

III	Special Paper-A: Clinical Biochemistry Special Paper-B: Molecular Endocrinology	80	20	4
IV	Special Paper-A: Diagnostics & prophylaxis Special Paper-B: Bioinformatics	80	20	4
LC-I	Lab Course I (Based on paper I & II)	80	20	2
LC-II	Lab Course I (Based on paper III & IV)	80	20	2
		Total	600	20

Important Note:

Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words.

Continuous evaluation of Performance*

Each student will be evaluated continuously throughout the semester. There will be a class test based on each theory paper. The full marks will be 10 for each paper. There will be a poster/oral presentation based on each theory paper. The full marks will be 10 for each presentation. Each student will be required to submit a brief write-up (not more than 15-20 pages) on his/her poster/oral presentation.

Project Work**

A student of IV semester will have the choice to opt for project work in lieu of four theory papers and two lab courses provided he/she secure at least **75%** or more marks in aggregate in semester I and II. The project has to be carried out in recognized national laboratories or UGC-recognized universities. No student will be allowed to carry out project work in private laboratories/ college/ institutions, excluding the colleges recognized as research centers by the RDC of Pt. Ravishankar Shukla University, Raipur. The valuation of all the projects will be carried out by an external examiner and HoD of UTD or its nominee at the UTD Centre.

Scheme for Lab Course (for each Semester) Maximum Marks 100

External/Internal

1-	Major exercise based on paper I	20
2-	Minor exercise based on paper I	10
3-	Major exercise based on paper II	20
4-	Minor exercise based on paper II	10
5-	Spotting/ Interpretation*	10
6-	Viva-voce	10

Internal

1-	Sessional	20
Total		100

- A student will be required to interpret on the displayed item/material

Naikhan
6.5.19

Adyup
6/5/19

S. Anand
06/05/2019

AD
6.5.19

Deepa
6/5/19

Abh
6.5.19

Prakash
06/05/19

ASL
6/5/19

MDeo
06/05/19

M. Sc. Biochemistry
FIRST SEMESTER (July 2019 – December 2019)
PAPER - I: CELL BIOLOGY
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

- UNIT-I Molecular organization of membranes** - Asymmetrical organization of lipids, proteins and carbohydrates. Membrane transport: Passive transport, Osmosis, ion channels, membrane pumps and, Active transport: ATP-powered pumps-types, properties and mechanisms, electrical properties of membranes.
- UNIT-II Protein trafficking:** Transport of proteins into mitochondria, chloroplast, endoplasmic reticulum and nucleus [in and out]. Transport by vesicle formation: exocytosis, endocytosis and its molecular mechanism.
- UNIT-III Cell signaling:** Signaling via G-protein linked and enzyme linked cell surface receptors, MAP kinase pathways.
Eukaryotic cell division cycle: different phases and molecular events, regulation and control of cell cycle. Oncogenes: retinoblastoma, E2F and p53 proteins.
Apoptosis: regulation by CASPases and formation of apoptosome. Pro- and anti-apoptotic factors.
- UNIT-IV** States of chromosomes during cell cycle. Mitotic chromosome. Organization of genes in chromosomes. Banding pattern of chromosomes. Lampbrush and Polytene chromosomes. DNA packaging: Chromatin, nucleosomes, heterochromatin and euchromatin.

Lab Course:

1. Study of chromosome behaviour during Mitosis and meiosis (Onion / Garlic root tips, Onion buds, human lymphocytes, rat or bird testis /grass hopper testis or any other materials).
2. Calculation of mitotic index in growing Onion / Garlic root tips
3. Squash preparation: Polytene chromosome (in chironomus / Drosophila or other insect salivary gland) and Barr body (in buccal epithelial cells).
4. Demonstration of secretory granules in the salivary gland cells of insect.
5. Demonstration of mitochondria by vital staining.
6. Study of permanent slides.
7. Estimation of DNA
8. Estimation of RNA
9. Sub-cellular fractionation and marker enzymes
10. Identification of biomolecules in different tissues by histochemical techniques
11. Preparation of mitotic plate by carmine squashing method and phase identification.
12. Demonstration of the nuclear matrix networks in onion cells.
13. Study of the effect of chemical agents on chromosomes plant cells.
14. Isolation of protoplast, measurement of cell density plating efficiency.
15. Preparation of Karyotype of metaphase plate.
16. Preparation of Meiotic plate and determination of phases.

Handwritten signatures and dates:
Anishka
adpud
6/5/19
S/D
6/5/2019
Dues
6/5/19
AR
6.5.19
Ranjan
06/05/19
M.Dewshi
06/05/19
ASH
6/5/19

17. Computation of Chiasma frequency and Terminalization of phases.

18. Micrometry and Camera Lucida drawings.

Books Recommended:

H. Lodish, A. Berk, S L Zipursky, P. Matsudaira D. Baltimore, and James Darnell.	Molecular Cell Biology
B. Alberts, D. Bray, K. Hopkin, A. Johnson	Essential of Cell Biology
H. Lodish, A. Berk, C. A. Kaiser & M. Krieger	Molecular cell Biology
B. Alberts, A. Johnson, J. Lewis and M. Raff Gerald Karp	Molecular Biology of the Cell Cell and Molecular Biology Concepts and experiments

M. Sc. Biochemistry
FIRST SEMESTER (July 2019 – December 2019)
PAPER – II: Biomolecules
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

- UNIT-I** Classification, structure and function of Carbohydrates, Lipid:
Carbohydrate: Monosaccharides, homo and hetero-polysaccharides, Peptidoglycan glycoproteins and liposaccharide.
Lipids: Simple; cholestrol and complex; phospholipids and TAG
- UNIT-II** Classification, structure and function of amino acids, Synthesis of peptides, Proteins-properties, secondary, tertiary and quaternary structure of proteins, Ramchandran plot.
Nucleic Acid: Structure and function of Purine and pyrimidine, DNA-types, linking number, RNA-types.
- UNIT-III** Enzyme: apoenzymes, cofactors, coenzymes, active site, factors contributing to the catalytic efficiency of enzyme; enzyme kinetics- Michaelis-Menten equation, determination of Km, enzyme inhibition, allosteric enzymes, isoenzymes, multienzyme complexes
- UNIT-IV** Structure and biological role of: Porphyrins in biology, structure of hemoglobin and chlorophyll
Animal hormones: protein, peptide and steroid hormones.
Vitamins: fat and water soluble.

Lab Course:

1. Specific tests for sugars, amino acids and lipids
2. Formal titration of amino acids
3. Estimation of proteins using ninhydrin and biuret method
4. Estimation of sugar by anthrone and Folin-Wu method.
5. Saponification value and iodine number of fat.
6. Estimation of ascorbic acid.
7. Achromic point determination using salivary amylase
8. Effect of ions on salivary amylase activity.
9. Enzyme assay and kinetics (ex. Amylase, Protease)

Handwritten signatures and dates in blue ink:
- *Shrikant*
- *Asp...* 6/5/19
- *(S) Aswad* 06/05/2019
- *Abh* 6.5.19
- *M. Deewo* 06/05/19
- *ASH* 6/5/19

Books Recommended:

Nelson, Cox and Lehninger	Principles of Biochemistry
G. Zubay	Biochemistry
Stryer	Biochemistry
Garrett and Grosham	Biochemistry
West, Tood, Mason & Bbruglen	Text book of biochemistry
White, Handler & Smith	Biochemistry-clinical application
D. Voet and J C Voet	Biochemistry

M. Sc. Biochemistry
FIRST SEMESTER (July 2019 – December 2019)
PAPER – III: Microbiology
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

UNIT-I General characteristics of fungi, classification of fungi, life cycle of selected fungal genus (Aspergillus, Pencillium, Fusarium and Mucor). Economic importance of fungi. Microbial association, parasitism, mutualism and symbiosis with plants and animals. Mycorrhiza, VAM. Algae: Distribution, classification, reproduction, ecology and importance.

UNIT-II Morphology and ultra-structure of bacteria: Morphological types, cell wall of archaebacteria, gram negative, gram positive eubacteria. Bacterial cell membranes – structure, composition and properties. Structure and function of flagella, cilia, pili, gas vesicles. Cyanobacteria, protozoa, mycoplasma and Rickettsia. Gene transfer mechanisms: transformation, transduction, conjugation and transfection. Plasmids and cosmid vector for gene cloning

UNIT-III Nutritional types (autotrophs, heterotrophs, phototrophs, chemotrophs), growth curves, measurement of growth, factors affecting growth, generation time, growth kinetics. Batch and continuous culture, Basis of microbial classification, classification and salient feature of bacteria according to Bergey's manual of determinative bacteriology.

UNIT-IV Viruses: Structure and classification; General concepts: Viral genome, capsids, envelopes, viroids and prions). Virus reproductions: Lysogeny and Lytic phase, Bacteriophages and their types. Introduction to Plant and animal viruses (TMV, HIV, Hepatitis virus, H1N1 virus, Small Pox virus and Ebola virus), Route of transmission of viruses, Laboratory diagnosis and treatment, Antiviral therapy

Lab Course:

1. Glassware preparation and sterilization techniques- wet heat- dry heat- filter types- laminar flow chamber types- CDC- safety levels.
2. Preparation of liquid & solid media, plating, pouring, inoculation and incubation for growth of microorganism
3. Methods of obtaining pure culture of microorganisms (a) streak plate (b) Pour plate, and (c) spread plate methods
4. Identification and Microscopic examination of the microorganisms.

Handwritten signatures and dates:
MUD 6.18.19
Anilhan
Aspuph 6/5/19
SK Sawad 06/05/2019
Dua 6/5/19
Ah 6.5.19
Renuka 06/05/19
M Dewani 06/05/19
ASH 6/5/19

5. Motility of bacteria by hanging drop technique.
6. Bacterial DNA isolation from *E-coli* culture.
7. Grams' staining for Gram positive and Gram's negative Bacteria.
8. Study of bacterial growth by turbidimetry/ spectrophotometry
9. Isolation and enumeration of microorganisms from soil by serial dilution agar plating method.
10. Enumeration of viruses by plaque assay technique.

Books Recommended:

Microbiology	L.M. Prescott, J.P. Harley and D.A. Klein
General Microbiology	RY Stanier, J L Ingrahamana, ML Wheelis & P. R. Painter
Principles of Microbiology	R.M. Atlas
Microbiology	Peleczar, Chan & Krieg.
General Virology	Luria, Darnell, Baltimore and Campell.
Introduction to Mycology	CJ Alexopoulos and CW Mims
Principles of Virology: Molecular	S. J. Flint, V. R. Racaniello, L. W. Enquist,
Biology, Pathogenesis, and	V. R. Rancaniello, A. M. Skalka
Control of Animal Viruses	

M. Sc. Biochemistry
FIRST SEMESTER (July 2019 – December 2019)
PAPER – IV: Biology of Immune System
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

- UNIT-I** Innate immune mechanism and characteristics of adaptive immune response. Cells of immune system: Hematopoiesis and differentiation, mononuclear cells and granulocytes, antigen presenting cells.
 Primary and Secondary lymphoid organs and tissues.
 Ontogeny and phylogeny of lymphocytes. Lymphocyte traffic.
- UNIT-II** Antigen receptor molecules: B-cell receptor complex, Immunoglobulin- structure, types and function. T-cell receptor complex. Major Histocompatibility Complex- types, structural organization, function and distribution. Transplantation and Rejection. Complement system.
- UNIT-III** Antigens: nature of antigens, factor affecting immunogenicity, Haptens and super antigens. Antigenic determinants. Recognition of antigens by T and B cell.
 Antigen processing. Role of MHC molecules in antigen presentation and co-stimulatory signals. Antigen and antibody interaction.
- UNIT-IV** Cell mediated immune response. Cytokines and interleukins- structure and function. Immunity to infections. Hypersensitive reactions and their types.

Handwritten signatures and dates:
 Anil Kumar
 6/5/19
 SK Sonawar
 06/05/2019
 Anand
 6/5/19
 Ashish
 6/5/19
 Ashish
 06/05/19
 Ashish
 6/5/19
 Ashish
 06/05/19

Immunodeficiency disorders. Autoimmunity and autoimmune disorder. Immunological tolerance.

Lab Course:

1. Identification of cells of immune system
2. Separation of mononuclear cells by Ficoll-Hypaque
3. Identification of Lymphocytes and their subsets
4. Lymphoid organs and their microscopic organization
5. Isolation and purification of Antigens
6. Purification of IgG from serum
7. Estimation of Levels of gamma globulins and A/G ratio in blood
8. Antigen antibody interaction

Books Recommended:

Kuby's Immunology	R.A. Goldsby, T. J Kindt and B. A. Osborne
Immunology- A short Course	E. Benjamini, R. Coico and G. Sunshine
Immunology	Roitt, Brostoff and Male
Fundamentals of Immunology	William Paul
Immunology	Tizard
Immunology	Abbas et al

M. Sc. Biochemistry
SECOND SEMESTER (January 2020 – June 2020)
PAPER – I: Genetics and Molecular Biology
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

- UNIT-I** Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants, complementation analysis.
Mutation: Types, mutagens and detection.
Mutant types – lethal, conditional, biochemical, loss of function, gain-of-function, germinal verses somatic mutants, insertional mutagenesis.
- UNIT-II** DNA replication in eukaryotes and prokaryotes : enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons.
DNA damage and repair mechanisms: Repair of Base-excision, Nucleotide excisions, Mismatch and Double Strand. p_{53} and p_{21} .
- UNIT-III** RNA synthesis and processing: enzymes involved, formation of initiation complex, transcription activator and repressor, elongation, and termination, RNA processing, capping, RNA editing, splicing, and polyadenylation, RNA transport.
- UNIT-IV** Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors, elongation and elongation factors and their regulation, termination.

Handwritten signatures and dates:
Dhisham
abpupe 6/5/19
S. S. S. 06/05/2019
Rendhan 06/05/19
mDeoHo 06/05/19
B. F. 19
Devi 6/5/19
A. S. 6/5/19
A. S. 6/5/19

Aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors.

Post Translational modification of proteins.

Lab Course:

1. Isolation, purification and estimation of RNA
2. Isolation, purification and estimation of DNA
3. Determination of T_m of nucleic acid
4. Fraction of poly (A) RNA
5. Restriction Mapping
6. Restriction Digestion
7. Ligation
8. DNA molecular size determination

Books Recommended:

Molecular Cell Biology	H. Lodish, A. Berk, SL Zipursky, P. Matsudaira, D. Baltimore, and James Darnell.
Essential Cell Biology	B. Alberts, D. Bray, K. Hopkin and A. Johnson
Molecular Biology of the Cell	B. Alberts, A. Johnson, J. Lewis and M. Raff
Cell and Molecular Biology : Concepts and experiments	Gerald Karp
Molecular Biology of the Gene	JD Watson et al.
Molecular Biology of the Cell The Problems	John Wilson, Tim Hunt
Molecular Biology of the Cell	Bruce Albert's, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter
Genes VIII	Benjamin Lewin

M. Sc. Biochemistry

SECOND SEMESTER (January 2020 – June 2020)

PAPER – II: Bioenergetics & Metabolism

[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

UNIT-I First and second laws of thermodynamics. Gibbs free energy G , free energy change ΔG , endergonic & exergonic reactions. Standard state free energy changes- ΔG , ΔG^0 and ΔG^0 , Relationship between equilibrium constant and ΔG^0 , Feasibility of reactions. ATP-Structure, properties and energy currency of the cell, Importance of Coupled reactions, other high energy compounds.

UNIT-II Carbohydrate metabolism: Glycolysis, Kreb's cycle, glycogenolysis, glycogenesis, pentose phosphate pathway, gluconeogenesis, and glyoxylate pathway. Regulation of carbohydrate metabolism.

Handwritten signatures and dates:
Anil Kumar 6/5/19
adp... 6/5/19
SK... 06/05/2019
Anil 6/5/19
AB 6.5.19
R... 06/5/19
M... 06/05/19
ASB 6/5/19

UNIT-III Electron transport and oxidation phosphorylation: electron carriers, complexes I to IV, substrate level phosphorylation, mechanism of oxidative phosphorylation. Shuttle system for entry of electron.

Biosynthesis and degradation of Lipids. Regulation of lipid metabolism

UNIT-IV Nitrogen Assimilation: Overview of Nitrogen in biosphere and uptake by organism.

Biosynthesis and degradation of amino acids. Regulation of amino acid metabolism

Biosynthesis and degradation of purine and pyrimidine nucleotides.

Lab Course:

1. Protein estimation by Lowry, Bradford and Spectrophotometric method
2. Estimation blood cholesterol
3. Estimation of sugar by Nelson- Somagy and Benedict's reagent
4. Isolation and estimation of lipid from seeds and egg.
5. Estimation of inorganic and total phosphorus by Fiske-Subba Rao method
6. Assay of phosphatases in blood and seeds
7. Urease estimation in plant tissues

Books Recommended:

Principles of Biochemistry	Nelson, Cox and Lehninger
Biochemistry	G. Zubay
Biochemistry	Stryer
Biochemistry	Garrett and Grosham
Text book of biochemistry	West, Tood, Mason & Bbruglen
Biochemistry	White,Handler & Smith
Biochemistry with clinical application	D. Voet and J C Voet
Enzymes	Dixon and Webb
Fundamentals of Enzymology	Price and Steven
Practical biochemistry	Plummer
Enzyme biotechnology	G. Tripathi
Enzyme Reaction Mechanism	Walsh
Enzyme catalysis and regulation	Hammes

M. Sc. Biochemistry

SECOND SEMESTER (January 2020 – June 2020)

PAPER- III: Instrumentation and Techniques

[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

UNIT-I Centrifugation: Principle, techniques. Preparative, analytical and ultracentrifuges, sedimentation coefficient and factors affecting sedimentation coefficient. Application of centrifugation.

Handwritten signatures and dates:
Anwar Khan
S. H. Towad 06/05/2019
Ravi 06/05/19
Ash 06/05/19
M. Deewana 06/05/19
6/5/19
6/5/19

Photometry: Basic principles of colorimetry, UV- visible spectrophotometry & IR- spectrophotometry. Spectrofluometry
Atomic absorption spectroscopy: Principle, Instrumentation and applications

UNIT-II Microscopic techniques: light microscopy, phase-contrast microscopy, scanning and transmission electron microscopy, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in microscopy.

UNIT-III Chromatography: Paper and Thin Layer Chromatography. Gel filtration, Ion exchange and Affinity chromatography. GLC and HPLC.
Histochemical and immunohistotechniques: Detection of molecules using immunoprecipitation, EIA, RIA and FIA.

UNIT-IV Electrophoresis: Agarose, PAGE, 2D-E.
Radioactivity: GM counter, liquid Scintillation counter, solid Scintillation counter, gamma counters.
Lyophilization: Principle, instrumentation and applications.
Microtomy: types, principle and applications

Lab Course:

- Verification of Beers Law
- Determination of absorption maxima
- Quantitative determination, Enzyme kinetics
- Amino acid and carbohydrate separation by paper and TLC
- Ion exchange and gel filtration chromatography
- SDS Polyacralamide Gel Electrophoresis
- Isoenzymes
- Separation of sub-cellular organelles by differential centrifugation.
- Isolation of DNA and Agarose gel Electrophoresis

Books Recommended:

K Wilson and John Walker
RF Boyer

Practical Biochemistry: Principles & Techniques
Biochemistry Laboratory: Modern Theory & Techniques

S Carson, H Miller and D Scott

Molecular Biology Techniques: A Classroom Laboratory Manual

TC Ford and J. M. Graham
R Baserga and D Malamud
T Chard

An Introduction to Centrifugation
Autoradiography: techniques and application
An Introduction to Radioimmunoassay and Related Techniques , Volume 6

TA Jennings
James M. Miller
LR Synder, JJ Kirkland and JL Glajch
Anna Pratima Nikalje & D. Bhosale
Mark F. Vitha
AGE Pearse
PA Midgley
DB Murphy & MW Davidson

Lyophilization: Introduction and Basic Principles
Chromatography: Concepts and Contrasts
Practical HPLC Method Development, 2nd Edition
A Handbook of Chromatography
Chromatography: Principles and Instrumentation
Histology and Histochemical methods
The principles of microscopy
Fundamentals of Light Microscopy and Electronic Imaging, Second Edition

Wadhwa

abpurose
6/5/19

Sit
6/5/2019

AD
6/5/19

Am
6/5/19

AS
6.5.19

Am
6/5/19

AS
6/5/19

MDewano
06/05/19

IW Watt
RF Egerton

P Haselet, G-W Oetjen
EC Clayden
T Chandak, M Chaudhary & V
Chandak
Simon Renshaw

IB Buchwalow & W Bocker
JB Birks

The Principles and Practice of Electron Microscopy
Physical Principles of Electron Microscopy
An Introduction to TEM, SEM, and AEM
Freeze-Drying, 3rd Edition
Practical Section Cutting and Staining
Microtomy: Microtome and its applications

Immunohistochemistry and Immunocytochemistry:
Essential Methods, Second Edition
Immunohistochemistry: Basics and Methods
The Theory and Practice of Scintillation Counting

M. Sc. Biochemistry

SECOND SEMESTER (January 2020 – June 2020)

PAPER- IV: BIOMETRY, COMPUTER AND SCIENTOMETRY

[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

- Unit-I** Introduction to biostatistics. Types of biological data: data on different scales. Frequency distributions. Cumulative frequency distributions. Random sampling. Parameters and statistics. Measures of central tendency and dispersion: Mean, Median, Mode, Range, Variance and Standard deviation. Coefficient of variation. The effects of coding data. Data transformations: Log-transformation, Square-root transformation and Arcsine transformation. Distribution: normal & binomial. Probability: Basic laws of probability, addition law, multiplication law. Probability and frequency.
- Unit-II** Statistical errors in hypothesis testing. Testing goodness of fit: Chi-square goodness of fit. Heterogeneity Chi-square. The 2 x 2 contingency table. One sample hypothesis. Two-sample hypothesis. Testing for difference between two means (t-test). Testing for difference between two variances (F-test). The paired sample t-test. Multiple-sample hypothesis (ANOVA): Single factor and two factors ANOVA. Multiple comparisons: Duncan's multiple-range tests. Simple linear regression. Regression vs. Correlation. Regression equation. Interpretations of regression functions. Simple linear correlation. The correlation coefficient.
- Unit-III** Introduction to MS-Office software: Word processing; creating new document, editing documents, adding graphics to documents, Word tables. Management of Workbook & Worksheets; Applications, Features, Using formulas and functions, Features for Statistical data analysis, Excel ToolPak for data analysis, Generating charts/ graph. Presentation software; Working in PowerPoint, Creating new presentation, working with slides.

(Handwritten signatures and dates in blue ink)

Watt
6/5/19

Nalhan
6/5/19

adynale
6/5/19

S. D. Saad
06/05/2019

Devi
6/5/19

Ab
6.5.19

Ramya
06/05/19

m Dewansh
06/05/19

Ash
06/5/19

Unit-IV Introduction to Internet and Applications. Basics of internet, e-mailing, Search engine – Google and Yahoo; Pub med, Scopus, Web of Science, Google Scholar, Indian Citation Index, Science Citation Index (SCI), h-index, i-10-index. Journal Impact Factor (JIF). Introduction to Plagiarism and Cyber laws.

Lab Course:

1. Exercises for data distribution
2. Exercises for computation of measures of central tendency
3. Exercises for computation of measures of variability
4. Computation of correlation coefficient, r , and regression constants
5. Data analysis by ANOVA and multiple-range tests
6. Hypothesis testing by t-test, F-test, and Chi-square test
7. Graphical presentation of data using a suitable package
8. Statistical analysis of a data using a suitable package
9. Preparation of document using a suitable package
10. Preparation of slides using a suitable package
11. Hands-on-practice for finding indices [SCI, h-index, i-10 index] of articles using relevant database

Books Recommended:

Campbell RC	Statistics for biologists
Zar JH	Biostatistical Analysis
Wardlaw AC	Practical Statistics for Experimental Biologists
Snedecor GW & Cochran WG	Statistical Methods
Sokal RR & Rohlf FJ	Introduction to Biostatistics
Sumner M	Computers: Concepts & Uses
White R	How Computers Work
Cassel P et al.	Inside Microsoft Office Professional
Coleman P and Dyson P	Mastering Internets
Gralla P	How the Internet Works
Shelly GB, Vermaat ME, Cashman TJ	Microsoft 2007: Introductory Concepts & Techniques
Habraken J	Microsoft Office 2003 All in One Microsoft Office 2010 In Depth
Gilmore B	Plagiarism: Why it happens, How to prevent it?
Buranen L & Roy AM	Perspectives on Plagiarism & Intellectual Property in a Post-Modern World
Kumar Anupa P	Cyber Law
Sood V	Cyber Law Simplified

M. Sc. Biochemistry
THIRD SEMESTER (July 2020 – December 2020)
PAPER – I: Genetic Engineering
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

UNIT- I Molecular tools and their applications: restriction enzymes, modification enzymes.

Handwritten signatures and dates:
M. S. 06/05/19
S. K. 06/05/2019
A. S. 6.5.19
R. S. 06/03/19
M. S. 06/05/19
M. S. 06/05/19

MB Wilkins
JA Hopkins
FB Salisbury & CW Ross
Hans-Walter Heldt

Advanced Plant Physiology
Introduction to Plant Physiology
Plant Physiology
Plant Biochemistry & Molecular Biology

M. Sc. Biochemistry
THIRD SEMESTER (July 2020 – December 2020)
PAPER- III: Environmental Biochemistry
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

- UNIT-I** Environmental Pollution: Major types. Outdoor and indoor air pollution, structure, sources, health effects and control strategies; water pollution, soil contamination, noise pollution and electromagnetic radiations: Sources, health effects and control strategies.
- UNIT II** Definition and scope of toxicology: Eco-toxicology and its environmental significance. Toxicity: Types, Acute and chronic exposures; toxicants and their classification. Health effects of toxic substances, Dose Response relationships; synergism and antagonism, determination of ED₅₀, LD₅₀, factors influencing toxicity. Toxicity testing – Test control, genetic toxicity testing.
- UNIT III** Biochemical basis of toxicity: Mechanisms of Toxicity, disturbance of excitable membrane function, altered calcium homeostasis. Covalent binding to cellular macromolecules and genotoxicity. Tissue specificity of toxicity. Xenobiotic metabolism: Phase I reaction – oxidation – reduction, hydrolysis and hydration. Phase II reaction – conjugation and methylation.
- UNIT- IV** Pesticide toxicity: Insecticides, fungicides, herbicides and biopesticides; Toxicology of food additives; Metal toxicity : arsenic, mercury, lead, cadmium and fluoride. Occupational hazards and risk assessment.

Lab Course:

1. Estimation of toxicants like fluoride and heavy metals in air, water and food.
2. Estimation of fluoride in human urine
3. Exposure of fishes to various concentrations of toxicants and assessment of their toxic effects by -
 - a. Determination of percent mortality, LC 50 and LD50.
 - b. Determination of Bioconcentration Factor (BCF) of toxicants
 - c. Effect of various toxicants on serum enzymes, such as ASAT, ALAT, GPX, SOD, CAT and proteins
 - d. Demonstration of genotoxic effects of toxicants - Comet Assay and Micronuclease assay

Books Recommended:

LG Corkerhem & BSS Shane
DA Valler

Basic Environmental Toxicology
Environmental Contaminants: Assessment and Control

Dr. Naikhan

Dr. Gupta
6/5/19

SK Sharma
06/05/2019

Dr. Singh
6/5/19

Dr. Singh
6.5.19

Dr. Singh
06/5/19

Dr. Singh
06/5/19

Dr. Singh
06/05/19

Dr. Singh
6.5.19

SVS Rana
Ming Ho Yu
DW Sparling

Environmental Pollution: Health and Toxicology
Environmental Toxicology: Biological and health effects of
pollutants
Basics of Ecotoxicology

M. Sc. Biochemistry
THIRD SEMESTER (July 2020 – December 2020)
PAPER - IV: Enzymology
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

UNIT-I General properties and effects of pH, substrate and temperature on enzyme catalyzed reactions.

Kinetics of catalyzed reaction: Single substrate reactions, bisubstrate reactions, concept of Michaelis - Menten, Briggs Haldane relationship, Determination and significance of kinetic constants, Limitations of Michaelis-Menten Kinetics, Concept of convergent and divergent evolution of enzyme.

UNIT-II Enzyme Turnover and methods employed to measure turnover of enzymes, significance of enzyme turnover.

Multienzyme system : occurrence, their properties , mechanism of action & regulation; Pyruvate dehydrogenase complex, fatty acid synthetase complexes.
Mechanism of action of lysozyme, chymotrypsin, carboxypeptidase and DNA polymease

UNIT-III General mechanisms of enzyme regulation

Allosteric enzymes, sigmoidal kinetics and their physiological significance, symmetrical and sequential modes for action of allosteric enzymes and their significance.

Water soluble enzymes and their coenzymes. Metallo enzymes.

Immobilized enzymes and their industrial applications.

UNIT-IV Enzymes of Industrial Importance; their source, characteristic properties, functions and uses.

Enzymes used in leather, paper, textile industries.

Enzymes in baking, brewing, Alcohol products; enzymes in detergents, starch and animal feeds.

Amylases, cellulases, catalase, pectinase, lipase, protease, xylanase, laccase, beta glucanase

Handwritten signatures and dates:
Anil Kumar
Abhishek 6/5/19
S. K. Howard 06/05/2019
Rishabh 06/5/19
Rishabh 06/5/19
Rishabh 06/5/19
Rishabh 06/5/19
Rishabh 06/5/19
Rishabh 06/5/19

UNIT-II Embryo culture and embryo rescue.

Anther, pollen and ovary culture for production of haploid plants & homozygous lines.

Protoplast isolation, culture and fusion; selection of hybrid cells and regeneration of hybrid plants; symmetric and asymmetric hybrids, cybrids.

Germplasm conservation: Cryopreservation & slow growth cultures.

Chloroplast Transformation: Advantages, vectors, success; tobacco & potato.

UNIT-III Plant transformation technology: Plant transformation technology: basis of tumor formation,

hairy root, features of Ti and Ri plasmids, mechanism of DNA transfer, role of virulence genes, use Ti and Ri as vectors, binary vectors, use of 35S and other promoters, use of reporter genes, particle bombardment, electroporation, microinjection.

UNIT-IV Applications of plant transformation for productivity and performance: herbicide resistance,

insect resistance, long shelf-life of fruits. Bt genes, Non-Bt like protease inhibitors & amylase inhibitors, virus resistance, nucleocapsid gene, disease resistance, PR (Pathogenesis Related) proteins, nematode resistance, abiotic stress, male sterile lines

Lab Course:

1. Preparation of culture media.
2. To perform meristem/ bud culture, shoot multiplication & rooting phenomenon.
3. To study organogenesis.
4. To perform somatic embryogenesis.
5. To study the process of plantlet acclimatization.
6. To perform embryo culture.
7. To study the process of anther culture development.
8. Study of molecular markers.
9. Extraction of DNA from plant cultures.
10. Estimation & separation of DNA: Agarose gel electrophoresis & spectrophotometer.

Books Recommended:

Razdan MK	Introduction to Plant Tissue Culture
Vasil IK	Plant Cell and Tissue Culture
Bhojwani SS and Razdan MK	Plant Tissue Culture
Fu TJ, Singh G and Curtis WR	Plant Cell & Tissue Culture for the production of Food Ingredients
Hammond, McGarvP & Yusibov	Plant Biotechnology
Singh BD	Biotechnology: Expanding Horizons
RH Smith Plant Tissue Culture	Techniques and Experiments
L Kyte and J Kleyn	Plants from Test Tubes: An Introduction to Micropropagation
M Smith	Plant Propagator's Bible
MR Ahuja	Micropropagation of Woody Plants
YPS Bajaj	Trees III
YPS Bajaj	Trees IV

Swilkam
adpude 6/5/19
(S) So wadp 06/05/2019
Rundha 06/5/19
ASH 6/5/19
AD 6-5-19
MDewano 06/05/19
AD 6-5-19

M. Sc. Biochemistry
FOURTH SEMESTER (January 2021 – June 2021)
PAPER- II: Nutraceutical and Functional Foods
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

Unit-I: Introduction to Nutraceuticals as Science:

Historical perspective, classification, scope and future prospects. Scrutinising the term 'nutraceutical', Regulation of various countries. Medicinal Plants: Ethnomedicine in India, Applied aspects of the Nutraceutical Science. Sources of Nutraceuticals. Relation of Nutraceutical Science with other Sciences: Medicine, Human physiology, genetics, food technology, chemistry and nutrition

Unit-II: Properties, structure and functions of various Nutraceuticals:

Glucosamine, Octacosanol, Lycopene, Flavonoids, Carnitine, Melatonin and Ornithine alpha, ketoglutarate. Use of proanthocyanidins, grape products, flaxseed oil as Nutraceuticals. Nutraceutical Industry and Market Information, New technologies in development of Nutraceuticals and functional foods
Functional Foods, Scope of Genetic engineering, Nutritional Genomics

Unit-III: Food as remedies

Nutraceuticals bridging the gap between food and drug, Special Dietary Needs, Disease and Nutrition; Nutraceuticals in treatment for cognitive decline, Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc. Brief idea about some Nutraceutical rich supplements e.g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and Spirulina etc.

Unit-IV: Anti-nutritional Factors present in Foods

Types of inhibitors present in various foods and how they can be inactivated. General idea about role of Probiotics and Prebiotics as nutraceuticals. Recent advances in techniques & feeding of substrates. Assessment of nutritional status and Recommended Daily allowances.

Lab Course:

- Identification using characteristic features of nutraceutically important plants like; *Phyllanthus emblica*, *Curcuma longa*, *Zinziber officinalis*, Solanaceae (*Withania somnifera*), *Aloe vera*, Lilliaceae (*Alium sativum*), Lamiaceae (*Ocimum sanctum*), Apiaceae (*Coriandrum sps*) and Liliaceae (*Asparagus sps.*), *Centella asiatica*.
- Study of following Parasites/ Vectors/ pests: Identification, Habits and control measures (museum Specimens / slides): *Entamoeba histolytica*, *Taenia sps*, *Ascaris lumbricoides*, *Ancylostoma dueodenaei*, *Trichinella spiralis*, *Trichura trichuris*, Mosquito (*Culex and Anopheles*), House fly, Green bottle fly, Head Louse, Cockroach (*Periplanata & Blatta*), bed bug, *Mus sps.* (Mouse) and *Rattus sps.* (House rat)
- Reactions of mono, di and polysaccharides and their identification in unknown mixtures

Anwar Khan
Aspuro 6/5/19
SI Howard 06/05/2019
Ab 6.5.19
Rudra 06/5/19
MDeosoo 06/05/19
MSK 6/5/19
MD 6.5.19
Abu 6/5/19

M. Sc. Biochemistry
FOURTH SEMESTER (January 2021 – June 2021)
Special Paper PAPER - III (A): Clinical Biochemistry
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

UNIT-I: Plasma proteins – Properties, functions and their variations in diseases, Plasma lipids and lipoproteins, Interrelationship of lipids, lipoproteins and apolipoproteins. Erythropoiesis, abnormalities in blood formation. Anemias. Hemoglobinopathies. Cerebrospinal fluid – composition in health and diseases. Plasma enzymes in diagnosis and prognosis.

UNIT-II: Kidney & Liver function tests: Renal function tests, osmolarity and free water clearances, acute and chronic renal failure. Renal hormones–Renin, erythropoietin and angiotensin. Liver function tests: clinical features and test based on bile pigments level, prothrombin time.

UNIT-III: Gastric function tests: collection of gastric contents, examination of gastric residuum, Fractional Test Meal, stimulation tests, tubeless gastric analysis. Gastrointestinal hormones - Gastrin, secretin and cholecystokinin. Disorders of gastric function. Pancreatic exocrine secretions and pancreatic diseases.

UNIT-IV: Molecular diagnosis of genetic defects: Diagnosis of genetic diseases by molecular biology techniques (cystic fibrosis, Hemochromatosis, thalassemias, sickle cell diseases) DNA probes; restriction fragment length polymorphism (RFLP); polymerase chain reaction (PCR); amplification of mRNA. AIDS: Clinical diagnosis.

Lab Course:

1. Assay of Alkaline and Acid Phosphates
2. Estimation of blood glucose by GOD and POD method
3. Various types of glucose tolerance tests.
4. Estimation of SGOT, SGPT, LDH and CPK, Serum Amylase enzymes
5. Estimation of HDL- cholesterol, LDL- cholesterol.
6. Estimation of uric acid and creatinine in plasma.
7. Estimation of urine and blood bilirubin.

Books Recommended:

Textbook of Biochemistry with Clinical Correlations: T.M. Devlin
Lippincott's Illustrated Reviews in Biochemistry: P.C.Champe, R.A.Harvey and D.R.Ferrier
Harper's Biochemistry : R.K.Murray, D.K.Granner, P.A. Mayes & V.W.Rodwell
Clinical Laboratory Science Review: Robert R. Harr
Fundamentals of Clinical Chemistry: C.A. Burtis, E.R. Ashwood Tietz

Handwritten signatures and dates:
Anil Kumar
S.K. Ashwood
06/05/2019
Ash
6/5/19
M.D. Ashwood
06/05/19
Ash
6/5/19

Notes on Clinical Chemistry:- Whitby, Smith, Beckett, Walker, Harrison
 The structure and function of enzymes: S.A. Bbernhard
 Enzymes- biochemistry, Biotechnology, Clinical chemistry: J. Palmer
 Enzymes: Dixon, Webb, Thorne & Tipton
 Enzyme structure and Mechanism: Alan Fersht
 Enzymatic reaction mechanism: C. Walsh, F. Pub
 Enzyme Assay: A Practical Approach: Eisenthal and Danson

M. Sc. Biochemistry
FOURTH SEMESTER (January 2021 – June 2021)
Special Paper: PAPER- III (B): Molecular Endocrinology
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

Unit-I	Definition and scope of molecular endocrinology. Chemical nature and general classes of hormones: Peptide, Amino acid derived, Steroid, Neurotransmitters, Neuropeptides, Chalcones, Eicosanoids and Pheromones. Hypothalamic octapeptide hormones: Oxytocin and Vasopressin. Purification and characterization of hormones. Hypothalamo-hypophyseal axis.
Unit-II	Genetic control of hormone synthesis: Structure and expression of protein hormone encoding gene. Molecular aspects of peptide hormone biosynthesis and secretion. Molecular aspects of synthesis and delivery of thyroid hormones, biogenic amines and steroid hormones. Production of protein hormones by recombinant DNA technology
Unit-III	Molecular mechanism of hormone action: Membrane, cytoplasmic and nuclear hormone receptors, Non-genomic mechanism of hormone action, Receptor-ligand interactions. Hormonal signal transduction: G-proteins and second messengers. Genomic mechanism of hormone action: Steroid and thyroid hormones.
Unit-IV	Molecular aspects of Reproductive endocrinology: Genetics of sex. Testicular and ovarian determining genes. Mullerian inhibiting substance genes. Stem cell renewal in testis. Molecular basis of male and female contraception. Endocrine disruptors. Neuroendocrine control of reproduction and feedback mechanism.
Lab Course:	
1.	Purification of any protein hormone.
2.	Assay of steroid dehydrogenase
3.	Isolation and characterization of steroid/prostaglandin.

Handwritten signatures and dates:
 Anshuman
 6/5/19
 S/S Swad
 06/05/2019
 Ashu
 6/5/19
 Ashu
 6/5/19
 Ashu
 6/5/19
 Ashu
 6/5/19
 Ashu
 6/5/19

Regulation of immune response by antigen, antibody, immune complex, MHC and cytokines.

UNIT-II Immunoprophylaxis: Principles of Vaccination. Immunization practices. Vaccines against important bacterial and parasitic diseases. DNA vaccines; passive prophylactic measures. Viral vaccines and antiviral agents. Vaccination schedules and safety. Production of vaccines.

UNIT-III Diagnosis of microbial diseases - Collection, transport and preliminary processing of Clinical pathogens. Clinical, microbiological, immunological and molecular diagnosis of diseases. Principles of immunodiagnosics. Antigen-antibody based diagnosis and the techniques involved – Enzyme, Radio and Fluorescence Immuno assays, Immunoblotting, Flow cytometry. Effector cell assays, Cytotoxic assays. Isolation of pure antibody. Monoclonal & Designer antibody and their application in immunodiagnosics.

UNIT-IV Modern methods of microbial diagnosis. Use of nanotechnology in diagnosis. Synthesis of Nanomaterials, Nanoparticle based drug delivery, Toxicity and environmental risks of nanomaterials. Biosensors: Biosensor-development, types and characteristics, DNA biosensors, application of biosensors in clinical diagnostics: detection of infectious diseases, food pathogen and environmental monitoring.

Lab Course:

1. Preparation of Parasite/ microbe Antigen and analysis by PAGE
2. Immunizations and Production of Antibody
3. Antigen antibody reaction by Double Diffusion, Counter Current and IEP, RID and ELISA
4. Western Blot Analysis
5. Immunodiagnosis using commercial kits (VDRL, RPR, Widal etc.)
6. Identifications of nanomaterials using physical and chemical properties.
7. Green and chemical route for synthesis of nanomaterials.
8. Nanomaterial characterizations using UV-Vis and FT-IR spectroscopy.
9. Assessment of antibacterial properties of nanomaterials.
10. Identification of different analyte/ biomolecules for biosensing system.

Books Recommended:

R.A. Goldsby, T.J Kindt & B. A. Osborne
E. Benjamini, R. Coico and G. Sunshine
Roitt, Brostoff and Male
William Paul
Stewart Snell
Elgert
M. Wilson, K. Kannangara, G Smith,
Simmons, B. Raguse
G. Cao

Challa S.S.R. Kumar
Charles P. Poole Jr. and Franks. J. Qwens
C. M. Niemeyer, C. A. Mirkin (Editor)

Kuby's Immunology:
Immunology-A short Course
Immunology
Fundamentals of Immunology
Immunology, Immunopathology and Immunity
Understanding Immune System
Nanotechnology: Basic science and Emerging M.
technologies,
Nanostructures and Nanomaterials: Synthesis, properties and
applications
Nanomaterials for medical diagnosis and therapy,
Introduction to Nanotechnology
Nanobiotechnology: Concepts, Applications and Perspectives

Handwritten signatures and dates:
D. N. K. / 6/15/19
A. S. / 6/15/19
S. / 06/05/2019
A. / 6.5.19
K. / 06/15/19
M. / 06/05/19
A. S. / 6/15/19
A. / 6.17.19

M. Sc. Biochemistry
FOURTH SEMESTER (January 2021 – June 2021)
Special Paper: PAPER- IV (B): Bioinformatics
[Credit: 4 and Maximum Marks: 80]

(Each theory paper will have questions divided into four sections, A, B, C & D. Section A will have 20 MCQ of 1 mark each covering whole syllabus. Section B will have 8 very short answer questions, two from each unit, of 2 marks each to be answered in two to three lines. Section C will have 8 questions, two from each unit, of 3 marks each. The question has to be answered in about 75 words. Section D will have 4 questions, one from each unit with internal choice, of 5 marks each. The question has to be answered in about 150 words).

Unit I Introduction to bioinformatics and data generation

Bioinformatics and its relation with molecular biology. Examples of related tools (FASTA, BLAST, BLAT, RASMOL), databases (GENBANK, Pub med, PDB) and software (RASMOL, Ligand Explorer).

Data generation; Generation of large scale molecular biology data. (Through Genome sequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-Ray Diffraction, and microarray). Applications of Bioinformatics.

Unit II Biological Database and its Types

Introduction to data types and Source. Population and sample. Classification and Presentation of Data. Quality of data, private and public data sources. General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDB sum)

Unit III Data storage and retrieval and Interoperability

Flat files, relational, object oriented databases and controlled vocabularies. File Format (Genbank, DDBJ, FASTA, PDB, SwissProt). Introduction to Metadata and search; Indices, Boolean, Fuzzy, Neighboring search. Data exchange and integration. Ontologies, interchange languages and standardization efforts.

General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE.

Unit IV Gene Expression and Representation of patterns and relationship

General introduction to Gene expression in prokaryotes and eukaryotes, transcription factors binding sites. SNP, EST, STS.

Regular Expression, Hierarchies, and Graphical models (including Marcov chain and Bayes notes). Genetic variability and connections to clinical data.

Lab Course:

01. Retrieval of sequences from NCBI, EBI and EMBL databases.
02. Retrieval of sequences from NBRF-PIR, SWISSPROT and P databases.
03. Transition and Translation of sequences.
04. Retrieval of genome from genome databases.
05. Exploring DIP and PPI.
06. Exploring BIND and PIM.
07. Exploring MINT and GRID.
08. Analysis of phylogenetic tree
09. Exploring PDB file.
10. Analysis of active site by pymol

Handwritten signatures and dates:
Anwar Khan
6/5/19
S. Howard
06/05/2019
Ahsan
6-5-19
M. Debnath
06/05/19
6/5/19

Books Recommended:

- BAXEVANIS, AD & OUELLETTE, BFF : Bioinformatics: a practical guide to the analysis of genes and proteins. 2nd Ed.. 2002.
- BAXEVANIS, AD, DAVISON, DB, PAGE: Current protocols in bioinformatics. 2004.
- RDM & PETSKO, GA
- ORENGO, C, JONES, D & THORNTON, J : Bioinformatics: genes, proteins and computers. 2003
- Ingvar Eidhammer, Inge Jonassen, : Protein Bioinformatics. 2003
- William R Taylor
- HIGGINS, D & TAYLOR, W : Bioinformatics: sequence, structure, and databank. 2000.
- David Mount : Bioinformatics: sequence and genome analysis. 2004

adpuzk.
6/5/19

ASH
6/5/19

SK ~~ansad~~
6/5/2019

Indira
6/5/19

ASH
6.5.19

MDewano
6/5/19

A. H. Hani
6.5.19

Amir
6/5/19

AM
6.5.19

