (1 Cr)**

Principle, instrumentation and application of atomic absorption (i.e. flame, graphite furnace, hydride generation and cold vapor) spectroscopy and atomic emission (i.e. flame, plasma, spark and arc) spectroscopy.

**Unit-IV:** Principle, instrumentation and application of X-ray fluorescence spectroscopy (XRF),  $\gamma$ -ray spectroscopy, proton induced X-ray emission spectroscopy (PIXE), NMR and ESR spectroscopy.

### **Books & References**

- 1 G. D. Christian, Analytical Chemistry, 6th Ed, John Wiley & Sons, 2007.
- 2 H. A. Strobel and W. R. Heineman, Chemical instrumentation: a systematic approach, Wiley, 1989.
- 3 H. H. Willard, Instrumental methods of analysis, Van Nostrand, 1981.
- 4 Z. Marczenko and M. Balcerzak, Separation, preconcentration and spectrophotometry in Inorganic Analysis, Elsevier, 2000.
- 5 E. B. Sandell and H. Ōnishi, Photometric determination of traces of metals, Wiley, 1978.
- 6 B. Welz and M. Sperling, Atomic Absorption Spectrometry, John Wiley & Sons, 2008
- 7 Ed Metcalfe, Atomic absorption and emission spectroscopy, J. Wiley, 1987.

### **Course-3: Analytical Methods in Environmental Sciences (4 Cr)**

#### **Unit- I: Separation techniques (1 Cr)**

Concept and application of separation probes: adsorption, centrifugation, chromatography, crystallization, decantation, demister (vapour), distillation, drying, electrophoresis, elutriation, evaporation, leaching, liquid-liquid extraction, solid phase extraction, flotation, flocculation, filtration, reverse osmosis, dialysis (biochemistry) fractional distillation, fractional freezing, magnetic separation, precipitation, crystallization, sedimentation, sieving, stripping, sublimation, vapour-liquid separation, winnowing and zone refining.

#### **Unit- II: Chromatography (1 Cr)**

Principle, instrumentation and application of gas, liquid, adsorption, paper, gel, size exclusion, HPLC, TLC, electrophoresis and ion exchange chromatography.

#### **Unit- III: Mass spectroscopy (1 Cr)**

Principle, instrumentation and application of mass spectroscopy, types of mass spectroscopy, fragmentation, ionization and characterization of organic and inorganic materials.

#### **Unit- IV: Miscellaneous methods**

Principle, instrumentation and application of classical analytical methods(i.e. gravimetric, volumetric and thermal methods); Automatic analytical methods and Hybrid analytical methods.

#### **Books & References**

- 1 E. Katz, Quantitative Analysis Using Chromatographic Techniques, John Wiley & Sons, 2009.
- 2 J. Rydberg, M. Cox and C. Musikas, Solvent extraction principles and practice, CRC Press, 2004
- 3 P. J. Haines, Principles of Thermal Analysis and Calorimetry, Royal Society of Chemistry, 2002.
- 4 E. de Hoffmann and V. Stroobant, Mass Spectrometry: Principles and Applications, John Wiley & Sons, 2007

## **Course-4: Renewable, Non-renewable and Perpetual Resources (4 Cr)**

### **Unit-I: Renewable Resources (forest) (1 Cr)**

Importance of Forest with reference to major and minor produce, climate, soil erosion, pollution control and water management,. Loss of forest cover with reference to world and Indian Context, Impact of deforestation and shifting cultivation on forest ecosystems, Management of forests involving different silvicultural principles and practices. Raising forest cover through social forestry, agroforestry and extension forestry, Eucalyptus dilemma ,Joint Forest management ,People's participation and role of NGOs, , Concept of Biosphere Reserve , Biodiversity and forest : definition and type of biodiversity, global distribution of biodiversity, mega biodiversity countries, key stone species, dominant species, biodiversity hot spots, significance of biodiversity , factors influencing biodiversity loss, biodiversity conservation ( in situ and ex situ).

### **Unit-II: Renewable Resources (Rangeland and Wildlife) (1 Cr)**

Rangeland: Importance and extent of rangeland, causes of rangeland loss, conservation and management of rangeland, Wild Life resources: Wild life & its importance. Human activities and Wild Life, Concept of Endangered Species, IUCN classification and Red data Book, ecological basis of wild Life conservation and management, some case studies on crocodile, sea turtle and project tiger

### **Unit-III: Non-renewable Mineral and Fossil Fuel Resources (1 Cr)**

Mineral Resources :Economic mineral deposits, grouping of ores minerals ,various steps involved in extraction processes of pure metals, uses of common metals and their recycling, Radioactive minerals, Environmental impact of mining and processing mineral resources, conservation of mineral resources. Fossil fuels: Classification, Coal, its type and its analysis, Carbonization, oil : fractionation, cracking Octane and octane number, addition of TEL; natural gas and other gaseous fuels derived from fossil fuels, Environmental Impact of Fossil Fuel use.

### **Unit-IV: Perpetual & Nonrenewable and Perpetual and Renewable Energy Source (1 Cr)**

Geothermal energy: Source, Principle of harnessing energy and its operation. Nuclear Energy : Source, fission and fusion reactions, broad idea of nuclear reactor, its operations, management and electrical power generation, safety measures. Solar energy: its secret, devices based on solar energy, their advantages and drawbacks, wind energy: wind mills and applications, aero-generators, their advantages and disadvantages, Water energy: Hydroelectricity, wave and tidal energy, tidal power plant, their advantages and drawbacks Energy from biomass: Biomass as fuel, Biogas plants and generation, uses of biogas

### **Books & References**

- 1 F. Ramade, Ecology of natural resources, John Wiley & Sons, 1984.



- 2 R. Toossi, Energy and the Environment: Sources, Technologies, and Impacts, VerVe Publishers, 2008.
- 3 K. Singh, Handbook of Environment, Forest and Wildlife Protection Laws in India, Natraj, 1998.
- 4 S. S. Negi, India's Forests, Forestry and Wildlife, India Book House, 2006.
- 5 C. A. Simon, Alternative Energy: Political, Economic, and Social Feasibility, Rowman & Littlefield, Lanham, Maryland, 2006.
- 6 O. Edenhofer, Renewable Energy Sources and Climate Change Mitigation, Cambridge University Press, 2011.
- 7 A.Karen, Environmental Science: Understanding Our Earth, Cengage Learning, 2011
- 8 L. R. Berg and M. C. Hager, Visualizing Environmental Science, Second Edition, Wiley and National Geographic, 2009.
- 9 B. Judy and St. A. Sara, Environmental Science, Pearson – AGS Globe, 2007.

### **Course-5: Practical (4 Cr)**

1. Verification of Beer's law.
2. Determination of detection limit and molar absorptivity.
3. Determination of absorption maximum,  $\lambda_{\max}$ .
4. Simultaneous determination of two or more components in a given mixture.
5. Determination of retardation factor ( $R_f$ ) value of components in a given mixture by using paper chromatography.
6. Determination of  $pK_a$  value of weak electrolytes.
7. Determination of electrode potentials.
8. Determination of cell constant.
9. Determination of specific conductivity.
10. Determination of distribution ratio by using solvent extraction technique.
11. Determination of percentage extraction (%) of given substance by using solvent extraction. technique.
12. Other advanced practical.

### **Course-6: Practical (4 Cr)**

1. Determination of dissolved oxygen of water samples.
2. Determination of reduction potential of water samples.
3. Determination of total dissolved solid of water samples.
4. Determination of hardness of water samples.
5. Determination of alkalinity of water samples.
6. Determination of COD and BOD value of water samples.
7. Determination of color value of waste water.
8. Determination of salinity of water.
9. Determination of microbe content of water.
10. Other advanced practical.

## **Semester-II (24 Cr)**

**Course-7:**

**Meteorology and Climat**

### **Unit-I: Atmosphere, Oceans and Earth's Radiation Balance ( 1Cr)**

Introducing the Atmosphere, The heterosphere, Subdivisions of the homosphere, the troposphere, atmospheric pressure, Introducing the oceans: Composition of Sea water, Density of sea water, Layered structure of Oceans; Solar radiation, Insolation over the Globe, World Latitudinal zones, Insolation losses in the atmosphere, Long wave radiation, Latitude and the radiation balance, Annual and Daily Cycles of radiation, Man's Impact upon the Earth's Energy Balance, Cosmic particles and Ionizing radiation, The magnetosphere, radiation belts Meteorology fundamentals – Pressure, temperature, wind, humidity, radiation, atmospheric stability adiabatic diagrams, turbulence and diffusion. Scales of meteorology. Applications of micrometeorology to vegetated surfaces, urban areas, human beings, animals.

### **Unit-II: Thermal Environments of the Earth's Surface and Circulation Systems in Atmosphere and Oceans (1Cr)**

Heat flow mechanisms, The Heat Balance Equation, The daily and annual heat balance cycles, Heating and cooling of the soil, Arctic permafrost, Energy absorption by water layers, Heating and cooling of lakes and oceans, Sea Surface Temperatures, Sea Ice and its distribution, Daily cycle of air temperature near the ground, Thermal extremes near the ground, The Annual Cycle of Air temperature, Global distribution of air temperatures, Radiation and Heat Environments of High altitudes; Barometric pressure and winds, Idealized circulation on a nonrotating earth, Coriolis effect and the geostrophic wind, Cyclones and anticyclones, The Planetary circulation, Angular momentum transport by air masses, Atmospheric circulation in middle and high latitudes, Heat transport across parallels of latitude, Global patterns of barometric pressure and surface winds, Monsoon winds systems, Local winds, Wind and waves, The causes of ocean currents, The global pattern of ocean currents, Zones of convergence and upwelling, , El Nino, ENSO, The Earth's heat balance, Seasons in India.

### **Unit –III: Atmospheric Energy Releases ( 1Cr)**

Relative humidity and vapor pressure, Absolute and specific humidity, air masses, condensation and adiabatic process, clouds and fog, forms of precipitation, Convective precipitation and thunderstorms, Orographic precipitation, Cyclonic and frontal precipitation, World precipitation regions, Water balance of the atmosphere,

### **Unit-IV: Man's Impact upon the Atmosphere ( 1Cr)**

Carbon dioxide and oxygen levels in the atmosphere, Man induced changes in Atmospheric temperature, water vapor, clouds, and precipitation, Planned weather modification, Urbanization and balances of radiation and heat, Pollutants in the atmosphere, Inversion and smog, Glacial ice as a recorder of air pollution, Harmful effects of atmospheric pollution, Global effects of particles in the atmosphere, Testimony of the glacial ice layer, Application of meteorological principles to transport and diffusion of pollutants, Scavenging processes, Effects of meteorological parameters on pollutants and vice versa, Wind roses, Topographic effects, concepts of climate change.

## Books & References

- 1 Helmis C. G. and Nastos, P. T. (Eds.), Advances in Meteorology, Climatology and Atmospheric Physics, Springer Atmospheric Sciences, 2013.
- 2 P. V. Hobbs and J. M. Wallace, Atmospheric Science: An Introductory Survey, Academic Press Inc, 2006.
- 3 C. Booker, The Real Global Warming Disaster, Continuum Publishing Corporation, 2009.
- 4 A. Goudie, The nature of the environment, Blackwell, 2001.
- 5 K. S. Valdiya, Environmental Geology, Tata Mc Graw Hill, 1984.
- 6 Atmosphere, Weather and Climatology: A textbook on climatology, Kisalaya Pub. Pvt. Ltd, New Delhi, 1984.
- 7 R. G. Barry and R. J. Chorley, Atmosphere, Weather and Climate, Routledge, 2009.
- 8 J. E. Martin, Introduction to Weather and Climate Science, Cognella Academic Publishing, 2013.
- 9 J. O. Ayoade, Introduction to Climatology for Tropics, Wiley, 1993.
- 10 The Atmosphere : An Introduction to Meteorology, Prentice Hall; 12 edition, 20012.

## Course-8: Environmental Pollution and Control: Air and Water (4 Cr)

### Unit-I: Air Pollution (1Cr)

Atmosphere and its functions, Physical and chemical properties of atmosphere, , natural and anthropogenic sources of atmospheric pollutants, Major and Minor Pollutants in atmosphere (SO<sub>x</sub>, NO<sub>x</sub>, CO<sub>2</sub>, Fluoride etc. ), Gas laws governing the behavior of pollutants in atmosphere, transport and dispersion of pollutants – effect of meteorological and topographical factors, significance of these pollutants and their reactions in the lower and upper atmosphere,, Greenhouses effect, Photochemical smog, Ozone layer depletion Acid rain and their impact. History of some major air pollution episodes and case studies of some air polluting industries (thermal power , steel ,aluminum ,cement etc.) ,effect of air pollutants on plants, animals, microorganisms, man, physical structures and materials.

### Unit-II: Water Pollution (1 Cr)

History of major water pollution episodes , Sources, Classification and types of Water Pollution, characteristics of domestic, municipal, industrial and agricultural wastes – their effects with special reference to oil and detergents, and Heavy metals (mercury, lead, Arsenic cadmium, chromium), pesticides, and other toxic organics and inorganic constituents, Eutrophication and ecological magnification due to water pollution, History of some major water pollution episodes and case studies of some water polluting industries ( Sugar and molasses Pulp and Paper Dairy Textile, Food processing, leather etc.)

### Unit-III: Prevention and Control of Air Pollution( 1Cr)

Source-emission inventory, Air quality criteria, Air quality standards( Ambient and Emission Standards), Natural self cleansing properties of the environment, Dilution methods for controlling air pollution from stationary source, Prevention Methods for control of gaseous

air pollutants (Combustion ,Absorption and Adsorption ), Methods for control of Particulate air pollutants Mechanical device , Filtration , ,Wet scrubber ,Dry Scrubber , Electrostatic precipitator )

#### **Unit-IV: Prevention and Control of Water Pollution ( 1Cr)**

Water quality standard: Drinking Water quality standard, Irrigation water standard , Stream standard and effluent standard, Selection of appropriate unit operation for ETP to achieve desired standards. Methods of treatment of waste water: Preliminary Treatment, Primary treatment, (Sedimentation, Equalization and Neutralization, etc.), secondary treatment (Activated Sludge Technique & Trickling Filter) Tertiary treatment methods for waste water treatment (Evaporation, Ion Exchange ,Adsorption, Electro dialysis, Electrolytic Recovery, Reverse Osmosis) Characteristics of primary, secondary sludge from effluent treatment plant. Sludge dewatering by sludge thickener, sludge drying beds, vacuum filtration and filter press. Sludge disposal and fill and additive in fertilizers.

#### **Books & References**

- 1 N. de Nevers, Air pollution Control Engineering, Mc Graw Hill, 2000.
- 2 K. Work and C. F Warner, Air Pollution, its origin & Control, New York, 1997.
- 3 H. Braur and Y. B. G. Verma, Air Pollution Control Equipment, Springer Verlag, 1981.
- 4 G. Gaur, Air Pollution and its Management, Sarup & Sons, 1997.
- 5 R. K. Trivedi and P. K. Goel, Air Pollution, Techno-science, 1998.
- 6 G. Kiely, Environmental Engineering, Tata MC. Graw Hill, 1997.
- 7 P. K. Goel, Water Pollution , Causes ,effect and Control, New Age International, 2006.
- 8 S. K. Garg, Sewage Disposal & Air Pollution Engineering, Khana Publisher, 2008.
- 9 I. J. Higgins and R. Burns, The Chemistry and ecology of pollution, Academic Press, 1975.
- 10 S. S. Dara, A text book of Environmental Chemistry and Pollution Control, S. Chand, 1993.
- 11 A. K. De, Environmental Chemistry, New Age International, 2003.
- 12 J. W. Moore and E. A. Moore, Environmental Chemistry, Academic Press, 1991.
- 13 T H Y Tebbut, Principal of water quality control, Pergamon Press, 1992.
- 14 R. K. Trivedy and S. N. Kaul, Advances in Waste water Treatment and Technologies, Vol. II, Global Science, 2000.

#### **Course-9: Environmental Pollution and Control: Soil, Solid Waste, Radiation and Noise (4 Cr)**

##### **Unit-III: Soil Pollution and Control (1 Cr)**

The nature and importance of soil. Physical and Chemical properties of soil, Industrial wastes of different kinds, their interactions with soil components, problems due to toxic heavy metals and. Contamination of radionuclides, Source translocation, distribution and uptake of heavy metals, toxic and ecological effect, Pollution due to pesticides in soil, persistence, fate and degradation of pesticides in soil, Toxicity and effect of pesticides on soil organisms and plants, Alternate methods of pest control: Biological control, Hormonal control, Integrated pest management, Pollution due to fertilizers (N, P and K) and their interactions with

different components of soil, fate of fertilizers, due to volatilization, leaching and microbial immobilization, their toxicity and pollution, Alternatives to conventional pesticides and fertilizers( biofertilizers, biopesticides and organic farming)

### **Unit-II: Solid Waste Pollution and Control (1 Cr)**

Sources, nature and characterization of municipal solid waste, Hazards from these solid waste, various methods of disposal and management of solid and hazardous waste (composting, recycling, bio-methanation, pelletisation, pyrolysis, incineration, gasification, sanitary disposal etc.), hazardous and biomedical waste: categorization, generation, collection, transport, treatment and disposal, Hazardous waste and biomedical waste. Guidelines for HWM and Biomedical waste management. Treatment and disposal of some industrial solid waste like fly-ash & red mud.

### **Unit-III: Radiation Pollution and Control (1 Cr)**

Discovery of Radioactivity, Units of measurement and definition of radioactivity, Sources and Classification of radioactive pollution, Methods of radioactivity measurements, biological pathways, transport and effects of radiation, Mechanism of Radiation action on living system – Stochastic and Non-stochastic effects: delayed effects; protection and control from radiation, disposal of radio active waste.

### **Unit-IV: Noise Pollution and Control (1 Cr)**

Basic properties of sound waves-plane and spherical waves, sound pressure and intensity levels, decibel, effect of meteorological parameters on sound propagation. Noise sources; (machinery noise, pumps; compressors, building and construction equipment, domestic appliances, traffic – vehicular, train, aircraft) effect of noise on human health, noise standards and limit values. Prevention and control of Noise Pollution (sound absorbing materials, reverberation time, acoustic silencers, mufflers, barriers, vibration and impact isolation, anechoic chamber, greenbelt development).

### **Books & References**

- 1 S. E. Manahan, Environmental chemistry. Lewis Publ., 1992
- 2 A.P. Sincero and G.A. Sincero, Environmental Engineering, Prentice, 1996.
- 3 C. S. Rao, Environmental Pollution Control Engineering, Willey Estern, 2007
- 4 P. F. Cunniff, Environmental noise pollution, Wiley, 1977.
- 5 A. Farmer, Handbook of Environmental Protection and Enforcement: Principles and Practice, Earthscan, 2007.
- 6 S. Dara, Textbook of Environmental Chemistry and Pollution Control, Chand (S.) & Co Ltd ,2006.
- 7 H. J. Arnikaar, Essential of Nuclear Chemistry: New Age International Publishers, 2011
- 8 P. R.Trivedi and Raj G. (Eds.) Encyclopaedia of Environmental Sciences: Solid Waste Pollution Vol.24. Akashdeep, Publishing House, 1992.
- 9 D. Mani and S. G. Mishra, Soil Pollution, APH Publishing, 2009.
- 10 P. K. Gupta, Pesticides in Indian Environment, Interprint, 1986



- 11 H. D. Forth, Fundamentals of Soil Sciences : New York : Wiley, 1990
- 12 T. D. Biswas and S. K. Mukherjee, Text-Book of Soil Sciences, Tata McGraw-Hill, 1987

## **Course-10: Environmental Geosciences (4 Cr)**

### **Unit-I: Fundamentals of Geosciences (1 Cr)**

Different spheres in the earth: lithosphere, hydrosphere, atmosphere, biosphere; Primary differentiation and formation of core, mantle, crust, magma generation and formation of igneous rocks: earth dynamic processes: plate tectonics, types of plates, isostasy, geomorphic agents: river, wind, snow, glacier, volcanoes, weathering, erosion, transportation and deposition of earth's materials by running water, wind and glaciers: formation of land forms and sedimentary rocks

### **Unit-II: Environmental Geochemistry (1 Cr)**

Concept of major, trace and rare earth element, Geochemical classification of elements: Abundance of elements in the bulk earth, crust, hydrosphere, atmosphere and biosphere. mobility of trace elements, geochemical cycles, biogeochemical factors in environmental health, human use, trace elements and health, Mineral stability diagrams and controls on the chemistry' of natural waters.

### **Unit-III: Surface Water Resources and Environment (1 Cr)**

Global water balance, ice sheets and fluctuation of sea levels, origin and composition of sea water, hydrological cycle, and its components. Precipitation (Various form of precipitation, interpretation of precipitation data), Evaporation and Evapo-transpiration (Meteorological factors, transpiration, methods of estimating evaporation from land surface using Penman's equation), Infiltration and percolation ( Infiltration capacity of soil, Factors influencing infiltration capacity, methods of determining infiltration capacity) Runoff (Duration of runoff, flow rating curves-their determination, adjustment and extension, catchment characteristics and their effects of runoff), climatic factors. Hydrological forecasting: Frequency analysis, probability of the N-year event, series of events, Probability plotting, cyclical nature of hydrological phenomena.

### **Unit-IV: Ground Water Resources and Environment (1 Cr)**

The occurrence of ground water factors of influence, ground water flow, abstraction of ground water, Darcy's law: Darcy's experiment; Fundamental Equation of ground water flow: Generalization of Darcy's law.

Aquifer and its types; Confined and Unconfined aquifers; Properties of Aquifer, permeability, porosity.

Groundwater occurrence & movement; Ground water levels and Environmental influences.

## **Books and References**

1. Environmental Geology: Indian Context by K. S.Valdiya ,Tata Macgraw Hill
2. Environmental Science : E. D. Enger and B. F. Smith
3. Introduction to Geochemistry : Krauskoph K. B.
4. Geology and our environment, Davis, S. N. , Reiton, P. H.& Pestrong, P. Mc.Graw Hill, NY
5. Environmental Geology, Keller, E.,A., Bell &Howell, Columbus, Ohio
6. Physical Geology, Strahler, A. N., John Harper & Row
7. Focus on Environmental Geology, Tank, R.W.Oxford Univ. Press
8. Text Book of Geology, P. K. Mukherjee
9. Environmental geology, Coates, D. R. , John wiley, NY

## **Course-11: Practical (4 Cr)**

- 1 Determination of NPK in water, soil and sediment.
- 2 Determination of Al in water, soil and sediment.
- 3 Determination of Mg and Ca in water, soil and sediment.
- 4 Detection and determination of micro nutrients in water, soil and sediment.
- 5 Determination of  $\text{Cl}^-$  in water, soil and sediment.
- 6 Determination of  $\text{SO}_4^{2-}$  in water, soil and sediment.
- 7 Determination of  $\text{NO}_3^-$  in water, soil and sediment.
- 8 Determination of  $\text{NH}_4^+$  in water, soil and sediment.
- 9 Other advanced practical.

## **Course-12: Practical (4 Cr)**

- 1 Determination of bulk density, moisture content and ash residue of solid fuels.
- 2 Determination of gross calorific value of liquid and solid fuel.
- 3 Determination of flash point of oil.
- 4 Determination of refractive index and viscosity of oil.
- 5 Detection of glucose, fructose, sucrose, starch, etc.
- 6 Determination of iodine value of oil.
- 7 Determination of acid value of oil.
- 8 Determination of saponification value of oil.
- 9 Determination of chlorophyll in plant leaves.
- 10 Other advanced practical.

## **Semester-III (24 Cr)**

### **Course-13: Environmental Toxicology (4 Cr)**

#### **Unit-I: Introducing Toxicology (1 Cr)**

History, disciplines and importance of toxicology, Potency and Toxicity, Acute toxicity, chronic toxicity), Hazards ,Risks, Benefit-to-risk-ratio, tolerance limits, Acceptable daily intake, Threshold value. Factors affecting toxicity : Host factor (Age ,species and strain, sex, life stage, health and nutrition, Idiosyncratic toxicity) interaction between chemicals

(synergistic, additive and antagonistic). Environmental factors, Physico-chemical properties of toxic substances, route and rate of exposure, Dose, Effect and response, Dose-response curves, & Dose effect relationships (Graded & Quantal response). Statistical concept of toxicity, margin of safety and therapeutic index

### **Unit-II Translocation of Toxicity (1 Cr)**

Absorption, Distribution and Excretion of toxic substances. Absorption: membrane permeability, mechanism of chemical transfer (passive transport, active transport, facilitated transport), absorption (Gastrointestinal, skin, lungs). Distribution: tissue affecting distributions and tissues retention. Excretion: Renal excretion, Biliary excretion and Gastrointestinal. Receptor Concept, Nature of receptors, Theory of toxicant receptor interaction, Mechanism of action of some Pesticides (organochlorine, carbamate and organophosphate) and heavy metals (lead, arsenic, mercury, cadmium and chromium)

### **Unit-III: Biotransformation and Bioaccumulation of Toxicants (1 Cr)**

Site, Biotransformation reactions, Phase-I (Oxidation, Reduction, Hydrolysis) and Phase- II (Conjugation) reactions and associated enzymes (cytochrome P450 system, cytochrome-b5 system, amine oxidase epoxide hydrolase, esterases and amidases, glutathione-s-transferase), factors (environmental, chemical and organismal) affecting biotransformation of xenobiotics, concept of bioconcentration, bioaccumulation and biomagnifications. Process of accumulation and elimination of toxicants

### **Unit IV: Toxicity Tests and Safety Evaluation of Chemicals (1 Cr)**

Toxicity tests: Types of toxicity test based on number of species (single species, Multiplespecies and Ecosystem tests), based on exposure (single dose and multiple dose), based on duration of exposure (acute and chronic toxicity test), specific toxicity tests (potentiation, teratogenicity, reproductive, carcinogenicity, skin, eye tests), safety evaluation of chemicals: introduction and definition of safety, process of risk assessment and safety evaluation programme (nature of chemical, usage pattern, environmental level & fate, human exposure & effect, monitoring, surveillance and follow-up, decision making)

### **Books and References**

1. Toxicology Vol I, II and III : Gupta, Metropolitan
2. Experimental toxicology : Anderson & Conning
3. Environmental Pollution and Toxicology: Ray Choudhury & Gupta, Today & Tomorrow Publ.
4. Toxicology, Omkar
5. Toxicology, Sood, Sarup and Sons

## **Course-14: Environmental Microbiology (4 Cr)**

### **Unit – I: Fundamentals of Environmental Microbiology (1 Cr)**

An over view of microbial diversity (Archaea, Eubacteria, Eukaryotic microbes) cellular organization of bacteria and their types and distribution , microorganisms as component of the environment. Distribution of microbes in air, Allergic disorders by air microflora fungal and pollen allergens. The microbial community in Marine and Fresh water environments. Microbiology of soil – soil habitats, Nutritional types of microorganisms.

### **Unit- II: Microbial Culture, Enumeration, Growth and Metabolism (1 Cr)**

Concept of microbial culture ( culture media, culture techniques like enrichment culture, pure, synchronous and continuous culture), Collection and enumeration of aeroallergens. Bacteriological analysis of water, sewage and waste water. Microbial examination of milk & dairy products. Microbial growth (different growth phases, multiplication and kinetics of growth) and microbial metabolism (aerobic, anaerobic, fermentative pathways)

### **Unit-III: Control of Microorganisms (1 Cr)**

Physical agents (temperature, pressure, radiation), chemical agent (bacteriocidal and bacteriostatic compounds, halogens and phenolic) for control of microbes, chemotherapeutic agents (drugs and antibiotics) and their mode of action

### **Unit-IV: Applied Microbiology**

Microbes as biofertilizers, biopesticides and single cell protein, mycorrhiza and their significance, microbial leaching of metals, microorganisms as source of fuel, role of microbes in the synthesis of Alcohols, Antibiotics, Amino acids, dairy products enzymes, vitamin productions and other organic acids, role of microbes in degradation of xenobiotics, microbes for biological treatment of waste water, microbiological biodegradation of Industrial wastes

### **Books & References:**

1. Microbiology – Fundamentals and application R.M.Atlas ,Maxwell-Mcmillan International Ed. 1996
2. Broke –Biology of Microorganisms M.T. Madigan , J.M Martinko and J.Parker ,Prentice Hall International 1998
3. Microbiology -L.M. Prescott, J.P. Harley and D.A. Klein, Tata Mc Graw Hill 2003
4. Fundamentals of Microbiology and immunology, A.K. Banerjee and N. Banerjee ,Central Book Deport 2006
5. Microbiology -Michael J. Pelzer, Tata Mcgraw Hill
6. Microbes, Man and Animals : The Natural History of Microbial Interactions : Linton, A. H. and Burns, R.G. (1982) john Wiley and Sons.
7. Elements of Microbiology : Pelczar, M.J. and Chan ECS, 1981 McGraw Hill.

### **Course-15: Environmental Biotechnology (4 Cr)**

#### **Unit-I: Bioremediation (1 Cr)**

Scope of bioremediation; types of bioremediation (Natural, solid phase ,slurry phase and bioventing); applications of bioremediation; Bioremediation efficacy testing; Approaches to bioremediation; Role of microbes in biodegradation of xenobiotic compounds:- halocarbons, polychlorinated biphenyls, alkyl benzyl sulfonates and oil mixtures, biodegradation of

pesticides, enzyme catalyzed pesticide degradation reactions. Biosorption, Use of bacteria, fungi and algae in biosorption, biomineralisation & bioleaching: Microorganisms involved in Bioleaching of ores, mechanisms of bioleaching, Bioleaching & Metal recovery. Bio indicators, Biomarkers and Biosensors in waste treatment.

## **Unit-II: Bioremediation of Contaminated Sites, Wastelands and Industrial Wastes (1 Cr)**

Bioremediation of contaminated soils (natural attenuation and in-situ subsurface bioremediation) and aquifers (Root Zone Technology and Water Hyacinth – Based Treatment Systems); bioremediation in aquaculture, Bioremediation of industrial wastes (distillery, pulp and paper, tannery, textile and dye ,dairy and food processing). Phytoremediation (phyto-extraction, phyto-stabilization, phytovolatilization, rhizodegradation and rhizofiltration), phytoremediation of inorganic, metallic and organic pollutants in contaminated sites, bioremediation of problematic soil: Coastal saline soil, Alkali soil and mine waste soil; waste land, types of waste land, microbial and earthwormic way of amelioration of waste lands.

## **Unit-III: Biotechnology for Air and water Pollution Abatement (1 Cr)**

Air Pollution abatement: Bio-scrubber and Bio-filter, Water Pollution Abatement: Aerobic ( Activated Sludge Process, Career advanced Activated Sludge Process, Biological Filters ,Rotating Biological Contractors, Fluidized Bed Reactors, Inverse Fluidized and Bed Biofilm Reactor, Expanded Bed Reactor ) Anaerobic Biological Treatment (Contact digester, Packed bed or Packed Volume Reactor , Anaerobic baffled digester, Up flow anaerobic sludge blanket reactors), Membrane Bioreactor and Biocatalyst

## **Unit-IV: Biotechnology for Solid Waste Management (1 Cr)**

Potential availability and composition of crop residues and other solid organic wastes. Principles of microbial Composting, Factor influencing composting. Methods of composting (aerobic and anaerobic). Degradation of cellulose, hemicelluloses, chitin, lignin, proteins, fats and waxes) during composting, and end products of composting, Vermicomposting (composting through Earthworms), advantages of vermicomposting over composting. Types of earthworm suitable for vermicomposting. Method of vermicomposting Changes during vermicomposting. Nutrient value of vermicomposts, Effect of vermicomposting on soil fertility and crop productivity, aquatic plant, organic wastes and energy crops for biogas, alcohol and hydrogen production using microorganisms, bioconversion of agricultural, Sewage sludge, Paper waste, sugar mill wastes, tannery sludge) to feed stuffs and fertilizers.

### **Books & References:**

1. Wastewater Engineering Treatment disposal Reuse – Metacalf & Eddy Inc. 4<sup>th</sup> ed TMGHI ,New Delhi, 2003
2. Environmental Engineering Peavy, HS, Donald RR & G Tchobanoglous MGH Int. Ed. New York 1985
3. Wastewater Treatment for Pollution Control – Soil J Arceivala, Tata Mc Graw Hill 2<sup>nd</sup> ed. 1998



4. Wastewater Treatment Plants: Planning, Design and Operation- S.R. Qasim, Holt, Rinehart & Winston, 1985
5. Industrial Water Pollution Control – WW Eckenfelder, Jr. McGraw Hill 2<sup>nd</sup> Edition NY 1989
6. Sewage Disposal and Air Pollution Engineering, S.K. Garg, Khanna Publisher
7. Waste Water Engineering, G.L Karia & R.A Christian ,Prentice Hill Publication,2<sup>nd</sup> Edition, 2006.
8. Microbial Methods for Environmental Biotechnology: Grainer, J.M. and Lynch, J.M. 1984. Academic Press.
9. Methods in Biotechnology: Hans Peter Schmauder
10. Global environmental Biotechnology: D. L. Wise
11. Basic environmental technology: Jerry A. Nathanson.
12. Basic Biotechnology Ed. Colin Ratledge & B Jorn Kristiasen, Cambridge.
13. Environmental Biotechnology S.K. Agarwal, APH
14. Managing Industrial Pollution S.K. Bhatia, MacMillan
15. Biological and Biotechnological control of insect Pests, Rechcigl and Rechcigl, Lewis
16. Hand book of Bioremediation, Norris et al., Lewis
17. Micro-organism in Action: Lynch & Hobbie
18. Soil Biotechnology: Lynch Blackwel
19. Waste Recycling for energy conversion: Kutand and Hare, Johnwiley and Sons, N Y.
20. Refuse Recycling : Holms, John wiley & Sons, New York

## **Course-16: Data Analysis in Environmental Sciences (4 Cr)**

### **Unit-I: Fundamentals of Statistics (1Cr)**

Population & sample, Variables, Primary and secondary data, Collection of data, Classification and tabulation of data, Need and usefulness of Diagrams & Graphs, Different types of diagrams and graphs. Frequency distribution: Discrete and continuous frequency distribution, sampling methods (random sampling, Stratified random sampling, Systematic sampling), sampling errors, Experimental design: completely randomized block design, randomized block design, Latin square design.

### **Unit-II: Descriptive Statistics (1 Cr)**

Measure of central tendency (Averages), Types of mean: Arithmetic mean, Geometric mean, Harmonic mean; Median, Mode, relation between mean median and mode; Measure of dispersion: Range, Mean deviation & Standard deviation; Skewness and Kurtosis .

### **Unit-III: Theoretical Probability Distribution (1Cr)**

Binomial, Poisson and normal distribution; Testing of Hypothesis: Null and Alternative Hypothesis, level of significance, Student's t distribution and its application, Chi-square( $\chi^2$ ) test & its application.

### **Unit-IV: Correlation, Regression and ANOVA Analysis (1 Cr)**

Types of correlation; simple, partial and multiple correlation, Method of study & testing the significance of correlation coefficient, Rank correlation, Regression analysis: regression equations and regression lines, Properties of regression lines, regression coefficient, testing the significance of regression coefficient. Analysis of variance (ANOVA): One way and two way classification and their applications.

### **Books and References**

1. Walpole, R. and R. Myers (1993). Statistics for Engineers and Scientists, 5th edn. MacMillan, N.Y.
2. Manly (2001) Statistics for environmental science and management, Chapman and Hall / CRC.
3. Statistics : Gupta, Sultan & Chand
4. Fundamental of Statistics: Elhance
5. Biostatics: Mishra & Mishra
6. Statistical Methods: Snedecor and Cochran
7. Introduction to Biostatistics by N. Gurumani, MJB Publisher

### **Course-17: Practical**

- 1 Sampling of indoor and outdoor aerosols.
- 2 Detection and determination of trace gases in air.
- 3 Determination of sound intensity in air.
- 4 Determination of carbon di-oxide levels in air.
- 5 Determination of meteorological parameters in air.
- 6 Determination of ions and metals in aerosols.
- 7 Determination of toxic elements in air.
- 8 Other advanced practical.

### **Course-18: Practical**

- 1 Analysis of ions with ion chromatography.
- 2 Analysis of metals with flame photometer.
- 3 Analysis of metals with AAS.
- 4 Analysis of the VOCs with gas chromatography.
- 5 Analysis of H, C, N and O.
- 6 Analysis of organics with HPLC.
- 7 Analysis of ions with ion-selective electrodes.
- 8 Other advance practical.

## **Semester-IV (24 Cr)**

### **Course-19: Remote Sensing and Geographical Information System (4 Cr)**

#### **Unit-I: (1 Cr)**

Introduction to Remote sensing Science & Technology: Principles of Remote sensing, Physical basis of Remote sensing. The nature and generation of Electromagnetic radiation (EMR). Interaction of EMR with the atmosphere and earth's surface features. Spectral signatures and characteristic spectral reflectance curves for rocks, soil, vegetation and water. Spectral quantities. Far and near infrared and microwave remote sensing.

#### **Unit-II: (1 Cr)**

Remote Sensing Observation and Platforms: Air borne and space borne platforms, their relative importance and applications, Orbital geometry. Remote Sensing Satellites. Sensors, Aerial cameras and type of aerial photography, Photo scale and photo elements, Single and multi band scanners MSS sensor and other type of sensors. Aerial Stereo coverage and. Details of sensors on board. Latest Earth resources Satellites viz. LANDSAT 6/7/8, SPOT, IKONOS, IRS,ERS, MODIS, RESOURCESAT, CARTOSAT, GOES,OCEANSAT. Hyperspectral imaging, RADAR and LIDAR techniques, Indian scenario of remote sensing.

#### **Unit-III: (1 Cr)**

Digital image processing: Introduction to digital structure and data recording format sets. Visual Photo-Interpretation Techniques based on Photo elements and Terrain elements, Image Restoration, Enhancement and classifications, Significance of Ground Truths and Training Sets in Image Processing and in automated processing.

#### **Unit-IV: (1 Cr)**

Geographic information system: Introduction, Definition and Terminology, Map Projection and Coordinate system, GIS system hardware, software and infrastructures. Basic components of GIS software. Data structures. Data models, Data acquisition, Data Input and Data processing and management including topology, TIN model, DEM/DTM generation, overlying and Integration and final data product and report generation Integration of Remote sensing and GIS techniques and its applications in land use/land cover and Environmental resource studies .

#### **Books and references:**

1. Remote Sensing and GIS, Angi Reddy, The Books Syndicate, Hyderabad, 2000
2. Principles of Geographical Information Systems- P. A Burrough and R. A. Mc Donnel, OUP, Oxford, 1998.
3. Remote sensing for Earth Resource-Rao, D. P., AEG Publication, Hyderabad, 1987.
4. Geographical Information System-Kang Tsung Chang, Tata Mc Graw Hill, Publication Edition, 2002
5. Remote Sensing and Its Application –LRA Narayan University Press
6. Remote Sensing and GIS- Basudeb Bhatta Oxford University Press, 09-Oct-2011 - 752 pages
7. Remote Sensing of the environment, John R. Jensen, Dorling Kindersley India, Pvt. Ltd. 2009 - 592 pages
8. Remote sensing and image interpretation, Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman - 2008 – 756

9. Geographical Information Science-Narayan Panigrahi
10. GIS fundamentals, a first text on geographic information system, Paul Bolstad
11. Getting started with geographic information systems, Keith C. Clarke Prentice Hall, 2001 – p. 352

## **Course-20: Environmental Disaster and Risk (4 Cr)**

### **Unit-I: Hazard, Risk and Disaster (1 Cr)**

Hazard in the Environment, the concepts of hazard, risk and disaster, Human vulnerability to hazard, Disaster trends, complexity in hazard and disaster, Hazard zoning and risk assessment, Environmental Security and Hazards Zoning, hazard zoning maps & preparedness plan. Risk Assessment management: Disaster management cycle, Hazards vs. Risk, Evaluation of Risk, Strategies for Hazard Mitigation: Priorities, Prediction, warning & Public information, Minimizing the probability of hazards, Public policy for hazard management.

### **Unit-II: Earthquakes, Volcanic and Mass movement Hazards (1 Cr)**

Origin of Earthquake, its magnitude and intensity, Earthquake prone zones in the Earth, Reservoir induced seismicity, effects of earthquake, stability of structure & Risk Assessment, coping with seismic hazards, seismic zoning map, seism tectonic map, earthquake prediction & control. Types of volcanic eruptions, Active volcanic belts in the world, nature and magnitude of volcanic hazards, prediction of volcanic eruptions, mitigation of volcanic hazards. Mass movement hazards: Landslides, Rock fall, snow avalanche hazards with some case studies.

### **Unit-III: Floods, Cyclones, Tornadoes and Tsunamis (1 Cr)**

Floods and flood management, causes of excess flows, reduced carrying capacity of rivers, Runoff versus infiltration, sediment load & changing course of rivers, management of floods - strategy, treatment of watersheds, reservoir & detention basis, water spreading, ground water recharge, stream channelization, flood embankments, flood plain zoning, flood forecasting & warning. Regions of flood prone zones in India. Origin of cyclones, tornadoes and tsunamis, their severity and impacts, coastal hazards mitigation measures.

### **Unit-IV: Technological hazards: Nature and Definition of Technological Hazards (1 Cr)**

Concepts of industrial pollution, nuclear radiation, toxic wastes, dam failures, transport accidents, factory explosions, fires, chemical spills, and technological hazards as a result of the impacts of a natural hazard. Definition of hazardous waste, solid waste generation, concept of solid waste management. Onsite handling and processing, disposal techniques- open dumping, land filling, incineration, composting, potential methods of disposal- utilization, recovery and recycling. The growth of industrial hazard, Some case studies of Technological Disasters like Bhopal gas Tragedy 3 December, 1984, Chernobyl Nuclear accident 1986, Minnamata Japan, Japan's earthquake- tsunami- Fukushima nuclear disaster: 2011

## **Books and references:**

1. Environmental Hazards: assessing risk and reducing hazards, Smith, K. and Petley, D.N. Routledge publication, London.2009, p.383.
2. Atmosphere, weather and climate, a textbook on climatology, Siddhartha, K. Kisalaya Publications Pvt. Ltd. New Delhi, 2000, p. 511
3. Environmental Geology, Valdiya K.S., Tata Mc-Graw Hill, 1987, p.
4. Landslide risk assessment, Lee E.M. and Jones D.K.C., Thomas Telford, 2004, p. 454
5. Environmental Geoscience: interaction between Natural Systems and Man, Strahler, A.N. and S Trahler A.H., Hamilton Publishing Company, California, p.511.
6. The nature of the Environment, Goudie, A., Blackwell Publications, 2001, p.544.
7. Living with Risk: The Geography of Technological Hazards by Susan L. Cutter (Jun 15, 1993)
8. Technological Disasters, P.C. Sinha, Anmol Publications Pvt. Limited, 1998 - 516 pages
9. Earthquakes and Tsunamis in the Past: A Guide to Techniques in Historical Seismology, E. Guidoboni and John E. Ebel, Cambridge University Press, 2009
10. Earth quakes: Bruce A. Bolt
11. Elementary Seismology: Charles F. Richter

## **Course-21: Environmental Impact Assessment, Environmental Audit and Environmental Management System Standards (EIA, EA and EMSS) (4 Cr)**

### **Unit-I: Origin and Development of EIA (1 Cr)**

Nexus between Development and Environment, Comparison between economic and Ecological criteria, Concept of externalities, shared resources, Global commons & carrying capacities. Origin and Development of EIA. Relationship of EIA to sustainable Development. EIA in Project planning & Implementation, EIA process: Evaluation of proposed action, Scoping, EIA methodologies. Role of GIS in EIA baseline studies. Risk Assessment and Risk Management: Mitigation measures, comparison of alternatives, Reviews and decision making ,compensatory actions, EIA notifications/regulations in India, Green belts: Review of Procedure, Practices and guidelines in India. EIA vs. SEA, Carrying capacity, Cumulative impact assessment.

### **Unit-II: Case Studies on EIA (1 Cr)**

EIA of (a) River valley Projects, (b) Thermal Power Plants, (c) Mining Projects, (d) Integrated Iron and Steel Industries, (e) Cement Industries, (f) Oil Refineries and Petrochemicals, (g)Tourism, (h)Coastal zone Development.

### **Unit-III: Environmental Audit (1 Cr)**

Concept of Environmental Audit, Objectives of Audit, Types of Audit, Audit methodology, Features of effective auditing, Elements of audit process, Program Planning, Organization of auditing Program, Pre-visit data collection, Audit Protocol, On site audit: Data sampling,



Inspection, Evaluation and Presentation, Audit report, Action Plan, Management of audit, Waster audits and pollution prevention assessment, Liability audit and site assessment, auditing of EMS, SWOT Analysis (Strength, Weakness, Opportunities and Threats analysis) for EIA, Audit Assessing, Economic & Environmental benefits direct from Environmental Audit, Life Cycle Assessment

#### **Unit-IV: Environmental Management System Standards (1 Cr)**

Core elements of EMS, Benefits of EMS, Certification Body Assessment of EMS, Documentation for EMS, EMS standard (ISO9000 & 14000 series): evolution, principles and structure, supporting systems, EMS specification standards & Certification procedures, EMS specification standards:ISO14001, Benefits of Implementing ISO 14001: Indian scenario.

#### **Books and references:**

1. Environmental Impact Assessment: Canter, L.W. 1977. Mc Graw Hill, New York
2. Environmental Impact Assessment Methodologies: Anjaneyulu Y. and Minickam V., BS Publications, Hyderabad
3. Manual of Environmental Impact Evaluation-Rosen JJ 1976 Prentice Hall
4. A practical guide to Environmental Impact Assessment, Erickson, P.A., Academic Press
5. Environmental Impact Analysis Hand book Rao & Woolen (eds) 1980 Mc Graw Hill
6. Environmental Quality Management: Bindu N Lohani 1984, South Asia Publ.
7. Environmental Impact Assessment: Alan Gilpin 1995, Cambridge Univ. Press
8. Manual of Environmental Impact Evaluation-Sharma, J. Rosen. Prentice Hall
9. Current documents on guidelines of EIA, MOEF, Govt. of India.
10. Strategic Environmental Assessment. R. Therirvel, E. Wilson, S. Thampson, D. Heany & D. Pritchard.
11. Environmental Impact Assessment- Cutting edge by 21<sup>st</sup> century- Cutting edge by Alan Gilpin, Cup, London
12. Environmental Impact Assessment & Practice- Theory, P. Wathem, U. Hynman, Sydney
13. A Practical Guide to Environmental Impact Assessment – Paul A Erickson Academic Press
14. Planning and Implementation of ISO 14001, Environmental Management system- Gyani & Amit Lunia, Girdhar Raj Publ, House Jaipur.
15. A guide to the implementation of the ISO 14000 series on Environmental Management- Ritchie I and Hayes co Prentic Hall, New Delhi .
16. Environmental Management, Kulkarni, V. and Ramachandra, T.V., TERI press, New Delhi, 2009
17. Uberoi, N.K. (2010). Environmental Management, Excel Books, New Delhi.
18. ISO 14004 – Environmental management systems : General guidelines on principles, systems and supporting techniques (ISO 14004 : 1996 (E)).
19. Environmental management systems : Specification with guidance for use (ISO 14001 : 1996b (E)). (International organization for standardization – Switzerland).
20. Handbook of environmental management and technology : Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.
21. Environmental Impact Assessment, L. W. Canter, Mc Graw Hill Publication, New York.

## **Course-22: Environmental Law, Policies and Society ( 4 Cr)**

### **Unit-I: Water, Air, Forest and Wildlife act (1 Cr)**

Constitution of Central and State Pollution Control Boards, Power ,Function and responsibility of Central and State Boards (Objectives, Area of jurisdiction, responsibility of an industry, power and function of state and central Government, Cognizance of offence, Penalties and Punishment), Brief account of The Forest Act 1927 ,Forest conservation Act. 1980: Objective and Jurisdiction, Responsibility of Industry. Wildlife Protection Act 1972 Authorities under the Act. Wild life Advisory Boards and their functions, Detection and prevention of offences. Cognizance of offences, the wildlife (protection) Amendment Act. 1991

### **Unit-II: The Environment Protection Act 1986 (1 Cr)**

Necessity and Scope of the Environmental Protection Act, Powers of the Central Government , Parallel Provisions with the water and the Air act, The Public Liability Insurance Act 1991, Important rules & notification under the Environment Protection Act 1986 : Public Hearing notification 1997 , Biomedical waste (Handling and Disposal) rules 1998. Recycled plastic manufacture and usage rules 1999 , Municipal Solid Waste (Management and Handling) Rules 2000 ,The Noise Pollution ( Regulation and Control ) Rules 2000 , , Environmental Impact Assessment Notification 2006 , e-wastes Management and Handling Rules 2011

### **Unit-III: Environmental Policies (1 Cr)**

Environment and constitutional provisions in India, National & International Trend. Changes in Global Prospective, International Treaties, Brief Note on Stockholm Conference 1972 , , Nairobi Declaration, Rio (Brazil) conference 1992, Rio+5 and the Rio+10, Rio+20 ,Kyoto Protocol ,Johannesburg Conference 2002 National Authorities: Green Tribunal ,Global environmental issues and International policies relating to control Global warming, Ozone depletion, hazardous waste, CITES etc. Role of UN authorities in protection of Global Environment, Multinational authorities and agreements

### **Unit-IV: Economics, Society and Environmental Ethics (1 Cr)**

Economic growth, Gross National product and the quality of life: Sustainable-earth economy, Economics and Pollution control, Discount factor, Cost-benefit and cost effectiveness analysis, Human impact on the Earth, Hunting and Gathering Society, Agriculture Society, Industrial Society, Sustainable -Earth Society: Concept of throw-away and sustainable -Earth Society, our future society; Environmental Ethics: Ethics and moral, ethics of Throw-away & Sustainable-Earth Society, Ethical guidelines.

### **Books and References**

1. Hand Book of Environment, Forest and Wild life laws in India, WPSI, Natraj
2. Pollution Control Acts, rules and Notifications issued under CPCB, New Delhi

3. Environmental Laws, New Perspectives, K. C. Agrawal, Nidhi Publisher, Bikaner
4. Wildlife of India, Conservation and Management, K. C. Agrawal, Nidhi Publisher
5. Environmental laws in India, Gurdip Singh, Quality Law Books
7. The Economics of the Environment, Oates W.E.
8. Kanchan Chopra, et al., Ecological Economics and Sustainable Development
9. Economy and the Environment, Goodstein
10. Sumi Krishna : Environmental Politics, Peoples' Lives and Developmental Choices, Sage, New Delhi, 1996
11. Cone J.D., Hayes S.C., Environmental Problems / Behavioral Solutions (1980) California
12. Declaration of The Stockholm Conference, Rio
13. Constitution of India [Referred articles from Part-III, Part-IV and Part-IV-A].

### **Course-23 Dissertation (8 Cr)**

Review or case studies on detection, determination, mapping, sources and control of environmental contaminants.

## **Elective courses**

### **FOOD ADULTERATION**

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#### **Courses**

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#### **UNIT-I: Food chemistry**

Chemistry of Food, Introduction to Food Processing & Preservation, Technologies of Milk & Milk Products, Introduction to Food Microbiology, Processing & Preservation of Fruits & Vegetables, Processing Technology of Meat & Meat Products, Cereals, Food Packaging, Cereals & Legume Processing, Food Additives, Processing Technology of Beverages, Preservative, Jam, Jellies & Marmalade, Fermentation & Unfermented Products, Food Adulteration, Team Management, Project & Case Study, Industrial Training.

#### **UNIT-II: Adulteration, preservatives and colouring agents**

Adulteration, Chemical preservatives, Colouring matters, Baking powder and baking-powder chemicals, adulteration of specific foods (i.e. Beverages, Alcoholic, Non-alcoholic, Canned vegetables, Cereal products, Breakfast foods, Flour, Cocoa and chocolate, Coffee and tea, Condimental sauces, Dairy products, Butter, Cheese, Cream, Milk, Edible fats and oils, Flavouring extracts, Fruit products, Meat preparations, Spices, Sugars, sirups, Vinegar, etc.

#### **UNIT-III: Characterization of food preservatives and colors**

Detection of salicylic acid, Detection of benzoic acid, Detection-of boric acid and borax, Detection of formaldehyde, Detection of saccharin, Detection of coal-tar dyes, Detection of copper, Detection of turmeric, Detection of caramel

#### **UNIT-IV: Characterization of adulterants in major foods**

Detection and determination of adulterants (pesticides, POPs & others) in cereals, seeds, vegetables, fruits, milk, butter and dairy products, meats, chicken, coffee and tea, spices, Condimental sauces, flavoring agents, oils.

#### *Books*

1. Introduction to Food Analysis. S.S. Nielsen, 1998. Aspen Publishers - The best general overview of food analysis techniques currently available. (Required).
  2. Food Analysis: Theory and Practice. Y. Pomeranz and C.E. Meloan, Chapman and Hall - General overview of food analysis techniques (Useful)
  3. Food Analysis: Principles and Techniques. D.W. Gruenwedel and J.R. Whitaker, Marcel Dekker - General overview of food analysis techniques (Useful)
  4. Analytical Chemistry of Foods. C.S. James, Blackie Academic and Professional - General overview of food analysis techniques (Useful)
  5. Official Methods Of Analysis, Association of Official Analytical Chemists - Officially recognized methods of analysis for many food components (Very Useful - Available in my office).
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## **WASTE MANAGEMENT**

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### **Courses**

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#### UNIT-I: Domestic waste

Definitions  
The Earth environment  
Conservation and use of resources  
Value of resources: economic, ecological and aesthetic  
Damage being caused by urbanization  
The impact of humans  
Sewage and it's treatment  
Characteristics of Sewage  
Components of Sewage –solids, organic material, industrial waste  
Decomposition of Sewage  
The nitrogen cycle  
Classification of Sewerage Systems  
Storm Water Systems and Management  
Dry Rubbish  
Nature of Refuse  
Placement and protection of nins  
Trade waste  
Refuse Collection Systems  
Refuse Collection vehicles  
Salvage materials  
Safe disposal of household chemicals

#### UNIT-II: Street Cleaning & Disposal of Refuse

Types of Street Refuse  
Methods of street cleaning –gritting, sanding, sweeping, washing, etc  
Cleaning storm water pits  
Managing snow  
Refuse disposal–separation, controlled tipping, combustion, pulverization, etc  
Refuse for fertilizer  
Methods of Refuse Sorting –screening, magnetic, hand  
sorting Types of incinerators  
Vacuum systems for refuse collection –Garchey system,  
gandillon Harvesting energy from combustion

**UNIT-III: Industrial Waste & recycling**

Types of industrial pollution  
The greenhouse effect  
Ozone depletion  
Nuclear power  
Nuclear fission  
Mining nuclear fuel  
Uranium enrichment  
Gas Diffusion  
Gas centrifuge  
Nuclear waste  
Transporting nuclear waste  
Reprocessing  
Health risks of nuclear waste  
Scope and nature of recycling  
Rubbish tips (dumps)  
Recycling plastics  
Recycling metals  
Recycling glass  
Recycling paper  
Recycling rubber  
Actions by individuals (at home or work) –reducing, reusing and recycling waste

**UNIT-IV: Water Quality & Treatment**

Industrial effluent  
Pricing control compared with direct control  
Types of water impurities  
Scope of purification  
Managing water for public supply  
Water treatment methods  
Purification methods –sedimentation, filtration, disinfection, aeration, screening,  
etc .  
Recycling sewage water  
Recycling waste water  
Reed bed treatment  
Improving water quality from any source –physical, chemical, biological impurities  
Water borne diseases

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**Books**



- 1 M. Georgacarakos, Guide to waste management including information on recycling, landfills, sustainability, composting, and ways to protect the environment, Webster's Digital Services, USA, 2011.
- 2 A. S. Weinberg, D. N. Pellow, A. Schnaiberg, Urban recycling and the search for sustainable community development, Princeton University Press, 2000.
- 3 L. F. Diaz, M. de Bertoldi, W. Bidlingmaier, Compost Science and Technology, Elsevier, 2007.
- 4 S. R. Rao, Resource recovery and recycling from metallurgical wastes, Elsevier, 2006.
- 5 M.H. van Agteren, Sytze Keuning, Jan Oosterhaven, Handbook on Biodegradation and Biological Treatment of Hazardous Organic Compounds, Springer; 1998.



**SCHOOL OF STUDIES IN ENVIRONMENTAL SCIENCE**  
**Pt. Ravishankar Shukla University, Raipur**

**Pre - PhD Course 2018-19**  
**Environmental Science**

**Duration of course: 6 Months**

**Max. Marks: 200**

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**Course-I: Theory**

**Max. Marks: 100**

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**Unit-I      Research methodology**

**Marks: 25**

**Unit-II      Biostatistics**

**Marks: 25**

**Unit-III     Instrumentation**

**Marks: 25**

**Unit-IV      Conservation, energy and toxicology**

**Marks: 25**

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**Course-II: Dissertation**

**Max. Marks: 100**

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**A              Case studies or review work**

**Marks: 50**

**B              Project based seminar**

**Marks: 50**

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# PRE - Ph.D. COURSE

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<b>Course-I: THEORY</b>	<b>Max Marks:100</b>
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<b>UNIT-I: Research methodology</b>	<b>Marks:25</b>
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Principles of scientific research experimentation in natural sciences; Design, execution, analysis and evaluation of experiments; Selection of methodology of study various tools and their scope and limitation in application; Selection of research topic, Library consultation, compilation of working data, Technique and knowledge of preparation of abstracts, manuscripts, dissertation thesis and report writing. Writing research grant proposal and reports; Preparation of articles for scientific journal, typing / printing -manuscripts, margins, spacing, heading and title page numbers, tables and illustrations, corrections and insertion, preparation of contents; Preparation of list of work cited: general guidelines, placement, arrangement, citation of books, and other references.

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<b>UNIT-II: Biostatistics</b>	<b>Marks:25</b>
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Definition, population and samples, sampling techniques and types of samples, statistics and parameters; Summarization of data and estimation, measures of central tendency – mean, median, mode; Measures of dispersion – variance and standard deviation, confidence interval, hypothesis testing – significance testing, student's 't' test, chi square test; analysis – Anova, regression and correlation analysis.

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**UNIT-III: Analytical techniques**

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Principle, theory, instrumentation of analytical techniques such as gas chromatography, high pressure liquid chromatography, mass spectroscopy, induced coupled plasma-emission spectroscopy, atomic spectroscopy and X-ray fluorescence spectroscopy.

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**UNIT-IV: Conservation, energy and toxicology**

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**Conservations:** Recent trends in conservation of wild life, and genetic resources, gene pool and endangered species and their conservation and protection.

**Eco-toxicology:** Manual and methods of studying toxicology, animal agents in toxicology, evaluation method, toxicity test, statistical concept or  $LD_{50}$ , dose effect and dose response, biological and chemical factors that influence toxicity response of ecosystems to chemical stress.

**Trends in energy studies:** Present state, prospects and problems of alternative measures, energy from biomes, plantation for clean environment and ecological balance, biogas and wind mills for rural energy supply, city garbage and domestic wastes and their recycling for energy and fertilizer.

<b>Course-II: Dissertation work</b>	<b>Max Marks:100</b>
A. Project based case studies or review work	Max Marks:50
B. Project based seminar	Max Marks:50

### **Books suggested**

- C. K. Kothari, Research methodology: methods and techniques, New Age International, New Delhi, 2004.
- K. N. Krishnaswamy, Siva Kumar, Appa Iyer, M. Mathiranjani, Management research methodology; integration of principles, methods and techniques, Pearson education, New Delhi, 2006.
- Simon A. Levin, John R. Kelly, Mark A. Harwell, Kenneth D. Kimball, Ecotoxicology: Problems and Approaches, Springer Advance Text, 1989.
- Ute Jacob, Eoin O'Gorman, G. Woodward, Advances in Ecological Research, Elsevier, 2012.



**SCHEME OF EXAMINATION  
COURSE STRUCTURE & SYLLABUS**

**M.Sc. (ELECTRONICS) PROGRAMME  
(SEMESTER SYSTEM)**



**FACULTY OF SCIENCE**

**Approved by Board of Studies in Electronics**

**Effective from Academic Session JULY 2020**

**School of Studies in Electronics and Photonics**

**Pt. Ravishankar Shukla University**

**Amanaka, GE Road Raipur (C.G.) 492010**

**WEBSITE: -[www.prsu.ac.in](http://www.prsu.ac.in)**

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Syllabus revised & approved by Board of Studies in Electronics on 18<sup>th</sup> Jan., 2020

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**PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR**

**Scheme of Examination  
M.Sc. (Electronics) Programme  
(Semester System)**

**Effective from Academic Session JULY 2020**

M.Sc. Electronics is a four semester course spread over the period of two years. Every semester course consists of four theory courses and two laboratory courses, each theory course carrying weight-age of 100 marks (4 credits) and lab course of 100 marks (2 Credits). However, in the final semester, there will be one project in lieu of one practical.

The School of Studies in Electronics & Photonics, Pt Ravishankar Shukla University, Raipur offers this course on its campus. It is designed to offer in depth knowledge of the subject starting from its basic concepts to the state of art technologies in use today. Students are also provided extensive laboratory training on the course content and the current requirements of industries and R and D. In the final semester every student has to undertake a project. Moreover the course structure intends to inculcate strong laboratory skills so that the student can take up independent projects which will help to be an entrepreneur. The students passed out from the revised course will serve as quality human resource to take up the state of art research work of the Department. This course provides exposure to the students to the technologies in-vogue and trains them to take up projects relevant to the industrial needs, the R& D activities and self-employment opportunities. Advanced papers are offered to the students in the areas of Communications, Photonics, Nano and Opto Electronic Devices, Laser Technology Digital Signal Processing, Embedded Systems, Power Electronics and Microcontrollers. In addition the course caters to the requirements of providing complete exposure to NET/SET syllabus for Electronics formed by the U.G.C. . The student after passing the M.Sc. course has many opportunities of employment, self-employment and higher studies. Department of Higher Education, Govt. of Chhattisgarh has declared Electronics as allied subject of Physics for recruitment of Assistant Professor in colleges.. The students may opt for UGC -AICTE approved M.Tech. in Optoelectronics & Laser Technology in the department after M.Sc.

**Employment Opportunities:** - - Electronics and Telecommunication Industries. - I.T. Industries (India and Abroad). - Process and Manufacturing Industries. - Research and Development Laboratories. - Employment in Academic and Other Govt. Organizations.

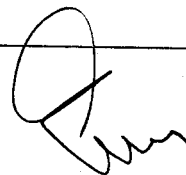
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Syllabus revised & approved by Board of Studies in Electronics on 18<sup>th</sup> Jan., 2020

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*18-1-2020*

*18-01-2020*



**Educational Opportunities:** - - Higher studies in I.I.T, I.I.Sc., and CERE Pilani. For M.Tech. and Ph.D. - Research in Pt. Ravishankar Shula University or any other University. M.Phil, M.Tech. and Ph.D. - M.Tech. /M.E courses of Various Universities in India and Abroad. -Higher Studies Like M.S. in relevant discipline and Research Opportunities in foreign universities. .

**Eligibility Criteria:** A student shall be held eligible to the admission to the M.Sc. course provided he/she has passed the B.Sc. examination with Electronics or Physics as one of the core subjects in all the three years. of this University or the degree of any other statutory University recognized as equivalent. A student with Bachelor in Vocation in Renewable Energy Technology & Management degree of the University is also eligible for admission to M.Sc Electronics course.

### Semester - I

The following shall be the scheme of examination for the course:

Code	Theory	Marks			Credits
		Theory	Internal	Total	
ELT 101	Paper I : Analog Integrated Electronics and Physics of Electronic Materials	80	20	100	4
ELT 102	Paper II : Digital Design and Applications	80	20	100	4
ELT 103	Paper III : Signals, Mathematical and Computational Methods in Electronics	80	20	100	4
ELT 104	Paper IV : Optical , Quantum and Organic Electronics	80	20	100	4

Code	Practical	Experiment	Viva	Intern I	Max	Credits
ELP 105	1. Lab course "A" Analog Electronics"	60	20	20	100	2
ELP 106	2. Lab course "B" Digital Electronics"	100	60	20	100	2
	Total (Theory & Lab)				600	20

**Total Marks for Semester I =600 & Credit = 20**

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## Semester - II

Code	Theory	Marks			Credits
		Theory	Internal	Total	
ELT 201	Paper I Network Analysis and Synthesis	80	20	100	4
ELT 202	Paper II Microprocessor and C++ Programming	80	20	100	4
ELT 203	Paper III Analog and Digital Communication Systems	80	20	100	4
ELT 204	Paper IV Electromagnetic Plane wave, Transmission lines and Microwave Devices	80	20	100	4

Paper Code	Practical	Experiment	Viva	Internal	Max	Credits
ELP 205	1. Lab course "C" Analog and Digital Communication Lab	60	20	20	100	2
ELP 206	2. Lab course "D" - 8085 Microprocessor Programming, Study Cards and Interfacing Lab	60	20	20	100	2
	Total (Theory & Practical)				600	20

**Total Marks for Semester II=600 & Credits=20**

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### Semester - III

Code	Theory	Marks			Credits
		Theory	Internal	Total	
ELT 301	Paper I ( Code) Advance Microprocessors and Microcontroller (AMM)	80	20	100	4
ELT 302	Paper II Data Communication, Mobile and Wireless Communication	80	20	100	4
ELT 303	Paper III Photonics <del>Paper III Instrumentation and Measurement</del>	80	20	100	4
ELT 304	Paper IV Power Electronics, Information Theory and Coding	80	20	100	4

Code	Practical	Experime nt	Viva Voce	Interna l	Max	Credits
ELP 305	Lab course "E" - - Optical Electronics, Transducer and Instrumentation Lab	60	20	20	100	2
ELP 306	2. Lab course "F" - 8086 Microprocessor Programming, Interfacing and "C++" Programming Lab	60	20	20	100	2
	<b>Total [Theory &amp; lab]</b>				<b>600</b>	<b>20</b>

Total Marks for Semester III = 600 & Credits=20

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### Semester IV

Code	Theory	Marks			Credits
		Theory	Internal	Total	
ELT 401	Paper I Digital Signal Processing	80	20	100	4
ELT 402	Paper II (Code EL 402) Optical and Satellite Communication	80	20	100	4
ELT 403	Paper III (Code EL 403) Automatic Control System and Artificial Neural Network	80	20	100	4
ELT 404	Paper IV (Code EL 404). Embedded Systems, Microcontrollers and Advanced Instrumentation	80	20	100	4

Code	Practical	Experiment	Viva	Internal	Max	Credits
ELP 405	1. Lab course "G" - Optical Communication and 8051 Programming Lab	60	20	20	100	2
ELP 406	2. Project & Seminar	80	20	-	100	2
	Total [Theory & lab]				600	20

Total Marks for Semester IV = 600 & Credits=20

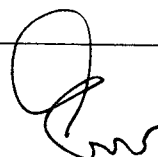
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**M. Sc. Electronics (Semester System)**

July - Dec 2020

**Semester - I**

Electronic devices play a crucial role in today's societies and in the physical sciences where they originated. Contemplating that in just a few decades, technology guiding electrons and photons has emerged that makes possible oral and visual communication between peoples on opposite sides of the planet is truly a triumph of science and technology. Present day information technology is based on the physical properties of semiconductors, in particular the functioning of the transistor. The intension of this paper is to take the students from the principles of quantum mechanics through the quantum theory of metals and semiconductors all the way to how devices are used to perform their duties in electric circuits

**ELT 101 Paper 1 - Analog Integrated Electronics and Physics of Electronic Materials**

**Max. Marks: 80, Min. Marks: 16**

**Student should be allowed to use Programmable Scientific Calculator in Examination hall**

**Unit I - Physics of Electronic Materials**

Crystal structures, classification of crystals, lattices, reciprocal lattice, Miller indices, amorphous materials. Lattice Vibration and Phonons, Bloch theorem, Phonons, Nearly Free electron theory. Dielectric properties, electronic polarisability, Clausius Mossotti relation, dielectric Constant static and frequency dependent. Introduction to Fermi Dirac and Bose Einstein Statistics.

**Semiconductors:** Direct and indirect band gap methods to determine the Forbidden gap, mobility and conductivity, intrinsic and extrinsic semiconductor, Impurities, carrier concentration, electrical properties of Ge and Si, experimental methods to study the electrical parameters, Drift and Diffusion, Hall effect, electrons and phonons in semiconductors.

**Unit II -Quantum Electronics and Transistor model**

Uncertainty principle, Experiments on duality, Schrodinger's equation and its applications to square well potential, square potential barrier (1D).

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Infinite array of potential wells, Kronig-Penny model, Barrier penetration, applications to tunnel diode, Josephson effect, Perturbation theory and its applications, Scattering.

Transistor at low frequency - Analysis of a transistor amplifier circuit using h-parameter, Emitter follower, comparison of transistor amplifier configurations, Miller's Theorem and its dual, cascading transistor amplifiers, High Electron Mobility Transistor (HEMT). Basics of Transistor biasing and stabilization

### **Unit III - Multistage and Feedback Amplifiers Analysis**

Transistor at high frequencies, Hybrid - pi model, gain bandwidth product.

Multistage Amplifiers Analysis - Introduction, frequency response of an amplifier, band pass of cascaded stages, Coupling scheme - RC coupled, transformer coupled and direct coupled amplifiers, low frequency response of RC coupled stage, effect of emitter bypass capacitor on low frequency response, high frequency response of two cascaded CE transistor stages.

**Feedback Amplifiers** - Basic concept, types of feedback method of analysis of a feedback amplifier.

### **Unit IV - Operational Amplifier, Characteristics and Applications**

Basic operational amplifier and its characteristics, characteristics of ideal and practical operation amplifier, parameters of operational amplifier, measurement of operational amplifier parameters, frequency response of operational amplifier, Linear and Nonlinear Circuits analysis using operational amplifier - Inverting and Non inverting Amplifiers, Differentiator, Integrator, Voltage to current converter, Instrumentation amplifier, Sine wave Oscillator, Low pass and band - pass filters, Comparator, Multivibrator and Schmitt trigger, Triangular wave generator, Log and Antilog amplifiers

### **Unit V - Integrated Circuit Fabrication and Characteristics**

IC fabrication - crystal growth, epitaxy, oxidation, lithography, doping, etching, isolation methods, metallization, bonding, MOS technology and VLSI, scaling of MOS devices, NMOS and CMOS structures and fabrication, Characteristics of MOS transistors and threshold voltage, NMOS and CMOS inverters, Charge-Coupled Device (CCD) - structure, charge storage and transfer, Basics of VLSI design, stick diagrams, Layout design rules.

### **TEXT BOOKS**

1. Physics of Electronic Materials: Principles and Applications Jørgen Rammer

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- Cambridge University Press,  
2. Electronic Devices and Circuit Theory, 9th ed. Boylestad & Nashelsky PHI  
3. Microelectronics - Jacob Millman, Arvin Grabel, Tata Macgraw-Hill  
4. Physics of Semiconductor Devices: Shur PHI  
5. A Textbook of Applied Electronics (M.E.) Sedha R S, S. Chand Pub.  
6. Physics of Semiconductor Devices: Sze  
7. Ramakant A. Gayakwad, 'OP-AMP and Linear IC's', Prentice Hall  
8. Introduction to Quantum Mechanics J. Griffiths David Pearson  
9. Principles of Electronic Material & Devices: S O Kasap  
10. Quantum Mechanics Statistical Mechanics & Solid State Chattopadhyay D. and Rakshit P.C. S Chand & Company  
10. Integrated electronics – Analog and digital circuits and systems Jacob Millman, Cristos, C. Halkias, Tata Macgraw-Hill

## **ELT-102 Paper 2 - Digital Design and Applications**

**Max. Marks: 80, Min. Marks: 16**

**Student should be allowed to use Programmable Scientific Calculator in Examination hall**

### **Unit I - Basic Logic Circuit**

Introduction of basic gates, universal gates, number systems and codes, Boolean algebra, switching characteristics of semiconductor devices, logic gate characteristics - speed of operation, power dissipation, figure of merit, fan in, fan out, noise margin. Logic families - RTL, DTL, TTL, ECL interfacing, ECL and TTL, MOS logic - MOSFET NAND and NOR gates, CMOS inverters, CMOS - NAND and NOR gates, interfacing CMOS and TTL, inter facing CMOS and ECL, comparison of logic families.

### **Unit II - Combinational Logic Design**

Simplification of Boolean algebra using K-map, minterm and maxterm, design of binary adder, subtractor, digital comparator, parity generator/checkers, priority encoder, BCD to 7 - segments decoder, multiplexer, multiplexer tree, demultiplexer and demultiplexer tree.

### **Unit III - Sequential Circuit Design**

Excitation table of flip flops – S - R, J-K, Master-Slave – JK, D and T flip-flops, clocked flip flop design – conversion of one form of flip flop to another type.

**Analysis of clocked sequential circuits** - State equation, state table, state diagram, state input equations, analysis with - flip flops, JK flip flops and T flip flops.

State reduction and assignment, design procedure – synthesis using D flip flops, JK Flip flops and T flip flops.

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#### **Unit IV - Registers, Counters and A/D, D/A converters**

**Registers** - Shift registers, application of shift registers, serial to parallel converter, parallel to serial converter.

**Counters** - Ring counter, modulo-n-counter, synchronous counter -ripple counter (binary, BCD) and up-down counter, asynchronous counters - ripple counter (binary, BCD) and up-down counter. Other counters - counter with unused states, ring counter, Johnson counter.

**A/D, D/A Converters** - D/A weighted register type, R/2R ladder type, D/A converter specifications, A/D converters - successive approximation type, parallel comparator, dual slop ADC using voltage to frequency conversion and frequency to time conversion.

#### **Unit V - Memory and Programmable Logic**

General Memory Operation; CPU-Memory Connections; ROM: Architecture, Timing, Types: MROM PROM, EPROM, EEPROM, Flash Memory;

RAM: Architecture & Operation of SRAM, DRAM; Memory Expansion; Introduction to Programmable Logic Devices (PLDs): PLA, PAL, GAL, CPLD, FPGA. Analysis and Design of digital circuits using HDL.

#### **TEXT BOOKS**

1. T. L. Floyd & R. P. Jain, Digital fundamentals, Pearson Education India, New Delhi.
2. M. Moris Mano, Digital Design, PHI Learning Pvt. Ltd. New Delhi.
3. A. P. Malvino & D. P. Leach, Digital Principals and Applications, Tata McGraw Hill, New Delhi.
4. A. P. Malvino & J. A. Brown, Digital Computer Electronics, Tata McGraw Hill, New Delhi.
5. A. Anand Kumar, Fundamentals of Digital Circuits, PHI Pvt. Ltd. New Delhi.
6. R. J. Tocci & N. S. Widmer, Digital Systems, Pearson Education India, New Delhi.
7. John. M. Yarbough, Digital Logic: Applications and Design, Thomson Brooks/Cole, Boston.
8. John F. Wakerly, Digital Design Principles and Practices, Pearson Education India, New Delhi.
9. M. Moris Mano, Computer System Architecture, PHI Pvt. Ltd. New Delhi.

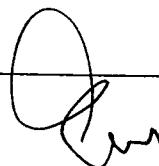
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## **ELT 103 PAPER 3 - Signals, Mathematical and Computational Methods in Electronics**

**Max. Marks: 80, Min. Marks: 16**

**Student should be allowed to use Programmable Scientific Calculator in Examination hall.**

### **UNIT I - Signal Analysis**

**Introduction** - Classification of signals and systems, some ideal signals, energy signal, Power signals, energy and power spectral densities.

Fourier Series, Complex Fourier Spectrum, The Fourier Transform, Continuous Spectrum, Fourier Transform involving Impulse Function, Properties of Fourier Transform, Fourier Transform of Periodic Functions, Convolution, Sampling Theorem.

### **UNIT II - Linear Systems and State Variables Techniques**

Introduction, System Function (Transfer Function), Distortion less Transmission, Paley-Wiener criterion, Correlation, Autocorrelation

**State Variables Techniques** - State variable concepts, form of the state equations, time domain and frequency domain solution of state equations, state transition matrix, state equations for networks, state equations from transfer functions.

### **UNIT- III- Probability and Random Signal Theory**

Introduction, set theory, Introduction to Probability, Conditional Probability Statistical Impedance, Baye's Theorem, Random variables, Discrete and Continuous Random Variables, Joint Distributions, Characteristics of Random Variables, Binomial, Poisson and normal Distributions, Uniform and other Distributions, Random and Markov Processes.

### **UNIT IV - Mathematical Methods**

**Laplace Transform** - Definition, transform of elementary function, properties of Laplace transform, convolution theorem, application to differential equation, simultaneous Linear equations with constant coefficients, unit step and unit impulse function

**Special Function** - Bessel equations, recurrence formula, expansion for  $J_0$  and  $J_1$ , values of  $J_{1/2}$ , generating function for  $J_n(x)$ , equation reducible to Bessel equation

### **UNIT V - Computational Methods**

**Numerical Differentiation and Integration**

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Finite Differences, Derivatives using Forward, Backward and Central Difference Formulae, Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's rules, Weddle's rule.

**Numerical methods for Solution of Ordinary Differential Equation**-Picards Method, Taylor Series Method, Eulers and Modified Eulers methods, Runge and Runge Kutta Methods, Newton- Raphson Method, Gauss Elimination Method Predictor and Corrector Method.

#### **TEXT BOOKS**

1. Communication System- Analog and Digital - R.P.Singh & S.D. Sapre TMH.
2. Signal and System - Nagrath, Sharan and Ranjan. Mcgraw hill Publishing
3. Signal and Systems - Rodger E. Ziemer. Continuous and Discrete 2nd ed. Maxwell Macmillan Int. Edition,
4. Higher Engineering Mathematics - B.S. Grewal, Khanna Publications
5. Numerical Methods - Kandaswami, Thilagavathi and Gunavathi, S.Chand & Co.
6. An introduction to Numerical methods: A MATLAB approach by Abde/Wahab Kharab, Ronald B Guenther
7. Optoelectronics and Photonics Engineering Dutta, Partha S. Springer

### **Paper 4-Optical, Quantum and Organic Electronics**

**Max. Marks: 80, Min. Marks: 16**

**Student should be allowed to use Programmable Scientific Calculator in Examination hall**

#### **Unit I - Quantum Electronics**

Coherent light sources, basic principle of lasers, laser pumping, stimulated emission, light amplification, threshold condition, Einstein's coefficient, laser rate equations for two, three and four level laser systems, variation of power around threshold, rectangular cavity, open plane resonator, mode locking and Q-switching of lasers.

#### **Unit II - Applications of Quantum Electronics**

**Types of Lasers** - Ruby Laser, He-Ne laser, Ar-ion laser, Co2 laser, Solid State Laser: Host material and its characteristics, doped ions Nd:YAG laser, Liquid laser: Dye laser, Semiconductor laser

**Laser Applications** - Laser in manufacturing, laser cutting of material, laser marking, laser transmitter, measurement of distance through Laser

#### **Unit III - Optical Display Devices**

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**Optical Display Devices** - LED- Basic principle of operation, radiative recombination process, the spectrum of recombination process, the internal quantum efficiency, double heterostructure, response time of LED, carrier configuration and modulation bandwidth, edge emitting LED, LED design. Liquid Crystal Display - construction, basic principle of emission, Plasma Display- construction, basic principle of emission

#### **Unit IV - Photo Detectors and Organic Electronics**

**Photodiodes-** General Principles, quantum efficiency, silicon P-N photodiodes, heterojunction photodiodes, Schottky barrier diode, P-I-N photodiodes, avalanche photodiodes, and phototransistors.

**Introduction to Organic Electronics,** Organic versus Inorganic solids, Molecular materials, Organic Semiconductors, Electronic states in conjugated molecules, Conjugated polymers, Basics of OLED

#### **Unit V - Electro-Optical Devices**

**Nonlinear Optics:** Origin of nonlinearity, susceptibility tensor, phase matching, second harmonic generation, methods of enhancement, frequency mixing processes, nonlinear optical materials.

**Electro-Optic Effect** - Kerr effect, Pockels effect, Farady effect, Electro-Optic Modulator- Electro-optic phase modulator, electro-optic amplitude modulator, Kerr modulator

**Acousto-Optic Effect** - Raman-Nath and Bragg Diffraction, Raman-Nath acousto-optic Modulator, Bragg modulator, acousto-optic modulator.

**Magneto-Optic Effect** - Faradays effect, magneto-optic modulator

#### **TEXT BOOKS**

1. Optical Electronics - Ghatak Thyagarajan, University Press
2. Optical Communication System - John Gower, PHI Publication.
3. Optoelectronics Devices & Systems - S.C. Gupta, PHI Publication
4. Optoelectronics - An Introduction - J.Wilson and J.F.B. Hawkes, PHI Publication.
5. Semiconductor Optoelectronic Devices, 2nd ed. **Bhattacharya PHI**
6. Pope and Swenborg, Electronic Processes in organic crystals and polymers, 2nd Ed., Oxford
7. Organic molecular crystals, E.A. Sininsh EA and V. Capek.
8. Optoelectronics & Photonics Principles and Practices S.O. Kasap Pearson
9. Optical Processes in Solids Mark Fox Oxford Press
10. Optoelectronics and Optical Fiber Sensors A B Maity PHI

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**M. Sc. Electronics**  
**Jan-June 2021**  
**Semester-II**

**Paper 1-Network Analysis and Synthesis**

**Max. Marks: 80, Min. Marks: 16**

- 1. Student should be allowed to use Programmable Scientific Calculator in Examination hall.**
- 2. Special graph paper viz. Polar graph & Semi log graph papers should be provided to the students in the examination hall.**

**Unit I - Mesh and Node Analysis and Network Theorems**

**Mesh and Node Analysis** - Kirchhoff's laws, Star and Delta conversion, source transformation, mesh and node analysis of electric circuits, response of the network by differential equation and Laplace transform method, initial conditions in the network.

**Network Theorems** - Thevenin's theorem, Norton's Theorem, Superposition, Millman theorem, Maximum power transfer theorem, and Reciprocity theorem, Tellegen theorem and Substitutions theorem.

**Unit II - Coupled Circuit, Waveform Synthesis and Graph Theory Coupled Circuit** - Dot convention and magnetic coupling

**Waveform Synthesis** - Standard signals, unit step function, ramp function, impulse function, initial and final value of  $f(t)$  from  $F(s)$ , the convolution integral.

**Graph Theory** - Concept of a network graph, twigs and links, trees, co trees, formation of incidence matrix, cut-set matrix, tie-set matrix and loop currents, analysis of networks, network equilibrium equation, duality, network transformation

**Unit III - Network Function and Frequency Response Plots**

**Network Function** - Network function for one port and two port, the calculation of network functions - ladder networks and general networks, pole and zero of network functions, restrictions on pole and zero locations for driving point functions, restrictions on pole zero locations, time domain behavior from the pole and zero plot, stability of active networks.

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**Frequency Response Plots-** Magnitude and Phase plots, Root Loci, Bode Diagrams, Nyquist- Stability Criterion

**Unit IV -Two Port Network Analysis**

Relationship of two port variable , Z-parameters, Y- parameters, Hybrid parameters, ABCD parameters, conditions of reciprocity and symmetry, inter-relationship between parameter of two port network, different types of interconnections of two port networks.

**Unit V- Network Synthesis**

Concept, Procedure of Synthesis, Reactive Networks, Properties of Expressions of Driving point Admittances of L-C Networks, Pole-Zero Interpretations in L-C Networks. L-C Networks Synthesis-Foster's Canonic Form (First and Second Foster form), Significance of Elements in the Foster form, Caueer Canonic form of Reactive Networks-First and Second form of Caueer Networks, Applicability of Foster and Caueer forms, R-L & R-C Network Synthesis by Foster form, Identification of foster form , Identification of Admittance, R- L& R-C Network Synthesis by Caueer form, Identification of Admittance Function in Caueer form, Determination of end elements in Foster and Caueer R-L & R-C Networks.

**TEXT BOOKS**

1. Networks and System - D. Roy Choudhary, New Age International
2. Network Analysis: M.E. Van Valkenburg.PHI
3. Circuit theory (analysis and synthesis) - A. Chakrabarti, Dhanpat Rai and co.
2. Network Synthesis: M.E. Van Valkenburg.PHI

**Paper 2 - Microprocessor and C++ Programming**

**Max. Marks: 80, Min. Marks: 16**

**1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall**

**Unit I - Micro-Computer System & 8085 Microprocessor Architecture**

**Microcomputer System & its operation-** Overview of a basic Microcomputer structure and operation, Ideal microprocessor, Microprocessor evolution and types, Microprocessor initiated operation & Bus organization, internal data operation & registers, peripheral initiated operation.

**Memory-** Memory organization, memory map, memory & instruction fetch, types of memory. Interfacing Devices - Tri-state devices, buffer, decoder, encoder, latch.

**Microprocessor Architecture** - Introduction to 8085 Microprocessor, pin diagram & its function, bus timing, Demultiplexing of address & data Bus, generation of

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control signals, microprocessor architecture of 8085, decoding & execution of an instruction, memory interfacing, timing diagram of memory, read & write cycle.

### **Unit II - Instruction Set & Programming of 8085, Stack & Subroutines**

Instruction classification, instruction format, addressing modes, basic instructions and simple programming, Additional Instructions - DAA, DAD, LHLD, SHLD, PCHL, STC, XCHG, XTHL and programming, Code Conversion - BCD to Binary, Binary to BCD, Binary to ASCII, ASCII to Binary.

**Stack & Subroutines** - Concept of stack, PUSH/POP instruction, illustrative example, Concept of subroutines, call & return instruction, conditional call & return instruction, advanced subroutines concept.

### **Unit III - Counters, Time Delay, Interrupts & Interrupt Controller**

**Counters and Time Delay** - Time delay using one register, Time delay using a register pair, flow chart & program for a hexadecimal counter and modulo 10 counter, delay calculations.

**Interrupts** - Interrupts of Intel 8085, hardware and software interrupts, vectored/non vectored interrupts, maskable/non-maskable interrupts, Interrupts priority concept, DI, EI, RIM, SIM instructions, pending interrupts.

**Programmable Interrupt Controller** - Architecture of 8259, initialization command words (ICW's), operational command words (OCW's), 8259 interrupts mode, simple initialization program for 8259.

### **Unit IV - Data Transfer & Peripheral Interfacing Devices, Co-processor**

Format of data transfer, modes of data transfer, microprocessor controlled data transfer, peripheral control data transfer, peripheral I/O instruction, serial I/O lines, SOD and SID.

**Programmable Peripheral Interfacing Devices** - Programmable keyboard / display interface - 8279, Programmable peripheral interface - 8255, Programmable interval timer - 8253, Programmable Interrupt controller - 8259, Synchronous data communication device - 8251, DMA Controller 8257, RS 232 interface. Numeric co-processor 8087

### **Unit V - "Object Oriented Programming**

Principles and Basic concepts, OOPs languages, Application of OOPs, Simple programming in C++, Tokens, expressions and control structures - Tokens, keyword, identifiers and constants, declaration of variables, operators in C++, manipulators, control structure.

Functions in C++ - main function, function references, return references, default arguments and constant arguments. Classes and Objects- C structures revisited,

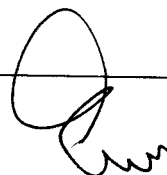
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specifying class, C++ program with classes, arrays within Classes, memory allocation of objects, arrays of objects, returning objects, pointer to members, local classes.

#### **TEXT BOOKS**

1. Microprocessor Architecture Programming - Ramesh S. Gaonkar & Application with 8085/8080 Penram Int. Pub2
2. 0000 to 8085: Introduction to Microprocessors for Engineers and Scientists, 2nd ed. Ghosh & Sridhar PHI
3. Fundamentals of Microcomputer & Microprocessor r - B.Ram, Dhanpat Roy Pub.
4. Object Oriented Programming E - Balaguruswamy with C++ Second Edition
5. PROGRAMMING IN C++ P.B.MAHAPATRA, S Chand & Co

#### **ELT 203 Paper 3- Analog and Digital Communication Systems**

**Max. Marks: 80, Min. Marks: 16**

**1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall**

**Unit I Radiation and Propagation of Waves** - Electromagnetic Radiation -Effect of environment, Propagation of waves -Ground Wave and Sky-wave Propagation - The ionosphere - Space waves - Tropospheric scatter propagation - Extraterrestrial communications

**Introduction to Communication Systems** -Block diagram of communication system -

Transmitter, Receiver, Modulation, Bandwidth requirements

**Noise** - Source of Noise, External Noise -Atmospheric Noise, Extra Terrestrial Noise, Industrial Noise, Internal Noise-Shot Noise, Resistor or Johnson Noise, Calculation of noise in Linear Systems, Noise Bandwidth, Power, Noise Temperature, Noise in Two Port Networks, Noise Figure, Cascaded stages, Measurement of Noise Figure, Signal in presence of Noise, Narrowband Noise.

#### **Unit II - Amplitude Modulation System**

**Amplitude Modulation** - Frequency spectrum of AM wave, Representation of AM wave, Power relation in AM wave, Single side band techniques - Suppression of carrier, suppression of side bands, vestigial side band,

**Transmitters** - Classification of radio transmitter, AM radio transmitter, Generation of AM -Transistor as AM Generator, balanced modulator, filter method, phase shift method, third method.

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**Receivers** - Classification of radio receiver, basic function of AM receiver, tuned radio frequency receiver, super heterodyne receiver, AM demodulation - RC demodulator, square law demodulator. Noise in Amplitude Modulated Systems, Comparison of various AM systems,

### **Unit III - Angle Modulation System**

**Angle Modulation** - Frequency modulation, analysis of FM waveform, frequency spectrum, Bessel function, Narrowband FM and Wide Band FM, Phase modulation

**FM Modulators and Transmitters** - Method of frequency modulation - Direct method - reactance modulator (FET and varactor diode method), Indirect Method, pre-emphasis and de-emphasis

**FM Demodulators and Receivers** - Super heterodyne FM receiver - block diagram, amplitude limiter, FM demodulator - phase discriminator, ratio detector, PLL demodulator. Comparison of AM, FM and PM, , frequency division multiplexing(FDM).

### **Unit IV - Pulse Modulation System**

**Pulse Amplitude Modulation** - Natural Sampling, flat top sampling, equalization signal recovery to holding, PAM modulator and demodulator. Pulse time modulation (PTM)- Generation of PTM signals, PTM modulator and Demodulator, time division multiplexing (TDM).

**Pulse Code Modulation**- Quantization of signals, quantization error, pulse code modulation (PCM), companding, Bandwidth of PCM System, Noise in PCM System, Differential pulse code modulation, Delta modulation, Adaptive Delta modulation.

**Digital Modulation Techniques** - Introduction, Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Quadrature Amplitude Shift Keying (QASK) and Binary Frequency Shift Keying (BFSK).

### **Unit V - Monochrome and Colour Television**

Elements of a TV System - Concept of Picture and sound transmission and reception, Flicker, Composite Video Signal, signal transmission and Channel bandwidth, Monochrome picture tube, Television Camera tube - Vidicon and CCD. Monochrome TV transmitter and receiver (Block Diagram), Essentials of Colour TV - Three Colour theory, Luminance, Hue and saturation, Triniton Colour Picture tube, Block diagram of Colour TV transmitter and receiver, PAL Colour TV System. CCTV, HDTV, CATV and DTH, Concepts of Home Theatre

### **TEXT BOOKS**

1. Principles of Communication Systems - Taub & Schilling, TMH
2. Principles of Communication Systems - George Kennedy, TMH
- 3, Communication System- Analog and Digital - R.P.Singh & S.D. Sapre TMH

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4. Radio Engineering - G. K. Mithal G.K. Pub.
5. Monochrome and Colour Television - R.L. Gulati, New Age International, Wiley Eastern Ltd. New Delhi.
8. Advanced Electronic Communication Systems: Tomasi PHI
9. Television Engineering - A.M. Dhake, TMH
10. Electronic communication, Roddy and Coolen, PHI, New Delhi,

**ELT 204 Paper 4 - Electromagnetic Plane Wave, Transmission Lines and Microwave Devices**

**Max. Marks: 80, Min. Marks: 16**

**1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall**

**UNIT I - Electromagnetic Plane Wave**

**Electromagnetic Plane Wave** - Electron motion in electric field, electron motion in magnetic field, electron motion in electromagnetic field, electric and magnetic wave equations, Maxwell equation, Poynting theorem, uniform plane wave and reflection, uniform plane wave propagation in free space and lossless dielectric, plane wave propagation in lossy media, Ionospheric propagation, conductors and dielectrics, skin depth, polarization, phase velocity and group velocity.

**UNIT II - Transmission Lines and Antennas**

**Transmission Line** - Basic equation, reflection and transmission coefficient, standing wave and standing wave ratio, line impedance and admittance, Determination of characteristics impedance, Fundamental of Smith Chart, Impedance Matching: Single and Double Stub Matching, microwave Coaxial Connectors.

**Antennas** - The Radiation mechanism, Current and Voltage distribution, Antennas gain, Antenna resistance, Bandwidth, Beam width and Polarization, effects of Antenna height, Dipole arrays, Folded dipole. Microwave Antennas - Parabolic reflector, Horn and Lens antenna, Special purpose antennas - Yagi, Log periodic and Loop antennas.

Radar- block diagram of Radar, frequencies and power used, Radar range equation.

**UNIT III - Microwave Waveguides and Components**

**Waveguides** - Rectangular Wave guide - TE and TM modes, power transmission, excitation in rectangular wave guide, circular wave guides - TE, TM and TEM mode, **Microwave Components** - Waveguide Tee - E-plane tee, H-plane tee, Hybrid tee, scattering parameters (s-matrix), circulators, isolators, directional couplers.

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#### **UNIT IV – Microwave Sources and Measurements**

**Microwave Sources** - Reflex Klystron - principle of operation of velocity modulation, power output and efficiency, electronic admittance, Cylindrical Magnetron – principle of operation, equation of electron motions, cyclotron angular frequency, power output and efficiency.

**Microwave measurement techniques**, - Microwave bench, precautions, power measurement, bolometric method, attenuation, VSWR, impedance, frequency and Q of the cavity, standing wave measurements, impedance measurement, cavity resonator, dielectric measurements.

#### **UNIT V - Microwave Semiconducting and Avalanche Transit -Time Devices**

##### **Microwave Semiconducting Devices**

Microwave Transistor – Microwave Bipolar Transistor – principle and amplification phenomenon, power frequency limitation, Microwave Tunnel Diode – principle and characteristics of microwave tunnel diodes, JFET operation and characteristics. Microwave integrated circuit design, introduction, hybrid microwave integrated circuits (HMIC), monolithic microwave integrated circuit (MMIC), MIC materials, substrate material, conductor material, dielectric materials, resistive films, types of MIC'S, microwave monolithic integrated circuits (MMIC'S).

Transferred Electron Devices – Gunn Effect Diodes, GaAs diode Ridley Watkins Hilsum (RWH) theory – Differential negative resistance

**Avalanche Transit -Time Devices** - Read Diode - Avalanche multiplication, carrier current and external current, output power and quality factor. IMPATT Diodes and TRAPATT Diodes- Principles of operation, power output and efficiency

#### **TEXT BOOKS**

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI Pub
2. Microwave Engineering – Annapurna Das, Sisir K. Das, Tata Mc Graw Hill.
3. Microwave and Radar Engineering - M. Kulkarni, Umesh Publication
4. Electronic Communication Systems - George Kennedy, 3rd Edition TMH
5. Introduction to electrodynamics by David J. Griffiths, PHI
6. Elements of engineering electromagnetics by Narayana Rao, PHI

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**M. Sc. Electronics**

**July-Dec 2021**

**Semester III**

**ELT 301 Paper - 1 Advance Microprocessors and Microcontroller (AMM)**

**Max. Marks: 80, Min. Marks: 16**

**1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall**

**UNIT I** *16-bit microprocessors*

8086 internal architecture; memory organization, 8086 basic configurations: minimum mode, maximum mode, 8284 clock generator, 8288 bus controller, system bus timings for minimum and maximum modes. Introduction to 8088, 80186, 80286, 80386, 80486

**UNIT II** *Programming of 8086*

8086 addressing modes, Instruction formats, instruction set: data transfer instructions, arithmetic instructions: binary, packed and unpacked arithmetic; branch instructions: conditional and unconditional branch instructions; loop instructions, flag manipulation instructions, shift and rotate instructions, byte and string; assembler directives; programming examples.

**UNIT III** *Interfacing*

Basic interfacing concepts; Interfacing memories: I/O mapped I/O, memory mapped I/O, 8086 memory interface, I/O operations: programmed I/O, Interrupt I/O, Direct memory access, Programming and interfacing of peripheral devices: programmable peripheral interface (8255), Interrupt controller (8259), DMA controller (8257); Co-processor (8087): architecture, data types, and interfacing.

**UNIT IV** *Microcontroller 8051*

8051 architecture: oscillator and clock, PC and data pointers, CPU registers, flags, and PSW; internal RAM; stack and stack pointer, SFRs, internal ROM, I/O ports; external memory; Counters and timers: timer counter interrupts, timing, timer modes of operation, counting, Serial Data I/O: serial data interrupts, data transmission, data reception, serial data transmission modes, Interrupts: timer flag interrupt, serial port

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interrupt, external interrupts, reset, interrupt control, interrupt priority, interrupt destinations, software generated interrupts.

**UNIT V** *Programming of Microcontroller 8051*

Instruction set: Moving data: addressing modes, external data moves, code memory read-only data moves, push and pop opcodes; Logical operations: byte and bit level logical operations, rotate and swap operations; Arithmetic operations: flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic; Jump and call instructions: jump and call program range, jumps, calls and subroutines, interrupts and returns; simple programming examples.

**TEXT BOOKS**

1. Yu Cheng Liu, Glenn A. Gibson, **Microcomputer systems: The 8086/8088 family architecture, programming and design**, Prentice Hall of India, New Delhi.
2. Douglas V. Hall, **Microprocessors and interfacing**, Tata McGraw-Hill Company Limited, New Delhi.
3. Bhupinder Singh Chabra, **The Intel 8086/8088 microprocessor architecture programming design and interfacing**, Dhanpat Rai Publishing Company Limited, New Delhi.
4. Ramesh S. Gaonkar, **Microprocessor architecture, programming and application with 8085/8080A**, Wiley Eastern Limited, New York.
5. Kenneth J. Ayala, **The 8051 Microcontroller architecture, programming, and applications**, Penram International Publishing, India.
6. Barry B. Brey, **The Intel Microprocessors 8086/8088, 80186, 80286, 80386 and 80486 Architecture, programming and interfacing**, Prentice Hall of India, New Delhi.
7. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, S.K. Shah, **Microprocessors and Interfacing 8086, 8051, 8096 and advanced processors**, Oxford university press.

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**ELT 302 Paper 2-Data Communication, Mobile and Wireless  
Communication**

**Max. Marks: 80, Min. Marks: 16**

**1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall**

**Unit I- Data Communication**

Data Signal, Signaling & Data Transmission Media, Communication Mode-Half Duplex/Full Duplex, Data Communication System-Synchronous/Asynchronous Transmission, Serial/Parallel Data, Switching & Multiplexing-Circuit Switching, Message Switching, Packet Switching, Network Topology-Bus/Star/Ring/Mesh Topology, LAN, OSI Reference Model, Network Protocol(TCP/IP).

**Unit II- Introduction to Mobile and Wireless Devices**

Mobile and wireless devices, history, applications wireless transmission, frequencies for radio transmission, regulations, signals, antennas, signal propagation, multiplexing, modulation, wireless LANs and wireless WANs, spread spectrum, FHSS and DSSS spread spectrum technology, cellular systems, medium access control, specialized MAC.

**Unit III- Telecommunications and Broadcast Systems**

GSM, mobile services, system architecture, GSM subsystems, GSM communication frame, localization and calling, handover, security, new data services, satellite systems applications, GEO, LEO, MEO, routing, localization, broadcast systems, cyclic repletion of data.

**Unit IV- Wireless Networks and others 3G Technologies**

Wireless LAN, infrared v/s radio transmission, infrastructure and adhoc networks, IEEE 802.11, architecture (details of protocol not required), DFWMAC schemes, MAC frames, MAC management, roaming, HIPERLAN (just basics, frame and protocol details not required), Bluetooth, applications, physical layer, modes MAC layer, packet format, networking security, link management, brief discussions (frame details and protocols not required) on GPRS, DECT, TETRA, UMTS, IMT-2000, CDPD.

**Unit V- Mobile Network and Transport Layers**

Mobile network layer, requirements, entities, IP packet delivery, agent advertisement and discovery, registration, encapsulation and tunneling, optimization, messages, reverse tunneling, IPv6, DHCP, Mobile IP, DHCP, ad-hoc networks, mobile transport layer, traditional TCP, indirect TCP, snooping TCP,

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mobile TCP, fast transmit/fast recovery, transmission/time out freezing, selective retransmission, transaction oriented TCP.

#### **TEXT BOOKS**

1. Data Communication & Networking - Behrouz A Foruzon.
2. Wireless communications and networking" William Stallings, PHI
3. Data and Computer Communications – By William Stalling., 7<sup>th</sup> Ed., PHI
4. Mobile communications"-by Johan schiller, PEA, 2nd ED
5. Mobile and personal communications systems and services" Rajpandya, PHI
6. Computer Networks - Tanenbaum, PHI.
- 7 Data Communications and Distributed Networks, 3rd ed. Black PHI
- 8 Computer Networks: Protocols, Standards and Interfaces, 2nd ed. Black PHI

### **ELT 303 Photonics**

**Max. Marks: 80, Min. Marks: 16**

**Student should be allowed to use Programmable Scientific Calculator in Examination hall**

#### **Course Objectives:**

- Photonic Devices have emerged as the key technology for optical communications, environmental sensing, biomedical diagnostics in the life sciences, energy efficient lighting and solar energy harvesting.
- Upon completion of this course, students should understand the functioning and design of most photonic devices in use. **Course Outcomes:**
- At the end of the Course students will be able to understand the basic components and devices of photonic integrated circuits.
- At the end of the Course, students should understand propagation in optical fiber couplers, fiber Bragg grating and long period fiber gratings and their applications
- At the end of Course, students should understand the area of silicon photonics which is an upcoming area of photonic integration with Electronics.

**Unit I-** Theory of Light, Light as Electromagnetic wave, Polarization of Light, Principle of superposition, Interference, Diffraction, Scattering, Photon nature of light, Light wave in homogeneous medium, Plane Electromagnetic Wave, Maxwell's Wave equation and Diverging Waves.

Basics of LED, and flexible display devices. Thin film deposition and characterization Techniques: XRD, TEM, SEM, EDX, Thin film active and passive devices,

#### **Unit II -**

Guide Wave Integrated Optic Devices: Planar and channel waveguides, Waveguide platforms on various materials and their fabrication techniques. Waveguide directional

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couplers, tapered waveguides and Y-junction splitters/combiners, Ring resonators, Mach-Zehnder interferometers/modulators. Sagnac interferometer/gyroscope. Coupling in and out of Photonic Integrated Circuits: Optical mode converters, prism and grating couplers. Wavelength-division multiplexing components: Multiplexers, Demultiplexers, Multimode interferometers, Arrayed waveguide gratings.

**Unit III - Solar Photovoltaics:** Solar cell materials and their properties. Solar cell research: technology (silicon, organic, Dye sensitized, perovskites), applications and limitations. Characterization and analysis: ideal cell under illumination- solar cell parameters, optical losses; electrical losses, surface recombination velocity, quantum efficiency - measurements of solar cell parameters; I-V curve & L-I-V characteristics, internal quantum yield measurements – effects of series and parallel resistance and temperature - loss analysis. Solar photovoltaic(PV) modules from solar cells, series and parallel connections, design and structure of PV modules.

#### **Unit IV- Non Linear Optical processes**

Introduction, Second Harmonic Generation,, susceptibility tensor, phase matching, propagation of EMW through second order nonlinear media, experimental technique in study second order non linearity Self Focussing and Defocussing, Optical Parametric Interactions, Chirped pulse amplifier, parametric oscillations, Optical Mixing, Four Wave Mixing, Multiphoton Absorption.

#### **Unit V -Advances in Photonics and photonic Materials**

Emerging materials for future Devices: Graphene, Carbon Nano tubes (CNT), ZnO, SiC etc. Low dimensional semiconductor devices – quantum wells, quantum wires, quantum dots

**Silicon Photonics:** Motivation towards silicon photonics, Silicon on Insulator (SOI) waveguides or nanowires .Optical fiber to silicon waveguide: edge, grating, evanescent coupling, spot-size converters. III-V integration with silicon photonics. Photonic modulators: electro-optical and thermo-optical effects.

Raman Scattering, Photorefractive effect, Photothermal Deflection effect, Photorefraction in diffusing medium, Squeezed state, Optical Solitons, Optical Bistability, Optical interconnect, Photonic switches, Optical Computers, Ultrafast phenomena

#### **TEXT BOOKS**

1. Optical Electronics - Ghatak Thyagarajan, University Press
2. Optoelectronics An Introduction: Wilson & Hawkes PHI
3. Optoelectronics & Photonics S.O.Kasap, Pearson
4. Optoelectronics Devices & Systems - S.C. Gupta, PHI Publication
5. Photonics Sasi Kumar PHI

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**ELT 304 Paper 4- Power Electronics, Information Theory and Coding**

**Max. Marks: 80, Min. Marks: 16**

**1. Student should be allowed to use Non Programmable Scientific Calculator in Examination Hall**

**Unit I- Thyristors, Controlled Rectifiers and Commutation Techniques**

**Thyristors** – Thyristor Characteristics, Two- transistor model of Thyristor, Turn ON and Turn OFF of Thyristor, di/dt protection, dv/dt protection, Type of Thyristors, Series operation and Parallel operation of Thyristors, Thyristor Firing Circuits, Unijunction Transistor. **Controlled Rectifiers** – Single Phase semiconverter with RL load, Single Phase full converter with RL load

**Thyristor Commutation Techniques** – Natural Commutation, Forced Commutation, Self Commutation, Complementary Commutation, External Pulse Commutation,

**Unit II- AC Voltage Controllers, DC Choppers and Inverters**

**AC Voltage Controllers** – Introduction, Principle of ON-OFF control, Principle of Phase control, Single Phase bi-directional controllers with inductive loads, Cycloconverters.

**C Choppers** – Principle of operation, Classification of Choppers – Class A, Class B, Class C, Class D and Class E Choppers.

**Inverters** – Introduction, classification of Invertors, Single phase, full bridge Voltage source inverter with RL load,

**Unit III- Power Drives- DC Motor and AC Motor**

**DC Motor** – Basic Characteristics, Speed control of DC motors – Armature voltage, Armature Resistance and Field flux controls, Solid state speed control of DC motor – Single Phase half wave converter, Single phase full wave converter.

**AC Motor (Induction Motor)** – Construction & Principle, Speed control of Induction motor – Stator voltage, Stator frequency, Pole changing, Rotor resistance and Slip power recovery control, Basic Construction and principle of Stepper motor

**Unit IV – Power conditioners:**

EMI/ RFI filter, CVT, Voltage regulators, Solid state regulators, UPS online & OFF line, reliability of UPS system. Batteries used for UPS, Important terms related to the UPS System & comparison of UPS system.

Applications of Power Electronics: Electronic ballast, Power factor correction, Induction heating, Dielectric heating.

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**Unit V - Information Theory** :Introduction, Unit of Information, Entropy, Rate of Information, Joint Entropy and Conditional Entropy, Mutual Information, Channel Capacity-noise-free channel, symmetric channel, Binary Symmetric channel & cascaded channel, Shannon's Theorem, Continuous Channel, Capacity of a Gaussian Channel: Shannon Hartley Theorem, Bandwidth S/N Trade-off.  
**Coding** - Introduction, Coding Efficiency, Shannon-Fano Coding, Huffman Coding, Error-Control Coding, Block Codes, Convolution Codes.

**TEXT BOOKS**

1. Power Electronics - Muhammad H. Rashid, Prentice Hall of India, Second Edition, New Delhi
2. Power Electronics - A.K. Gupta & L.N. Singh, Dhanpat Rai Publishing Company, 1st Edition
3. Power Electronics - J. Asger, PHI Publication.
4. Communication System - R.P.Singh & S.D. Sapre TMH Analog and Digital
5. Power Electronics - R.M. Jalnekar & N.B. Pasalkar
6. Pspice Simulation of Power Electronic Circuits: Raymond Ramshaw
8. Communication Systems-Simon Haykin, John Wiley & sons, NY, 4th Edition
9. Information theory- F.M Reza, McGraw Hill
10. A Text book of Electrical Technology (Volume -II) - B. L. Thereja & A K Theraja, S Chand & Co. Ltd (2006)
11. Principles of Electrical Machines- V K Mehta & Mehta, S Chand & Co. Ltd (2006)
12. Electrical Machines - A Hussain, Dhanpat Rai & Co

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**M. Sc. Electronics**  
**Semester-4**  
**(Jan-June 2022)**

**ELT 401 Paper 1 -Digital Signal Processing**

**Max. Marks: 80, Min. Marks: 16**

**1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall**

**Unit I- Discrete Time Signals, Systems and Z-Transform**

**Discrete Time Signals, Systems**-An introduction to analog signal processing, Discrete time signals & systems- discrete time signals (sequences), Linear shift, Invariant systems, Stability & Casuality, linear constant coefficient Differential equations, Frequency domain representation of discrete time systems & signals, Sampling of continuous time signals.

**Z-Transform**- Introduction, Z-transforms (of finite length sequences, Right sided, left sided & two sided sequences) Inverse Z-transform, Z-transform theorems & properties – Region of convergence of rational Z-transform, Linearity, Shift of a sequence, multiplication by an exponential sequence, Initial value theorem, Convolution of sequences, system functions.

**Unit II-Discrete Fourier Transform**

Discrete time fourier transform (DTFT), Representation of periodic sequence - Discrete Fourier series(DFS), Properties of the Discrete Fourier series- Linearity, Shift of a sequence, symmetry properties, periodic convolution; Fourier representation of finite duration sequences- The Discrete Fourier transform(DFT), Properties of discrete Fourier transform - Linearity, Circular shift of a sequence, Symmetry Properties, Circular convolution, Linear Convolution using the Discrete Fourier Transform.

**Unit III- Fast Fourier Transform and Network Structures**

Fast Fourier Transform (FFT), Inverse DFT, Radix FFT.

Signal Flow Graph Representation of Digital Network, Matrix Representation of digital

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Networks, Basic network structures for IIR systems (Direct form, cascaded form, and parallel form) Transposed forms, Basic network structures for FIR systems (direct form, cascaded form).

#### **Unit IV- Digital IIR filter**

Digital filter design techniques- design of IIR digital filters from analog filters, impulse invariance, Bilinear Transformation, Design examples: Analog-Digital Transformation - Digital Butterworth Filters (impulse invariance, bilinear transformation), Digital Chebyshev filters (impulse invariance, bilinear transformation), Comparison of IIR and FIR Digital Filters.

#### **Unit V- Digital FIR filter**

Finite impulse response (FIR) Filter Design, Rectangular, Triangular, Hanning, Hamming, Blackman and Kaiser Window, Linear phase and Optimal Filter .

Application Digital Signal Processing-speech processing, speech analysis- short term Fourier analysis, cepstral analysis & linear predictive analysis, speech coding, channel vocoder

#### **TEXT BOOKS**

1. Digital Signal Processing - A.V. Oppenheim & Schafer. PHI
2. Discrete Time Signal Processing - A.V. Oppenheim & Schafer. PHI
3. Digital Signal Processing - Johny Jonson, Pearson PHI
4. Digital Signal Processing - Proakis
5. Digital Signal Processing -Vallavaraj, Salivahanan, Ghanapriya, THM

#### **ELT 402 Paper 2-Optical Communication and Satellite Communication**

**Max. Marks: 80, Min. Marks: 16**

**1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall**

**Unit I-Optical Fibers** Optical fiber theory and applications, advantages and disadvantages, parameters and types of optical fibers, Propagation of light through optical fiber ,single mode step index fiber, multimode step index fibers, multimode graded index fibers, Comparison of Three types of Optical fibers, Acceptance angle and acceptance cone, Numerical Aperture, , construction of optical fiber cables,

**Transmission Characteristics of Optical Fiber:** Attenuation in Optical Fibers, loss mechanisms - absorption and Rayleigh scattering, Radiation losses, Wavelength dispersion, intermodal and intramodal, Bending losses, Coupling losses: misalignment and mismatch losses

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## **Unit II- Principle of Optical Communication**

Optical Fiber Communication System Block Diagram

**Optical sources:** Heterojunction LED, Edge emitting LEDs, Injection Laser LEDs

**Light Detectors:** PIN Diode and Avalanche Photodiode, Structure of In, GaAs APDs  
Characteristics of Light Detectors, Connector types and splices, Optical Fiber System  
Link Budget, Optical fiber manufacturing processes. Optical fiber testing and  
parameter (cut off

Wavelength, loss per unit length, numerical aperture, bending loss,  
connector/spliceloss) measurement

## **Unit III- Optical Fiber Communication Systems and Applications**

Typical Fiber Optic Communication System, Optical Transmitter, Optical Receiver,  
Optical Repeaters, Optical Amplifiers, semiconductor optical amplifiers, EDFA,  
Raman Amplifier. Basic idea of WDM and DWDM systems, System Architecture:  
Point to point link, Distributed Network, AN Fiber Optic Sensors in Health care,  
Optical Computing, Optical Logic Gates

## **Unit IV-Satellite Communication - I**

Satellite Communication - Introduction, Kepler's laws, orbit, Power systems,  
Satellite Frequency Allocations and Band Spectrum, Elements of a Satellite  
Communication System, Active and Passive Satellites, Modem and Codec,  
Communication Satellite Link Design - General Link Design Equations, Effective  
Isolated Radiated Power (EIRP), System Noise Temperature, C/N and G/T ratio,  
Atmospheric and Ionosphere Effects on Link Design, Uplink Design, Complete Link  
Design, Interference Effects on complete link design, Earth Station parameters.

## **Unit V- Satellite Communication - II**

Satellite orbits - synchronous orbit, orbital parameters, Satellite location with  
respect to the earth, Look Angles, Earth coverage and Slant range. Satellite  
Transponder model, Satellite RF Front End, Satellite Carrier Processing, Antenna -  
Antenna parameters, Gain, Resistance, Bandwidth, Beam-width and polarization,  
Parabolic antenna, Application of Satellite Communication in Television - Direct  
Home Broadcast, Telephone services and Data Communication.

### **TEXT BOOKS**

1. Optical Fiber Communication -G. Keiser, Mc. Graw Hill
2. Fiber Optics Communication -D. C. Agrawal
3. Satellite Communication -D.C. Agrawal, Khanna Pub.
4. Satellite Communication -R.M. Gagliardi
5. Fundamentals of Optical Fibre Communication: Satish Kumar PHI
6. Optical fibre and Laser Anuradha De New Age International Publishers
7. Optical Fiber Communication: V.S.Bagad Technical Publications

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8. Optical Fiber Communications', John Senior: PHI.  
9 Electronic communications, Roddy and Coolen, PHI, New Delhi,

**ELT 403 Paper 3- Automatic Control System and Artificial Neural Network**

**Max. Marks: 80, Min. Marks: 16**

**1. Student should be allowed to use Non Programmable Scientific Calculator in Examination Hall**

**2. Special graph paper viz. Polar graph & Semi log graph papers should be provided to the students in the examination hall.**

**Unit I - Fundamental of Control System**

Basic Definition, Classification of Control System, Open Loop & Closed loops System, Effect of feedback on System response, Impulse Response & Transfer Function, Block diagram, Block Diagram Reduction Techniques. Signal Flow Graph-Basic Definition in SFG, Rule for SFG, Properties of SFG, Masons Gain Formula.

**Unit II -Time Domain analysis and Stability of Linear Control System**

Time Response of Continuous Data system, test Signal ,Steady State Errors and error constants, Unit Step response, Time Domain specifications, time Response of first order System, Transient Response of Prototype second order System, effect of adding a zero to the system, Stability of Linear Control System-Absolute Stability, Relative Stability, Routh-Hurwitz Criterion-Ruth Tabulation, Special Cases.

**Unit III- Frequency Domain Analysis and Frequency Response Plots**

**Frequency Domain Analysis** - Frequency Response of closed loop control System, Frequency Domain Specifications of prototype Second Order System, Nyquist Stability Criterion and plot, Root Loci- basic properties, Relative Stability-Gain Margin & Phase Margin, Correlation Between Time & Frequency response, Polar Plot, Bode Plot.

**Unit IV-State Variable Analysis and Controllors**

**State Variable Analysis and Design** – Concept of state variables, state model, state model for linear continuous time system, diagonalization, solution of state equations, concept of controllability and observability, PID Controller, Theory of lag, lead and lag-lead compensators.

**Unit V- Artificial Neural Network**

**Introduction to ANS Technology**-Models of a neuron, neural networks, viewed as directed graph, feedback from neurons to ANS, **Learning and training**- Hebbian,

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memory based, competitive, error-correction and learning. **Assignment problem** supervised and unsupervised learning. **Network architectures-Single layered-** feed forward networks, multi-layered feed forward networks, Activation and Synaptic Dynamic. **Stability and convergence-** single layered perception - least mean square algorithm, multilayered perceptions - backpropagation algorithm

#### **TEXT BOOKS**

1. Control systems Theory & Application - Samarajit Ghosh (Pearson Edu)
2. Control System Engineering - B.C.Kuo(PHI)
3. Control Systems Engineering - I.J. Nagrath, M. Gopal
4. Artificial Neural networks - B. Yagna Narayan
5. Neural Computing -Philips D. Wasserman  
Theory and practice -Vannostrand Reinhold

#### **ELT 404 Paper 4 – Embedded Systems , Microcontrollers and Advanced Instrumentation**

**Max. Marks: 80, Min. Marks: 16**

**1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall**

#### **Unit I- Introduction to Embedded systems:**

Introduction, Application Areas, Categories of embedded systems, Overview of embedded systems architecture, Specialties of embedded systems, challenges and issues in embedded software development Recent Trends, hardware architecture, Software architecture, core platform development, boot sequence, development/testing tools.

Fundamentals of Internet of Things (IoT) for communication and Cloud Computing.

#### **Unit - II**

FPGA Architecture Introduction to Programmable logic, Basic Components of FPGA ( LUT, CLB, Switch Matrix, IOB), Basic FPGA Architecture

**PIC Microcontrollers** – Introduction to PIC 16C6x/7x family microcontrollers, Architecture, Registers, Register File Structure, Addressing Modes, Instruction set. Interrupt Structure, Timers, Counters, I/O Port Concepts, Peripheral Interfacing and Applications,

Basics of ARM Architecture: Introduction to ARM microprocessor and its features, Architecture, Programming model.

CISC and RISC architecture comparison, advantages of RISC, Power saving methods

#### **Unit III**

#### **Concept of Measurement & Transducers**

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Basic concept of Measurement, Performance & Static Characteristics, Error in Measurement, Types of Errors-Gross, Systematic & Random,

Fundamental Concept Transducers - Resistance, Inductance, Capacitance, Piezoelectric, Thermoelectric, Hall effect, Photoelectric, Measurement of displacement, velocity, acceleration, force, torque, strain, temperature, pressure, flow, humidity, thickness, pH. Measuring Equipment - Measurement of R, L and C, Bridge and Potentiometers, voltage, current, power, energy, frequency/time, phase,

#### **Unit IV- Instrumentation Electronics**

Instrumentation Amplifiers, Basic Characteristics, D.C. Amplifiers, Isolation Amplifiers, Feedback Transducers system, feedback Fundamentals, Inverse Transducers, Temperature Balance System. Digital Multimeters, CRO, Digital Storage Oscilloscope, Spectrum Analyzer., Impedance analyzer

#### **Advanced Instrumentation Systems**

Semiconductor sensors; smart sensors; micro sensors; IR radiation sensors; ultrasonic sensors; fibre optic sensors; chemical sensors; bio sensors; thermometry and thermography; nano instrumentation; environmental pollution monitoring;

#### **Unit V-Biomedical Electronic Instrumentation and Measurements**

Introduction to biomedical instrumentation, sources of bioelectric potentials, electrodes- electrode theory, biopotential electrodes, biochemical transducers, cardiovascular measurements- electrocardiography, measurement of blood pressure, blood flow and heart sound, plethysmography, the elements of intensive care monitoring; calibration and reparability of patient monitoring equipment, pace makers. MEMS and its applications Sensors for IoT applications.

#### **TEXT BOOKS**

1. Embedded systems - Raj Kamal, TMH
2. Embedded/Real Time Systems - Dr.K.V.K.K.Prasad, dreamtech Press.
3. FPGA based System design by Wayne Wolf
4. 2. Digital Systems Design With FPGAs And CPLDs By Ian Grout, Elsevier(2008)
5. Unleash the System On Chip Using FPGAs and Handel C By Rajanish K. Kamat, Santosh A. Shinde, Vinod G Shelake, Springer (2010)
6. Design with PIC Microcontrollers - John B.Peatman, Pearson Education Asia
7. PIC Microcontrollers: An Introduction to Microelectronics, Martin P. Bates, Elsevier.

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8. D.V.S. Murti, **Transducers and Instrumentation**, PHI Learning Pvt Ltd, New Delhi.
9. Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, **Instrumental Analysis**, CENGAGE Learning, Indian Edition.
7. Internet of Things (IoT) – Jeeva Jose, Khanna Publishers, Delhi

**BOOK FOR REFERENCE:**

1. Intel Embedded Microcontrollers and Processors Vol. I

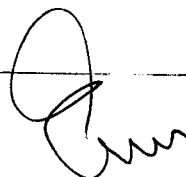
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**ELP 105 LAB COURSE "A"- ANALOG ELECTRONICS LAB**

**M.Sc. Electronics**

**July-Dec 2020**

**Semester I**

**Max. Marks: 100, Min. Marks: 20**

1. To study the Astable and Monostable Multivibrator using IC741.
2. To study the RC Phase Shift Oscillator by determining its frequency of oscillation and Compare calculated and observed frequency.
3. To study the Schmitt Trigger using transistor and IC7413 by observing the output Waveform.
4. To study the Colpitt Oscillator, determine its frequency of oscillation and compare the Calculated and observed frequency.
5. To study the Negative Feedback Amplifier by measuring closed loop gain and gain bandwidth product.
6. Calculation of barrier height and ideality factor at room temperature (for Si and GaAs devices) from the  $I-V$  characteristics.
7. Calculation of diode parameters at varying frequency from the  $C-V$  characteristics.
8. Calculation of semiconductor conductivity type and carrier concentration using Hall Effect.
9. Calculation of semiconductor resistivity and band gap using Four-Probe method.
10. Calculation of carrier mobility and drift velocity using an experimental setup.
11. Verification of following network theorems (1) Superposition (2) Thevenin's (3) Norton's theorem.
12. To study and plot the MOSFET characteristics.
13. To study the Active Band pass filter and calculate its (1) Bandwidth: - Lower cutoff & upper cutoff frequency. (2) Quality factor.
14. Construct a Wein Bridge Oscillator and determine its frequency of oscillation and compare calculated and observed frequency.
15. To study the Active Low pass filter and to evaluate: -(1) Cutoff frequency, (2) Band pass gain, and (3) Plot the frequency response.
16. To study the Clipping circuits as positive and negative logic.
17. To study the Clamping circuits as positive and negative logic.
18. To Study the phototransistor characteristics.
19. To study the comparison of Schmitt trigger and phototransistor.

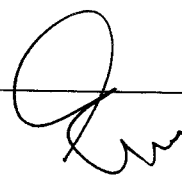
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20. Verification of the Maximum Power Transfer theorem.
21. To study the characteristics of JFET (Junction field effect transistor) in common source configuration & evaluate— 1. AC drain resistance, 2. Amplification factor and 3. Drain Resistance.
22. To study the operation of Class B Amplifier.
23. To study the Z parameter of a passive Two Port Network.
24. To study the Op - Amp as voltage to current converter.
25. To study of characteristics of NPN transistor in common emitter configuration and evaluate— 1. Input resistance, 2. Output resistance and 3. Current gain.
26. To study the Active High pass filter and to evaluate:--
  - a. Low cutoff frequency, (2) Bandpass gain, and (3) Plot the frequency response.
27. To study, identify and testing the electronic components using Physical and electronic equipments (CRO, Digital Multi Meter).
28. To study the Clipping and Clamping circuits as positive and negative logic using expEYES-17 kit.
29. To study transfer characteristic and functional verification of a Weighted Resistor D/A Converter.
30. To study transfer characteristic and functional verification of a Integrated D/A Converter.
31. To study transfer characteristic and functional verification of a Ladder Network D/A Converter.
32. To study and testing the working of a counter A/D converter.
33. To study and testing the working of a monolithic A/D converter.
34. To study and analysis of comparator operational amplifier.
35. To study of operational amplifier as Integrator and Differentiator.
36. To study of operational amplifier as Square Wave Generator.

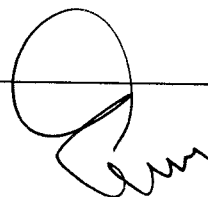
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37. To study and observe buffer operational amplifier.

38. To study and observe operational amplifier as Adder and Subtractor.

**Note : Each student has to perform at least fifteen experiments. The teacher in-charge may add or delete experiments as per the availability of the equipment and need of the course .**

**Reference Books**

- 1 .Laboratory Experiments and PSPICE Simulations in Analog Electronics Maheshwari & Anand PHI
- 2 Laboratory Manual for Operational Amplifiers and Linear ICs, 2nd ed. Bell PHI
3. Student Reference Manual for Electronics Instrumentation Lab Wolf & Smith PHI
4. ELECTRONIC LAB PRIMER By B. Sasikala, S. Poorna Chandra S.Chand Pub

**ELP 106 LAB COURSE "B" - DIGITAL ELECTRONICS LAB**

**M.Sc. Electronics**

**July -Dec 2020**

**Semester I**

**Max. Marks: 100, Min. Marks: 20**

**List of Experiments: -**

1. Verify the following Boolean expressions--

i)  $A + A'B = A + B$  ii)  $AB + AB' = A$

iii)  $AB + A'C + BC = AB + A'C$  iv)  $AB + A'C = (A + C)(A' + B)$ .

2. To study the operation of 4 bit binary full adder and subtractor (IC 7483) having input and output carry bits. Add and subtract any two binary numbers of four bits.

3. To study the characteristics of C-MOS integrated circuits, verify the operation of C-MOS Inverter/NAND gate ICs and study the voltage level of C-MOS for proper ON/OFF (logic 1 or logic 0) condition.

4. To study the interfacing of C-MOS to TTL IC's and vice-versa. Different TTL logic gates and C-MOS logic gates with pull up resistance are provided for interfacing.

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5. To study the master slave J-K flip-flop and verify truth table.
6. To study R-S/D/T flip-flops using NAND ICs and verify truth table.
7. To study the operation of shift register as serial in parallel and parallel in serial mode.
8. To study the operation of shift register as parallel in parallel and serial in serial mode.
9. To study write/read operation of digital data into semiconductor memory using IC 7489. Store and retrieve some set of data. (RAM)
10. To study the operation and application of a modern LSI D/A converter. Parallel binary Inputs from switches are applied to DAC, which in turn converts the binary number into a proportional output voltage.
11. To study the operation of modulo-n-counter as MOD 3 & MOD 4 and verify the Truth Table.
12. To study the operation of modulo-n-counter as MOD 8 & MOD 9 and verify the Truth Table.
13. To study the operation of a Presetable Divide by N Counter and verify its truth table.
14. To study the operation of Multiplexer IC having 16: 1 channels.
15. To study the operation of Demultiplexer IC having 1:16 channels and 4 select inputs.
16. To study the operation of BCD Up-Down Counter.
17. To study the operation of Memory programming with seven segment display.
18. To study the operation of comparison of JK flip-flops and verify the difference with Timing diagram.
19. To study and verify the truth table of Parity Generator and Checker.
20. Verification of operation of IC 74190 as mod- N programmable counter.
21. To study the Binary to BCD converter.
22. To study the BCD to Decimal converter.

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23. To study the Binary to Gray code converter and Gray to Binary code converter.

24. To study the 4- bit Synchronous binary up/down counter.

25. To study the 4- bit Asynchronous binary up/down counter.

Any other experiment of equal standard relevant to syllabus can also be set.

**Note: -Students have to perform at least 15 experiments from the above list.**

**Books:**

1. Laboratory Manual for Operational Amplifiers and Linear ICs, 2nd ed. **Bell PHI**

2. Student Reference Manual for Electronics Instrumentation Lab Wolf & Smith **PHI**

**ELP 205 LAB COURSE "C"- ANALOG AND DIGITAL COMMUNICATION LAB**

**M.Sc. Electronics**

**Jan-June 2021**

**Semester II**

**Max. Marks: 100, Min. Marks: 20**

List of Experiments :-

**Analog Communication**

1. To study the operation of balanced modulator DSBSC using IC 1496.
2. To study the phase modulation using IC 2206 and calculate the modulation index.
3. To study amplitude modulation and demodulation and construct an AM generator and a diode detector and observe its operations under various conditions.
4. To demonstrate (i) use of 4046 PLL as an FM modulator. (ii) Use of 4046 PLL IC as an FM demodulator.
5. To study the characteristics and testing methods of T attenuators.
6. To study the Carrier Wave (CW) operation of Klystron tube and determine its operating frequency.
7. To study the Square Wave operation of Klystron tube and determine its operating frequency.

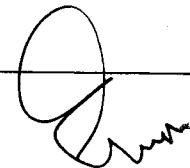
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8. To study the modes of Klystron tube.
9. To determine the frequency and wavelength of rectangular waveguide, working on TE<sub>10</sub> mode.
10. To determine the standing wave ratio (SWR) of Klystron tube.
11. To determine the Reflection Coefficient of Klystron tube.

**Digital communication-**

1. Study of signal sampling and reconstruction techniques and to verify Nyquist criteria and tracing.
2. Study of PAM, PWM and PPM modulation and demodulation techniques.
3. Study of TDM pulse amplitude modulation and demodulation.
4. Study of pulse code modulation and demodulation techniques.
5. Study of delta and adaptive-delta modulation methods.
6. Study of Phase Shift Keying Modulation and Demodulation Technique.
7. Study of Amplitude Shift Keying Modulation and Demodulation Technique.
8. Study of Frequency Division Multiplexing and Demultiplexing.
9. Study of Frequency Shift Keying (FSK) modulation.
9. Study of DPSK modulation.

Any other experiment of equal standard relevant to syllabus can also be set.

**Note: -Students have to perform at least 10 experiments from the above list.**

**Books: Laboratory Experiments and PSPICE Simulations in Analog Electronics  
Maheshwari & Anand PHI**

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**ELP 206 LAB COURSE "D"- 8085 MICROPROCESSOR PROGRAMMING,  
STUDY CARDS AND INTERFACING LAB**

**M.Sc. Electronics  
Jan-June 2021  
Semester II**

**Max. Marks: 100, Min. Marks: 20**

List of Experiments:-

1. Program of 8085 to add 8-bit numbers from memory & display result to C060H memory location & carry in C061 H.
2. Program of 8085 of 8085 to transfer the data of 16 consecutive locations into other 16 Consecutive locations in forward order and vice versa
3. Program of 8085 to search the memory location that contained 05 H data in a string of length of 16 byte and display it to memory location to C060 H.
4. Program of 8085 to search number of 05 H data in a string of length of 16 byte and display it to memory location to C060 H.
5. Program of 8085 to multiply two 8-bit numbers.
6. Program of 8085 to divide two 8-bit numbers.
7. Program of 8085 to solve a Boolean Equation which rep. Combinational logic as follows:-  
$$X = A'(B+C). D' + A.B. (D+C), A.B.C. \& D \text{ are four independent variables.}$$
8. Program of 8085 to convert BCD into its equivalent binary number.
9. Program of 8085 to convert Binary number into its equivalent unpacked BCD number.
10. Program of 8085 to count the number of Zeros, positive and negative number in a series of 16 bytes.
11. Program of 8085 to convert Binary number into its equivalent ASCII number.
12. Program of 8085 to convert ASCII into its equivalent binary number.
13. Program of 8085 to find the largest and smallest number in a data array.
14. Program of 8085 to arrange the data array in ascending and descending

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order.

15. Program of 8085 to add a series of data of 16 consecutive memory location and display the result in C060 H and carry in C061 H memory location using subroutine.

16. Program of 8085 to subtract two 8-bit data from memory location using 2's complement method and display the result in C060 H and borrow in C061 H.

**Note: -Students have to perform at least 15 Programs of 8085 from the above list.**

**\* STUDY OF 8255 CARD \***

1. Program 8255 in mode-0; i.e. simple I/O mode Program Port-A, Port-B, Port-C in O/P mode, transmit data from keyboard to all the ports.
2. Repeat program no.(1), with all ports in I/P mode. Store data to M.P.U.'s registers
3. Program 8255 in B.S.R. mode. Set port-C in O/P mode Using appropriate delay set/reset PC.
4. Program 8255 in mode-1; i.e. strobe I/O mode Program Port-A, Port-B is in mode-1 and Port-A is in O/P mode and Port-B is in I/P mode and Port-C is used in control signal.
5. Program 8255 in mode 0 i.e. simple I/O mode. Program Port A in I/P mode and Port B in output mode.
6. Program 8255 in mode 0 i.e. simple I/O mode/ Program Port B in I/P mode and Port A in output mode.
7. Program 8255 in mode 0 i.e. simple I/O mode. Program Port A in I/P mode, Port B in input mode. Read data from Port A&B, add it & display

**\* STUDY OF 8253 CARD \***

8. Program 8253 in mode-0 i.e. interrupts on terminal count. Select counter c; Read/load lower 8-bits & then higher bits. Draw and explain the function of Gate, Out & Clock Signals.

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9. Program 8253 in mode 1. Draw and explain the function of GATE, OUT and CLOCK Signals.

10. Program 8253 in mode 2. Draw and explain the function of GATE OUT and CLOCK Signals.

11. Program 8253 in mode 3 to generate square wave. Draw and explain the function of GATE, OUT and CLOCK Signals.

**\* STUDY OF LBDR CARD \***

12. Study of Buffer IC-74L8245 on L.B.D.R. Card using 8085 M.P.U. kit.

13. Study of Latch IC-74L8245 on L.B.D.R. Card using 8085 M.P.U. kit.

14. Study of LBDR as 2 & 4 decoder.

15. To access memory locations (RAM) specified by generation control signals on L.B.D.R.

card using 8085 M.P.U.

**\* STUDY OF 8259 CARD \***

16. Study of master 8259 in stand-alone mode. Generate and interrupt request-using 8259

and display the respective interrupt in address field.

17. Study of 8259 in cascaded mode i.e. in 8259 as master and the other as slave.

Generate

an interrupt request using 8259 and display the respective interrupt in address field.

**\* STUDY OF 8251 CARD \***

18. Interface 8251 with 8085 M.P.U. and program it in asynchronous transmitter mode, use

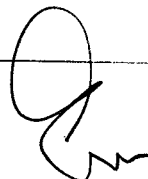
8251 Group A.

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19. Interface 8251 with 8085 M.P.U. and program it in asynchronous receiver mode, use 8251 Group A.
20. Interface 8251 with 8085 M.P.U. and program it in synchronous transmitter mode, use 8251 Group A.
21. Interface 8251 with 8085 M.P.U. and program 8251 Group A is in synchronous transmitter mode and 8251 B is in synchronous receiver mode.

**\*STUDY OF 8237/57 CARD \***

22. Interface 8237 IC with 8085 M.P.U. memory to I/O transfer (Read Mode)
23. Interface 8237 IC with 8085 M.P.U. and Study memory to I/O transfer in block transfer mode (write mode).
24. Interface 8237 IC with 8085 M.P.U. and study I/O to memory transfer in single transfer mode (write mode)
25. Interface 8237 IC with 8085 M.P.U. and study I/O to memory transfer. In this mode data stored at 4150H to 415AH

**Note: -Students have to perform at least 5 Study Cards from the above list.  
PIO Card**

**\*STUDY OF DAC CARDS \***

26. Program to demonstrate DAC as positive going staircase (or ramp) generator.
27. Program to demonstrate DAC as triangular wave generator.
28. Program to demonstrate DAC as exponential binary staircase generator.
29. Program to demonstrate DAC as R-C charging and discharging waveform.

**\*STUDY OF DYNA THUMBWHEEL CARDS \***

30. To study interfacing of Thumbwheel with microprocessor based system as Dyna-85.


**\*STUDY OF SERIAL DISPLAY INTERFACE CARDS \***

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31. To study interfacing of Serial Display Interface Card with microprocessor based system  
as Dyna-85.

**Note: -Students have to perform at least 2 PIO Cards from the above list**

Any other experiment of equal standard relevant to syllabus can also be set.

**ELP 305 LAB COURSE "E" - OPTICAL ELECTRONICS AND PHOTONICS M.Sc  
Electronics  
July-Dec 2021  
Semester III**

**Max. Marks: 100, Min. Marks: 20**

**List of Experiments: -**

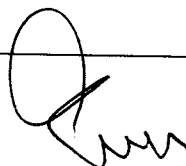
- 1- To calculate the diameter of a pinhole using Laser.
- 2- To observe the diffraction pattern and calculate the slit width using single slit.
- 3- To determine the Grating pitch of transmission Grating.
- 4- To study the output characteristic of Phototransistor.
- 5- To study the I-V characteristic of Photodiode.
- 6- To study the characteristic of LED.
- 7- To determine the I-V characteristics of PV module with varying radiation and temperature level.
- 8- To determine the P-V characteristics of PV module with varying radiation and temperature level.
- 9- To determine the I-V and P-V characteristics of series combination of PV module.
- 10- To determine the I-V and P-V characteristics of parallel combination of PV module.

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- 11- To show the effect of variation in tilt angle on PV module power.
- 12- To study the V-I characteristics of DIAC with positive and negative biasing.
- 13- To study the Optical transducer in Optically Controlled Switching System.
- 14 To study the Optical transducer characteristics of photovoltaic cell.
- 15- To study the Optical transducer characteristics of photoconductive cell.
- 16- To study the Optical transducer characteristics of filament Lamp.
- 17- To study the characteristics of phototransistor.
- 18- To study the characteristics of PIN photodiode.
- 19- To study the effect of variation in tilt angle on PV module power.
- 20- To determine the Planck's constant.
- 21- To study the I-V characteristic of LED using expEYES-17 kit.
- 22- To study the characteristic of LDR using expEYES-17 kit.
- 23- To calculate velocity of sound using expEYES-17 kit.

#### **For Optional Paper Instrumentation Lab**

##### **Transducer control system Trainer kit**

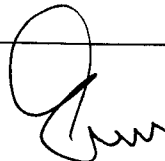
1. To study the characteristics of a 3 wire RTD and to observe the change in resistance as  
Temperature increases (Wheatstone bridge).
2. To study the application of 2 wire RTD in a potentiometer circuit.
3. To study the application of 3 wires RTD in a Wheatstone bridge circuit.
4. To study the characteristics of thermocouple and observe the change in output voltage with the change in temperature.
5. To study semiconductor diode as a temperature sensor.
6. To study transistor as a temperature sensor.

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7. To study the application of thermistor in a DC wheatstones bridge circuit.
8. To study the application of thermistor in a non- inverting Op – Amp circuit.

#### **Thyristor Application trainer**

1. To study & plot the SCR characteristics.
2. To study & plot the UJT characteristics.
3. To study & plot the DIAC characteristics.
4. To study & plot the TRIAC characteristics.

#### **Virtual Instrumentation Using National Instrument LabView Software**

1. Design a Virtual Instrument of Half adder digital circuit using LabView.
2. Design a Virtual Instrument of Full adder digital circuit using LabView.
3. Design a Virtual Instrument of Half subtractor digital circuit using LabView.
4. Design a Virtual Instrument of Full subtractor digital circuit using LabView.
5. Design a Virtual Instrument. to find maximum & minimum amplitude of given waveform using LabView.
6. Design a Virtual Instrument to convert Analog waveform to Digital waveform using LabView.
7. Design a Virtual Instrument to generate multitone waveform (sine & square) using LabView.
8. Design a Virtual Instrument to convert Celcius into equivalent Fahrenheit using LabView.

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**ELP 306 LAB Course "F" - 8086 MICROPROCESSOR PROGRAMMING  
INTERFACING AND "C" PROGRAMMING LAB**

**M.Sc Electronics  
July-Dec 2021  
Semester III**

**Max. Marks: 100, Min. Marks: 20**

**List of Experiments:-**

**8086 ASSEMBLY LANGUAGE PROGRAMMING**

1. Write a program to transfer an 8-bit data from register to C060H memory location.
2. Write a program to transfer an 16-bit data from register to C060H memory location.
3. Write a program to add two 8-bit data and result is stored in C060H.
4. Write a program to add two 16-bit data and result is stored in C060H.
5. Write a program to subtract two 8-bit data and result is stored in C060H.
6. Write a program to subtract two 16-bit data and result is stored in C060H.
7. Write a program to multiply two 8-bit data and result is stored in C060H.
8. Write a program to multiply two 16-bit data and result is stored in C060H.
9. Write a program to divide 16-bit data by 8-bit and result is stored in C060H.
10. Write a program to divide 32-bit data by 16-bit and result is stored in C060H.

**\* STUDY OF 8255 CARD \***

Study the Interfacing of 8255 Study card with 8086 Microprocessor.

**\* STUDY OF 8259 CARD \***

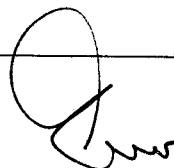
Study the Interfacing of 8259 Study card with 8086 Microprocessor.

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**List of C Programming**

1. Write a program to calculate the roots of quadratic equation  $Ax^2+Bx+C=0$ .
2. Write a program to calculate the average of a set of n numbers including zero and negative numbers.
3. Write a program to sort an array element in ascending order using bubble sort technique.
4. Write a program to sort and array element in descending order using bubble sort technique.
5. Write a program to plot a sin (X).
6. Write a program to read and print a single dimension array A and B each having 10 elements write a program that prints out an array C having elements, which are sum of the elements of array A and B.
7. Write a program to find a row sum and column sum of a given matrix and built a new matrix with the help of row sum and column sum and previous matrix.
8. Write a program to read and print two-dimensional matrix of order nxm. Find the sum of diagonals.
9. Write a program that calculate and prints out the maximum and minimum of array.
10. Write a program for sorting names in alphabetical order.
11. Write a program to plot and exponential series.
12. Write a program to print the terms in the exponential series, till the term is equal to 0.00001 also compute the exponential series of x,  
$$e^x=1+x+x^2/2!+x^3/3!+\dots\dots\dots+0.00001.$$
13. Write a program for matrix multiplication.
14. Write a program for matrix addition.
15. Write a program for the operation of (a) addition (b) subtraction (c) multiplication (d)

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Division, using switch command

16. Write a program to find the factorial of a given number and Fibonacci series using switch

command

17. Write a program to find the sum of natural numbers using function

Any other experiment of equal standard relevant to syllabus can also be set

**ELP 405 LAB COURSE "G"- OPTICAL COMMUNICATION AND 8051 PROGRAMMING LAB**

**M.Sc. Electronics**

**Jan-June 2022**

**Semester IV**

**Max. Marks: 100, Min. Marks: 20**

List of Experiments: -

**Fiber Optics Communication kit**

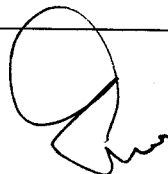
1. Study of setting up a fiber Optic Analog Link.
2. Study of setting up a fiber Optic Digital Link.
3. Study of Losses in Optical Fiber.
4. Measurement of Numerical aperture of a optical fiber.
5. Study of Manchester Coding & Decoding of optical signal.
6. Study of Time Division Demultiplexing through fiber optic link -B.
7. Measurement of Bit Error Rate of an optical signal through fiber optic link -B.
8. Study of Eye Pattern of fiber through fiber optic link -B.
9. Forming PC to PC Communication Link using Optical Fiber & RS-232 Interface.
10. Study inverting amplifier using an Op-amp and test it by expEYES-17 kit.
11. Study inverting amplifier using an Op-amp and test it by expEYES-17 kit.
12. Study Intensity modulation and demodulation of analog signal transmission through a fiber optic cable.

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**8051 Programming: -**

Any 10 Basic programming in 8051 Microcontroller  
**General Programming Practical of 8051**

1. Write a program to find the addition of two 8- Bit Numbers.
2. Write a Program to subtract Two 8 – Bit Numbers.
3. Write a Program to find Multiplication of Two 8- Bit Numbers.
4. Write a Program to find Division of Two 8- Bit Numbers.
5. Write a Program to find the Factorial of a given numbers.
6. Write a Program to transfer the Data block in Forward order.
7. Write a Program to transfer Data Block in Reverse order.
8. Write a Program to find Addition of Series of numbers.
9. Write a program for searching no. of (05H) in a given Memory Location.
10. Write a Program to find out no. of Even & Odd no. in a given Data Series.
11. Write a Program to count Zero, Positive, Negative no. in a given Data Series.
12. Write a program to count the numbers which are divisible by 3 in a given Data Series
13. Write a Program to find the largest number in a given Data Series.
14. Write a Program to find the smallest number in a given Data Series.
15. Write a Program to arrange the Data in ascending order.
16. Write a Program to arrange the Data in descending order.
17. Write a program to convert Binary Number to BCD Number.
18. Write a program to convert Binary Number to ASCII Number

**Interfacing Practical of 8051**


1. To Study & Analyze the Interfacing of 16×2 LCD.
2. To Study & Analyze the Interfacing of 5×7 LED Matrix.
3. To Study & Analyze the Interfacing of Seven Segment Display.
4. To Study & Analyze the Interfacing of ADC & DAC Module.

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5. To Study & Analyze the Interfacing of DC Motor.
6. To Study & Analyze the Interfacing of Stepper Motor.
7. To Study & Analyze the Interfacing of LEDs.

Any other experiment of equal standard relevant to syllabus can also be set.

## **ELP 406 Project & Seminar**

**Max. Marks: 100, Min. Marks: 20**

### **Project**

This course provides quality education to students on professional grounds. Apart from classroom lectures and Practical's, the students are also required to undertake a project in the fourth semester. This provides them with an opportunity to interact with the industry. Seminars are organized where eminent professionals from various organizations are invited.

Execution and documentation of a project on a specific topic with one of the following aspects

- o Part of ongoing research projects in the department
- o Developmental work related to industry requirements
- o State of the art new technological studies
- o Theoretical and experimental studies
- o Development of prototypes in the finished product form
- o Technical Writing and Project Documentation
- o Presentation and Appreciation.

### **Seminar**

Each student shall present a seminar in the Fourth semester on a topic relevant to Electronics for about 30 minutes. The topic should not be a replica of what is contained in the syllabus. The topic shall be approved by the Seminar Evaluation Committee of the Department. The committee shall evaluate the presentation of students. A seminar report in the prescribed form shall be submitted to the department after the approval from the committee.

The topics of current relevance covering following aspects should be chosen

- o Collection of reference material
- o Assimilation of concepts and preparing document
- o Communication skills
- o Presentation styles and use of projection aids
- o Appraisal and evaluation of delivered seminars

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**SCHEME OF EXAMINATION, COURSE STRUCTURE  
& SYLLABUS**

**M.Tech. in Optoelectronics & Laser  
Technology**



**FACULTY OF SCIENCE**

**Approved by Joint Board of Studies in  
Electronics & Physics on 18<sup>th</sup> Jan., 2020**

**EFFECTIVE FROM ACADEMIC SESSION**

**JULY – 2020**

**Joint Program of  
School of Studies in  
Electronics and Photonics  
&  
School of Studies in  
Physics and Astro-Physics**

**Pt. Ravishankar Shukla University  
Raipur (C.G.) 492010  
WEBSITE: [www.prsu.ac.in](http://www.prsu.ac.in)**

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**PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)**

School of Studies in Electronics and Photonics &

School of Studies in Physics and Astro-Physics

**SCHEME & SYLLABUS**

**M. Tech in Optoelectronics and Laser Technology  
(UGC & AICTE Approved)**

**SESSION – 2020-2022**

The Master of Science (MS) program in Photonics is designed to prepare students for technically demanding careers in industry as well as for post-master's graduate studies in photonics or related fields. It requires students to build depth in a photonics specialization selected from areas such as lasers and applications, photonics materials and devices, and fiber optics and optical communications. It has a practicum requirement that is satisfied by doing a Minor Project and Industrial training and taking two project-intensive courses Dissertation Phase –I and Phase-II.

The main goal of the master degree program is to prepare professionals with a high level of expertise in cutting-edge photonics technologies and being able to innovate using them, with a practical vision, providing sustainable solutions in different environments, having the proper tools to get involved in an industry demanding experts on those technologies, for creating starts-up or researching in that field.

Optoelectronics & Laser Technology is a highly interdisciplinary Masters programme concerned with fundamental physics of light and optical components as well as a wide range of applications which are essential to our high-tech society, for example our ability to communicate using IT technology.

The field of photonics covers all technical applications of light over the entire spectrum from ultraviolet through visible to near, mid, and far infrared light—and from lasers in CD players through the development of new, energy-saving light sources to integrated light wave circuits and optical fibers. Moreover, photonics plays an increasing role in biology and medicine, for instance in connection with food control or medical therapy, measurement methods for efficiency improvement of wind farms, and technologies capable of measuring the efficiency of combustion processes or carbon dioxide levels in the atmosphere.

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This master program aims at giving an extensive two-year teaching program from fundamentals to advanced research topics in Photonics and its interdisciplinary applications. Master students benefiting from this program will be able to work on today's new challenges in their academic or applied research carriers: understanding and control matter and optical phenomena at the ultimate nanometric scale, providing new imaging tools for the most complex biological processes from cells and tissues to clinical applications, bringing original tools in line with future optical devices.

It is worth-mentioning that in our country the number of postgraduate programmes on modern optics is a few, and in Chhattisgarh state, none of institutes and universities has M.Tech programme in Optoelectronics and Laser Technology. It is one of the programme in the country where Organic Electronics course was introduced after IIT, Kanpur This M.Tech. program is approved and supported by University Grants commission, New Delhi under its innovative Programme for Teaching and Research in Interdisciplinary and Emerging Areas and All India Council for Technical Education.

The interdisciplinary M. Tech Programme in Opto-Electronics and Laser Technology at PRSU, Raipur is offered jointly by S.O.S. in Electronics & Photonics and S.o.S. in Physics & Astro Physics, which has been running since 2008.. The main objective of the Programme is to generate trained professionals in the broad area of Opto-Electronics, Optical Communication and laser Technology with a strong background of engineering and science. Students who graduated in earlier batches are immensely contributing to growth of various industries and R&D organizations involved in the area of telecommunication, optical communication & networks, semiconductor technology, fiber integrated optics, Opto-Electronics, software etc.

Pt. Ravishankar Shukla University is one of the few Universities/ Institutions in India that have facilities for R & D activities and man Power training in Photonics and related areas. The department have collaboration with premier R & D institutes of national importance and students have an opportunity for one year project at BARC, Mumbai, RRCAT- Indore, CSIO- Chandigarh, CEERI –Pilani, IIT Mumbai, ISRO, RRI -Bangalore, PRL- Ahmadabad, IICT Hyderabad, , Raman Research Institute, Bangalore NPL New Delhi and other research centers of National & International reputation. They are getting placement in multinational companies, Industries, Academics and other private and Govt. Organizations.

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PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)

SYLLABUS

M. Tech. in Optoelectronics and Laser Technology

SEMESTER – I

JULY – DECEMBER, 2020

Course Code	Subject	Core/EI active	Marks			Credits
			Theory	Internal	Total	
OE-11	Modern Optics	C	80	20	100	4
OE-12	Laser Technology	C	80	20	100	4
OE-13	Optoelectronics	C	80	20	100	4
OE-14	Optical Communication	C	80	20	100	4
OE-15	Seminar	C	-	-	50	1
OE-16	Comprehensive Viva voce	C	-	-	Grade	
OE-17	Photonics Lab-I	C	External	Internal	150	3
			120	30		
OE-18	Quantum Optics	E	80	20	100	3
<b>Total for Semester-I</b>					700	23

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**SEMESTER – II**

**JANUARY - JUNE, 2021**

Course Code	Subject	Core/ Elective	Marks			Credits
			Theory	Internal	Total	
OE-21	Physics of Advanced Materials	C	80	20	100	4
OE-22	Fiber Optics & Laser Instrumentation and Solar Photovoltaic Technologies	C	80	20	100	4
OE-23	Optical Networks	C	80	20	100	4
OE-24	Advance Optical Communication	C	80	20	100	4
OE-25	Seminar		-	-	50	1
OE-26	Comprehensive Viva Voce		-	-	Grade	
OE-27	Photonics Lab-II	C	External	Internal	150	3
			120	30		
OE-28	Theory-V	E	80	20	100	3
<b>Total for Semester-II</b>					<b>700</b>	<b>23</b>

**Semester III  
JULY – DECEMBER, 2021**

Course Code	Subject	Core/Elective	Marks	Credits
OE-32	Major Project Phase -I	C	400	18

**Semester IV**

**JANUARY - JUNE, 2022**

Course Code	Subject	Marks	Credits
OE-41	Major Project Phase -II	400	18
OE-42	Comprehensive Viva- Voce	GRADE	
<b>TOTAL CREDITS ALL SEMESTERS</b>		<b>2200</b>	<b>82</b>

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**PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)  
SYLLABUS**

**SEMESTER – I  
July-Dec. 2020**

**OE-11-MODERN OPTICS**

**Unit I**

Classification of optical processes, optical coefficients, complex refractive index and dielectric constant.

**Optical materials** : Crystalline insulators and semiconductor, glasses, metal, molecular materials, doped glass and insulator characteristics, Optical Physics in the Solid state, crystal symmetry, electronics bands, vibronic band, the density of state, delocalized states and collective excitation.

**Light propagation:** Propagation of light in dense optical medium, Atomic oscillator, vibration oscillator, free electron oscillation, the Kramers – Kronig relationship, Dispersion, Optical anisotropy, birefringence. Matrix representation of polarization, Jones vector, Jones matrices, Jones calculus, orthogonal polarization. Reflection and refraction at a plane boundary, fresnel's equations.

**Unit II**

**Excitons** : Basic concept, free excitons in external electric and magnetic fields, Free Excitons at light densities, Frenkel excitons.

**Luminescence:** Light emission in solids, Interband luminescence, Direct and indirect gap materials, photoluminescence: Excitation and relaxation, degeneracy Photoluminescence spectroscopy.

**Electroluminescence:** General Principles of electroluminescence, light emitting diodes, diode laser.

**Unit III**

Electromagnetism in dielectrics, Electromagnetism fields and Maxwell equation. Electromagnetism waves, Quantum theory of radiative absorption and emission. Einstein coefficients, Quantum transition rates, selection rules. Basic concept of phonons, Polaritons and polarons.

Laser Plasma Interaction: Basic concepts and two-fluid description of plasmas, electromagnetic wave propagation in plasmas.

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#### Unit IV

**Nonlinear optics** : Non linear optics : Physical origin of optical nonlinearities, Non resonant and resonant nonlinearities, second order nonlinearities, Non linear frequency mixing, Crystal symmetry, Phase matching, Third order non linear media. Harmonic generation, mixing and parametric effects. multiphonon processes Two-photon absorption, saturated absorption, Spectroscopy Rayleigh, and Raman scattering. Stimulated Raman effect, Hyper Raman effect, Coherent Antistoke Raman scattering Self-focusing and self-phase modulation. Self-induced transparency. Solitons.

#### Unit V

**Optical Design, Fourier Optics & Holography** : Revision of geometrical optics. Fourier transforms. impulse response transfer function. Scalar diffraction, spatial and temporal coherence.

**Holography**: Image forming systems, The wavefront reconstruction process: Inline hologram, the off axis hologram, Fourier hologram, the lens less Fourier hologram. The reconstructed image: Image of a point, image magnification, orthoscopic and pseudoscopic images, effect of source size and spectral bandwidth. Thin hologram, volume hologram, volume transmission hologram and volume refraction holograms. Materials for recording holograms, holograms for displays, colour holography, holographic optical elements. Holographic interferometry: Real time holographic interferometry, double exposure holographic interferometry image hologram, Image forming systems, coherent and incoherent imaging. Spatial filtering. Holography (Fresnel, Fraunhofer, Fourier). Holographic techniques and applications. Fourier transforming property of thin lens.

#### REFERENCE BOOKS

1. Optical Electronics, A. Yariv Saunders
2. Optical Electronics, Ghatak & Thyagarajan, Cambridge U.K. 3.Essentials of Optoelectronics, A. Rogers (Chapman Hall) 4.Optical Properties of Solids Mark Fox
3. Jasprit Singh, Semi conductor Optoelectronics, McGraw Hill, 1995
4. P. Hariharan, Optical holography, (Cambridge University Press, 1984)

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July-Dec. 2020

## OE-12 -LASER TECHNOLOGY

### Unit I

#### Einstein Coefficients and Light Amplification

Introduction: The Einstein's coefficients, Quantum Theory for the Evaluation of the Transition Rates and Einstein Coefficients, Interaction with radiation having a broad spectrum, Introduction of a near monochromatic wave with an atom having a broad frequency response, More accurate solution for the two level system, Line broadening mechanisms, Saturation Behavior of homogeneously and homogeneously broadening transitions.

### Unit II

**Laser Rate Equations** : Introduction, The three Level System, The Four level System, Variation of Laser Power around Threshold, Optimum Output coupling. Laser spiking.

**Semi classical Theory of Laser**: Introduction, Cavity Modes, Polarization of cavity medium : First order & Higher order theory.

### Unit III

**Optical Resonators**: Introduction, modes of a rectangular cavity and the open planar resonator, The Quality factor, the ultimate line width of the laser, Transverse and longitudinal mode selection switching. Mode locking in Lasers Co focal Resonator system, Planar resonators, General Spherical Resonator.

Optical Pumping: Laser pumping requirement and techniques, Optical Pumping and Electrical discharge pumping. Introduction of Flash Lamp, Optically and diode pumped solid state lasers.

### Unit IV

#### Properties of Laser Beams and laser Structures

Coherence properties of Laser Light : Temporal Coherence, Spatial Coherence, Directionality

**Semiconductor**: Interaction of photons with electrons and holes in semiconductors. Optical joint density of states, Structure and properties, operating principle, Threshold condition, Power output.

**Heterojunction Laser**: Principle and structure, Losses in heterostructure laser, Heterostructure laser materials.

**Distributed feedback lasers**: Principle of working, Coupled mode theory.

Quantum well laser, Gain in quantum well lasers, Multiquantum well lasers, Strained quantum well laser, Vertical cavity surface emitting lasers.

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**Unit V**

**Types and Some important applications of laser:**

Properties of solid state laser materials, Ruby, Nd:YAG lasers, Er:lasers, Ti: Sapphire laser, Excimer lasers. Gas dynamic CO<sub>2</sub> lasers, High Power Laser. Laser induced fusion: Introduction, The fusion process, laser energy requirements. The laser induced Fusion Reactors.

**Lasers in Science:** Harmonic Generation, Stimulated Raman Emission, Self-focusing, Lasers in Chemistry, Rotation of the Earth, Lasers in isotope Separation. Laser in light detection and ranging (LIDAR).

**TEXT BOOKS**

1. Lasers Theory and Applications : K. Thyagrajan and A.K. Ghatak, Macmillan Publication
2. Laser Fundamentals - Willaim T Selfvast, Cambridge Univ-Press, 2nd edn (2008). (Text)
3. Optical Electronics, Ghatak & Thyagarajan, Cambridge U.P. 0-521-31408-9
4. Essentials of Optoelectronic, A Rogers (Chapman Hall), 0-412-40890-2

**REFERENCE BOOKS**

1. Fowles G.R., Introduction to Modern Optics, 2<sup>nd</sup> Edition, Holt, Rienhart and Winston
2. Lasers and nonlinear optics, BB Laud, Wiley Eastern, 3rd edition (2004)
3. Optical Electronics – A Yariv (4th Ed. Saunders College Pub. (1991).
4. Principles of lasers - Svelto and DC Hanna, 4th edn, Plenum Press (1998)
5. Solid State Laser Engineering - Koechonar (Springer Verlag. 1991
6. Lasers, principles, types and applications-K R Nambiar, New Age International, Delhi (2004)
7. Free Electron Lasers by T.C. Marshall

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July-Dec. 2020

## OE-13- OPTOELECTRONICS

### Unit I

#### Optical process in Semiconductors

Electron hole pair formation and recombination, absorption in semiconductor, effect of electric field on Absorption, Franz-keldysh and stark effects, Absorption in Quantum wells and Quantum confined stark effect, relation between Absorption and emission spectra, Stokes shift in optical transition, Deep level transitions, Measurement of absorption and luminescence Spectra, Time resolved Photoluminescence.

### Unit II

**Materials Growth & Fabrication** Growth of optoelectronics materials by MBE, MOCVD, Plasma CVD, photochemical deposition. Epitaxy, interfaces and junctions (advantages/disadvantages of growth methods on interface quality, interdiffusion and doping. Quantum wells and band gap engineering

**Equipments for Thin Film Deposition:** Working principle of Vacuum Coating Unit , Spin Coating Unit, Dip coating unit, Basics of Ellipsometer and Spray pyrolysis apparatus and their specifications and features.

### Unit III

#### Organic Electronics

Molecular materials, Electronic state in conjugated molecules, Optical spectra of molecules, Electronic vibration transitions, the Franck Condon principle hydrocarbons, conjugated polymer, Conductivity and Mobility of nearly-free Charge Carriers, Charge Carriers in Organic Semiconductors: Polarons, Shallow Traps and Deep Traps, Generation of Charge Carriers and Charge Transport: Experimental Methods. The TOF Method: Gaussian Transport. Space-Charge Limited Currents. Band or Hopping Conductivity, Electric-field Dependence, Charge Transport in Disordered Organic Semiconductors. The Bassler Model

### Unit IV

#### Organic Optoelectronic Devices:

Organic Light-Emitting Diodes (OLEDs). The Principle of the OLED, Multilayer OLEDs. Structure, Fundamental processes Efficiency, Characterization of OLEDs

**Organic photovoltaic diodes (OPVDs):** Fundamental process, Exciton absorption, Exciton dissociation, Charge collection characterization of OPVDs, Relevant performance parameters.

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### Unit V

**Introduction to Semiconductor Device Simulation:** Need of Simulation, Process Simulation, Device Simulation device simulation sequence, hierarchy of transport models, DD Model, Relationship between various transport regimes and significant length-scales.

Numerical Solution Methods - finite difference scheme, discretization of Poisson's and current continuity equations.

### TEXT BOOKS

1. Organic Molecular Solids Markus Schwoerer (Author), Hans Christoph Wolf, Wiley-VCH; 1 edition (March 27, 2007).
2. Semiconductor Devices Modeling and Technology" by Nandita Das Gupta and Amitava Das Gupta, Prentice Hall of India Pvt.Ltd.
3. Computational Electronics :Dragica Vasileska and Stephen M. Goodnick, CRC Press.
4. Semiconductor Optoelectronics Devices: Pallabh Bhattacharya. Pearson Education.
5. Optical Electronics, A. Yariv Saunders.
6. Optical Electronics, Ghatak & Thyagarajan, Cambridge U.P. 0-521-31408-9.
7. Essentials of Electronic & Optoelectronics properties of semiconductor, Jasprit Singh, Cambridge University Press.

### REFERENCE BOOKS

1. Organic Electronics: Materials, Manufacturing, and Applications Hagen Klauk Wiley-VCH; 1 edition.
2. Hand book of thin film technology, by L. I. Maissel and R. Glang.
3. Thin film phenomena, By K. L. Chopra.
4. Opto electronics -An introduction - J Wilson and J F B J iS Hawkers.(Prentice-Hall India, 1996).
5. Optical fibre communication - J M Senior (Prentice Hall India ( 1994).
6. Optical fibre communication systems - J Gowar (Prentice Hall 1995).
7. Introduction to optical electronics - J Palais (Prentice Hall, 1988).
8. Semiconductor opto electronics - J asprit Singh (McGraW-Hill, Inc, 1995).
9. Fibre Optics and Opto-electronics, R P Khare (Oxford University Press, 2004).
10. Opto electronics-Thyagaraj an and Ghatak, Cambridge Uni, Press (1997).

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## OE-14- OPTICAL COMMUNICATION

### Unit I

Need for fiber optic Communication, evolution of light wave systems and its components. Optical Fiber – their classification, essentials of electromagnetic theory – total internal reflection, Goos Hanchen shifts Dispersion in Single mode fiber, fiber losses, Non linear optical effects and polarization effect. Analysis of Optical fiber waveguides, electromagnetic mode. Theory for optical propagation attenuation and single distortion in optical waveguide. Characteristic equation of step-index fiber, modes and their cut-off frequencies, single-mode fibers, weakly guiding fibers, linearly polarized modes, power distribution. Graded-index fibers- WKB and other analysis, propagation constant, leaky modes, power profiles, dispersions – material, modal & waveguide, impulse response.

### Unit II

#### Physics and Technology of Optical Fiber

Passive photonic components: FO cables, Splices, Connectors, Couplers, Optical filter, Isolator, Circulator and Attenuator, switches.

**Fabrication of optical fibers:** MOCVD, OVD, VAD, PCVD; measurement of RI, attenuation. Etc. Fiber devices, fiber Bragg gratings, long period gratings, fiber amplifiers and lasers. Application of optical fibers in science, industry, medicine and defense.

### Unit III

Optical fiber systems, modulation schemes, Digital and analog fiber communication system, system design consideration, fiber choice, wavelength conversion, switching and cross connect Semiconductor Optical amplifier (SOA), characteristics, advantages and drawback of SOA, Raman amplifier, erbium doped fiber amplifier, gain and noise in EDFA, Brillion fiber amplifier, wideband Hybrid amplifier, noise characteristic, amplifier spontaneous emission, noise amplifier, noise figure, Cumulative and effective noise figure, Noise impairments, amplifier applications.

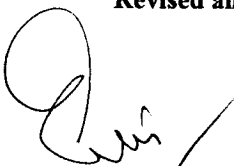
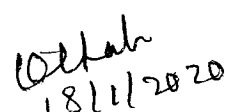
### Unit IV

**Optical Transmitters and Receivers :** Basic concepts, Light emitting diodes, Semiconductor laser, characteristics, Transmitter design, Optical Receivers; Basic concepts, P-n and pin photo detector. Avalanche photo detector MSM photo detector, Receiver design, Receiver noise, Receiver sensitivity, Sensitivity degradation, performance.

Electro-optic effect, electro optic retardation. Phase and amplitude modulators, transverse electro optic modulators, Acousto-optic effect, Raman-Nath and Bragg regime, acousto-optic

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modulators, magneto optic effects.

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## Unit V

### Optical Multiplexing Techniques

Wavelength division multiplexing (WDM): Multiplexing Technique, Topologies and architectures, Wavelength shifting and reverse, Switching WDM demultiplexer, optical Add/drop multiplexer. Dense wavelength division multiplexing (DWDM): System consideration, Multiplexer and demultiplexers, fiber amplifier for DWDM, SONET/SDH Transmission, Modulation formats, NRZ and RZ signaling, DPSK system modeling and impairments.

### OE-17- Photonics Lab- I

Experiments are to be performed in the Advance Photonics Laboratory of S. O.S. in Electronics Department.

#### L 1 Fiber Optics Lab:

1. Study of setting up a Optic Analog Link.
2. Study of setting up a fiber Optic Digital Link.
3. Study of Losses in Optical Fiber.
4. Measurement of Numerical aperture of a optical fiber.
5. Study of Manchester Coding & Decoding of optical Signal.
6. Study of Time Division Demultiplexing through fiber optic link – B.
7. Measurement of Bit Error Rate of an optical signal through fiber optic link – B.
8. Study of Eye Pattern of fiber through fiber optic link – B.
9. Forming PC to PC Communication Link-using Optical Fiber & RS – 232 Interface.

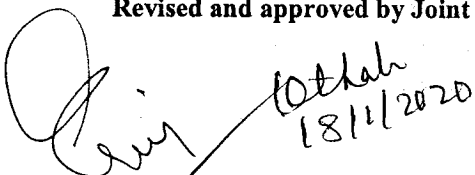
#### L 2 – Laser Lab:

1. Study of Diode Laser characteristic.
2. Construction of laser beam expander.
3. Measurement of screw parameter.
4. Measurement of electro-optic coefficient.
5. Magneto-optic effect (Faraday Rotation)
6. High voltage sensor based on electro-optic effect.
7. Molecular Weight Measurement.
8. Holography.
9. To demonstrate the I-V and P-V characteristics of PV module with varying radiation and temperature level.
10. To demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules.
11. To show the effect of variation in tilt angle on PV module power.

**The students are required to perform 5 programs using MATLAB platform**

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## OE 18 Quantum Optics

### Unit-I

**Introduction: What is quantum optics, A brief history of quantum optics**

**Classical optics** Maxwell's equations and electromagnetic waves ,Electromagnetic fields ,Maxwell's equations ,Electromagnetic waves , Polarization , Diffraction and interference.

### Unit-II

Formalism of quantum mechanics , The Schrödinger equation, Properties of wave functions m, Measurements and expectation values, the uncertainty principle, The Stern–Gerlach experiment ,The band theory of solids.

### Unit III

**Radiative transitions in atoms, Einstein** coefficients, Radiative transition rates , Selection rules

**Photon statistics** : Introduction, Photon-counting statistics, Coherent light, Classification of light by photon statistics.

**Coherent states and squeezed light** , Light waves as classical harmonic oscillators , Light as a quantum harmonic oscillator , Coherent states , Squeezed states , Detection of squeezed light.

### Unit IV

Quantum information processing, Quantum cryptography, Classical cryptography , Basic principles of quantum cryptography Quantum key distribution according to the BB84 protocol , System errors and identity verification , Error correction , Identity verification , Practical demonstrations of quantum cryptography ,Quantum cryptography in optical fibres .

### Unit V

#### Quantum computing

Introduction , Quantum bits (qubits) ,The concept of qubit, Quantum logic gates and circuits , Preliminary concepts Single-qubit gates , Two-qubit gates , Practical implementations of qubit operations optical realization of some quantum gates.


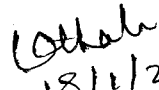
#### Reference Books:

1. Quantum Optics by M. Fox, Oxford Master series in Atomic, Optical and Laser physics
2. Introductory Quantum Optics by C.C. Gerry and P.L. Knight, Cambridge University Press
3. Quantum Optics by M.O. Scully and M.S. Zubairy, Cambridge University Press
4. Quantum Theory of Light by R. Loudon, Oxford science publication

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**PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)**

**SYLLABUS**

**M. Tech in Optoelectronics and Laser Technology**

**SEMESTER – 2**

**JANUARY – JUNE, 2021**

**OE-21- PHYSICS OF ADVANCED MATERIALS**

**UNIT I**

**Nano Particles and Nano Structured Materials:**

**Properties of Individual Nano-Particle:** metal nanoparticles, geometric and electronic structure, magnetic clusters, Semiconductor nanoparticles, optical properties, rare gas and molecular clusters, methods of synthesis of nanoparticles. Carbon nanostructure, C60 carbon nanotube and application.

**Bulk nano structured materials:** Solid disordered nanostructures, methods of synthesis, properties, metal nano-cluster composite glasses, porous silicon; Nano structured crystals.

**UNIT II**

**Quantum Nanostructures and Nano-Machines/Devices:**

Quantum wells, wires and dots, preparation, size & dimensionality effects, excitons, single electron tunneling, applications of quantum nanostructure. Super conductivity. Self-assembly, process of self-assembly, semiconductor islands, monolayers. Catalysis, surface area of nanoparticles, porous, and colloidal materials.

**Nanomachines and Devices:** Microelectromechanical system (MEMSs), Nanoelectromechanical system (NEMSs), Photonic nano & micro circuits, nano and micro fluidics. Application of NEMS and MEMS in Rf, Microfluids, Optics, BioScience, and Precious Manufacturing.

**UNIT- III**

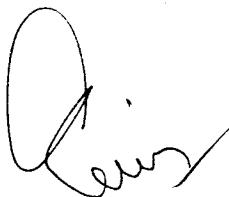
**Solid state lasers:** Material requirement for solid state lasers, Activator ions and centers, Material design parameters for semiconductor laser diode, choosing alloy composition and thickness, making ohmic contacts, Other III-V heterojunction laser materials. Introduction to organic laser. Material selection for light emitting diodes.

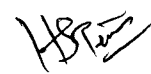
Electrical, Optical and Thermal properties of III-V and II-VI semiconductors required for optoelectronics devices for visible and IR range.

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## JANUARY – JUNE, 2021

Electroluminescent materials: Inorganic electroluminescence, AC powder EL, ACTFEL device, EL characteristics, EL excitation mechanism. Electroluminescence in Organic solids, Material useful for organic thin film EL devices, polymeric material for EL. LED Technologies for Light Emission and Displays. QLED.

### UNIT IV

**Characterization of Materials:** Introduction to emission and absorption spectroscopy: Nature of electromagnetic radiation, electromagnetic spectrum, atomic, molecular, vibrational and X-ray energy levels Basics of UV-VIS spectroscopy: Radiation sources, wavelength selection, Cells and sampling devices, Detectors, Basic ideal of IR spectrometry: Correlation of Infrared spectra with Molecular Structure.

Fundamental of X-ray diffraction, Powder diffraction method, Quantitative determination of phases; Structure analysis. EDAX, Lithography (top down and bottom up), Contact preparation of thin films for device fabrication.

Epitaxial thin film techniques : Liquid phase epitaxy, vapour phase epitaxy, Metal Organic chemical vapour deposition, Atomic layer epitaxy.

### UNIT V

**Experimental Techniques:** High resolution X ray diffraction, Double Crystal diffraction, Drift mobility and Hall mobility, Hall effect for Carrier density and Hall mobility, Photoluminescence (PL) and Excitation Photoluminescence (PLE) Optical pump probe experiments.

**Basic idea of Microscopic Techniques:** Optical microscope, Scanning Electron Microscope (SEM), Transmission Electron microscope (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Thickness measurement – Gravimetric method, Basics of Ellipsometry: Optical parameter measurements ( n and k).

### TEXTS BOOKS

1. Nanotechnology by Charles P. Poole Jr. and Frank J. Owens (Willey Inter. Science pub 2003).
2. Nanostructures and Nanomaterials – Synthesis properties and Applications by Guozhong Cao (Empirical College Press World Scientific Pub. 2004 ).
3. Physics of Semiconductor Devices by S. M. Sze(Willey Int., 1981).
4. Instrumental methods of analysis, H. H. Willard, L. L. Merritt, J A Dean, F A Sellte, CBS Publishers New Delhi 1996.

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## REFERENCE BOOKS

1. Scanning Electron Microscopy : Ootley.
2. Handbook of Electroluminescent Materials Ed. D. R. Vij Inst of Physics, Bristol and Philadelphia.
3. Electronic and Optoelectronic properties of Semiconductor, Jaspreet Singh, Cambridge University Press.
4. H. Baltes, O. Brand, Enabling Technology for MEMS and Nanodevices, Wiley, New York, 2004.

JANUARY – JUNE, 2021

## OE-22- FIBER OPTICS LASER INSTRUMENTATION AND SOLAR PHOTOVOLTAIC TECHNOLOGIES

### Unit I

#### OPTICAL FIBER AND THEIR PROPERTIES

Principle of light propagation through a fiber – Different types of fiber and their properties – Fiber materials and their characteristics – Transmission characteristic of fibers – absorption losses – scattering losses – Dispersion – measurement of optical fibers – optical sources – Optical detectors. Dispersion shifted Fiber Technologies.

### Unit II

#### FIBER OPTIC SENSORS IN MEASUREMENTS

**Fiber optic instrumentation system** – Fiber optic sensors, Different types of modulators, Application in instrumentation, Interferometric method of length Measurement, Measurement of pressure, temperature, current, voltage, liquid level and strain. Magnetic and electric field sensors based on the characteristics like intensity, phase, polarization, frequency and wavelength of light wave, Plasmonic nano-sensors.

**Laser Plasma Interaction:** Basic concepts and two-fluid description of plasmas, electromagnetic wave propagation in plasmas.

### Unit III

#### LASERS IN MEASUREMENTS AND TESTING

Laser for measurement of distance, velocity, acceleration, current, voltage, and atmospheric effect, Laser application in Spatial Frequency filtering. surface topology & optical component testing, beam modulation telemetry, laser Doppler velocimetry, surface velocity measurement using speckle patterns, measurements of rate and rotation using laser gyroscope.

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### Basics of Interferometer:

Michelson interferometer, Fizeau interferometer, Fourier-transform interferometer, Fresnel interferometer, Holographic interferometer, Fabry–Pérot interferometer

### JANUARY – JUNE, 2021

#### Unit IV

**Lasers in Industry** – Laser material processing: Laser matter interactions, mode of coupling energy from beam to the material. CW and pulsed heating and the resulting effect. Thermal processing of materials with lasers, Application in material processing, Laser Welding, Hole Drilling, Laser cutting, Laser Tracking, heat treatment, glazing, alloying, cladding, hardening of surfaces, semiconductor annealing and trimming.

BioMedical Application of Lasers: Medical applications of lasers; laser and tissue interaction – Laser instrument of surgery. Laser light scattering, application in biomedicine. Light transport in tissue.

Photochemical, photothermal, photomechanical effects and their therapeutic applications. Optical imaging and diagnosis. Biomedical Instruments.

#### Unit V

#### Solar Photovoltaic Technologies

Generation of Photo voltage, Light Generated current, I-V equation, Solar Cell Characteristics, parameters of solar cells, Relation of  $V_{oc}$  and  $E_g$ .

Design of solar cells: Upper limit of cell parameters, Losses in Solar Cell, Design for High  $I_{sc}$ ,  $V_{oc}$  and FF Analytical Techniques: Solar Simulator-IV measurement, Quantum efficiency measurement, Minority carrier lifetime & diffusion length measurement.

#### TEXT BOOKS

1. Optical Fiber Communication, Keiser, G. McGraw Hill, Int. Student Ed.
2. John and Harry, Industrial Laser and their applications, McGraw Hill.
3. Solar Photovoltaics: Fundamentals, Technologies and Applications, C. S. Solanki, 2nd Edition Prentice Hall of India, 2011.
4. John F Ready, Industrial application of lasers. Academic press 1978.
5. John Crisp, Introduction to Fibre Optics , an imprint of Elsevier Science 1996.
6. Understanding Fiber Optics, 4th or 5th edition; Jeff Hech; Prentice Hall Publishers.
7. Optical Fiber Communication Principles and Systems, A. Selvarajan, S. Kar and T. Srinivas TMH.

#### REFERENCE BOOK

Revised and approved by Joint Board of Studies in Electronics & Physics on 18<sup>th</sup> Jan ,2020

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1. Fiber Optic Communication System, G. P. Agarwal, Willey Eastern.
2. Introduction to Fiber Optics, A. Ghatak and K. Thyagrajan, Cambridge Univ. Press.
3. Laser Material processing by W.M. Steen.
4. M.L. Wolbarshi, Ed. Laser Applications in Medicine & Biology, Vol.1, 2 & 3 (Plenum, New York, 1971,74,77).
5. Solar cells: Operating principles, technology and system applications, by Martin A. Green, Prentice- Hall Inc, Englewood Cliffs, NJ, USA.

**JANUARY – JUNE, 2021**

**OE-23- OPTICAL NETWORKS**

**Unit I**

**WDM Technology and Issue in WDM Optical networks:** Introduction – Optical networks – WDM – WDM optical network evolution- Enabling Technology for WDM optical networks – WDM optical network architecture – Issue in Wavelength routed networks – Next generation optical Internet networks, The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

**Unit II**

**Wavelength Routing Algorithms :** Introduction – Classification of RWA algorithms – Fairness and Admission control – Distributed control protocols – Permutation routing and Wavelength requirements Wavelength Rerouting algorithms : Introduction – benefits of wavelength routing – Issue in Wavelength routing – Light path Migration – Rerouting schemes – Algorithm AG – Algorithm MWPG – Rerouting in WDM networks with Sparse Wavelength conversion – Rerouting in Multifiber networks – Rerouting in Multifiber Unidirectional ring Networks .

**Unit III**

**Wavelength Convertible networks :** Introduction - need for Wavelength converters – Wavelength convertible switch architecture – routing in convertible networks – Performance evaluation of convertible networks – Networks with Sparse Wavelength conversion – Converter placement problem – Converter allocation problem.

**Unit IV**

**Virtual topology Design:** Introduction – Virtual Topology design problem – Virtual topology sub problems – Virtual topology design Heuristics – Regular virtual topology design – predetermined virtual topology and lightpath routes – Design of multi fiber networks.

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Virtual Topology Reconfiguration: Introduction – Need for virtual topology reconfiguration – Reconfiguration due to Traffic changes – reconfiguration for fault restoration.

#### **Unit V**

**Network Survivability and provisioning:** Failures and Recovery – Restoration schemes – Multiplexing techniques – Distributed control protocols. Optical Multicast routing – Next generation optical internet network.

**JANUARY – JUNE, 2021**

#### **TEXT BOOKS**

1. C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks : Concepts, Design and Algorithms ", Prentice Hall India 2002.
2. Rajiv Ramasami and Kumar N. Sivarajan, " Optical networks : A Practical Perspective", A Harcourt publishers international company 2000.

#### **OE-24-ADVANCED OPTICAL COMMUNICATION**

##### **Unit I**

Introduction to optical components – optical amplifiers – types – issue in optical amplifiers – photonic switching – Cross connect – Wavelength conversion – Multiplexer – Demultiplexer, Filters– tunable filters, Photonic Crystal Fibers : Introduction, Guiding mechanism, modified total internal reflection and photonic bandgap guidance, properties and applications, introduction to OICs and its applications.

##### **Unit II:**

First Generation Optical Networks

SONET/SDH – multiplexing , element of a SONET/SDH infrastructure - SONET/SDH physical layer, Computer interconnects – ESCON, Fiber channel, HIPPI , Metropolitan area networks – FDDI, ATM, Layered Architecture - SONET/SDH layers – Second generation optical network layers.

##### **Unit III**

DWDM: Networks, Devices, and Technology :Fundamentals of DWDM Technology, Architecture and components, Working of DWDM, Topologies and Protection Schemes for DWDM, IP over DWDM Networks, Ethernet switching over DWDM, OTN (Optical Transport Networking), Capacity expansion and Flexibility in DWDM, Future of DWDM, Survivability in DWDM Networks.

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## Unit IV

### OTDM Technology

Important issues of OTDM – optical solitons. Optical pulse compression – fiber grating compressor soliton effect compressor. Modulation instability, fundamental and higher-order solitons, soliton lasers, soliton-based communication systems, fiber loss, frequency chirp, soliton interaction, design aspects, higher-order nonlinear effects. Broadcast OTDM networks, bit interleaving and packet interleaving, optical AND gates, nonlinear optical loop mirrors, terahertz optical asymmetric demultiplexer, switch based networks. Applications of solitons.

## Unit -V

### FTH and PON Technology

Proposed architecture and issues of Fiber to the home (FTH) – Passive Optical Network (PON), Near space communication – open air optical communication. Inter satellite link hops (ISL). Introduction to all optical networks (AON), Military, Civil, consumer and industrial applications.

### Architecture and Analysis of Terabit Packet Switches Using Optoelectronic Technologies:

Introduction, Transparent vs. Opaque, Electronic vs. Optical Buffers, An Overview of Related Work, Optical-Buffered Packet Switches, Electronic-Buffered Packet Switches, Generic Architecture of Optical Packet Switch, Optical Interconnection Networks (OIN) Based Architectures, All-Optical Packet Switching (AOPS) Based Architecture.

### TEXT BOOKS :

1. Rajiv Ramaswami and Kumar N. Sivrajan, " Optical networks – A practical perspective", A Harcourt Publishers International Company 2000
2. R. G. Junsperger, " Integrated Optics – Theory and Technology, Springer Series in Optical Sciences", 3rd Edition 1991
3. Gerd Keiser, " Optical Fiber Communications" ,McGraw Hill International Edition 191
4. G. P. Aggarwal, " Non Linear Optics", Academic Press.
5. Stamatios V. Kartalopoulos, "Understanding SONET/ SDH and ATM Communication network for Next Millennium", PHI 2000.
6. C. Sivaram and mohan Gurusamy, " WDM Optical Networks : Concepts, Design and Algorithms" PHI India 2002.

### REFERENCE BOOKS:

1. DWDM: Networks, Devices, and Technology 1st Edition, by "Stamatios, V. Kartalopoulos"
2. Broadband Networking ATM, Adh and SONET, " Mike Sexton, Andy Reid"
3. F. Poli, A. Cucinotta and S. Selleri : Photonic crystal fiber properties and application, Springer, 2007.
7. Optical Networks — Recent Advances: Recent Advances edited by Lu Ruan, Ding-Zhu Du, 2001 Kluwer Academic Publisher.

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JANUARY – JUNE, 2021

**OE-27- PHOTONICS LAB –II**

Experiments are to be performed in the Advance Photonics Laboratory of S.O.S. in Electronics & Photonics

**EXPERIMENTS**

1. To calculate the wavelength of Laser using Michelson interferometer.
2. To determine the size of tiny particles using Laser.
3. To determine the grating pitch of transmission grating.
4. To determine the wavelength of a Laser using meter scale ruling.
5. To find the refractive index of glass (transparent materials) by measuring Brewster angle.
6. To determine the bending losses that occurs in a multimode fiber when it is bent along various radii.
7. To determine the absorption coefficient of transparent materials (glass slide).
8. To study the variation of splice losses due to transverse offset, angular tilt and longitudinal separation.
9. To observe the refraction of light in liquid and to calculate its refractive index.
10. To study the wavelength dependence of attenuation in the given optical fiber.
11. To determine insertion loss of each channel of WDM mux, loss uniformity and optical cross talk in channels.
12. To setup optical Add/Drop multiplexer (OADM) using fiber Bragg grating .
13. To setup the WDM link with the given components and determine the total loss for each wavelength.
14. To find the refractive index of transparent Bar using diode Laser.
15. To observe the absorption of Laser light when various colors are introduced in its path.
16. Preparation of thin films with the help of Dip Coating Unit and resistance/ impedance measurement using Source measuring unit.
17. Preparation of thin films with the help of Spray pyrolysis method and resistance/ impedance measurement using Source measuring unit.
18. Preparation of thin films with the help of Spin Coating Unit and optical constant measurement using ellipsometer.
19. Measurement of absorbance and transmittance of solution by using photospectrometer.
20. To demonstrate the effect of shading on PV module output power.
21. To demonstrate the working of diode as Bypass diode and blocking diode.
22. Characterization of semiconductor devices and materials by using Agilent Semiconductor Parameter Analyzer.

**Note:** Students have to perform at least 15 experiments

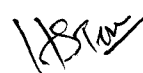
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## OE 28 Theory-V

The motivation for the course is to make the students understand the fundamentals and physics of photonic materials, devices and nano photonics, as well as nano-photonic devices. **The student may elect one from OE 28 [A] or OR 28 [B].**

### OE 28[A] PHOTONICS MATERIALS AND DEVICES

#### UNIT I

Materials for nonlinear optics, preparation and characterization, evaluations of second order and third order nonlinear coefficients, 3 wave and 4 wave mixing in uniaxial and biaxial crystals.

#### UNIT II

Frequency up and Frequency down conversions, Photorefractive materials, phase conjugation and its applications.

#### UNIT III

AO Phenomenon, Raman-Nath and Bragg modulators, deflectors, spectrum analyser devices based on EO and MO effects.

#### UNIT IV

EL and POS devices, fluoride glass based fibres and their applications, optical fibre based signal processing.

#### UNIT V

Optical Integrated Circuits, architecture fabrication and applications, CD read/write mechanism, memory storage, information storage and retrieval using holography.

#### REFERENCE BOOKS

1. Optoelectronic devices and systems, SC Gupta, Prentice Hall India (2005) (Text)
2. Handbook of Nonlinear optical crystals - Dmitriev (Springer Verlag), 2003
3. Optical Electronics - Thyagarajan and Ghatak W (Cambridge University Press), 1997

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## [OE 28 B] NANOPHOTONICS

### UNIT I

#### Foundations for Nanophotonics

Confinement of Photons and Electrons, Propagation Through a Classically Forbidden Zone: Tunneling, Localization Under a Periodic Potential: Bandgap, Cooperative Effects for Photons and Electrons, Nanoscale Optical Interactions, Axial and Lateral Nanoscopic Localization, Nanoscale Confinement of Electronic Interactions, Quantum Confinement Effects, Nanoscopic Interaction Dynamics, Nanoscale Electronic Energy Transfer. Near-Field Interaction and Microscopy : Near-Field Optics, Modeling of Near-Field Nanoscopic Interactions, Near-Field Microscopy, Aperture less Near-Field Spectroscopy and Microscopy, Nanoscale Enhancement of Optical Interactions, Time- and Space-Resolved Studies of Nanoscale Dynamics.

### UNIT II

Quantum-Confined Materials : Quantum Wells, Quantum Wires, Quantum Dots Quantum Rings, Manifestations of Quantum Confinement, Optical Properties, Quantum-Confined Stark Effect, Dielectric Confinement Effect, Single-Molecule Spectroscopy, Quantum-Confined Structures as Lasing Media, Metallic Nanoparticles and Nanorods, Metallic Nanoshells Applications of Metallic Nano structures. Growth and Characterization of Nanomaterials : Growth Methods for Nano materials, Epitaxial Growth, Laser-Assisted Vapor Deposition (LAND) Nano chemistry, Characterization of Nano materials, X-Ray Characterization, Transmission Electron Microscopy (TEM) Scanning Electron Microscopy (SEM), Scanning Probe Microscopy (SPM).

### UNIT III

Nanostructured Molecular Architectures : Non covalent Interactions, Nanostructured Polymeric Media, Molecular Machines, Dendrimers, Supramolecular Structures, Monolayer and Multilayer Molecular Assemblies. Photonic Crystals : Basics Concepts, Theoretical Modelling of Photonic Crystals, Features of Photonic Crystals, Methods of Fabrication, Photonic Crystal Optical Circuitry Nonlinear Photonic Crystals, Photonic Crystal Fibers (PCF), Photonic Crystals and Optical Communications, Photonic Crystal Sensors.

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#### **UNIT IV**

Nanocomposites ,Nanocomposites as Photonic Media, Nanocomposite Waveguides, Random Lasers: Laser Paints, Local Field Enhancement, Multiphasic Nanocomposites, Nanocomposites for Optoelectronics.

Industrial nanophotonics: Nanolithography, Nanosphere Lithography, Dip-Pen Nanolithography, Nanoimprint Lithography, Nanoparticle Coatings, Sunscreen Nanoparticles, Self-Cleaning Glass Fluorescent Quantum Dots, Nano barcodes.

#### **UNIT-V**

Bio Nano photonics and nanomedicine :Bioderived Materials, Bioinspired Materials Bio templates, Bacteria as Biosynthesizers, Near-Field Bio imaging, Nanoparticles for Optical Diagnostics and Targeted Therapy, Semiconductor Quantum Dots for Bio imaging Bio sensing, Nano clinics for Optical Diagnostics and Targeted Therapy, Nanoclinic Gene Delivery Nano clinics for Photodynamic Therapy.

#### **REFERENCE BOOKS**

Nanophotonics : P N Prasad, Wiley Interscience ( 2003) ( Text)

Biophotonics: P N Prasad, Wiley Publications ( 2004)

L. Novotny and B. Hecht, Principles of Nano-optics, Second Edition, Cambridge University Press, 2012

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### Comprehensive Viva-Voce

A comprehensive viva -voce will be held immediately after the end of Semester I, II and IV. The Comprehensive Viva- Voce is intended to assess the student's understanding of various subjects he has studied during the M.Tech. course of study. The Viva-Voce would be conducted by a Board of Examiners consisting of the Head, Course Coordinator and all concerned Faculty Members of the both Electronics and Physics department. The Comprehensive Viva- Voce is evaluated on the basis of Grade. A candidate has to secure a minimum Grade to be declared successful. If he fails to obtain the minimum Grade, he has to reappear for the viva-voce during the next examination. The Grades are as follows.

RANGE	QUALITATIVE_ASSESSMENT/GRADE	
91% - 100%	O	Outstanding
81% - 90%	A	Very Good
71% - 80%	B	Good
61% - 70%	C	Fair
50% - 60%	D	Pass
Below 50%	F	Failure



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**SEMESTER III (July – December, 2020)**

**Major Project Phase - I**

**&**

**SEMESTER IV (January – June, 2021)**

**Major Project Phase- II**

**Project Work Scheme**

**Project** evaluation shall be done at the end of III and IV semesters and the students will have to submit a dissertation on his / her project work as per the Regulation for M.Tech. The problem may be selected from an appropriate Industry or Institution. The candidate is expected to work under the guidance of a project guide for at least for a period as decided. In case the project work is taken up in an external Industry/Institution, the project shall have two guides: one in the participating organization (Industry/Institution) who is the external guide and the other shall be one of the faculty members from Department who is the internal guide. The dissertation should be submitted within two calendar years from the starting date of the third semester, Six copies of the dissertation have to be submitted to the M.Tech. Course Coordinator. These copies shall be distributed to the External examiner, Internal Examiner, Project guide (Faculty), Department Library and University Library and the Candidate.

**Evaluation of Project Work**

The project evaluation committee shall be responsible for the project work evaluation. The project evaluation committee as per M.Tech. Regulation. The project guide (faculty from department) shall be the internal examiner. The external examiner shall be a technical expert in the concerned subject from any organization other than that of the project guide and is selected from the panel of experts submitted by the Course Coordinator. The dissertation shall be evaluated by the external examiner.

Three bound copies along with a soft copy of the dissertation shall be submitted to the Head of the Department/Coordinator within the last date prescribed by the Department / School for the purpose. The project work shall be evaluated through presentations and viva voce. The grade/marks shall be given to the students according to the level and quality of work and presentation/documentation.

*Q. N. Kothari*  
18/1/2020

*H. S. Tam*

**Course Structure and Syllabus**  
**CHOICE BASED CREDIT SYSTEM**  
**IN**  
**M.Sc.ELECTRONICSPROGRAMME**



**FACULTY OF SCIENCE**

**Approved by Board of Studies in Electronics**

(Academic Session July 2020 and onwards)

School of Studies in Electronics and Photonics

Pt.RavishankarShuklaUniversity

Raipur (C.G.) 492010

[www.prsu.ac.in](http://www.prsu.ac.in)

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Syllabus revised and approved by Board of Studies in Electronics on 18<sup>th</sup>Jan., 2020

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# School of Studies in Electronics & Photonics, Pt. Ravishankar Shukla University, Raipur

M. Sc. Electronics CBCS

Scheme & Syllabus

Session 2020-22

Sr. No.	Paper Code	Title of Elective Paper	Marks			Credit
			External	Internal	Total	
1.	ELCBCS-1	Basics of Electronics <sup>a</sup>	80	20	100	3
2.	ELCBCS-2	Fundamentals of Biomedical Equipments <sup>b</sup>	80	20	100	3

<sup>a</sup>For all students except students of Electronics and Physics

<sup>b</sup>For all students

- Each elective paper comprises of three units and carries a total of 3 credits.
- Note: Student can earn maximum of 6 credits or minimum of 3 credits out of the aforesaid elective papers.
- Enrolment of 10 students is minimum requirement for switching on the course for a particular semester with the maximum limit of 30 students
- The courses will be offered either during the second or the third semester.
- Classes will be held on 3pm to 4pm or 4pm to 5 pm.
- Basis of Selection: First come and first serve basis.

*Q. M.*

*18-1-2020*

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Name of the Department - **SOS in Electronics and Photonics, PRSU, Raipur**

Course - Choice Based Course **ELCBCS-1, Second Semester**

Name of Question Paper - **ELCBCS-1 Basics of Electronics**

Total Credit - **03**; Total Marks - **100**

**Course Details-** This course introduces students to the basic components of electronics: diodes, transistors, and op amps. It covers the basic operation and some common applications.

### **EL1 Basics of Electronics**

**Basic electronics-** Introduction, Applications, Concepts of charge, potential, voltage, current, power and their units, Active and passive components,

**Basic concepts and resistor circuits** Resistor and its color codes, AC signals

**AC circuits** Introduction, Capacitors, Inductors, RC circuits, Response to a sine wave

**Overview of Analog circuitry-** Introduction to semiconductors, Conductors, Insulators, Diode and its type, Transistor and its types- NPN & PNP, Transistor as an amplifier and switch. Introduction to MOSFETS, Operational Amplifiers and Integrated Circuits.

**Digital Electronics-** Analog vs digital signals, Concept of amplitude and frequency, Number system and their conversions, Boolean arithmetic, De – Morgan laws, basic logic gates: their realization, Universal gates, Exclusive – OR and Exclusive NOR-gates.

### **Text Books**

- [1.] Basic Electronics for Scientists and Engineers, Dennis L. Eggleston, Cambridge University Press.
- [2.] Basic Electronics and Linear Circuit by N. N. Bhargava, DC Kulshreshtha and S. C. Gupta, Tata McGraw-Hill
- [3.] Electronic Devices and Circuit Theory, 9th ed. Boylestad & Nashelsky, PHI
- [4.] Digital Principles and Application - Malvino Leach, Tata McGraw Hill
- [5.] Modern Digital Electronics - R.P. Jain, Tata McGraw

### **References**

- [6.] Basic Electronics Solid State by B. L. Thereja, S Chand
- [7.] Electronic Devices & Circuit Analysis – K Lal Kishore, BS Publications



Name of the Department - **S.O.S. in Electronics and Photonics, PRSU, Raipur**  
Course - Choice Based Course **ELCBCS-2, Third Semester**  
Name of Question Paper - **ELCBCS-2 Fundamentals of Biomedical Equipments**  
Total Credit - **03** ; Total Marks - **100**

Course Details-

### **EL2 Fundamentals of Biomedical Equipments**

**Basics of measuring instruments of electronics-** Overview of electricity, Circuit basics, Concept of various measuring parameters- voltage, current, power, ohm's law, Kirchoff's law.

**Biomedical equipment overview-** Electronics and Medicine, medical electronics, Importance of measuring instruments in Biomedical, Overview of Electrocardiograph-operation, origin of the ECG waveform

**Electroencephalography (EEG)** - Signal sources, Recording modes, Applications of the EEG; Techniques to Aid observation- X-ray and Radiography, Diagnostic Ultrasound.

#### **Text Books-**

- Principles of Medical Electronics and Biomedical Instrumentation- C. Raja Rao, S. K. Guha, Universities Press (India Limited)
- Introduction to Biomedical Instrumentation- Mandeep Singh, PHI Learning Pvt. Ltd.

#### **Reference Books-**

- Biomedical instrumentation and measurements – Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer
- Measurements And Instrumentation- A.V.Bakshi U.A.Bakshi, Technical publication, Pune
- Biomedical Instrumentation and Measurment- R. Anandanatarajan, PHI

**SCHEME OF EXAMINATION  
& SYLLABUS of  
Course Work for Ph.D.(ELECTRONICS)  
PROGRAMME**



**FACULTY OF SCIENCE**

**Approved by Board of Studies in Electronics**

**Effective from Academic Session from starting**

**JULY 2020**

**School of Studies in Electronics and Photonics**

**Pt. Ravishankar Shukla University**

**Amanaka, GE Road, Raipur (C.G.) 492010**

**[www.prsu.ac.in](http://www.prsu.ac.in)**

**PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR**

**SCHEME OF EXAMINATION & SYLLABUS PRESCRIBED FOR THE  
EXAMINATION OF COURSE WORK FOR  
Ph.D. (Electronics)**

**EFFECTIVE FROM JULY 2020**

**Scheme of Examination**

The Course Work for PhD degree in Electronics is a six month course after completion of P.G. Degree in the subject. There shall be two compulsory papers based on the research areas of Electronics discipline. The structure of the course is given below:

<b>S No</b>	<b>Theory Paper</b>	<b>Marks</b>
1.	Research Methodology, Quantitative Methods & Computer Applications	100
2.	Review of Literature in Concerned Subject, Seminar/ Project Report	100
<b>Total</b>		<b>200</b>

**Paper I**

**Research Methodology, Quantitative Methods & Computer Applications**

**Unit I - Introduction and Design of research**

Meaning, objective and significance of research, types and parameters of research, research process, identification and definition of the research problem, definition of construct and variables, pure and applied research design, exploratory and descriptive design methodology, qualitative Vs quantitative research methodology, field studies, field experiments Vs laboratory experiments, research design in social and physical sciences.

**Unit II - Data Analysis**

Procedure for testing of Hypothesis, the null hypothesis, determining level of significance , type I and type II errors, grouped data distribution, measures of central tendency, measures of spread/dispersion, normal distribution, analysis of variance: one way, two

way, Chi square test and its application, students 'T' distribution, non parametric statistical techniques, binomial test, Correlation and regression analysis- discriminate analysis- factor analysis- cluster analysis, measures of relationship.

### **Unit III – Solar PV fundamentals and Emerging Solar Cell Technologies**

**P-N junction under illumination:** Generation of Photo voltage, Light Generated current,, I- V equation, Solar Cell Characteristics, parameters of solar cells, Relation of Voc and Eg

**Design of solar cells:** Upper limit of cell parameters, Losses in Solar Cell, Design for High Isc, Voc and FF

**Analytical Techniques:** Solar Simulator-IV measurement, Quantum efficiency measurement, Minority carrier lifetime & diffusion length measurement.

**Thin film solar cell technologies,:** amorphous Si solar cells, CdTe solar cells, Quantum Dot Solar Cells, Dye Sensitized Solar cells, Perovskite Solar Cells, Present status of different PV technologies, Shockley-Queisser limit.

### **Unit IV – Molecular Devices and Semiconductor Device Simulation**

**Molecular Devices:** Operation fundamentals of organic LEDs, Organic FETs and Organic solar cells, Basic physics underlying device operation, Fundamental benefits and limitations of the organic materials

**Introduction to Semiconductor Device Simulation:** Need of Simulation, Process Simulation, Device Simulation device simulation sequence, hierarchy of transport models, DD Model, Relationship between various transport regimes and significant length-scales.

Numerical Solution Methods - finite difference scheme, discretization of Poisson's and current continuity equations.

### **Unit V - Image Fundamentals –**

Digital Image representation, fundamental steps in Digital Image processing, image acquisition, storage, processing, communication & display, Simple image model, sampling and quantization, some basic relationships between pixels: Neighbors of a pixel, connectivity, labeling of connected Components, Relations, distance Measures.

#### **Image Transforms**

Introduction to Fourier Transform, The Discrete Fourier Transform, some properties of two dimensional Fourier transform: Separability, translation, periodicity & conjugate symmetry, rotation, distributive and scaling, average value, convolution and correlation, sampling. The Fast Fourier Transform: FFT algorithm, number of operations, the inverse FFT, implementation. Other Separable Image Transforms: Walsh Transforms, Discrete Cosine Transform, Hadamard Transform, the Haar & Slant transform.

Study of basic functions of image processing toolbox of Matlab software

#### **Reference Books –**

1. Research in education, By J W Best and J V Kann. Pearson/ Allyn and Bacon.
2. Research Methodology - Methods and Techniques, C K Kothari, New Age International.



3. Solar Photovoltaic's: Fundamentals, Technologies and Applications, C. S. Solanki, 2nd Edition, Prentice Hall of India, 2011.
4. Solar cells: Operating principles, technology and system applications, by Martin A. Green, Prentice-Hall Inc, Englewood Cliffs, NJ, USA,
5. Physics of Solar Cells: From Basic Principles to Advanced Concepts Peter Würfe Wiley-VCH; 1 edition
6. Organic Electronics: Materials, Manufacturing, and Applications Hagen Klauk Wiley-VCH; 1 edition
7. Organic Molecular Solids Markus Schworer (Author), Hans Christoph Wolf, Wiley-VCH; 1 edition (March 27, 2007)
8. Semiconductor Devices Modeling and Technology" by Nandita Das Gupta and Amitava Das Gupta, Prentice Hall of India Pvt.Ltd.
9. Digital Image Processing : Gonzalez and Woods, 2nd Edition, Pearson Education Publication
10. Fundamental of Digital Image Processing - A.K.Jain, PHI.

## **Paper – II**

### **Review of Literature in Concerned Subject, Seminar/ Project Report**

Review work related to latest developments in any related field excluding Ph.D. thesis topics.

The student should submit a detailed report of the review work and deliver a seminar before submission of the report and one final seminar.

**PT. RAVISHANKAR SHUKLA UNIVERSITY**  
**RAIPUR - 492 010, CHHATTISGARH**

## **M Sc Environmental Science**

### **SYLLABUS**

### **SEMESTER EXAMINATION**



**2020-2021**

## M.Sc. ENVIRONMENTAL SCIENCE COURSES

The Environmental Science is a multidisciplinary subject includes chemistry, physics, geology, geography & biology. The teaching and research in the environmental science is urgently required for understanding and controlling the complex environmental issues arising at the local, regional and global scales.

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### Semester-I (Credit: 24)

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PAPER	COURSE	DURATION	INTERNAL ASSESSMENT	THEORY MARKS	TOTAL MARKS
ENV-01	Fundamental of Ecology	3 Hrs	20	80	100
ENV-02	Instrumental Techniques: Principle and Application	3 Hrs	20	80	100
ENV-03	Analytical Methods in Environmental Sciences	3 Hrs	20	80	100
ENV-04	Renewable, Nonrenewable and Perpetual Resources	3 Hrs	20	80	100
ENV-05	Lab work-1	8 Hrs.			100
ENV-06	Lab work-2	8 Hrs.			100

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### Semester-II(Credit: 24)

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ENV-07	Meteorology and Climatology	3 Hrs	20	80	100
ENV-08	Environmental Pollution and Control : Air and Water	3 Hrs	20	80	100
ENV-09	Environnemental Pollution and Control: Soil, Solid Waste, Radiation and Noise	3 Hrs	20	80	100
ENV-10	Environmental Geosciences	3 Hrs	20	80	100
ENV-11	Lab work-3	8 Hrs.			100
ENV-12	Lab work-4	8 Hrs.			100

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**Semester-III(Credit: 24)**

ENV-13	Environmental Toxicology	3 Hrs	20	80	100
ENV-14	Environmental Microbiology	3 Hrs	20	80	100
ENV-15	Environmental Biotechnology	3 Hrs	20	80	100
ENV-16	Data Analysis in Environmental Sciences	3 Hrs	20	80	100
ENV-17	Lab work-5	8 Hrs.			100
ENV-18	Lab work-6	8 Hrs.			100

**Semester-IV(Credit: 24)**

ENV-19	Remote Sensing and GIS	3 Hrs	20	80	100
ENV-20	Environmental Disaster and Risk	3 Hrs	20	80	100
ENV-21	Environmental Impact Assessment, Environmental Audit and Environmental Management System Standards (EIA, EA and EMSS)	3 Hrs	20	80	100
ENV-22	Environmental Law, Policies and Society	3 Hrs	20	80	100
ENV-23	Dissertation	8 Hrs.			200

**Internal elective paper (Credit: 4)**

- (i) Food adulteration
- (ii) Waste management

**External elective paper (Credit: 4)**

- (i) Renewable, Nonrenewable and Perpetual Resources
- (ii) Environmental Disaster and Risk
- (iii) Environmental Law, Policies and Society

## **Semester-I (24 Cr)**

### **Course-1: Fundamentals of Ecology ( 4 Cr)**

#### **Unit-I: Concept of Ecology (1 Cr)**

History and scope of ecology: autecology, synecology, population, community, ecosystem, biome, tolerance range and limiting factors; Component parts of an ecosystem; Classification of ecosystems; Ecological factors: temperature, light, water; Bio-geo-chemical cycles: Carbon cycle, nitrogen cycle, sulfur cycle, phosphorous cycle; Functional attributes of an Ecosystem :Biological diversity and stability; Biodiversity: Index of diversity and dominance, Biological indices, relationship between species diversity, dominance and stability; Food chain: Trophic levels & ecological pyramid concept; Types of food chain & significance of food chains, pyramid of number, biomass & energy.

#### **Unit-II: Primary and Secondary Production and Ecosystem Energy Flow (1 Cr)**

Concept of Primary Production; Factors affecting primary production; Method for measuring primary production; Relationship between GPP & NPP, atmospheric respiration, primary productivity of different world sites; Secondary production: concept of secondary production and secondary productivity, maintenance cost, production-assimilation efficiency and secondary productivity; Relationship of secondary production to net primary production, Energy flow in Ecosystems, Concept of Energy, Energy source in Ecosystem, Laws governing energy transformation, concept of free energy, Enthalpy and Entropy, Energy flow in producers and consumers, Lindeman's Trophic-Dynamic concept, Ecological efficiencies, Energy flow models.

#### **Unit-III: Population Attributes, Population Fluctuation and Population Interaction (1 Cr)**

Biotic potential and natality, mortality, survivorship curves, life table, age structure, population growth forms, concept of carrying capacity and environmental resistance; Life history strategies, r and k selection, extrinsic and intrinsic abiotic, biotic, density dependent and independent factors associated with population fluctuation; Population interaction like symbiosis, commensalism, parasitism, predation, competition etc.; Models for single and interacting population, social behavior in animals. Factors affecting change in size of human population: death rate and net population change, migration, fertility, age structure, Human population control; economic development and demography transition, family planning method of birth control, socio-economic methods of controlling human population growth.

#### **Unit-IV: Biotic Community and Ecological Succession (1 Cr)**

Concept of habitat and niche, types of niches: spatial, trophic and hyper volume niche; ecological equivalents, community organization, types of communities, community structure (analytical and synthetic), qualitative features of community (Composition, stratification, Physiognomy, dispersion, sociability, vitality, etc. ), quantitative characteristics of community (frequency, density, cover dominance and diversity, important value index),

Ecotone and edge effect. Ecological succession and kind of succession, succession process, concept of climax, monocl意思, and polyclimax theories, examples of succession (hydrosere, lithosere and xerosere) and vegetation of India.

### **Books & References**

- 1 E. P. Odum, Fundamental of ecology, W.B Sounders, 1971.
- 2 M. Dash and S. Dash, Fundamentals of ecology, Mc Graw Hill Education, India, 2009.
- 3 R. T. Wright and B. J. Nebel, Environmental science: Toward A sustainable future, Prentice Hall, 2002.
- 4 P. Stiling, Ecology: Theories and Applications, Prentice Hall, 2001.
- 5 C. Faurie, Ecology: Science and Practice, Oxford & IBH, 2001.
- 6 G. T. Miller, Living in the environment: An introduction to environmental science, Wadsworth Publishers, 1998.
- 7 J. Turk, Introduction to Environmental Studies, Saunders, 1980.
- 8 E. J. Kormondy, Concepts of ecology, Prentice Hall, 1996.
- 9 M. M. Saxena, Applied Environmental Biology, Agrobios, 1990.
- 10 E. Odum and G. W. Barrett, Fundamentals of Ecology, Brooks Cole, 2004

## **Course-2 : Instrumental Techniques: Principale & Application (4 Cr)**

### **Unit-I: Electrochemical Techniques (1 Cr)**

Idea of pH and buffer, Buffer capacity and ionic strength; Principle and application of pH-metry, potentiometry, conductometry, coulometry, polarography, voltammetry (cyclic and anode stripping), amperometry and ion selective electrodes.

### **Unit-II: Spectroscopic Techniques (1 Cr)**

The principle, instrumentation and application of the infrared, FTIR, visible, ultraviolet and Raman and fluorescence spectrometry, nephelometry and turbidimetry.

### **Unit-III: Atomic Spectroscopic Techniques (1 Cr)**

Principle, instrumentation and application of atomic absorption (i.e. flame, graphite furnace, hydride generation and cold vapor) spectroscopy and atomic emission (i.e. flame, plasma, spark and arc) spectroscopy.

**Unit-IV:** Principle, instrumentation and application of X-ray fluorescence spectroscopy (XRF),  $\gamma$ -ray spectroscopy, proton induced X-ray emission spectroscopy (PIXE), NMR and ESR spectroscopy.

### **Books & References**



- 1 G. D. Christian, Analytical Chemistry, 6th Ed, John Wiley & Sons, 2007.
- 2 H. A. Strobel and W. R. Heineman, Chemical instrumentation: a systematic approach, Wiley, 1989.
- 3 H. H. Willard, Instrumental methods of analysis, Van Nostrand, 1981.
- 4 Z. Marczenko and M. Balcerzak, Separation, preconcentration and spectrophotometry in Inorganic Analysis, Elsevier, 2000.
- 5 E. B. Sandell and H. Ōnishi, Photometric determination of traces of metals, Wiley, 1978.
- 6 B. Welz and M. Sperling, Atomic Absorption Spectrometry, John Wiley & Sons, 2008
- 7 Ed Metcalfe, Atomic absorption and emission spectroscopy, J. Wiley, 1987.

### **Course-3: Analytical Methods in Environmental Sciences (4 Cr)**

#### **Unit- I: Separation techniques (1 Cr)**

Concept and application of separation probes: adsorption, centrifugation, chromatography, crystallization, decantation, demister (vapour), distillation, drying, electrophoresis, elutriation, evaporation, leaching, liquid-liquid extraction, solid phase extraction, flotation, flocculation, filtration, reverse osmosis, dialysis (biochemistry) fractional distillation, fractional freezing, magnetic separation, precipitation, crystallization, sedimentation, sieving, stripping, sublimation, vapour-liquid separation, winnowing and zone refining.

#### **Unit- II: Chromatography (1 Cr)**

Principle, instrumentation and application of gas, liquid, adsorption, paper, gel, size exclusion, HPLC, TLC, electrophoresis and ion exchange chromatography.

#### **Unit- III: Mass spectroscopy (1 Cr)**

Principle, instrumentation and application of mass spectroscopy, types of mass spectroscopy, fragmentation, ionization and characterization of organic and inorganic materials.

#### **Unit- IV: Miscellaneous methods**

Principle, instrumentation and application of classical analytical methods(i.e. gravimetric, volumetric and thermal methods); Automatic analytical methods and Hybrid analytical methods.

#### **Books & References**

- 1 E. Katz, Quantitative Analysis Using Chromatographic Techniques, John Wiley & Sons, 2009.
- 2 J. Rydberg, M. Cox and C. Musikas, Solvent extraction principles and practice, CRC Press, 2004
- 3 P. J. Haines, Principles of Thermal Analysis and Calorimetry, Royal Society of Chemistry, 2002.
- 4 E. de Hoffmann and V. Stroobant, Mass Spectrometry: Principles and Applications, John Wiley & Sons, 2007

## **Course-4: Renewable, Non-renewable and Perpetual Resources (4 Cr)**

### **Unit-I: Renewable Resources (forest) (1 Cr)**

Importance of Forest with reference to major and minor produce, climate, soil erosion, pollution control and water management,. Loss of forest cover with reference to world and Indian Context, Impact of deforestation and shifting cultivation on forest ecosystems, Management of forests involving different silvicultural principles and practices. Raising forest cover through social forestry, agroforestry and extension forestry, Eucalyptus dilemma ,Joint Forest management ,People's participation and role of NGOs, , Concept of Biosphere Reserve , Biodiversity and forest : definition and type of biodiversity, global distribution of biodiversity, mega biodiversity countries, key stone species, dominant species, biodiversity hot spots, significance of biodiversity , factors influencing biodiversity loss, biodiversity conservation ( in situ and ex situ).

### **Unit-II: Renewable Resources (Rangeland and Wildlife) (1 Cr)**

Rangeland: Importance and extent of rangeland, causes of rangeland loss, conservation and management of rangeland, Wild Life resources: Wild life & its importance. Human activities and Wild Life, Concept of Endangered Species, IUCN classification and Red data Book, ecological basis of wild Life conservation and management, some case studies on crocodile, sea turtle and project tiger

### **Unit-III: Non-renewable Mineral and Fossil Fuel Resources (1 Cr)**

Mineral Resources :Economic mineral deposits, grouping of ores minerals ,various steps involved in extraction processes of pure metals, uses of common metals and their recycling, Radioactive minerals, Environmental impact of mining and processing mineral resources, conservation of mineral resources. Fossil fuels: Classification, Coal, its type and its analysis, Carbonization, oil : fractionation, cracking Octane and octane number, addition of TEL; natural gas and other gaseous fuels derived from fossil fuels, Environmental Impact of Fossil Fuel use.

### **Unit-IV: Perpetual & Nonrenewable and Perpetual and Renewable Energy Source (1 Cr)**

Geothermal energy: Source, Principle of harnessing energy and its operation. Nuclear Energy : Source, fission and fusion reactions, broad idea of nuclear reactor, its operations, management and electrical power generation, safety measures. Solar energy: its secret, devices based on solar energy, their advantages and drawbacks, wind energy: wind mills and applications, aero-generators, their advantages and disadvantages, Water energy: Hydroelectricity, wave and tidal energy, tidal power plant, their advantages and drawbacks Energy from biomass: Biomass as fuel, Biogas plants and generation, uses of biogas

### **Books & References**

- 1 F. Ramade, Ecology of natural resources, John Wiley & Sons, 1984.

- 2 R. Toossi, Energy and the Environment: Sources, Technologies, and Impacts, VerVe Publishers, 2008.
- 3 K. Singh, Handbook of Environment, Forest and Wildlife Protection Laws in India, Natraj, 1998.
- 4 S. S. Negi, India's Forests, Forestry and Wildlife, India Book House, 2006.
- 5 C. A. Simon, Alternative Energy: Political, Economic, and Social Feasibility, Rowman & Littlefield, Lanham, Maryland, 2006.
- 6 O. Edenhofer, Renewable Energy Sources and Climate Change Mitigation, Cambridge University Press, 2011.
- 7 A.Karen, Environmental Science: Understanding Our Earth, Cengage Learning, 2011
- 8 L. R. Berg and M. C. Hager, Visualizing Environmental Science, Second Edition, Wiley and National Geographic, 2009.
- 9 B. Judy and St. A. Sara, Environmental Science, Pearson – AGS Globe, 2007.

### **Course-5: Practical (4 Cr)**

1. Verification of Beer's law.
2. Determination of detection limit and molar absorptivity.
3. Determination of absorption maximum,  $\lambda_{\max}$ .
4. Simultaneous determination of two or more components in a given mixture.
5. Determination of retardation factor ( $R_f$ ) value of components in a given mixture by using paper chromatography.
6. Determination of  $pK_a$  value of weak electrolytes.
7. Determination of electrode potentials.
8. Determination of cell constant.
9. Determination of specific conductivity.
10. Determination of distribution ratio by using solvent extraction technique.
11. Determination of percentage extraction (%) of given substance by using solvent extraction. technique.
12. Other advanced practical.

### **Course-6: Practical (4 Cr)**

1. Determination of dissolved oxygen of water samples.
2. Determination of reduction potential of water samples.
3. Determination of total dissolved solid of water samples.
4. Determination of hardness of water samples.
5. Determination of alkalinity of water samples.
6. Determination of COD and BOD value of water samples.
7. Determination of color value of waste water.
8. Determination of salinity of water.
9. Determination of microbe content of water.
10. Other advanced practical.

## **Semester-II (24 Cr)**

**Course-7:**

**Meteorology and Climat**

### **Unit-I: Atmosphere, Oceans and Earth's Radiation Balance ( 1Cr)**

Introducing the Atmosphere, The heterosphere, Subdivisions of the homosphere, the troposphere, atmospheric pressure, Introducing the oceans: Composition of Sea water, Density of sea water, Layered structure of Oceans; Solar radiation, Insolation over the Globe, World Latitudinal zones, Insolation losses in the atmosphere, Long wave radiation, Latitude and the radiation balance, Annual and Daily Cycles of radiation, Man's Impact upon the Earth's Energy Balance, Cosmic particles and Ionizing radiation, The magnetosphere, radiation belts Meteorology fundamentals – Pressure, temperature, wind, humidity, radiation, atmospheric stability adiabatic diagrams, turbulence and diffusion. Scales of meteorology. Applications of micrometeorology to vegetated surfaces, urban areas, human beings, animals.

### **Unit-II: Thermal Environments of the Earth's Surface and Circulation Systems in Atmosphere and Oceans (1Cr)**

Heat flow mechanisms, The Heat Balance Equation, The daily and annual heat balance cycles, Heating and cooling of the soil, Arctic permafrost, Energy absorption by water layers, Heating and cooling of lakes and oceans, Sea Surface Temperatures, Sea Ice and its distribution, Daily cycle of air temperature near the ground, Thermal extremes near the ground, The Annual Cycle of Air temperature, Global distribution of air temperatures, Radiation and Heat Environments of High altitudes; Barometric pressure and winds, Idealized circulation on a nonrotating earth, Coriolis effect and the geostrophic wind, Cyclones and anticyclones, The Planetary circulation, Angular momentum transport by air masses, Atmospheric circulation in middle and high latitudes, Heat transport across parallels of latitude, Global patterns of barometric pressure and surface winds, Monsoon winds systems, Local winds, Wind and waves, The causes of ocean currents, The global pattern of ocean currents, Zones of convergence and upwelling, , El Nino, ENSO, The Earth's heat balance, Seasons in India.

### **Unit –III: Atmospheric Energy Releases ( 1Cr)**

Relative humidity and vapor pressure, Absolute and specific humidity, air masses, condensation and adiabatic process, clouds and fog, forms of precipitation, Convective precipitation and thunderstorms, Orographic precipitation, Cyclonic and frontal precipitation, World precipitation regions, Water balance of the atmosphere,

### **Unit-IV: Man's Impact upon the Atmosphere ( 1Cr)**

Carbon dioxide and oxygen levels in the atmosphere, Man induced changes in Atmospheric temperature, water vapor, clouds, and precipitation, Planned weather modification, Urbanization and balances of radiation and heat, Pollutants in the atmosphere, Inversion and smog, Glacial ice as a recorder of air pollution, Harmful effects of atmospheric pollution, Global effects of particles in the atmosphere, Testimony of the glacial ice layer, Application of meteorological principles to transport and diffusion of pollutants, Scavenging processes, Effects of meteorological parameters on pollutants and vice versa, Wind roses, Topographic effects, concepts of climate change.

## Books & References

- 1 Helmis C. G. and Nastos, P. T. (Eds.), Advances in Meteorology, Climatology and Atmospheric Physics, Springer Atmospheric Sciences, 2013.
- 2 P. V. Hobbs and J. M. Wallace, Atmospheric Science: An Introductory Survey, Academic Press Inc, 2006.
- 3 C. Booker, The Real Global Warming Disaster, Continuum Publishing Corporation, 2009.
- 4 A. Goudie, The nature of the environment, Blackwell, 2001.
- 5 K. S. Valdiya, Environmental Geology, Tata Mc Graw Hill, 1984.
- 6 Atmosphere, Weather and Climatology: A textbook on climatology, Kisalaya Pub. Pvt. Ltd, New Delhi, 1984.
- 7 R. G. Barry and R. J. Chorley, Atmosphere, Weather and Climate, Routledge, 2009.
- 8 J. E. Martin, Introduction to Weather and Climate Science, Cognella Academic Publishing, 2013.
- 9 J. O. Ayoade, Introduction to Climatology for Tropics, Wiley, 1993.
- 10 The Atmosphere : An Introduction to Meteorology, Prentice Hall; 12 edition, 20012.

## Course-8: Environmental Pollution and Control: Air and Water (4 Cr)

### Unit-I: Air Pollution (1Cr)

Atmosphere and its functions, Physical and chemical properties of atmosphere, , natural and anthropogenic sources of atmospheric pollutants, Major and Minor Pollutants in atmosphere (SO<sub>x</sub>, NO<sub>x</sub>,CO<sub>2</sub>, Fluoride etc. ),Gas laws governing the behavior of pollutants in atmosphere, transport and dispersion of pollutants – effect of meteorological and topographical factors, significance of these pollutants and their reactions in the lower and upper atmosphere,, Greenhouses effect, Photochemical smog, Ozone layer depletion Acid rain and their impact. History of some major air pollution episodes and case studies of some air polluting industries (thermal power , steel ,aluminum ,cement etc.) ,effect of air pollutants on plants, animals, microorganisms, man, physical structures and materials.

### Unit-II: Water Pollution (1 Cr)

History of major water pollution episodes , Sources, Classification and types of Water Pollution, characteristics of domestic, municipal, industrial and agricultural wastes – their effects with special reference to oil and detergents, and Heavy metals (mercury, lead, Arsenic cadmium, chromium), pesticides, and other toxic organics and inorganic constituents, Eutrophication and ecological magnification due to water pollution, History of some major water pollution episodes and case studies of some water polluting industries ( Sugar and molasses Pulp and Paper Dairy Textile, Food processing, leather etc.)

### Unit-III: Prevention and Control of Air Pollution( 1Cr)

Source-emission inventory, Air quality criteria, Air quality standards( Ambient and Emission Standards), Natural self cleansing properties of the environment, Dilution methods for controlling air pollution from stationary source, Prevention Methods for control of gaseous

air pollutants (Combustion ,Absorption and Adsorption ), Methods for control of Particulate air pollutants Mechanical device , Filtration , ,Wet scrubber ,Dry Scrubber , Electrostatic precipitator )

#### **Unit-IV: Prevention and Control of Water Pollution ( 1Cr)**

Water quality standard: Drinking Water quality standard, Irrigation water standard , Stream standard and effluent standard, Selection of appropriate unit operation for ETP to achieve desired standards. Methods of treatment of waste water: Preliminary Treatment, Primary treatment, (Sedimentation, Equalization and Neutralization, etc.), secondary treatment (Activated Sludge Technique & Trickling Filter) Tertiary treatment methods for waste water treatment (Evaporation, Ion Exchange ,Adsorption, Electro dialysis, Electrolytic Recovery, Reverse Osmosis) Characteristics of primary, secondary sludge from effluent treatment plant. Sludge dewatering by sludge thickener, sludge drying beds, vacuum filtration and filter press. Sludge disposal and fill and additive in fertilizers.

#### **Books & References**

- 1 N. de Nevers, Air pollution Control Engineering, Mc Graw Hill, 2000.
- 2 K. Work and C. F Warner, Air Pollution, its origin & Control, New York, 1997.
- 3 H. Braur and Y. B. G. Verma, Air Pollution Control Equipment, Springer Verlag, 1981.
- 4 G. Gaur, Air Pollution and its Management, Sarup & Sons, 1997.
- 5 R. K. Trivedi and P. K. Goel, Air Pollution, Techno-science, 1998.
- 6 G. Kiely, Environmental Engineering, Tata MC. Graw Hill, 1997.
- 7 P. K. Goel, Water Pollution , Causes ,effect and Control, New Age International, 2006.
- 8 S. K. Garg, Sewage Disposal & Air Pollution Engineering, Khana Publisher, 2008.
- 9 I. J. Higgins and R. Burns, The Chemistry and ecology of pollution, Academic Press, 1975.
- 10 S. S. Dara, A text book of Environmental Chemistry and Pollution Control, S. Chand, 1993.
- 11 A. K. De, Environmental Chemistry, New Age International, 2003.
- 12 J. W. Moore and E. A. Moore, Environmental Chemistry, Academic Press, 1991.
- 13 T H Y Tebbut, Principal of water quality control, Pergamon Press, 1992.
- 14 R. K. Trivedy and S. N. Kaul, Advances in Waste water Treatment and Technologies, Vol. II, Global Science, 2000.

#### **Course-9: Environmental Pollution and Control: Soil, Solid Waste, Radiation and Noise (4 Cr)**

##### **Unit-III: Soil Pollution and Control (1 Cr)**

The nature and importance of soil. Physical and Chemical properties of soil, Industrial wastes of different kinds, their interactions with soil components, problems due to toxic heavy metals and. Contamination of radionuclides, Source translocation, distribution and uptake of heavy metals, toxic and ecological effect, Pollution due to pesticides in soil, persistence, fate and degradation of pesticides in soil, Toxicity and effect of pesticides on soil organisms and plants, Alternate methods of pest control: Biological control, Hormonal control, Integrated pest management, Pollution due to fertilizers (N, P and K) and their interactions with



different components of soil, fate of fertilizers, due to volatilization, leaching and microbial immobilization, their toxicity and pollution, Alternatives to conventional pesticides and fertilizers( biofertilizers, biopesticides and organic farming)

### **Unit-II: Solid Waste Pollution and Control (1 Cr)**

Sources, nature and characterization of municipal solid waste, Hazards from these solid waste, various methods of disposal and management of solid and hazardous waste (composting, recycling, bio-methanation, pelletisation, pyrolysis, incineration, gasification, sanitary disposal etc.), hazardous and biomedical waste: categorization, generation, collection, transport, treatment and disposal, Hazardous waste and biomedical waste. Guidelines for HWM and Biomedical waste management. Treatment and disposal of some industrial solid waste like fly-ash & red mud.

### **Unit-III: Radiation Pollution and Control (1 Cr)**

Discovery of Radioactivity, Units of measurement and definition of radioactivity, Sources and Classification of radioactive pollution, Methods of radioactivity measurements, biological pathways, transport and effects of radiation, Mechanism of Radiation action on living system – Stochastic and Non-stochastic effects: delayed effects; protection and control from radiation, disposal of radio active waste.

### **Unit-IV: Noise Pollution and Control (1 Cr)**

Basic properties of sound waves-plane and spherical waves, sound pressure and intensity levels, decibel, effect of meteorological parameters on sound propagation. Noise sources; (machinery noise, pumps; compressors, building and construction equipment, domestic appliances, traffic – vehicular, train, aircraft) effect of noise on human health, noise standards and limit values. Prevention and control of Noise Pollution (sound absorbing materials, reverberation time, acoustic silencers, mufflers, barriers, vibration and impact isolation, anechoic chamber, greenbelt development).

### **Books & References**

- 1 S. E. Manahan, Environmental chemistry. Lewis Publ., 1992
- 2 A.P. Sincero and G.A. Sincero, Environmental Engineering, Prentice, 1996.
- 3 C. S. Rao, Environmental Pollution Control Engineering, Willey Estern, 2007
- 4 P. F. Cunniff, Environmental noise pollution, Wiley, 1977.
- 5 A. Farmer, Handbook of Environmental Protection and Enforcement: Principles and Practice, Earthscan, 2007.
- 6 S. Dara, Textbook of Environmental Chemistry and Pollution Control, Chand (S.) & Co Ltd ,2006.
- 7 H. J. Arnikaar, Essential of Nuclear Chemistry: New Age International Publishers, 2011
- 8 P. R.Trivedi and Raj G. (Eds.) Encyclopaedia of Environmental Sciences: Solid Waste Pollution Vol.24. Akashdeep, Publishing House, 1992.
- 9 D. Mani and S. G. Mishra, Soil Pollution, APH Publishing, 2009.
- 10 P. K. Gupta, Pesticides in Indian Environment, Interprint, 1986

- 11 H. D. Forth, Fundamentals of Soil Sciences : New York : Wiley, 1990
- 12 T. D. Biswas and S. K. Mukherjee, Text-Book of Soil Sciences, Tata McGraw-Hill, 1987

## **Course-10: Environmental Geosciences (4 Cr)**

### **Unit-I: Fundamentals of Geosciences (1 Cr)**

Different spheres in the earth: lithosphere, hydrosphere, atmosphere, biosphere; Primary differentiation and formation of core, mantle, crust, magma generation and formation of igneous rocks: earth dynamic processes: plate tectonics, types of plates, isostasy, geomorphic agents: river, wind, snow, glacier, volcanoes, weathering, erosion, transportation and deposition of earth's materials by running water, wind and glaciers: formation of land forms and sedimentary rocks

### **Unit-II: Environmental Geochemistry (1 Cr)**

Concept of major, trace and rare earth element, Geochemical classification of elements: Abundance of elements in the bulk earth, crust, hydrosphere, atmosphere and biosphere. mobility of trace elements, geochemical cycles, biogeochemical factors in environmental health, human use, trace elements and health, Mineral stability diagrams and controls on the chemistry' of natural waters.

### **Unit-III: Surface Water Resources and Environment (1 Cr)**

Global water balance, ice sheets and fluctuation of sea levels, origin and composition of sea water, hydrological cycle, and its components. Precipitation(Various form of precipitation, interpretation of precipitation data), Evaporation and Evapo-transpiration (Meteorological factors, transpiration, methods of estimating evaporation from land surface using Penman's equation), Infiltration and percolation( Infiltration capacity of soil, Factors influencing infiltration capacity, methods of determining infiltration capacity) Runoff (Duration of runoff, flow rating curves-their determination, adjustment and extension, catchment characteristics and their effects of runoff), climatic factors. Hydrological forecasting: Frequency analysis, probability of the N-year event, series of events, Probability plotting, cyclical nature of hydrological phenomena.

### **Unit-IV: Ground Water Resources and Environment (1 Cr)**

The occurrence of ground water factors of influence, ground water flow, abstraction of ground water, Darcy's law: Darcy's experiment; Fundamental Equation of ground water flow: Generalization of Darcy's law.

Aquifer and its types; Confined and Unconfined aquifers; Properties of Aquifer, permeability, porosity.

Groundwater occurrence & movement; Ground water levels and Environmental influences.

## Books and References

1. Environmental Geology: Indian Context by K. S.Valdiya ,Tata Macgraw Hill
2. Environmental Science : E. D. Enger and B. F. Smith
3. Introduction to Geochemistry : Krauskoph K. B.
4. Geology and our environment, Davis, S. N. , Reiton, P. H.& Pestrong, P. Mc.Graw Hill, NY
5. Environmental Geology, Keller, E.,A., Bell &Howell, Columbus, Ohio
6. Physical Geology, Strahler, A. N., John Harper & Row
7. Focus on Environmental Geology, Tank, R.W.Oxford Univ. Press
8. Text Book of Geology, P. K. Mukherjee
9. Environmental geology, Coates, D. R. , John wiley, NY

## Course-11: Practical (4 Cr)

- 1 Determination of NPK in water, soil and sediment.
- 2 Determination of Al in water, soil and sediment.
- 3 Determination of Mg and Ca in water, soil and sediment.
- 4 Detection and determination of micro nutrients in water, soil and sediment.
- 5 Determination of  $\text{Cl}^-$  in water, soil and sediment.
- 6 Determination of  $\text{SO}_4^{2-}$  in water, soil and sediment.
- 7 Determination of  $\text{NO}_3^-$  in water, soil and sediment.
- 8 Determination of  $\text{NH}_4^+$  in water, soil and sediment.
- 9 Other advanced practical.

## Course-12: Practical (4 Cr)

- 1 Determination of bulk density, moisture content and ash residue of solid fuels.
- 2 Determination of gross calorific value of liquid and solid fuel.
- 3 Determination of flash point of oil.
- 4 Determination of refractive index and viscosity of oil.
- 5 Detection of glucose, fructose, sucrose, starch, etc.
- 6 Determination of iodine value of oil.
- 7 Determination of acid value of oil.
- 8 Determination of saponification value of oil.
- 9 Determination of chlorophyll in plant leaves.
- 10 Other advanced practical.

## Semester-III (24 Cr)

### Course-13: Environmental Toxicology (4 Cr)

#### Unit-I: Introducing Toxicology (1 Cr)

History, disciplines and importance of toxicology, Potency and Toxicity, Acute toxicity, chronic toxicity), Hazards ,Risks, Benefit-to-risk-ratio, tolerance limits, Acceptable daily intake, Threshold value. Factors affecting toxicity : Host factor (Age ,species and strain, sex, life stage, health and nutrition, Idiosyncratic toxicity) interaction between chemicals

(synergistic, additive and antagonistic). Environmental factors, Physico-chemical properties of toxic substances, route and rate of exposure, Dose, Effect and response, Dose-response curves, & Dose effect relationships (Graded & Quantal response). Statistical concept of toxicity, margin of safety and therapeutic index

### **Unit-II Translocation of Toxicity (1 Cr)**

Absorption, Distribution and Excretion of toxic substances. Absorption: membrane permeability, mechanism of chemical transfer (passive transport, active transport, facilitated transport), absorption (Gastrointestinal, skin, lungs). Distribution: tissue affecting distributions and tissues retention. Excretion: Renal excretion, Biliary excretion and Gastrointestinal. Receptor Concept, Nature of receptors, Theory of toxicant receptor interaction, Mechanism of action of some Pesticides (organochlorine, carbamate and organophosphate) and heavy metals (lead, arsenic, mercury, cadmium and chromium)

### **Unit-III: Biotransformation and Bioaccumulation of Toxicants (1 Cr)**

Site, Biotransformation reactions, Phase-I (Oxidation, Reduction, Hydrolysis) and Phase- II (Conjugation) reactions and associated enzymes (cytochrome P450 system, cytochrome-b5 system, amine oxidase epoxide hydrolase, esterases and amidases, glutathione-s-transferase), factors (environmental, chemical and organismal) affecting biotransformation of xenobiotics, concept of bioconcentration, bioaccumulation and biomagnifications. Process of accumulation and elimination of toxicants

### **Unit IV: Toxicity Tests and Safety Evaluation of Chemicals (1 Cr)**

Toxicity tests: Types of toxicity test based on number of species (single species, Multiplespecies and Ecosystem tests), based on exposure (single dose and multiple dose), based on duration of exposure (acute and chronic toxicity test), specific toxicity tests (potentiation, teratogenicity, reproductive, carcinogenicity, skin, eye tests), safety evaluation of chemicals: introduction and definition of safety, process of risk assessment and safety evaluation programme (nature of chemical, usage pattern, environmental level & fate, human exposure & effect, monitoring, surveillance and follow-up, decision making)

### **Books and References**

1. Toxicology Vol I, II and III : Gupta, Metropolitan
2. Experimental toxicology : Anderson & Conning
3. Environmental Pollution and Toxicology: Ray Choudhury & Gupta, Today & Tomorrow Publ.
4. Toxicology, Omkar
5. Toxicology, Sood, Sarup and Sons

## **Course-14: Environmental Microbiology (4 Cr)**

### **Unit – I: Fundamentals of Environmental Microbiology (1 Cr)**

An over view of microbial diversity (Archaea, Eubacteria, Eukaryotic microbes) cellular organization of bacteria and their types and distribution , microorganisms as component of the environment. Distribution of microbes in air, Allergic disorders by air microflora fungal and pollen allergens. The microbial community in Marine and Fresh water environments. Microbiology of soil – soil habitats, Nutritional types of microorganisms.

### **Unit- II: Microbial Culture, Enumeration, Growth and Metabolism (1 Cr)**

Concept of microbial culture ( culture media, culture techniques like enrichment culture, pure, synchronous and continuous culture), Collection and enumeration of aeroallergens. Bacteriological analysis of water, sewage and waste water. Microbial examination of milk & dairy products. Microbial growth (different growth phases, multiplication and kinetics of growth) and microbial metabolism (aerobic, anaerobic, fermentative pathways)

### **Unit-III: Control of Microorganisms (1 Cr)**

Physical agents (temperature, pressure, radiation), chemical agent (bacteriocidal and bacteriostatic compounds, halogens and phenolic) for control of microbes, chemotherapeutic agents (drugs and antibiotics) and their mode of action

### **Unit-IV: Applied Microbiology**

Microbes as biofertilizers, biopesticides and single cell protein, mycorrhiza and their significance, microbial leaching of metals, microorganisms as source of fuel, role of microbes in the synthesis of Alcohols, Antibiotics, Amino acids, dairy products enzymes, vitamin productions and other organic acids, role of microbes in degradation of xenobiotics, microbes for biological treatment of waste water, microbiological biodegradation of Industrial wastes

### **Books & References:**

1. Microbiology – Fundamentals and application R.M.Atlas ,Maxwell-Mcmillan International Ed. 1996
2. Broke –Biology of Microorganisms M.T. Madigan , J.M Martinko and J.Parker ,Prentice Hall International 1998
3. Microbiology -L.M. Prescott, J.P. Harley and D.A. Klein, Tata Mc Graw Hill 2003
4. Fundamentals of Microbiology and immunology, A.K. Banerjee and N. Banerjee ,Central Book Deport 2006
5. Microbiology -Michael J. Pelzer, Tata Mcgraw Hill
6. Microbes, Man and Animals : The Natural History of Microbial Interactions : Linton, A. H. and Burns, R.G. (1982) john Wiley and Sons.
7. Elements of Microbiology : Pelczar, M.J. and Chan ECS, 1981 McGraw Hill.

### **Course-15: Environmental Biotechnology (4 Cr)**

#### **Unit-I: Bioremediation (1 Cr)**

Scope of bioremediation; types of bioremediation (Natural, solid phase ,slurry phase and bioventing); applications of bioremediation; Bioremediation efficacy testing; Approaches to bioremediation; Role of microbes in biodegradation of xenobiotic compounds:- halocarbons, polychlorinated biphenyls, alkyl benzyl sulfonates and oil mixtures, biodegradation of

pesticides, enzyme catalyzed pesticide degradation reactions. Biosorption, Use of bacteria, fungi and algae in biosorption, biomineralisation & bioleaching: Microorganisms involved in Bioleaching of ores, mechanisms of bioleaching, Bioleaching & Metal recovery. Bio indicators, Biomarkers and Biosensors in waste treatment.

## **Unit-II: Bioremediation of Contaminated Sites, Wastelands and Industrial Wastes (1 Cr)**

Bioremediation of contaminated soils (natural attenuation and in-situ subsurface bioremediation) and aquifers (Root Zone Technology and Water Hyacinth – Based Treatment Systems); bioremediation in aquaculture, Bioremediation of industrial wastes (distillery, pulp and paper, tannery, textile and dye ,dairy and food processing). Phytoremediation (phyto-extraction, phyto-stabilization, phytovolatilization, rhizodegradation and rhizofiltration), phytoremediation of inorganic, metallic and organic pollutants in contaminated sites, bioremediation of problematic soil: Coastal saline soil, Alkali soil and mine waste soil; waste land, types of waste land, microbial and earthwormic way of amelioration of waste lands.

## **Unit-III: Biotechnology for Air and water Pollution Abatement (1 Cr)**

Air Pollution abatement: Bio-scrubber and Bio-filter, Water Pollution Abatement: Aerobic ( Activated Sludge Process, Career advanced Activated Sludge Process, Biological Filters ,Rotating Biological Contractors, Fluidized Bed Reactors, Inverse Fluidized and Bed Biofilm Reactor, Expanded Bed Reactor ) Anaerobic Biological Treatment (Contact digester, Packed bed or Packed Volume Reactor , Anaerobic baffled digester, Up flow anaerobic sludge blanket reactors), Membrane Bioreactor and Biocatalyst

## **Unit-IV: Biotechnology for Solid Waste Management (1 Cr)**

Potential availability and composition of crop residues and other solid organic wastes. Principles of microbial Composting, Factor influencing composting. Methods of composting (aerobic and anaerobic). Degradation of cellulose, hemicelluloses, chitin, lignin, proteins, fats and waxes) during composting, and end products of composting, Vermicomposting (composting through Earthworms), advantages of vermicomposting over composting. Types of earthworm suitable for vermicomposting. Method of vermicomposting Changes during vermicomposting. Nutrient value of vermicomposts, Effect of vermicomposting on soil fertility and crop productivity, aquatic plant, organic wastes and energy crops for biogas, alcohol and hydrogen production using microorganisms, bioconversion of agricultural, Sewage sludge, Paper waste, sugar mill wastes, tannery sludge) to feed stuffs and fertilizers.

### **Books & References:**

1. Wastewater Engineering Treatment disposal Reuse – Metacalf & Eddy Inc. 4<sup>th</sup> ed TMGHI ,New Delhi, 2003
2. Environmental Engineering Peavy, HS, Donald RR & G Tchobanoglous MGH Int. Ed. New York 1985
3. Wastewater Treatment for Pollution Control – Soil J Arceivala, Tata Mc Graw Hill 2<sup>nd</sup> ed. 1998



4. Wastewater Treatment Plants: Planning, Design and Operation- S.R. Qasim, Holt, Rinehart & Winston, 1985
5. Industrial Water Pollution Control – WW Eckenfelder, Jr. McGraw Hill 2<sup>nd</sup> Edition NY 1989
6. Sewage Disposal and Air Pollution Engineering, S.K. Garg, Khanna Publisher
7. Waste Water Engineering, G.L Karia & R.A Christian ,Prentice Hill Publication,2<sup>nd</sup> Edition, 2006.
8. Microbial Methods for Environmental Biotechnology: Grainer, J.M. and Lynch, J.M. 1984. Academic Press.
9. Methods in Biotechnology: Hans Peter Schmauder
10. Global environmental Biotechnology: D. L. Wise
11. Basic environmental technology: Jerry A. Nathanson.
12. Basic Biotechnology Ed. Colin Ratledge & B Jorn Kristiasen, Cambridge.
13. Environmental Biotechnology S.K. Agarwal, APH
14. Managing Industrial Pollution S.K. Bhatia, MacMillan
15. Biological and Biotechnological control of insect Pests, Rechcigl and Rechcigl, Lewis
16. Hand book of Bioremediation, Norris et al., Lewis
17. Micro-organism in Action: Lynch & Hobbie
18. Soil Biotechnology: Lynch Blackwel
19. Waste Recycling for energy conversion: Kutand and Hare, Johnwiley and Sons, N Y.
20. Refuse Recycling : Holms, John wiley & Sons, New York

## **Course-16: Data Analysis in Environmental Sciences (4 Cr)**

### **Unit-I: Fundamentals of Statistics (1Cr)**

Population & sample, Variables, Primary and secondary data, Collection of data, Classification and tabulation of data, Need and usefulness of Diagrams & Graphs, Different types of diagrams and graphs. Frequency distribution: Discrete and continuous frequency distribution, sampling methods (random sampling, Stratified random sampling, Systematic sampling), sampling errors, Experimental design: completely randomized block design, randomized block design, Latin square design.

### **Unit-II: Descriptive Statistics (1 Cr)**

Measure of central tendency (Averages), Types of mean: Arithmetic mean, Geometric mean, Harmonic mean; Median, Mode, relation between mean median and mode; Measure of dispersion: Range, Mean deviation & Standard deviation; Skewness and Kurtosis .

### **Unit-III: Theoretical Probability Distribution (1Cr)**

Binomial, Poisson and normal distribution; Testing of Hypothesis: Null and Alternative Hypothesis, level of significance, Student's t distribution and its application, Chi-square( $\chi^2$ ) test & its application.

### **Unit-IV: Correlation, Regression and ANOVA Analysis (1 Cr)**

Types of correlation; simple, partial and multiple correlation, Method of study & testing the significance of correlation coefficient, Rank correlation, Regression analysis: regression equations and regression lines, Properties of regression lines, regression coefficient, testing the significance of regression coefficient. Analysis of variance (ANOVA): One way and two way classification and their applications.

### **Books and References**

1. Walpole, R. and R. Myers (1993). Statistics for Engineers and Scientists, 5th edn. MacMillan, N.Y.
2. Manly (2001) Statistics for environmental science and management, Chapman and Hall / CRC.
3. Statistics : Gupta, Sultan & Chand
4. Fundamental of Statistics: Elhance
5. Biostatics: Mishra & Mishra
6. Statistical Methods: Snedecor and Cochran
7. Introduction to Biostatistics by N. Gurumani, MJB Publisher

### **Course-17: Practical**

- 1 Sampling of indoor and outdoor aerosols.
- 2 Detection and determination of trace gases in air.
- 3 Determination of sound intensity in air.
- 4 Determination of carbon di-oxide levels in air.
- 5 Determination of meteorological parameters in air.
- 6 Determination of ions and metals in aerosols.
- 7 Determination of toxic elements in air.
- 8 Other advanced practical.

### **Course-18: Practical**

- 1 Analysis of ions with ion chromatography.
- 2 Analysis of metals with flame photometer.
- 3 Analysis of metals with AAS.
- 4 Analysis of the VOCs with gas chromatography.
- 5 Analysis of H, C, N and O.
- 6 Analysis of organics with HPLC.
- 7 Analysis of ions with ion-selective electrodes.
- 8 Other advance practical.

## **Semester-IV (24 Cr)**

### **Course-19: Remote Sensing and Geographical Information System (4 Cr)**

#### **Unit-I: (1 Cr)**

Introduction to Remote sensing Science & Technology: Principles of Remote sensing, Physical basis of Remote sensing. The nature and generation of Electromagnetic radiation (EMR). Interaction of EMR with the atmosphere and earth's surface features. Spectral signatures and characteristic spectral reflectance curves for rocks, soil, vegetation and water. Spectral quantities. Far and near infrared and microwave remote sensing.

#### **Unit-II: (1 Cr)**

Remote Sensing Observation and Platforms: Air borne and space borne platforms, their relative importance and applications, Orbital geometry. Remote Sensing Satellites. Sensors, Aerial cameras and type of aerial photography, Photo scale and photo elements, Single and multi band scanners MSS sensor and other type of sensors. Aerial Stereo coverage and. Details of sensors on board. Latest Earth resources Satellites viz. LANDSAT 6/7/8, SPOT, IKONOS, IRS,ERS, MODIS, RESOURCESAT, CARTOSAT, GOES,OCEANSAT. Hyperspectral imaging, RADAR and LIDAR techniques, Indian scenario of remote sensing.

#### **Unit-III: (1 Cr)**

Digital image processing: Introduction to digital structure and data recording format sets. Visual Photo-Interpretation Techniques based on Photo elements and Terrain elements, Image Restoration, Enhancement and classifications, Significance of Ground Truths and Training Sets in Image Processing and in automated processing.

#### **Unit-IV: (1 Cr)**

Geographic information system: Introduction, Definition and Terminology, Map Projection and Coordinate system, GIS system hardware, software and infrastructures. Basic components of GIS software. Data structures. Data models, Data acquisition, Data Input and Data processing and management including topology, TIN model, DEM/DTM generation, overlying and Integration and final data product and report generation Integration of Remote sensing and GIS techniques and its applications in land use/land cover and Environmental resource studies .

#### **Books and references:**

1. Remote Sensing and GIS, Angi Reddy, The Books Syndicate, Hyderabad, 2000
2. Principles of Geographical Information Systems- P. A Burrough and R. A. Mc Donnel, OUP, Oxford, 1998.
3. Remote sensing for Earth Resource-Rao, D. P., AEG Publication, Hyderabad, 1987.
4. Geographical Information System-Kang Tsung Chang, Tata Mc Graw Hill, Publication Edition, 2002
5. Remote Sensing and Its Application –LRA Narayan University Press
6. Remote Sensing and GIS- Basudeb Bhatta Oxford University Press, 09-Oct-2011 - 752 pages
7. Remote Sensing of the environment, John R. Jensen, Dorling Kindersley India, Pvt. Ltd. 2009 - 592 pages
8. Remote sensing and image interpretation, Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman - 2008 – 756

9. Geographical Information Science-Narayan Panigrahi
10. GIS fundamentals, a first text on geographic information system, Paul Bolstad
11. Getting started with geographic information systems, Keith C. Clarke Prentice Hall, 2001 – p. 352

## **Course-20: Environmental Disaster and Risk (4 Cr)**

### **Unit-I: Hazard, Risk and Disaster (1 Cr)**

Hazard in the Environment, the concepts of hazard, risk and disaster, Human vulnerability to hazard, Disaster trends, complexity in hazard and disaster, Hazard zoning and risk assessment, Environmental Security and Hazards Zoning, hazard zoning maps & preparedness plan. Risk Assessment management: Disaster management cycle, Hazards vs. Risk, Evaluation of Risk, Strategies for Hazard Mitigation: Priorities, Prediction, warning & Public information, Minimizing the probability of hazards, Public policy for hazard management.

### **Unit-II: Earthquakes, Volcanic and Mass movement Hazards (1 Cr)**

Origin of Earthquake, its magnitude and intensity, Earthquake prone zones in the Earth, Reservoir induced seismicity, effects of earthquake, stability of structure & Risk Assessment, coping with seismic hazards, seismic zoning map, seism tectonic map, earthquake prediction & control. Types of volcanic eruptions, Active volcanic belts in the world, nature and magnitude of volcanic hazards, prediction of volcanic eruptions, mitigation of volcanic hazards. Mass movement hazards: Landslides, Rock fall, snow avalanche hazards with some case studies.

### **Unit-III: Floods, Cyclones, Tornadoes and Tsunamis (1 Cr)**

Floods and flood management, causes of excess flows, reduced carrying capacity of rivers, Runoff versus infiltration, sediment load & changing course of rivers, management of floods - strategy, treatment of watersheds, reservoir & detention basis, water spreading, ground water recharge, stream channelization, flood embankments, flood plain zoning, flood forecasting & warning. Regions of flood prone zones in India. Origin of cyclones, tornadoes and tsunamis, their severity and impacts, coastal hazards mitigation measures.

### **Unit-IV: Technological hazards: Nature and Definition of Technological Hazards (1 Cr)**

Concepts of industrial pollution, nuclear radiation, toxic wastes, dam failures, transport accidents, factory explosions, fires, chemical spills, and technological hazards as a result of the impacts of a natural hazard. Definition of hazardous waste, solid waste generation, concept of solid waste management. Onsite handling and processing, disposal techniques- open dumping, land filling, incineration, composting, potential methods of disposal- utilization, recovery and recycling. The growth of industrial hazard, Some case studies of Technological Disasters like Bhopal gas Tragedy 3 December, 1984, Chernobyl Nuclear accident 1986, Minnamata Japan, Japan's earthquake- tsunami- Fukushima nuclear disaster: 2011

## **Books and references:**

1. Environmental Hazards: assessing risk and reducing hazards, Smith, K. and Petley, D.N. Routledge publication, London.2009, p.383.
2. Atmosphere, weather and climate, a textbook on climatology, Siddhartha, K. Kisalaya Publications Pvt. Ltd. New Delhi, 2000, p. 511
3. Environmental Geology, Valdiya K.S., Tata Mc-Graw Hill, 1987, p.
4. Landslide risk assessment, Lee E.M. and Jones D.K.C., Thomas Telford, 2004, p. 454
5. Environmental Geoscience: interaction between Natural Systems and Man, Strahler, A.N. and S Trahler A.H., Hamilton Publishing Company, California, p.511.
6. The nature of the Environment, Goudie, A., Blackwell Publications, 2001, p.544.
7. Living with Risk: The Geography of Technological Hazards by Susan L. Cutter (Jun 15, 1993)
8. Technological Disasters, P.C. Sinha, Anmol Publications Pvt. Limited, 1998 - 516 pages
9. Earthquakes and Tsunamis in the Past: A Guide to Techniques in Historical Seismology, E. Guidoboni and John E. Ebel, Cambridge University Press, 2009
10. Earth quakes: Bruce A. Bolt
11. Elementary Seismology: Charles F. Richter

## **Course-21: Environmental Impact Assessment, Environmental Audit and Environmental Management System Standards (EIA, EA and EMSS) (4 Cr)**

### **Unit-I: Origin and Development of EIA (1 Cr)**

Nexus between Development and Environment, Comparison between economic and Ecological criteria, Concept of externalities, shared resources, Global commons & carrying capacities. Origin and Development of EIA. Relationship of EIA to sustainable Development. EIA in Project planning & Implementation, EIA process: Evaluation of proposed action, Scoping, EIA methodologies. Role of GIS in EIA baseline studies. Risk Assessment and Risk Management: Mitigation measures, comparison of alternatives, Reviews and decision making ,compensatory actions, EIA notifications/regulations in India, Green belts: Review of Procedure, Practices and guidelines in India. EIA vs. SEA, Carrying capacity, Cumulative impact assessment.

### **Unit-II: Case Studies on EIA (1 Cr)**

EIA of (a) River valley Projects, (b) Thermal Power Plants, (c) Mining Projects, (d) Integrated Iron and Steel Industries, (e) Cement Industries, (f) Oil Refineries and Petrochemicals, (g)Tourism, (h)Coastal zone Development.

### **Unit-III: Environmental Audit (1 Cr)**

Concept of Environmental Audit, Objectives of Audit, Types of Audit, Audit methodology, Features of effective auditing, Elements of audit process, Program Planning, Organization of auditing Program, Pre-visit data collection, Audit Protocol, On site audit: Data sampling,

Inspection, Evaluation and Presentation, Audit report, Action Plan, Management of audit, Waster audits and pollution prevention assessment, Liability audit and site assessment, auditing of EMS, SWOT Analysis (Strength, Weakness, Opportunities and Threats analysis) for EIA, Audit Assessing, Economic & Environmental benefits direct from Environmental Audit, Life Cycle Assessment

#### **Unit-IV: Environmental Management System Standards (1 Cr)**

Core elements of EMS, Benefits of EMS, Certification Body Assessment of EMS, Documentation for EMS, EMS standard (ISO9000 & 14000 series): evolution, principles and structure, supporting systems, EMS specification standards & Certification procedures, EMS specification standards:ISO14001, Benefits of Implementing ISO 14001: Indian scenario.

#### **Books and references:**

1. Environmental Impact Assessment: Canter, L.W. 1977. Mc Graw Hill, New York
2. Environmental Impact Assessment Methodologies: Anjaneyulu Y. and Minickam V., BS Publications, Hyderabad
3. Manual of Environmental Impact Evaluation-Rosen JJ 1976 Prentice Hall
4. A practical guide to Environmental Impact Assessment, Erickson, P.A., Academic Press
5. Environmental Impact Analysis Hand book Rao & Woolen (eds) 1980 Mc Graw Hill
6. Environmental Quality Management: Bindu N Lohani 1984, South Asia Publ.
7. Environmental Impact Assessment: Alan Gilpin 1995, Cambridge Univ. Press
8. Manual of Environmental Impact Evaluation-Sharma, J. Rosen. Prentice Hall
9. Current documents on guidelines of EIA, MOEF, Govt. of India.
10. Strategic Environmental Assessment. R. Therirvel, E. Wilson, S. Thampson, D. Heany & D. Pritchard.
11. Environmental Impact Assessment- Cutting edge by 21<sup>st</sup> century- Cutting edge by Alan Gilpin, Cup, London
12. Environmental Impact Assessment & Practice- Theory, P. Wathem, U. Hynman, Sydney
13. A Practical Guide to Environmental Impact Assessment – Paul A Erickson Academic Press
14. Planning and Implementation of ISO 14001, Environmental Management system- Gyani & Amit Lunia, Girdhar Raj Publ, House Jaipur.
15. A guide to the implementation of the ISO 14000 series on Environmental Management- Ritchie I and Hayes co Prentic Hall, New Delhi .
16. Environmental Management, Kulkarni, V. and Ramachandra, T.V., TERI press, New Delhi, 2009
17. Uberoi, N.K. (2010). Environmental Management, Excel Books, New Delhi.
18. ISO 14004 – Environmental management systems : General guidelines on principles, systems and supporting techniques (ISO 14004 : 1996 (E)).
19. Environmental management systems : Specification with guidance for use (ISO 14001 : 1996b (E)). (International organization for standardization – Switzerland).
20. Handbook of environmental management and technology : Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.
21. Environmental Impact Assessment, L. W. Canter, Mc Graw Hill Publication, New York.



## **Course-22: Environmental Law, Policies and Society ( 4 Cr)**

### **Unit-I: Water, Air, Forest and Wildlife act (1 Cr)**

Constitution of Central and State Pollution Control Boards, Power ,Function and responsibility of Central and State Boards (Objectives, Area of jurisdiction, responsibility of an industry, power and function of state and central Government, Cognizance of offence, Penalties and Punishment), Brief account of The Forest Act 1927 ,Forest conservation Act. 1980: Objective and Jurisdiction, Responsibility of Industry. Wildlife Protection Act 1972 Authorities under the Act. Wild life Advisory Boards and their functions, Detection and prevention of offences. Cognizance of offences, the wildlife (protection) Amendment Act. 1991

### **Unit-II: The Environment Protection Act 1986 (1 Cr)**

Necessity and Scope of the Environmental Protection Act, Powers of the Central Government , Parallel Provisions with the water and the Air act, The Public Liability Insurance Act 1991, Important rules & notification under the Environment Protection Act 1986 : Public Hearing notification 1997 , Biomedical waste (Handling and Disposal) rules 1998. Recycled plastic manufacture and usage rules 1999 , Municipal Solid Waste (Management and Handling) Rules 2000 ,The Noise Pollution ( Regulation and Control ) Rules 2000 , , Environmental Impact Assessment Notification 2006 , e-wastes Management and Handling Rules 2011

### **Unit-III: Environmental Policies (1 Cr)**

Environment and constitutional provisions in India, National & International Trend. Changes in Global Prospective, International Treaties, Brief Note on Stockholm Conference 1972 , , Nairobi Declaration, Rio (Brazil) conference 1992, Rio+5 and the Rio+10, Rio+20 ,Kyoto Protocol ,Johannesburg Conference 2002 National Authorities: Green Tribunal ,Global environmental issues and International policies relating to control Global warming, Ozone depletion, hazardous waste, CITES etc. Role of UN authorities in protection of Global Environment, Multinational authorities and agreements

### **Unit-IV: Economics, Society and Environmental Ethics (1 Cr)**

Economic growth, Gross National product and the quality of life: Sustainable-earth economy, Economics and Pollution control, Discount factor, Cost-benefit and cost effectiveness analysis, Human impact on the Earth, Hunting and Gathering Society, Agriculture Society, Industrial Society, Sustainable -Earth Society: Concept of throw-away and sustainable -Earth Society, our future society; Environmental Ethics: Ethics and moral, ethics of Throw-away & Sustainable-Earth Society, Ethical guidelines.

### **Books and References**

1. Hand Book of Environment, Forest and Wild life laws in India, WPSI, Natraj
2. Pollution Control Acts, rules and Notifications issued under CPCB, New Delhi

3. Environmental Laws, New Perspectives, K. C. Agrawal, Nidhi Publisher, Bikaner
4. Wildlife of India, Conservation and Management, K. C. Agrawal, Nidhi Publisher
5. Environmental laws in India, Gurdip Singh, Quality Law Books
7. The Economics of the Environment, Oates W.E.
8. Kanchan Chopra, et al., Ecological Economics and Sustainable Development
9. Economy and the Environment, Goodstein
10. Sumi Krishna : Environmental Politics, Peoples' Lives and Developmental Choices, Sage, New Delhi, 1996
11. Cone J.D., Hayes S.C., Environmental Problems / Behavioral Solutions (1980) California
12. Declaration of The Stockholm Conference, Rio
13. Constitution of India [Referred articles from Part-III, Part-IV and Part-IV-A].

### **Course-23 Dissertation (8 Cr)**

Review or case studies on detection, determination, mapping, sources and control of environmental contaminants.

## **Elective courses**

### **FOOD ADULTERATION**

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#### **Courses**

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#### **UNIT-I: Food chemistry**

Chemistry of Food, Introduction to Food Processing & Preservation, Technologies of Milk & Milk Products, Introduction to Food Microbiology, Processing & Preservation of Fruits & Vegetables, Processing Technology of Meat & Meat Products, Cereals, Food Packaging, Cereals & Legume Processing, Food Additives, Processing Technology of Beverages, Preservative, Jam, Jellies & Marmalade, Fermentation & Unfermented Products, Food Adulteration, Team Management, Project & Case Study, Industrial Training.

#### **UNIT-II: Adulteration, preservatives and colouring agents**

Adulteration, Chemical preservatives, Colouring matters, Baking powder and baking-powder chemicals, adulteration of specific foods (i.e. Beverages, Alcoholic, Non-alcoholic, Canned vegetables, Cereal products, Breakfast foods, Flour, Cocoa and chocolate, Coffee and tea, Condimental sauces, Dairy products, Butter, Cheese, Cream, Milk, Edible fats and oils, Flavouring extracts, Fruit products, Meat preparations, Spices, Sugars, sirups, Vinegar, etc.

#### **UNIT-III: Characterization of food preservatives and colors**

Detection of salicylic acid, Detection of benzoic acid, Detection-of boric acid and borax, Detection of formaldehyde, Detection of saccharin, Detection of coal-tar dyes, Detection of copper, Detection of turmeric, Detection of caramel

#### **UNIT-IV: Characterization of adulterants in major foods**

Detection and determination of adulterants (pesticides, POPs & others) in cereals, seeds, vegetables, fruits, milk, butter and dairy products, meats, chicken, coffee and tea, spices, Condimental sauces, flavoring agents, oils.

#### *Books*

1. Introduction to Food Analysis. S.S. Nielsen, 1998. Aspen Publishers - The best general overview of food analysis techniques currently available. (Required).
  2. Food Analysis: Theory and Practice. Y. Pomeranz and C.E. Meloan, Chapman and Hall - General overview of food analysis techniques (Useful)
  3. Food Analysis: Principles and Techniques. D.W. Gruenwedel and J.R. Whitaker, Marcel Dekker - General overview of food analysis techniques (Useful)
  4. Analytical Chemistry of Foods. C.S. James, Blackie Academic and Professional - General overview of food analysis techniques (Useful)
  5. Official Methods Of Analysis, Association of Official Analytical Chemists - Officially recognized methods of analysis for many food components (Very Useful - Available in my office).
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## **WASTE MANAGEMENT**

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### **Courses**

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#### UNIT-I: Domestic waste

Definitions  
The Earth environment  
Conservation and use of resources  
Value of resources: economic, ecological and aesthetic  
Damage being caused by urbanization  
The impact of humans  
Sewage and it's treatment  
Characteristics of Sewage  
Components of Sewage –solids, organic material, industrial waste  
Decomposition of Sewage  
The nitrogen cycle  
Classification of Sewerage Systems  
Storm Water Systems and Management  
Dry Rubbish  
Nature of Refuse  
Placement and protection of nins  
Trade waste  
Refuse Collection Systems  
Refuse Collection vehicles  
Salvage materials  
Safe disposal of household chemicals

#### UNIT-II: Street Cleaning & Disposal of Refuse

Types of Street Refuse  
Methods of street cleaning –gritting, sanding, sweeping, washing, etc  
Cleaning storm water pits  
Managing snow  
Refuse disposal–separation, controlled tipping, combustion, pulverization, etc  
Refuse for fertilizer  
Methods of Refuse Sorting –screening, magnetic, hand  
sorting Types of incinerators  
Vacuum systems for refuse collection –Garchey system,  
gandillon Harvesting energy from combustion

**UNIT-III: Industrial Waste & recycling**

Types of industrial pollution  
The greenhouse effect  
Ozone depletion  
Nuclear power  
Nuclear fission  
Mining nuclear fuel  
Uranium enrichment  
Gas Diffusion  
Gas centrifuge  
Nuclear waste  
Transporting nuclear waste  
Reprocessing  
Health risks of nuclear waste  
Scope and nature of recycling  
Rubbish tips (dumps)  
Recycling plastics  
Recycling metals  
Recycling glass  
Recycling paper  
Recycling rubber  
Actions by individuals (at home or work) –reducing, reusing and recycling waste

**UNIT-IV: Water Quality & Treatment**

Industrial effluent  
Pricing control compared with direct control  
Types of water impurities  
Scope of purification  
Managing water for public supply  
Water treatment methods  
Purification methods –sedimentation, filtration, disinfection, aeration, screening,  
etc .  
Recycling sewage water  
Recycling waste water  
Reed bed treatment  
Improving water quality from any source –physical, chemical, biological impurities  
Water borne diseases

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**Books**

- 1 M. Georgacarakos, Guide to waste management including information on recycling, landfills, sustainability, composting, and ways to protect the environment, Webster's Digital Services, USA, 2011.
- 2 A. S. Weinberg, D. N. Pellow, A. Schnaiberg, Urban recycling and the search for sustainable community development, Princeton University Press, 2000.
- 3 L. F. Diaz, M. de Bertoldi, W. Bidlingmaier, Compost Science and Technology, Elsevier, 2007.
- 4 S. R. Rao, Resource recovery and recycling from metallurgical wastes, Elsevier, 2006.
- 5 M.H. van Agteren, Sytze Keuning, Jan Oosterhaven, Handbook on Biodegradation and Biological Treatment of Hazardous Organic Compounds, Springer; 1998.