FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. (HONOUR SCHOOL) BIOCHEMISTRY
1ST TO 6TH SEMESTER

AND

M.Sc. (HONOUR SCHOOL) BIOCHEMISTRY
1ST TO 4TH SEMESTER

EXAMINATIONS 2011-2012

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Outlines of tests, syllabi and courses of reading for B.Sc. (Honours School) in Biochemistry, 1st to 6th Semester for the examination 2011-2012.

B.Sc.(H.S.) Biochemistry 1st year (Semester System) Major/Subsidiary

1st Semester
1. BC-1101: Introductory Biochemistry
2. BC-1102: Cell Biology
3. BC-1151: Practical

2nd Semester
1. BC-1201: Carbohydrates and Lipids
2. BC-1202: Proteins, Nucleic Acids and Porphyrins
3. BC-2252: Practical

BIOCHEMISTRY (SUBSIDIARY) TWO YEAR COURSE
(For the students of Botany and Anthropology Departments)

1st Semester
1. BCS-1171: Biomolecules –I
2. BCS-1172: Practical

2nd Semester
1. BCS-1271: Biomolecules –I
2. BCS-1272: Practical

B.Sc.(H.S.) Biochemistry 2nd year (Semester System) Major/Subsidiary

3rd Semester
1. BC-2101: Enzymes
2. BC-2102: Metabolism of Carbohydrates
3. BC-2103: Metabolism of Nitrogenous Compounds-I
4. BC-2151: Practical

4th Semester
1. BC-2201: Bioenergetics & Enzymes Kinetics
2. BC-2202: Metabolism of Lipids and Oxidative Phosphorylation
3. BC-2203: Metabolism of Nitrogenous Compounds-II
4. BC-2252: Practical

Biochemistry (SUBSIDIARY) for Botany/Anthropology (2 years Course)

3rd Semester
1. BCS-2171: Metabolism and Molecular Biology-I
2. BCS-2173: Practical
4th Semester
1. BCS- 2271: Metabolism and Molecular Biology -II
2. BCS- 2273: Practical

Biochemistry(SUBSIDIARY) for Microbiology/Bio-Physics/Zoology (1 year Course)

3rd Semester
1. BCS- 2174: Biomolecules and Enzymology
2. BCS- 2176: Practical

4th Semester
1. BCS- 2274: Intermediary Metabolism and Molecular Biology -II
2. BCS-2276: Practical

B.Sc.(H.S.) Biochemistry  3rd year (Semester System)

5th Semester
1. BC-3101: Fundamentals of Molecular Biology-I
2. BC-3102: Plant Biochemistry-I
3. BC-3103: Endocrinology
4. BC-3104: Immuno Biochemistry-I
5. BC-3105: Nutritional Biochemistry: Basic Concepts
6. BC-3106: Techniques in Biochemistry-I
7. BC-3107: Practical-I
8. BC-3108: Practical-II

6th Semester
2. BC-3201: Fundamentals of Molecular Biology-II
3. BC-3202: Plant Biochemistry-II
3. BC-3203: Neurobiology
5. BC-3204: Immuno Biochemistry-II
5. BC-3205: Nutritional Biochemistry: Applied Aspects
6. BC-3206: Techniques in Biochemistry-II
7. BC-3207: Practical-I
8. BC-3208: Practical-II

The students of B.Sc (Hons. School) have also to study the subject of “Environment Education”. This is a compulsory qualifying paper which the students are required to qualify in the 1st/2nd/3rd year of the course. The examination will be conducted by the University.
### M.Sc. (HONS SCHOOL) IN BIOCHEMISTRY (SEMESTER SYSTEM) FOR THE EXAMINATION 2011-2012

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ENVIRONMENT EDUCATION  

1. Environment Concept  
   Introduction, concept of biosphere – lithosphere, hydrosphere, atmosphere; Natural resources - their need and types: Principles and scope of Ecology; concepts of ecosystem, population, community, biotic interactions, biomes, ecological, succession.

2. Atmosphere:  
   Parts of atmosphere, components of air: pollution, pollutants, their sources, permissible limits, risks and possible control measures.

3. Hydrosphere:  
   Types of aquatic systems; Major sources (including ground water) and uses of water, problems of the hydrosphere, fresh water shortage; pollution and pollutants of water. permissible limits, risks and possible control measures.

4. Lithosphere:  
   Earth crust, soil - a life support system, its texture, types, components. pollution and pollutants, reasons of soil erosion and possible control measures.

5. Forests:  
   Concept of forests and plantations, types of vegetation and forests, factors governing vegetation, role of trees and forests in environment, various forestry programmes of the Govt. of India, Urban Forests, Chipko Andolan.

6. Conservation of Environment:  
   The concepts of conservation and sustainable development, why to conserve, aims and objectives of conservation, policies of conservation; conservation of life support systems - soil, water, air, wildlife, forests.

7. Management of Solid Waste:  
   Merits and demerits of different ways of solid waste management - open dumping, landfill, incineration, resource reduction, recycling and reuse. vermicomposting and vermiculture, organic farming.

8. Indoor Environment:  
   Pollutants and contaminants of the in-house environment; problems of the environment linked to urban and rural lifestyles: possible adulterants of the food: uses and harms of plastics and polythene: hazardous chemicals, solvents and cosmetics.

9. Global Environmental issues:  
   Global concern, creation of UNEP; Conventions on climate change, Convention on biodiversity: Stratospheric ozone depletion, dangers associated and possible solutions.

10. Indian Laws on Environment:  
    Indian Laws pertaining to Environmental protection: Environment (Protection) Act, 1986; General information about laws relating to control of air, water and noise pollution. What to do to seek redressal.

11. Biodiversity:  
    What is biodiversity, levels and types of biodiversity, importance of biodiversity, causes of its loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.
12. **Noise and Microbial Pollution:**
  Pollution due to noise and microbes and their effects.

13. **Human Population and Environment:**

14. **Social Issues:**
  Environmental Ethics: Issues and possible solutions, problems related to lifestyle, sustainable development; Consumerisms and waste generation.

15. **Local Environmental Issues:**
  Environmental problems in rural and urban areas. Problem of Congress Grass & other weeds, problems arising from the use of pesticides and weedicides, smoking etc.

**Practicals:**
Depending on the available facility in the college, a visit to vermicomposting units or any other such non-polluting eco-friendly site or planting/caring of vegetation/trees could be taken.

*Note: Above 15 topics to be covered in 25 hour lectures in total, with 2 lectures in each topics from 2 to 11 and one each for the topics 1 and 12 to 15:*

- **Examination Pattern:**
  Fifty multiple choice questions (with one correct and three incorrect alternatives and no marks deduction for wrong answer or un-attempted question)

- All questions compulsory i.e. no choice.

- Qualifying marks 33 per cent i.e. 17 marks out of 50.

- Total marks : 50

- Duration of Examination: 60 minutes.

- Spread of questions: Minimum of 2 questions from each of the topics 1 and 12 to 15. Minimum of 4 questions from topics 2 to 11.
Outlines of tests syllabi and courses of reading for B.Sc. (Honours School) First Year English Subsidiary (Semester System)

FIRST SEMESTER

SECTION A

1. Fluency in English
   Units-I, II, III, IV
   20 Marks

2. Shorts Stories
   Unit I to VI
   10 Marks

3. Poems
   Unit I to IX
   20 Marks

SECTION B

Writing and Grammar

1. Paragraph Writing
   12 marks

2. Formal Letters and E-mails
   10 marks
   8 marks

3. Applied Grammar:
   20 marks
   - Types of Sentences
   - Sentence Linkers
   - Correction of Sentences

SECOND SEMESTER

SECTION A

1. Fluency in English
   Units-VIII, IX, XIV, XVI
   20 Marks

2. Short Stories
   Unit to VII to XII
   10 Marks

3. Poem
   Unit X to XVIII
   20 Marks
SECTION B

Writing and Grammar

1. Resume Writing 10 Marks
2. Précis Writing 8 Marks
3. Report Writing 12 Marks
4. Applied Grammar 20 Marks

- same word as different part of speech
- Formation of words
- One Word substitution
- Idioms & Phrases

TEXTS PRESCRIBED:

1. Fluency in English Eds. Mukti Sanyal & Tulika Prasad
   Macmillam Publishers
2. Twelve Contemporary Shorts Stories O.U.P.
3. The Silver Lute Macmillam Publishers

NOTE:

1. The book ‘Twelve contemporary Short Stories’ is meant for discussion and evaluation purposes.
2. Mode of Testing: All the questions of Section A would have Internal choice. Question 1 and 2 Essay type. Question 3 and 4 from poems based on central idea or summary.

RECOMMENDED READING:

B.Sc. (H.S.) 1st Year (1st Semester) Biochemistry (Major), 2011-12

Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

BC-1101: Introductory Biochemistry  
Credit: 3+0+0

Objective: To familiarize the students with properties of water, Bio-energetics and various techniques employed in biochemistry.

UNIT-I
Introduction: Scope of Biochemistry and Molecular Biology. Molecular logic of living systems.


UNIT-II

UNIT-III
Bio-energetics: First and second laws of thermodynamics. High energy compounds. Redox potential and Nernst equation.
Chromatographic Techniques: Paper, thin layer, gas - liquid, ion-exchange, affinity, gel filtration, HPLC.

UNIT-IV
Centrifugation; Electrophoresis; Radio-isotopic techniques, Spectrophotometry.

Books Suggested:
**BC-1102:  Cell Biology**  
**Credit: 3+0+0**

**Objective:** To learn cell biology and techniques employed in cell biology. Composition of blood and cell membranes. Idea of origin and evolution of life.

**UNIT-I**


**UNIT-II**

**Structure and Function of cell Organelles:** Detailed description of mitochondria, chloroplast, nucleus, smooth and rough endoplasmic reticulum, golgi apparatus, lysosomes, peroxisomes, cytoskeletal elements and extracellular matrix components.

**UNIT-III**


**UNIT-IV**

**Cell Membrane:** Chemical composition of bio membranes and its functions, cell junctions, organization of proteins and lipids in membranes, protein-lipid interactions, different models of membrane structure, asymmetry in biomembranes, structure of RBC membrane.

**Membrane Transport:** Passive and active transport, facilitated diffusion, ionophores and siderophores, exocytosis, endocytosis, pinocytosis and phagocytosis.

**Books Suggested:**


**BC-1151:  Practical**  
**Credit: 0+1+1**

B.Sc. 1st year (2nd Semester)

Instructions for paper-setter
Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

BC-1201: Lipids, proteins, nucleic acids and porphyrins. Credits: 3+0+0

Objective: To learn structures and functions of Lipids, proteins, nucleic acids and porphyrins.

UNIT-I


UNIT-II


UNIT-III


UNIT-IV


Books suggested:

BC-1202: Various types of cells. Cell division and cell cycle  Credit: 3+0+0

Objective: To learn various types of cells. Cell division and cell cycle

UNIT-I

UNIT-II
Structure of striated, smooth and cardiac muscle. Muscle proteins. Molecular organization of contractile system and Sliding filament mechanism of muscle contraction.

UNIT-III
Connective and bone tissue. Adipose and epithelial tissue. Kidney and Liver cells

Unit-IV
Cell division, cell cycle, Mendelian laws of inheritance, chromosomal changes, cytogenetics

Books Suggested

BC-1251: Practical  Credit: 0+1+1

Qualitative tests for amino acids and proteins. Separation of amino acids by paper chromatography. Estimation of protein (Biuret), glucose (Folin-Wu, Anthrone), DNA. RNA. Saponification and Iodine value of fat/oil.
BIOCHEMISTRY (SUBSIDIARY) TWO YEAR COURSE
(For the students of Botany and Anthropology Departments)

B.Sc.(H.S.) 1st year (1st Semester)
Instructions for paper-setter

*Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.*

BCS-1171: Biomolecules-I  
**Credit: 3+0+0**

**Objectives:** To learn structure and properties of Water, Carbohydrates, Lipids and Nucleic Acids

**UNIT-I**

**Water:** Physical properties and hydrogen bonding of water, structure of liquid water, other properties of hydrogen bonding, solvent properties of water, ionization of water, ion product of water. The pH scale, Acids and Bases, Acid-Base indicators, Buffers.

**UNIT-II**

**Carbohydrates:** Definition and classification, Families of monosaccharides, Stereoisomerism of monosaccharides, Mutarotation and the anomeric forms of D-glucose. Action of acids and bases on monosaccharides. Structure and functions of important derivatives of monosaccharides, disaccharides, polysaccharides (Glycans); storage polysaccharides, structural polysaccharides.

**UNIT-III**

**Lipids:** Definition and classification of lipids, fatty acids, triacylglycerols, phosphoglycerides, sphingolipids, waxes, prostaglandins, sterols, liposomes, their structure and functions.

**UNIT-IV**

**Nucleic Acids:** General structure of the pyrimidines and purines, nucleosides, nucleotides, nucleic acids, types of nucleic acids, hydrolysis of nucleic acids by acids and bases, enzymatic hydrolysis of nucleic acids, analysis of nucleotide sequence in nucleic acids, Nucleic acids – Protein supramolecular complexes. Structure and role of Cyclic nucleotides.

**Books Suggested:**

BCS: 1172: Practical: Based On Theory  
**Credit: 0+0+1**
SEMESTER II

BCS-1271: Biomolecules - II  Credit: 3+0+0

Objectives: To learn structure of Amino Acids and Proteins. Techniques of Protein Purification and Properties of Enzymes

UNIT-I


UNIT-II


UNIT-III

Techniques in Protein Purification: Protein purification; Need for purification, Preliminary purification, precipitation techniques, Adsorption and ion-exchange chromatography, Gel filtration, affinity chromatography, Electrophoresis. Criteria of purity.

UNIT-IV


Books Suggested:


BCS-1272 : Practical  Credit: 0+0+1

Qualitative tests of amino acids and proteins, Paper chromatography of amino acid, Beer-Lambert’s law verification, Estimation of proteins by Biuret method, Preparation of milk casein, Achromatic point of salivary amylase, Alkaline phosphatase activity, Km determination.
B.Sc. (Honours School) SEMESTER III

Credit: 3+0+0

BC-2101: Enzymes

Objectives: Introduction to enzymes, co-enzymes and mechanism of Catalysis.

Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT – I


UNIT – II

Role of coenzymes (NAD/NADP,FMN/FAD, coenzyme A, bioytin, lipoamide, TPP, pyridoxal phosphate, tetrahydrofolate, cobalamine) and metal cofactors in enzyme catalysis.

UNIT – III

Mechanism of catalysis, transition state theory, covalent catalysis, acid-base catalysis, metal ion catalysis, proximity and orientation effects, strain and distortion theory.

UNIT – IV


SUGGESTED BOOKS

**BC-2102: Metabolism of Carbohydrates**

**Objectives:** Study of major metabolic pathways of carbohydrates

**Instructions for paper-setter**

*Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.*

**UNIT-I**


**UNIT-II**

Metabolic pathways for the degradation of carbohydrates: glycolysis, fermentation, tricarboxylic acid cycle, phosphogluconate pathway, glycogenolysis, glucuronate pathway and glyoxylate cycle. Catabolism of fructose and galactose. Regulation of glycolysis, TCA cycle and HMP pathway.

**UNIT-III**

Major pathways for biosynthesis of carbohydrates: gluconeogenesis and glycogenesis. Biosynthesis of disaccharides, cell wall polymers and mucopolysaccharides. Regulation of glycogen metabolism.

**UNIT-IV**

Various mechanisms of metabolic regulations. Kinetic factors. Feedback inhibition and feed forward stimulation. Reversible and irreversible covalent modification of regulatory enzymes. Monocyclic cascade systems. Cyclic AMP (cAMP) and Ca\(^{2+}\) ions as bioregulators.

**SUGGESTED BOOKS**

BC-2103: Metabolism of Nitrogenous Compounds-I

Credit: 3+0+0

Objectives: Pathways of amino acid, nucleotide and heme catabolism

Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

UNIT-II

UNIT-III
Catabolism of essential amino acids except aromatic amino acids.

UNIT-IV
Catabolism of aromatic amino acids, purines, pyrimidines and heme.

BOOKS SUGGESTED

BC-2151: Practical 0+1+1
B.Sc. (HS) SEMESTER IV

BC-2201: Bioenergetics and Enzyme Kinetics

Objectives: To learn principles of thermodynamics & enzyme Kinetics

Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Concepts of bioenergetics, principles of thermodynamics & their application in Biochemistry, concept of free energy, relation between equilibrium constant & standard free energy change, biological standard state and standard free energy change in coupled reactions, biological redox reactions, redox potential, its relation with the free energy change (including derivation & numericals). High energy phosphate compounds: introduction, phosphate group transfer potential.

UNIT-II


UNIT-III

Enzyme inhibition. Reversible enzyme inhibition: competitive, non-competitive and uncompetitive enzyme inhibition, change in kinetic parameters by various types of inhibitors. Irreversible inhibition. Specific enzyme inhibitors and their mode of action: suicide inhibitors, side chain specific reagents, affinity reagents.

UNIT-IV

Regulation of enzyme activity, general considerations and theories, amplification of signals. Control of activity by changes in the covalent structure of enzymes, allosteric enzymes, ligand-induced conformational changes, examples of metabolic control.

SUGGESTED BOOKS

**BC-2202: Metabolism of Lipids and Oxidative Phosphorylation**

**Credit:** 3+0+0

**Objectives:** To learn pathways of lipid metabolism, electron transport chain and oxidative phosphorylation

**UNIT-I**


**UNIT-II**

Biosynthesis of saturated and unsaturated fatty acids, their elongation and regulation. Biosynthesis & functions of triglycerides, phospholipids and cholesterol and their regulation.

**UNIT-III**

Structure, metabolism and functions of lipoproteins. Lipid transport, structure and applications of liposomes. Biosynthesis of eicosanoids.

**UNIT-IV**


**SUGGESTED BOOKS**

Objectives: Pathways of amino acids and nucleotide biosynthesis

Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Biosynthesis of non-essential amino acids. Biosynthesis of heme.

UNIT-II

Biosynthesis of essential amino acids except basic amino acids.

UNIT-III

Biosynthesis of basic amino acids. Conversion of amino acids to specialized products (polyamines, melanin, NAD⁺, creatinine). Regulation of amino acid biosynthesis.

UNIT-IV

Biosynthesis & regulation of purine & pyrimidine nucleotides, biosynthesis of deoxy ribonucleotides, salvage pathways.

SUGGESTED BOOKS

Biochemistry (SUBSIDIARY) SEMESTER III
Botany/Anthropology (2 year course)

BCS-2171: Metabolism and Molecular Biology-I

4+0+0

**Instructions for paper-setter**

*Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.*

**Objectives:** Introduction, nature of genetic material and its expression to carbohydrate and lipid metabolism.

**UNIT-I**


**UNIT-II**


**UNIT-III**


**UNIT-IV**

SUGGESTED BOOKS


BCS-2173: Practical 0+0+1

BCS-2271: Metabolism and Molecular Biology-II 4+0+0

Instructions for paper-setter
Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

Objectives: Pathways of amino acid, nucleotide and heme metabolism, Concept of operon. Structure of viruses. Recombinant DNA Technology. Biomembranes

UNIT-I


UNIT-II


UNIT-III


UNIT-IV

membranes; molecular components of membranes, fluid mosaic model of membrane structure, membrane fluidity, transport through cell membranes.

**SUGGESTED BOOKS**


**BCS-2273: Practical**

**BCS-2174: Biomolecules and Enzymology**

**Instructions for paper-setter**

*Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.*

**Objectives:** To learn structure and function of various biomolecules, structure, function and elementary kinetics of enzymes

**UNIT-I**

Water and its properties, ionization of water, pH scale, buffer solutions, Henderson-Hasselbalch equation.
Carbohydrates: definition and classification, monosaccharides and their properties, isomerism in sugars, disaccharides of biological importance, oligosaccharides, storage and structural polysaccharides, mucopolysaccharides. Lipids: definition and classification, fatty acids and their properties, structure and properties of neutral fats, phospholipids and sterols, lipoproteins, fat soluble vitamins, gas liquid chromatography.

**UNIT-II**

Amino acids: structure, classification, properties, chemical reactions and titration curve. The peptide bond, polypeptides and proteins, structural level of proteins, primary structure determination. Nucleic acids: purine and pyrimidine bases,
nucleosides, nucleotides and their biological functions, polynucleotides. Structure of DNA and RNA, denaturation of DNA, determination of DNA sequence.

UNIT-III


Enzyme inhibition: different types of inhibition-competitive, un-competitive, non-competitive, irreversible. Significance of inhibition.
Chemical nature & theories of enzyme catalysis: general metal ion, proximity & orientation, transition state. acid-base, covalent, coenzymes & metal cofactors in enzyme catalysed reactions.

UNIT-IV


SUGGESTED BOOKS


BCS-2176: Practical 0+0+1
BCS-2274: Intermediary Metabolism


Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT-I

Introduction to metabolism, methods to study metabolism, bioenergetics, ATP-ADP cycle, electron transport chain and oxidative phosphorylation.

Digestion and absorption of carbohydrates, glycolysis and alcoholic fermentation, gluconeogenesis, TCA cycle and glyoxylate pathway, glycogenolysis and glycogenesis, glycogen storage diseases, HMP pathway and its significance, metabolism of galactose and fructose, regulation of carbohydrate metabolism. Diabetes mellitus.

UNIT-II


UNIT-III


UNIT-IV

Regulation of gene expression (lac operon & trp operon). Recombinant DNA technology. Molecular components of membranes, models of membranes, membrane transport.
**SUGGESTED BOOKS**


**BCS-2276: Practical**

0+0+1
Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

BC-3101: FUNDAMENTALS OF MOLECULAR BIOLOGY-1

Objective: Introduction to nature of genetic material, replication and transcription.

Unit-I


Unit-II


Unit-III


Unit-IV


Suggested Books

1. Freifelder, D. Essential of Molecular Biology, 1998 (3rd Ed.)
BC-3102: PLANT BIOCHEMISTRY-I

**Objective:** To study fundamental processes of life in plants, plant lipids and phytohormones.

**Unit I**

**Unit II**

**Unit III**

**Unit IV**
Signals regulating the growth and development of plant organs: phytohormones - auxins, gibberellins, cytokines, abscisic acid and ethylene. Steroid and peptide hormones in plants. Phytochromes, G-proteins and signal transduction chains in plants.

**Suggested Books**
1. Introduction to Plant Biochemistry by Goodwin and Mercer (2nd Ed, 1983).

BC-3103: ENDOCRINOLOGY

**Objective:** Introduction to hormones, their mechanism of action and role in physiology and pathophysiology.

**Unit I**
Functional organization and general characteristics of endocrine system, target gland concept, Negative and positive feed back control, Assay and measurement of hormones.

**Unit II**
Mechanism of hormone action: role of receptors, cyclic AMP, cyclic GMP, phosphoinositides, calcium, diacylglycerol and nitric oxide.

**Unit III**
Structure, biosynthesis and release of hormones, biochemical and physiological role, and pathophysiology of the following endocrine systems: Hypothalamus; Pituitary;Thyroid; Parathyroid, Calcitonin acid Vitamin D3;Adrenals; Pancreas; Gonads; G.I.T. tract; Heart (Endothelins).
Unit IV
Growth factors: Chemistry, Biological functions and mechanism of action of epidermal growth factor; Hemopioetic cell growth factor; Fibroblast growth factor and Interleukins; Insulin like-growth factors, Nerve growth factors.

Suggested Books


BC-3104: IMMUNO BIOCHEMISTRY-I

Objective: To understand different components of the immune system, generation and functions of antigen binding macromolecules.

Unit I
Historical background, overview of the immune system, basic concepts of innate and adaptive immunity, cells and organs of the immune systems structure, properties and functions.

Unit II
Biological activities of antigen, hapten, epitopes (T&B cell), antigen-antibody interactions. Immunological techniques-I: precipitation and agglutination reactions, visualizing precipitation in gels: different types of immunodiffusion and immunoelectrophoresis, radio immunoassay, enzyme linked immunosrobent assays

Unit III
Antigen binding macromolecules involved in immune responses like immunoglobulins, T cell receptors, Major Histo-compatibility complex, Toll like and NOD like receptors. Basic structure, different classes, characteristics, functions. Generation of these receptors (Genetic organization), diversity

Unit IV
Development and survival of lymphocytes, antigen processing and presentation, T & B cell mediated immune response, lymphocyte activation, signal transduction.

Suggested Books

Objective: To provide comprehensive knowledge of different types of dietary components, their nutritional importance and biochemistry

Unit I
Energy metabolism, Physiological forms of energy, Caloric value & energy content of various foods. Measurement of energy expenditure: Direct and indirect Calorimetry. Respiratory quotient (RQ), Protein and non-protein RQ and its calculations. Basal metabolic rate (BMR: Factors affecting BMR, calculation of BMR. Specific dynamic of food, Energy requirement in various physiological and pathological conditions. Thermogenesis and the effect in various physiological process.

Unit II

Unit III
Carbohydrates: Dietary sources of carbohydrates, disposal of available carbohydrates. Dietary fibres, various types of dietary fibres, chemistry of fibres, physical properties, dietary source, physiological action. Role of Dietary Fibres in preventing cancer, diabetes, coronary heart disease. Possible adverse effects.

Unit IV

Suggested Books
Objective: The aim of the courses to provide in depth knowledge of various experimental/Instrumentation techniques in biochemistry

Unit I
General Laboratory Techniques: Membrane/Ultra filtration, dialysis, diffusion, surface tension, viscosity and their applications to biological systems.
Cell Biology techniques: Microbial, animal and plant cell/tissue culture, cell disruption/homogenization/sonication, cell sorting, cell counting, cryopreservation.

Unit-II

Unit III
Radioisotopic techniques: Isotopes and nature of radioactivity, radioactivity units, types of radioactive decay, rate of radioactive decay, half-life, specific activity. Detection and measurement of radioactivity, counters, autoradiography, radiodating. Applications of radioactivity in biological sciences, safety aspects.

Unit-IV
Chromatography: General principles, distribution coefficient, Partition chromatography-normal phase and reverse phase liquid chromatography. Modes of chromatography-column, thin layer and paper chromatography. Principles, matrices and applications of gel permeation, adsorption, ion exchange and affinity chromatography. TLC, GLC,HPLC.

Suggested Books


BC-3107: Practical-I

BC-3108: Practical-II
SEMESTER VI

BC-3201: FUNDAMENTALS OF MOLECULAR BIOLOGY-II

Objective: To familiarize the students with nature and discovery of genetic code, protein biosynthesis and targeting, regulation of gene expression and gene cloning.

Unit-I


Unit-II
Regulation of Gene Expression in Prokaryotes: Control at initiation of transcription. Lac Operon (genetical and biochemical aspects.), trp and his operons. Regulation of genes for ribosomes and bacterial viruses (Lytic and Lysogenic modes). Interactions between DNA and Proteins (Helix-turn-helix and β-Sheet Motifs). Locating the position of DNA binding sights in the genome. Co-crystal studies. Role of small molecules and RNA in gene control.

Unit-III

Unit-IV

Suggested Books
1. Freifelder, D. Essential of Molecular Biology, 1998 (3rd Ed.)
**Objective:** To study plant phenolics, plant cell wall and molecular biology of plants.

**Unit I**
Plant phenolics: General phenyl-propanoid metabolism. Introduction to alkaloids, lignins, flavonoids, tannins and quinones. Biosynthesis of some important alkaloids, lignins and flavonoids.

**Unit II**
Genome organization, protein synthesis and processing in plants: organization of nuclear genome, plastid genome and mitochondrial genome. Synthesis of nuclear encoded proteins; chloroplast and mitochondrial protein synthesis. Protein sorting.

**Unit III**
Genomes of plant cells: Transcription of nuclear genome, DNA polymorphism and its significance as genetic markers for plant breeding. Techniques to investigate DNA polymorphism.
Genetic engineering of plants: Plant cell and tissue culture. Marker genes: reporter genes and selectable marker genes used in plant genetic engineering. Agrobacterium mediated gene transfer, virus mediated gene transfer. DNA transfer without vectors.

**Unit IV**
Applications of plant genetic engineering: Developing insect resistant, virus resistant, herbicide resistant plant strains by genetic engineering. Use of genetic engineering for improvement of yield and quality of crops, protection against environmental stress and to produce raw material for industry and pharmaceuticals. Genetic manipulation of flower pigmentation.

**Suggested Books**
1. Introduction to Plant Biochemistry by Goodwin and Mercer (2nd Ed, 1983).
2. Molecular Biotechnology-Principles and Applications of Recombinant DNA by Glick and Pasternak (3rd Ed.).
3. Lea, P.J. and Leegood, R.C. Plant Biochemistry and molecular biology

**BC-3203: NEUROBIOLOGY**

**Objective:** Introduction to nervous system, biochemistry and molecular biology of neurological functions and dysfunctions

**Unit I**

**Unit II**
Synaptic transmission: Electrical and Chemical transmission, Electrical properties of neural membranes, Resting Potential and Action Potential: Origin and measurement of resting potential; Voltage clamp analyses, Patch-clamp analyses, generation and propagation of the action potential. Neurotransmitters and Neuromodulators: Types of neurotransmitters, synthesis, storage and release of neurotransmitters,
neurotransmitter receptors, postsynaptic signaling, synaptic modulation and mechanism of neural integration. Acetylcholine, glutamic acid, aspartic acid, glycine, GABA, Serotonin, Biogenic amines, Neuroactive peptides (Substance P and opioids).

**Unit III**

G-coupled Receptors: Messengers and receptors, B-adrenergic receptor (B-AR), muscarinic acetylcholine receptor (MAChR), substance K. receptor (SKR), rhodopsin, cone opsins. Ligand-gated channels: The nicotinic acetylcholine receptor, GABA receptor, Glycine receptor; receptors for excitatory amino acids (EAAs). Voltage gated channels: Potassium Channels (Delayed & Fast K+ channels, serotonin-dependent K+ Channel, Ca-dependent K+ channels, Potassium ‘leak’ Channels). Sodium Channels, Calcium Channels.

**Unit IV**

Sensory system: Taste, smell, hearing and vision. Learning & Memory: Types of Memory, Amnesia, correlation of behavioral and biochemical events, measurement of learning and memory, molecular basis of learning and memory. Neurodegenerative disorders: Amyotrophic lateral sclerosis (ALS), Alzheimer’s disease (AD); Huntington’s disease, Parkinson’s Disease (PD) and Multiple sclerosis

**Suggested Books:**


**BC-3204: IMMUNO BIOCHEMISTRY-II**

**Objective:** Immune system and associated disorders, application of immunological techniques.

**Unit-I**

Dynamics of adaptive immune response, mechanism and types of immunodeficiency diseases, allergy and hypersensitive reactions.

**Unit-II**

Immunological tolerance: mechanism and types, autoimmunity, autoimmune disorders, transplantation.

**Unit-III**

Complement system: components, types and functions, pathways, regulation. Immune response to infectious agents such as bacterial, viral, parasitic & fungal.

**Unit-IV**

Tumor Immunology. Vaccines: immunisations, types of vaccines, merits / demerits. Immunological techniques-II: generation of monoclonal antibodies, abzymes, flowcytometry, magnet / fluorescence activated cell sorting, T cell cloning, proliferation, apoptosis, different types of animal models.


Suggested Books

BC-3205: NUTRITIONAL BIOCHEMISTRY: APPLIED ASPECTS

Objective: To provide comprehensive knowledge of important nutritional components and their importance.

Unit I
Calcium:- Various forms of calcium present in food. physiological role of calcium in skeleton and non skeleton tissues. Calcium intake, absorption, role of calcium in lactation and pregnancy and in various other diseases. Hypocalcemia and hypercalcemia.
Copper:- Distribution in body. Cu deficiency, toxicity and treatment.
Physiological role of Iodine, Chlorine, Cobalt, Phosphorus, Manganese, Molybdenum.

Unit II

Unit III
Food Toxins: Types of toxins present in food. Lathyrus poisons, seawater fish, scombrotoxic poisoning; mussel poisoning. Argemone contamination, Ackee fruits, cycads, spices, oestrogens, carcinogens antivitamins hallucinogenic substance, toxins of fungal origin, pesticides and weed killers, antibiotics, hormones, fungicides, industrial wastes, chemical adulteration, radioactive fall out.

Unit IV
Food Additives:- Various types of additives, their chemical composition and physiological effects. Infective agents in food like bacteria, virus etc. Oxidative stress and oxidant defense
Food processing: Nutrition, safety and quality balances.

Suggested Books:
Objective: The aim of the course is to provide fundamental knowledge of various experimental/Instrumentation techniques in the applied biochemistry, molecular biology, omics and system biology.

Unit I

Electrophoresis: General principle, support media, types of electrophoresis.
Electrophoresis of nucleic acid: Agarose-gel electrophoresis of DNA and RNA, pulse-field gel electrophoresis, northern and southern transfer procedure.

Unit-II

Absorption spectroscopy: Principle, factors affecting absorption properties. UV-visible spectroscopy infrared spectroscopy.
Fluorescence spectroscopy: Principle, applications, Fluorescence activated cell sorting (FACS), fluorescence in situ hybridization (FISH), fluorescence immunoassay.

Unit III

Optical rotatory dispersion and Circular dichroism: Theory, techniques for measuring ORD and CD. Interpretation of curves, Applications.
Nuclear magnetic resonance (NMR) and Electron spin resonance (ESR): Theory, applications.

Unit IV

Atomic spectrometry, mass-spectrometry: Matrix assisted laser desorption ionization (MALDI).

Suggested Books


BC-3207: Practical-I

BC-3208: Practical-II
M.Sc. (HONOURS SCHOOL) BIOCHEMISTRY

SEMESTER –I

BC-501: APPLICATION OF BIOCHEMISTRY TO BIOTECHNOLOGY         Credits= 4+0+0

Objectives: Learning of modern molecular techniques employed in Biotechnology

Unit-I
Micromethods in Protein Chemistry: Analytical Electrophoretic techniques of peptides and protein separation. Isolation of peptides for sequence analysis. Peptide mapping, chemical and enzymatic hydrolysis of proteins, controlled and total hydrolysis, Western blot technique, Radioactive and nonradioactive procedures for the detection of protein blots. cDNA synthesis, extraction and fractionation of RNA and DNA, Gel Electrophoresis of Nucleic acids. Pulse Field Electrophoresis of DNA, isolation of plasmids, plasmid derived cloning vectors, and genome library. Ti plasmid as tool for genetic engineering in plants, N-labelling Random labeling of nucleic acid probes, nick translation,

Unit-II
Chromosomal walking, hybridization and blotting techniques. DNA microarray chip technology, dot blot, slot blot, Northern and Southern blot, South-Western blot analysis, use of restriction enzymes and T4 DNA ligase in molecular cloning cDNA synthesis. Bacterial transformation screening of transformants, use of Minicells and Maxicells to detect the expression of DNA. Auto-radiography and fluorography, finger printing and related techniques to study DNA protein interactions. In vitro translation, biotin-avidin system applications in detection of bio-molecules. Enzymes involved in recombinant DNA technology.

Unit-III
Polymerase Chain Reaction (PCR), basic principle, method, enzymes used, PCR thermo-cyler, amplification of specific DNA fragments: Applications in medicine and forensic sciences. DNA based diagnosis of genetic disorders. Recombinant DNA technology in medicine and industry, In situ hybridization with cDNA and with oligonucleotide probe. Generation of transgenic animals and plants, knockout animals.

Unit-IV
Monoclonal antibodies and vaccines: definition and nature of monoclonal antibodies (MCA); antigen preparation for MCA production; methodology producing MCA; immunization and generation of immune response; selection of animal-strain and immunization schedule. Myleoma cells for hybridization; cell fusion and selection of hybrids using HAT medium. Cloning and isolation of hybrid cell lines. Screening of specific MCA; Purification and labeling of MCA, uses and applications of MCA. T-cell hybridomas and their applications. Vaccines, subunit vaccines, live recombinant vaccines, attenuated vaccines, DNA vaccines.

Books & Suggested:

1. Barnard , R.Glick and J.J. Pasternak, Molecular Biotechnology. 3rd Ed.ASM Press
2. L.Davis et al, Basic Methods in Molecular Biology. Appleton & Lange
4. Winfried Hartmeier, Immobilized Biocatalysts, Spring-Verlager, Berlin, Germany
5. Sambrook, Friteseh and Maniastis, Molecular Cloning, Cold Spring Harbor Laboratory Press
Objectives: Learning of various diagnostic tests employed in clinical biochemistry

Unit-I

Diagnostic enzymology-enzyme determination in serum/plasma, urine and cells. Clinically important enzymes, use of isoenzymes in diagnosis.
Function tests: Hepatic: Tests based upon the metabolism of carbohydrates, lipids, protein and detoxification. Differential diagnosis of jaundice
Renal: GFR and its clinical importance, clearance tests (urea and creatinine)
Intestinal: Malabsorption of fats, carbohydrates and proteins.
Pancreas: amylase, lipase and trypsin assays in serum

Unit-II

Disorders of metabolism:
Carbohydrates- glycogen storage diseases, galactosemia
Amino acids- disorders of glycine, sulfur containing amino acids, aromatic amino acids, histidine, branched chain amino acids and proline, disorders of propionate and methylmalonate metabolism.
Disorders in urea biosynthesis.

Unit-III

Lipids: hyperlipoproteinemia, hyperlipidemia, Tay-Sachs Disease (Gangliosidosis), Neimann Pick disease, Gaucher’s disease, Krabb’s disease, Metachromatic leukodystrophy and Fabry’s Disease, Wolman’s Disease.
Disorders of porphyrin and heme metabolism

Unit-IV

Myocardial infarction and atherosclerosis
Quality control in clinical Biochemistry
Water & electrolyte balance, acid base balance

Suggested Books:

5. Lieberman, M and Marks, A.D. MARK’S Medical Biochemistry, A Clinical Approach, 3rd Ed. Lippin Williman wilkins
BC: 503: BIOCHEMICAL TOXICOLOGY  
Credits= 4+0+0

Objectives: Learning various toxins, their metabolism and toxicity

Unit-I

Definition, scope and relationship of toxicology to other sciences. Nature of toxic effects. Acute and chronic exposure.

Dose: response relationship, determination of LD-50, no effect observe level, acceptable daily intake, bioavailability, volume of distribution, plasma half life, total body burden, total body clearane. Synergism and antagonism

Unit-II


Unit-III

Toxicity testing- Decision-tree protocol, Ames test, Host mediated assay and dominant lethal test, Drosophila sex linked recessive lethal test, micronucleus test.

Unit-IV


Metal toxicity-Toxicity of lead and its effect on heme synthesis. Toxicology of various forms of mercury.

Drug toxicity-Paracetamol, metabolism and its toxic effects.

Books Recommended:

1. Frenhe. LY, Lu’s Basic toxicology 4th Ed. (2002),
2. A.Wallace Hayes, Principle & Methods of Toxicology 5th Ed. (2008)
4. Curtis D. Klassen, Casarett & Poul’s Toxicology, the Basic science of Pusion 7th Ed.
BC: 504: Molecular cell Biology

**Objectives:** Introduction to Cell Cycle, Apoptosis and cell proliferation, signal molecules and Embryonic development

**Unit-I**

Cell Cycle:
Initiation of cell lineage, stem cells, cell differentiation, control points, cell cycle events in *S. pombe*, *S. cerevisiae*, and mammalian system, M phase kinase, protein phosphorylation and dephosphorylation, p34 as key regulator in yeast, CDC 28, Cdk-cyclin complexes, function of Cdc2-cyclin and Cdk-cyclin dimers. Cdk inhibitors, reorganization of the cell at mitosis.

**Unit-II**

Apoptosis and cell proliferation:
Extrinsic and intrinsic pathways of apoptosis, techniques to analyze apoptosis, molecular basis of cancer, multistep carcinogenesis, signal transduction and cancer, tumor suppressor genes and protooncogenes and oncogenes, tumor causing viruses, DNA viral genes, Retroviral-associated oncogenes in growth regulation, strategies for cancer prevention and cure.

**Unit-III**

Signaling molecule and cell surface receptors:
Intracellular signal transduction, second messengers, protein functioning as signal transducers, localization of receptors and signal transducers, G-protein coupled receptors and downstream signaling, TGF receptors and activation of SMADS, cytokine receptors and JAK-STAT signaling, receptor tyrosine kinases and activation of Ras, Raf, MAP kinase signaling, phosphoinositide as signal transducer, pathways that involve signal induced protein cleavage (NF-KB and NOTCH), Hedge hog and wnt signaling pathways (classical and nonclassical) down regulation of receptor protein signaling.

**Unit-IV**

Cellular and molecular mechanisms of development;
*Drosophila melanogaster*; Gradients decide compartments, maternal gene products establish gradients in early embryogenesis, anterior-posterior development by gene regulators, dorsal ventral development uses, receptor-ligand interactions, compartments determine cell fate at blastula stage, complex loci involved in regulation, homebox and homeotic genes, Nematode (*C elegans*) development.

**Books Recommended:**

**Objectives:** Kinetics of multi substrate reactions, measurement of rate constants, study of active site and enzyme turn over

**Unit-I**

Enzyme diversity: concept of convergent and divergent evolution of enzymes, kinetics of multi substrate enzyme catalyzed reactions: classification, kinetics of multisubstrate reactions, derivation of rate of expression for ordered, ping-pong and Bi-Bi reaction mechanisms, investigation of reaction mechanism by using initial velocity, inhibition and isotope exchange studies.

**Unit-II**

Methods of measuring enzymatic rate constants and their magnitude:
Rapid mixing and sampling techniques, relaxation methods, absolute concentration of enzymes, sigmoidal kinetics: cooperativity phenomenon for protein ligand binding, symmetric & sequential models for action of allosteric enzymes and their significance, Hill and Scatchard plots.

**Unit-III**

Identification of active site of enzymes: by trapping of enzyme-substrate complex, use of substrate analogues, enzyme modification by chemical procedures affecting amino acid side chains, treatment with proteases and site-directed mutagenesis, by studying the effect of changing pH. A brief account of investigation of three dimensional structure of active site, structures & mechanisms of selected enzymes: the dehydrogenases, the proteoases, ribonuclease and lypoenzyme.

**Unit-IV**

Enzyme turnover: kinetics of turnover, methods for measuring rates of enzymes turnover, correlation between rates of turnover and the structure and functions of enzymes, mechanism of enzyme degradation, significance of enzyme turnover.

**Books Recommended:**

Objectives: Drug targets, drug discovery and development, antibiotic and herbal drugs

Unit-I

Introduction: Biochemistry in health & disease.
Molecular targets of drugs: enzymes as targets: medicinal uses of enzyme inhibitors, some examples of drug action at carrier and structural proteins.
Receptors as targets: families of receptors, agonists/antagonists and their design.
Nucleic acids and nucleic acid building blocks as targets.

Unit-II

Drug Discovery and drug development: identifying drug targets, finding and developing a lead compound, metabolism of drugs, designing drugs to resist metabolism, designing pro-drugs, quantitative structure-activity relationships (QSAR), a rational approach to drug design.

Unit-III

Antibacterial agent: β-lactam antibiotics: inhibitors of bacterial cell wall synthesis, bacterial agents which interfere with protein synthesis, bacterial agents which act on nucleic acid transcription. Drug resistance, acting at nervous system: cholinergics, anticholinergics and anticholinesterases

Unit-IV

Biochemistry of herbal drugs: risk/benefits of dietary supplements, additives and nutraceuticals, ethanol – drug Interactions

Book Suggested:

2. Lewke, T.L. Williams, D.A.; Roche, V.F. and Zito, S.W. Foyer’s, Principle of Medicinal Chemistry 6th Ed. Wallers Kluwer
3. Thomas, Medicinal Chemistry, latest Ed. Prentice Hall
5. King, F.D., Medicinal Chemistry principle and practical, Royal Society of Chemists
BC-507: Industrial Biochemistry                                                        Credits= 4+0+0

Objectives: Development of industrial fermentation, principles of fermentation process, enzyme biotechnology and biotreatment of effluents

Unit-I

Introduction: definition and scope of industrial biochemistry, biochemical basis and development of industrial fermentation process: screening and selection of the organisms for the production of biologically important compounds, strain improvements, detection and production of fermentation products, Fermentation media, scale up of fermentations, biological reactors, continuous and batch type reactors.

Unit-II

Biochemical principles of typical fermentation processes:
Amino acid: glutamic acid, lysine, tryptophan
Vitamins: B_{12}, riboflavin, β-carotene, tocopherol
Industrial products: ethanol, acetone, glycerol
Organic acids: citric Acid, gluconic Acid
Antibiotics: beta lactam antibiotics, amino acid and peptide antibiotics, carbohydrate antibiotics, tetracyclines and anthracyclines, nucleoside antibiotics, aromatic antibiotics etc.

Unit-III

Enzyme biotechnology: Isolation, production and immobilization of enzyme and cells in biochemical reactions, support for immobilization, biofilms and biosensor development, feature of enzymes in relation to biotechnology, enzyme sources, release of enzymes from cells, enzyme isolation and purification. Applications of biological catalysts, immobilization techniques-enzymes adsorption, covalent coupling to a carrier surface, cross-linking and copolymerization, entrapment in matrix, encapsulation, conformational changes and stability, steric restrictions and inactivation of enzymes molecules, biotransformation by microbes, industrial and therapeutic uses of immobilized enzymes and their applications in agriculture, food, dairy, textile, leather industry and in medicine.

Unit-IV

Biotreatment of Industrial effluents: lipid technology: natural resources of biologically important lipids, extraction, fractionation, esterification, and refining process, food emulsion and their storage, hydrogenation, non-food uses of lipids.

Book Suggested:
1. Doble Mukesh and Kumar Anil, Biotreatment of industrial effluents
4. Rainbow C. and Rose A.H., A.P., Biochemistry of Industrial micro-organisms
5. P. F. Stanbury, A. Whitaker and S. Hall, Principles of Fermentation Technology
Objectives: Introduction to immunology

Unit-I


Unit-II


Unit-III

Immunosenescence: possible causes, manifestations, control, Immunotherapy: types, role, efficacy, safety and clinical trials.

Unit-IV


Book Suggested:

SEMESTER- III

BC-601: Research Methodology and Biostatistics  
Credit = 4+0+0

Objectives: Introduction to methods and statistical tools employed in research

Unit-I

Animals in scientific experimentation: Laboratory animals, guidelines for care and use, alternatives to animal experimentation.  
Experiment design: planning and execution, good laboratory practices

Unit-II

Literature retrieval: online sources and databases
Preparation of project proposal, funding opportunities in biomedical research
Writing a research paper and peer review, impact factor and citation index, presentation of research paper (oral/poster).

Unit-III

Expression and critical evaluation, interpretation and presentation of data, statistical methods for analysis of data- probability, mean, median, frequency, t-test (paired and unpaired), ANOVA and correlations, statistical software

Unit-IV

Intellectual property and patents
Ethics in scientific research

Books recommended:

BC-602 Genomics and Bioinformatics  
Credit = 4+0+0

Objectives: Introduction to genomics and bioinformatics

Unit-I

Introduction to genomics, proteomics and metabolomics and bioinformatics
Protein and nucleic acid databases, tools and uses

Unit-II

Nucleic acid sequencing methods and analysis, computational assembly of a genome sequencing and Human genome project
Sequence alignment-pair wise and multiple sequence alignments, BLAST, FASTA and advanced BLAST

Unit-III

Predictive methods using DNA and protein sequence, Comparative genomics, disease association studies
Homology, Phylogeny and Evolutionary trees
Unit-IV

Functional genomics, proteomics and metabolomics
Drug discovery & pharmainformatics

Books recommended:

BC-603 :Computational Techniques

Objectives: Introduction to computer and C language

Unit-I

Introduction to computers: block diagram of a computer, concept of input-output devices, types of input-output devices, concept of memory, types of memory, concept of central processing unit (CPU), Control Unit (CU) and Arithmetic Logic unit (ALU).
Operating systems, commonly used word processing and spreadsheet programme

Unit-II

Introduction to C language: C character set; constants, variables, keywords; types of C constants; rules for constructing integer constants; rules for constructing real constants; rules for constructing character constants; types of C variables; rules for constructing variable names; C keywords; C instruction classification; type declaration instruction; arithmetic: instruction; integer and float conversion; type conversion in assignments; hierarchy operation; basic C program. flowcharts and algorithms: algorithms-their use; flowcharts; various boxes and symbols; examples.

Unit-III

If Statement: The if statement; its syntax; multiple statements within if, if-else statement; its syntax; nested if-else statement; its syntax; forms of if; Programs related to if, if-else statement, decision control structure: conditional operator: use of logical operators; conditional operators; its syntax; nested conditional operator; programs related to conditional operator. while, do-while loop: The while loop; its syntax; tips and traps; more operators; nesting of while loops; do-while statement; its syntax; nesting of do-while loops; difference between while and do-while; programs with the use of while, do-while loops.

Unit-IV

For loop: The for loop; its syntax; nesting of for loops; tips and traps; difference between while, do-while and for loops; programs with the use of for loops, arrays: array definition and syntax; Program related to arrays; array declaration; accessing elements of array; entering data into an array; Reading data from an array; array initialization; array elements in memory, Two Dimensional Arrays, Programs with the use of Arrays.
Books recommended:

BC-604 :Current Topics in Biochemistry Credit = 4+0+0

Objectives: Introduction to current topics in biochemistry

Unit-I
Activity-based protein profiling: from enzyme chemistry to proteomic chemistry
fat and beyond: the diverse biology of PPARγ
G protein signaling
Glycosyltransferases: structures, functions, and mechanisms

Unit-II
CFTR function and prospects for therapy
Methionine metabolism and liver disease
Genetic susceptibility to type 2 diabetes and implications for antidiabetic therapy
Genes in kidney development and disease

Unit-III
Aging and survival: the genetics of life span
Biochemistry and molecular biology of neurodegenerative disorders
Stem cells and regenerative medicine

Unit-IV
Phytochemicals in treatment of medical conditions
Structural biology of the tumor suppressor p53
Metals in biology

Books Recommended:

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