COURSE OUTLINE

B.Sc. WITH MAJOR IN BIOCHEMISTRY CBCS-2013

HIMACHAL PRADESH UNIVERSITY

SHIMLA
Effective from session 2013-14
1. The B.Sc. with major in Biochemistry will be of three years duration semester-based Choice Based Credit System [CBCS] course.
2. There will be broadly four types of courses for B.Sc. with major in Biochemistry programme.
   The one credit of practical/laboratory shall be of 2 hours duration and one credit of lecture/tutorial will be of one hour duration per week.
   A. The Compulsory courses will be of 3 credits each and a candidate has to choose a minimum of 3 Compulsory courses being offered by the concerned college/ institute. Thus a minimum of 9 [3 X 3 credits] will be opted by a candidate. Each of 3-credit courses will carry 75 marks.
   B. The core courses will be of 4-credits each and a candidate will complete 14 courses of 4-credits each [4 X 14 = 56 credits]. Each credit will carry 25 marks and each course of 4-credits will carry 100 marks. There will be 75 marks for theory and 25 marks for practical in each of the major/core courses. In theory 40 marks will be for semester end examination and 35 marks will be for continuous internal assessment. The component of internal assessment and marks will be as following:
      Internal assessment test 1 =10 marks (20 MCQs of ½ marks each)
      Internal assessment test 1I =10 marks (20 MCQs of ½ marks each)
      Assignment and presentation = 10 marks (5 each)
      Attendance = 5 marks
      The criteria for attendance to be followed shall be: Those having greater than 75% attendance (for those participating in Co-curricular activities, 25% will be added to per cent attendance) will be awarded CCA marks as follows:-
      ≥ 75% but < 80%  1 marks
      ≥ 80% but <85%   2 marks
      ≥ 85 but <90%   3 marks
      ≥ 90% but < 95%  4 marks
      ≥95%    5 marks
   C. Elective courses will comprise related to Minor subjects. Each Elective course will be of 4-credits each and a candidate will opt for 5 courses of a Minor subject or at least 5 courses of two different minor subjects. A minimum of 10 Elective courses [4 X 12 = 48 credits] will be chosen by a candidate to get specialization in one or two minor subjects.
   D. General Interest and/ or Hobby courses will comprise such courses as the name suggests and each candidate will opt for at least one course of 1 credit.
3. (a) The admission to B.Sc. Biochemistry programme of Himachal Pradesh University will be as per guidelines of Himachal Pradesh University, Shimla from time to time.
   (b) The candidate should have passed 10+2 (class XII) Examination or its equivalent from a recognized Board/University with any of the three subjects out of Physics, Chemistry and Biology or any other science subject with 50% or equivalent grade (for SC/ST candidates marks of eligibility will be 45% or equivalent grade).
   (c) In case of candidates who are studying in University/Board/College/Schools in any of the foreign countries the eligibility/Qualifying marks will be the same as recognized/equivalent to 10+2 by the University or the association of the Indian University with 50% marks of equivalent grade (for SC/ST candidates, eligibility will be 45% marks or equivalent grade).
   (d) The candidate who has appeared in the qualifying examination but whose result has so far not been declared can also apply but his/her eligibility for the entrance test will be purely provisional subject to the condition that he/she has to produced a passing certificate scoring at least the minimum percentage of marks as prescribed for the qualifying examination on the day and the specified time of counseling.
   (e) The candidate shall not be more than 22 years of age as on 01st July of the year of admission. Date of birth as recorded in the Secondary Education Board/ University Certificate Only will be considered as authentic.
4. Admission will be based on the merit of the entrance test to be conducted by HP University or any other mode as to be decided by the University from time to time.
5. The tuition fee and other monthly/annual charges will be as per University rules.
## OUTLINE OF COURSES FOR B. Sc. WITH MAJOR IN BIOCHEMISTRY

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses to be opted</th>
<th>Course name</th>
<th>Credits</th>
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Selection of various courses

A. Compulsory courses [Minimum 3 courses; 3 X 3 = 9 credits]

(a) Languages
   i. Compulsory English
   ii. Compulsory Hindi

(b) Social Sciences/Commerce/Management
   iii. Compulsory Social Science/Commerce/management course
   iv. Compulsory Geography of Himachal Pradesh
   v. Compulsory Indian Constitution
   vi. Compulsory Himachal Past, Present and Future

(c) Science
   vii. Compulsory Basic Science (not for students majoring in science subjects)
   viii. Climate Change and its impact on mountain sustainability
   ix. Compulsory Environmental Science (Audit Pass Course)

(d) Skill based courses
   x. Functional English
   xi. Office Computing
   xii. Functional Hindi
   xiii. Application Packages for finance
   xiv. Secretarial practice
   xv. Short hand and word processing
   xvi. Web applications

B. Core courses

CORE COURSES [Minimum 14 courses; 14 X 4 = 56 credits]

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<td>Bioenergetics and Enzymology</td>
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<td>Concepts in Immunology</td>
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<td>Introduction to Bioinformatics</td>
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<td>Basics of r-DNA Technology</td>
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<td>Endocrinology and neurobiology</td>
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### Minor (elective) Biochemistry courses

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### C. Minor elective Courses
Details of the syllabus will be as prescribed by the University.
Chemistry shall be compulsory minor elective for BSc students majoring in Biochemistry and second minor elective will be one of following subjects:
1. Economics
2. Computer
3. Physics
4. Mathematics

### D. General Interest (GI) and / or Hobby (H)
1. Details of the syllabus will be as prescribed by the University.
2. Commercial arts
3. German language
4. Russian language
5. Spoken English
6. Photography
7. General computer applications
8. Fine arts
9. Playing musical instrument(s)
COURSE: BSCBC101  
BASIC BIOCHEMISTRY

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Theory: 36 credit  
Practical: 12 credits  
Semester end examination : 40 marks  
Practical examination : 25 marks  
Internal Assessment : 35 marks

Instructions for setting end semester examination question paper:

The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus. There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

Unit I


Carbohydrates: Structure of important mono, di, oligo and polysaccharides, glycoproteins and peptidoglycan, glycolipids and lipopolysaccharides. Reaction of monosaccharides.

Unit II

Proteins: Structure of amino acids, non-protein and rare amino acids and their chemical reactions. Structural organisation of proteins (primary, secondary, quaternary domain structure), protein classification and function. Forces stabilizing primary, secondary and tertiary structure. Lectin antibodies

Unit III

Lipids: Classification of lipids and fatty acids, general functions of major lipid subclasses, acyglycerols, phosphoglycerols, phosphoglycerides, sphingolipids, glycosphingolipids and terpenes, sterols, steroids. Prostagladins, Prostaryclins, Leukotrienes etc.

Unit IV

Nucleic acids: Structure of nucleosides, nucleotides and nucleic acids, biologically important nucleotides and their functions. Applications of biochip and microarray.

Vitamins and hormones: Types of vitamins and their chemistry vitamins as cofactors, steroids and peptide hormones

Suggested books:
1. Biochemistry- Rawn, J.D.
3. Biochemistry- Stryer, L.
5. Carbohydrate Biotechnology Protocols- Bucke C.
7. An Introduction of practical biochemistry- Plummer D.T.
8. Practical Biochemistry- Bansal, D.D., Khardori, R & Gupta, M.M.

List of Practical:
1. Preparation of physiological buffers
2. Verification of Beer lamberts law for P-nitrophenol or cobaltchloride
3. Determination pKa value of p-nitrophenol
4. The colorimetric estimation of inorganic phosphates
5. Estimation of carbohydrates in given solution by Anthron method.
6. Estimation of sugars in biological samples
7. Protein estimation by lowry’s method.
8. Protein estimation by Bradford methods.
9. Analysis of urine for urea, glucose, uric acid and chloride.
10. The determination of acid value of a fat
11. Saponifaction value of a fat
12. Separation of lipids by thin layer chromatography.
COURSE: BSCBC102
INTRODUCTORY CELL BIOLOGY

Theory: 36 credit
Practical: 12 credits
Semester end examination : 40 marks
Practical examination : 25 marks
Internal Assessment : 35 marks

Instructions for setting end semester examination question paper:
The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus. There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

Unit-I
Cell as a basic unit of living systems. The cell theory. Precellular evolution: artificial creation of cells.
Broad classification of cell types: PPLO’s, bacteria, eukaryotic, microbes, plant and animal cells. A detailed classification of cell types within an organism. Cell, tissue organ and organisms as different levels of organizations of otherwise genetically similar cells.

Unit-II
Ecological amplitude of cells in high altitude, sediments, arctic, hot spring, arid, brackish, extremophytes and freshwater environments.
Biochemical composition of cells (proteins, lipids, carbohydrates, nucleic acids and the metabolic pool)
Biological Membranes: Supramolecular architecture of membranes; solute transport across membranes, model membranes and liposomes.

Unit-III
Structure and function of cell organelles, ultra structure of cell membrane, cytosol, Golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes, cytoskeletal structures (actin, microtubules etc.) Mitochondria, chloroplasts, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin).

Unit-IV
Cell division and cell cycle: mitosis, meiosis, stages of cell cycle, binary fission amitosis.
Cell-cell interaction
Cell locomotion (amoeboid, flagellar and ciliar)
Cell senescence and death: Apoptosis and necrosis
Cell differentiation in plants and animals: totipotent, multipotent, pleuripotent cell.

Suggested books:
1. Cell and Molecular Biology- De-Robertis, F.D.P. and De-Robertis Jr. E.M.F.
3. The Cell: A Molecular Approach- Geoffrey, M

List of Practical:
1. Microscopy: 
   a. Principles of compound, phase contrast, electron microscopy
   b. Use and care of Light compound microscope.
2. Study of cells:
   a. Prokaryotic cells: Lactobacillus, E.Coli, Blue green algae
   b. Eukaryotic cells. Testicular material (for studies of spermatogenesis)
4. Preparation of permanent slides: Principles and procedures; section cutting of tissues and staining of tissues with Haematoxylin/eosin method.
5. Study of permanent slides of various tissues (gut region, liver, lung, spleen, kidney, pancreas testis, ovary, tongue, skin etc.)
6. Cytochemical techniques to study carbohydrates, nucleic acids and proteins.
COURSE: BSCBC201
BIOENERGETICS AND ENZYMEOLOGY

L T P C
3 0 1 4

Theory: 36 credit
Practical: 12 credits
Semester end examination : 40 marks
Practical examination : 25 marks
Internal Assessment : 35 marks

Instructions for setting end semester examination question paper:
The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus.
There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from
each unit including compulsory question and each question will carry 8 marks.

Unit-I
Concepts of Bioenergetics: Principles of thermodynamics and their applications in Biochemistry- Introduction,
thermodynamic system, thermodynamic state functions, first and second law of thermodynamics, concept of
free energy, standard free energy, determination of $\Delta G$ for a reaction, relation between equilibrium constant and
standard free energy change, Biological standard state and standard free energy change in coupled reactions.
Biological oxidation – reduction reactions – introduction, redox potential, relation between standard reduction
potential and free energy change (Derivations and numerical included). High energy phosphate compounds
introduction, phosphate group transfers-free energy of hydrolysis of ATP and sugar phosphates along with
reasons for high $\Delta G$.

Unit-II
Introduction to Enzymology: Definition of enzymes. The nature of enzyme molecules. Experimental evidence
to the protein nature of enzymes. Holoenzyme, coenzyme and prosthetic groups, zymogens. Role of metals in
enzyme activity. Apoenzyme cofactor association. Nature of active site. Units and international units of enzyme
activity. Specific activity and its calculation, total number of enzymes. Nomenclature and classification of
enzymes. Isoenzyme and multienzyme system, ribozymes.

Purification of enzymes: objectives and strategy in enzyme purification. Judging the success of purification
procedure. Criteria of enzyme purity.

Unit-III
Enzyme kinetics: Order of reaction and its importance in enzymology. Effect of substrate concentration on
enzyme catalyse reactions. One - substrate reactions. Michealis-Menten equation. Steady state kinetics. Km and
Vmax determination. Introduction to multi-substrate reactions. Effect of enzyme concentration, pH and
temperature on enzyme catalysed reactions.

Enzyme catalysis: Transition state theory, role of co-enzymes as a cofactor - NAD/ NADP+, FMN/FAD,
coenzyme A, biocytin, cobalamide, lipoamide, TPP, pyridoxal phosphate and tetrahydrofolate, metal ions in
enzyme catalysis, covalent catalysis, acid-base catalysis, proximity and orientation effects, strain and
distortion theory. Structure and mechanism of chymotrypsin, carboxypeptidases, ribonuclease, lysesyme,
glutathione reductase, aconitate and papain.

Unit-IV
Enzyme Inhibitions: Irreversible and reversible enzyme inhibitions. Competitive, non-competitive enzyme
inhibitions. Suicide inhibitors. Changes in kinetic parameters by various types of inhibitors. Specific enzyme
inhibitors and their mode of action. Side chain specific reagents. Affinity reagents.

Regulation of Enzyme activity: Allosteric enzymes. Control of activity by changes in covalent structure of
enzymes. Ligand induced conformational changes in enzymes. Control of metabolic pathways- General
consideration. Amplification of signals. Theories for the control of metabolic pathways.

Suggested books:
3. Biochemistry- Stryer, L
5. Understanding enzymes By Trevor Palmer Prentice Hall/ Ellis Horwood

List of Practical:
1. Assay of salivary amylase.
3. Isolation and Purification and assay of invertase.
4. Effect of pH and temperature on enzyme activity.
5. Assay of amylases, proteases.
COURSE- BSCBC202  
CONCEPTS IN IMMUNOLOGY

Theory: 36 credit  
Semester end examination : 40 marks  
Practical: 12 credits  
Practical examination : 25 marks  
Internal Assessment : 35 marks

Instructions for setting end semester examination question paper:

The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus. There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

Unit-I

Introduction: Types of immunity-innate and adaptive; features of immune response-memory. Specificity and recognition of self and non-self; terminology and approaches to the study of immune system; immunity to viruses; bacteria; fungi and tumours; vaccines.

Unit-II

Cells and organs of the immune system.
Lymphoid cells, heterogeneity of lymphoid cells, T-cells, B-cells, Null cells; Monocytes, Polymorphs, primary and secondary lymphoid organs-thymus, Bursa of fabricius, spleen, lymph nodes, lymphatic system, Mucosa Associated Lymphoid Tissue (MALT), Lymphocyte traffic

Unit-III

Humoral Immunity
Antigen-antibody interactions; affinity and avidity; high and low affinity antibodies, immuno-globulins, classes and structure, molecular mechanism of generation of antibody diversity, complement fixing antibodies and complement cascade.

Cell Mediated Immunity
T-cell subsets and surface markers, T-dependent and T-independent antigens, recognition of antigens by T-cells and role of MHC, structure of T-cell antigen receptors.

Unit-IV

Immunodiagnostic Procedures.
Various types of immunodiffusion and immunoelectrophoretic procedures, Immunoblot, ELISA, RIA, Agglutination of pathogenic bacteria, Haemagglutination and Haemagglutination inhibition.

Suggested books:

1. Immunology- Roitt, I.M. Brostoff, J. and Male, D.K.
2. Immunology- Kuby, J.
4. Fundamental Immunology- Paul, W.E.
5. Monoclonal Antibodies Principles and Application- Britch, J.R. and Lennox, E.S.
6. Medical Immunology- Strites, D.P.Terr, A.I. & Oparslow T.G.
7. Clinical Immunology and Serology: A laboratory perspective- Stevers, C.D.

List of Practical:

1. To perform ELISA.
2. To perform single radial immunodiffusion (Mancini’s technique) using antigen and antibody.
3. To perform precipitation test  
   a). Ring test  
   b). Slide test  
   in solution given an antigen and antibody.
4. Determination of titer if antisera.
5. To perform immunoelectrophoresis.
6. Purification of antigen and immunoglobulins.
UNIT-I

UNIT-II
Various mechanisms of metabolic regulation. Kinetic factors. Feedback (End product) Inhibition and Feed forward stimulation. Reversible and irreversible covalent modification of regulatory enzymes. Monocyclic cascades systems. Cyclic AMP or (Camp) and Ca²⁺ ions as bioregulators.
Regulation of key regulatory enzymes of glycolysis, T.C.A. Cycle and H.M.P. pathway. Regulation of Glycolysis and Glycogenoysis, Key regulatory enzymes of Gluconeogenesis and reciprocal regulation of glycolysis and gluconeogenesis.

UNIT-III

UNIT-IV

Suggested Books:
5. Biochemistry by A.L. Lehninger. 2nd Ed.

List of practical:
1. Qualitative test for carbohydrates and lipids.
2. Determination of reducing and non reducing sugars.
3. Determination of acid value, iodine value of fats.
4. Identification and estimation of sugars using colorimetric method.
5. Identification and estimation of lipids using colorimetric method.
7. Solubility test for lipids.
8. Separation of lipids by thin layer chromatography.
COURSE: BSCBC302
METABOLISM OF PROTEINS, NUCLEIC ACIDS, Porphyrins AND THEIR REGULATION

Theory: 36 credit  
Practical: 12 credits

Semester end examination : 40 marks
Practical examination : 25 marks
Internal Assessment : 35 marks

Instructions for setting end semester examination question paper:
The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus. There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

Unit-I
Digestion and absorption of proteins and nucleic acids in human body.

Unit-II
General reactions of amino acid catabolism: Transamination, Oxidative Deamination, Decarboxylation, Urea Cycle.
Catabolism of Glycine, Alanine, Serine, Threonine, Leucine, Isoleucine, Valine, acidic and basic Amino Acids, Aromatic Amino acids- Methionine, Cysteine and Histidine.

Unit-III

Unit-IV

Suggested books:

List of Practical:
1. Qualitative tests for proteins and amino acids.
2. Estimation of proteins from blood plasma.
3. Identification and estimation of amino acid and proteins using chromatographic techniques.
4. Identification and estimation of amino acid and proteins using colorometric techniques.
5. Isolation and determination of urea and uric acid from tissue/ serum
6. Estimation of RNA and DNA.
COURSE: BSCBC401
BIOCHEMICAL AND BIOPHYSICAL TECHNIQUES

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Theory: 36 credit hours  
Practical: 12 credits

Semester end examination : 40 marks  
Practical examination : 25 marks  
Internal Assessment : 35 marks

Instructions for setting end semester examination question paper:

The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus. There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

Unit I
Centrifugation: Principle, types, application  
Electrophoresis: Principle, types, application  
DNA isolation and PCR techniques

Unit II
Spectrophotometry (UV & Visible) and spectrofluorimetry, Atomic absorption spectrophotometry  
Infrared and Raman spectroscopy, ORD and circular dichroism, Nuclear magnetic Resonance and Electron Spin Resonance spectroscopy, Magnetic Resonance Imaging.  
Concepts of microscopy-sections

Unit III

Unit IV
Radioisotope techniques: radiotracers GM Counter, Proportional and Scintillation counters, autoradiography, Mass spectrometry-GCMS and LCMS.

Recommended Books:
1. Principles and Techniques of Practical Biochemistry- Keith Wilson & John Walker (Eds.)
2. Spectroscopy of Biological Molecules: Modern Trends- P. Carmona, R. Navarro, A. Hernanz (Eds.)
4. Protein NMR for the Millennium (Biological Magnetic Resonance)- N. Rama Krishna, Lawrence J. Berliner (Eds.)

List of Practical:
2. To perform salting out for partial purification of protein(s) in a given mixture.
3. Preparation of serum by centrifugation.
4. To separate a mixture of amino acids by Ascending Paper Chromatography.
5. To separate a mixture of amino acids by Thin Layer Chromatography.
6. Agarose Gel electrophoresis of DNA.
7. SDS-PAGE of proteins.
8. Polymerase Chain reaction.
9. Sandwich ELISA.
10. To check the purity of DNA by UV Spectrophotometry.
UNIT I

History of Bioinformatics. The notion of Homology.
Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, Understanding the structure of each source and using it on the web.

UNIT II

Protein Information Sources, PDB, SWISSPROT, TREMBL, Understanding the structure of each source and using it on the web.
Introduction of Data Generating Techniques, Restriction Enzymes, Gel Electrophoresis, Chromatograms, Blots, PCR, Microarrays, Mass Spectrometry, What data each generates and what Bioinformatics problems they pose.

UNIT III

Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment Phylogenetic Analysis.
Searching Databases: SRS, Entrez, Sequence Similarity Searches-BLAST, FASTA, DATA Submission.

UNIT IV

Protein Structure: Protein structure classification, Structure Analysis, Secondary structure prediction methods, Comparative modeling

Genome Annotation: Pattern and repeat finding, Gene identification tools.

Suggested books:
2. Bioinformatics: A practical guide to the analysis of genes and proteins- Baxvanis (Ed.)
3. Bioinformatics online (Methods in Enzymology V. 266 Computer methods for macromolecular sequence)- Doolittle (Ed.)
4. Molecular Evolution: a phylogenetic approach, -Page, ROM and Holmas EC
5. Bioinformatics: Sequences, structure and databanks- Des Higgins and Willie Taylor

List of Practical:
1. Sequence information resource
2. Understanding and using on web:
3. EMBL, Genbank, Entrez, Unigene, Protein information resource
4. Understanding and using on web:
5. PDB, Swissprot, TrEMBL
6. Using BLAST and interpretation of results.
7. Multiple sequence alignment using Clustal W
8. PAGE
COURSE: BSCBC501
BASICS OF RECOMBINANT DNA TECHNOLOGY

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Theory: 36 credit  
Practical: 12 credits  
Semester end examination : 40 marks  
Practical examination : 25 marks  
Internal Assessment : 35 marks

Instructions for setting end semester examination question paper:

The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus. There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

Unit-I
Introduction, Historical Enzymes Restriction enzymes, Ligases, DNA polymerase, kinases, Reverse transcriptase, Endonucleases, Phosphatase.

Unit-II
Vectors: Plasmid, Cosmids, Lambda, Vectors (Intentional and Replacement vectors) M-13, Phagemids

Unit-III
Radioactive and non-radioactive DNA and RNA labelling techniques: Nick translation, random priming, Sequencing

Unit-IV
Southern and Northern blotting, hybridization  
Introduction to site directed mutagenesis  
PCR and its Applications  
Transformation of E.coli Yeast, animal and plant cells, Genomic cloning, cDNA cloning and colony hybridization.  
Application of rDNA technology to medicine, agriculture and environment.

Recommended Books:
4. Recombinant Gene Expression Protocols- Tuan Rockey S  
5. PCR Cloning Protocols- White Bruce A

List of Practical:
1. DNA isolation from plants  
2. DNA isolation from E.coli  
3. Spectrophotometer analysis of DNA  
4. Agarose gel electrophoresis of DNA  
5. Plasmid DNA isolation  
6. Restriction digestion of DNA  
7. Southern Blotting  
8. Making competent cells  
COURSE: BSCBC502  
FUNDAMENTALS OF PLANT BIOCHEMISTRY

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Theory: 36 credits  
Practical: 12 credits

Semester end examination: 40 marks  
Practical examination: 25 marks  
Internal Assessment: 35 marks

Instructions for setting end semester examination question paper:

The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus. There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

Unit-I


Electron transport and energy coupling in plant mitochondria. Cyanide resistant respiration.

Unit-II


Unit-III

Plant cell wall, lipids and phenolics: chemical composition of cell wall. Biosynthesis of cell wall components. Formation and growth of cell wall.

Lipid structures. Metabolism of lipids- fatty acid desaturation systems, fatty acid hydroxylation, fatty acid catabolism, glyoxylate cycle. Plant lipoxygenase, cutins, suberins and waxes.

General phenyl-propanoid metabolism, lignins, flavonoids, tannins, quinines, Alkaloids- biosynthesis of some important alkaloids.

Signals regulating the growth and development of plant organs- auxins, gibberellins, cytokinins, abscisic acid, ethylene, phytochromes, signal transduction chains.

Unit-IV

Genomes of plant cells: transcription of nuclear genome, DNA polymorphism and its significance as genetic markers for plant breeding genomes of plastids and mitochondria.

Genetic engineering of plants and its application- plant cell and tissue culture, Agro-bacterium mediated gene transfer, virus-mediated gene transfer. DNA transfer without vectors. Developing plants strains by genetic engineering – insect resistant, virus resistant, and herbicide resistant, for improvement of yield and quality of crops protection against environmental stress.

Suggested books:
1. An introduction of Plant Biochemistry By Goodwin and Mercer

List of Practical:
1. Sources of contamination and decontamination measures.
2. How to clean glass/plastic ware
3. Operational use of an autoclave.
4. Functions and operations of a Laminar Air Flow Hood
5. Preparation of simple growth nutrient (knop’s medium), full strength, half strength, solid and liquid.
6. Preparation of complex nutrient medium (Murashige & Skoog’s medium)
7. Laboratory design set up for a PTC laboratory.
8. Plugging and sealing of culture vessels.
9. To selection, Prune, sterilize and prepare an explant for culture.
10. Significance of growth hormones in culture medium.
11. To culture different explants for raising callus cultures.
12. To demonstrate various steps of Micropropagation.
COURSE: BSCBC503
FUNDAMENTALS OF MOLECULAR BIOLOGY

Theory: 36 credit
Practical: 12 credits

Semester end examination : 40 marks
Practical examination : 25 marks
Internal Assessment : 35 marks

Instructions for setting end semester examination question paper:

The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus. There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

Unit-I

Unit-II

Unit-III

Unit-IV

Suggested books:
1. Essentials of Molecular Biology By David Freifelder
2. Gene VIII By Benjamin Lewin
3. Molecular Cell Biology By James Dernell, Harvey Lodish and David Baltimore
4. From Genes to Genomes By Bale J. W. and Schantz M. V.
5. Biochemistry By Voet and Voet

List of Practical:
1. DNA isolation from plants
2. DNA isolation from E.coli
3. Spectrophotometer analysis of DNA
4. Agarose gel electrophoresis of DNA
5. Plasmid DNA isolation
6. Restriction digestion of DNA
7. Southern Blotting
8. Making competent cells
9. Transformation of competent cells
COURSE- BSCBC601
NUTRITIONAL BIOCHEMISTRY

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Theory: 36 credit
Practical: 12 credits

Semester end examination : 40 marks
Practical examination : 25 marks
Internal Assessment : 35 marks

Instructions for setting end semester examination question paper:
The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus. There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

UNIT-I


UNIT-II


UNIT-III

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


UNIT-IV

Food Toxins and additives
Toxins: Types of toxins present in food. Lathyrus poisons, seawater fish, scombrototoxic 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.

Additives: Various types of additives, their chemical composition and physiological effects. Infective agents in food like bacteria, virus etc.

Nutrition in physiological stress and disease:
Pregnancy and lactation, protein energy malnutrition, obesity, diabetes, coronary heart disease and hypertension.

Food processing: nutrition, safety and quality balances.

Suggested Books
2. Human Nutrition and dietetics by Davidson and Passmore, Longman Group Ltd., Hong Kong.

List of practical:
1. Saponification Value of fat.
3. Estimation of preservatives and antioxidants.
4. Analysis of lipids; acid value and iodine value.
5. Determination of tannins, chemical residues and alfatoxins.
7. Determination of food constituents like sugars, amino acids, fat, minerals like Calcium, phosphorus and iron.
COURSE: BSCBC602
MEDICINAL BIOCHEMISTRY

Theory: 36 credit
Practical: 12 credits

Semester end examination: 40 marks
Practical examination: 25 marks
Internal Assessment: 35 marks

Instructions for setting end semester examination question paper:
The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus.
There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

Unit I

Unit II

Unit III

Unit IV

List of Books:

List of practical:
2. Uric acid, creatine chloride, Glucose tolerance test.
4. Serum enzymes: acid and alkaline Phosphates, LDH, GOT
5. Cholesterol, Triglycerides.
6. Urine Protein, pigments and sugar.
COURSE: BSCBC603
ENDOCRINOLOGY AND NEUROBIOLOGY

Theory: 36 credits
Practical: 12 credits

Semester end examination : 40 marks
Practical examination : 25 marks
Internal Assessment : 35 marks

Instructions for setting end semester examination question paper:
The examiner will set nine questions in all. Q.No. 1 will be compulsory, objective type and covering entire syllabus. There will be 2 questions from each unit and each question will have 3-4 parts. Students will attempt one question from each unit including compulsory question and each question will carry 8 marks.

UNIT – I
ENDOCRINOLOGY
Functional organization and general characteristics of endocrine system. The target gland concept, Negative and Positive feed back control, Assay and measurement of hormones.
Mechanism of hormone action: role of receptors, cycle AMP, cycle GMP, phosphoinositides, calcium, diacylglycerol and nitric oxide.

UNIT – II
Structure, biosynthesis and release of hormones, biochemical and physiological role, and Pathophysiology of the following endocrine systems.
Hypothalamus ; Pituitary ; Thyroid ; Parathyroid ; Calcitonin and Vitamin D3 ; Adrenals; Pancreas; Gonads; G.I.T tract; Heart (Endothelins)
Growth factors: Chemistry, Biological functions and mechanism of action of Epidermal growth factor ; Hematopoietic cell growth factor ; Fibroblast growth factor and Interleukins ; Insulin like growth factors, Nerve growth factors.

UNIT – III
NEUROBIOLOGY
Cells of the nervous system: Neurons, Glia, Organization of synapses. Neuron as a Secretary Cell Synthesis in the perikaryon, Co-translational synthesis and post – Translational modification, transport along the axon.
Syraptic 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 Neutromodulators:Types of neurotransmitters, synthesis, storage and release of neurotransmitters, neurotransmitters receptors, postsynaptic signaling, synaptic modulation and mechanism of neural integration.Acetylcholine, glutamic acid, aspartic acid, glycine, GABA, Serotonin, Biogenic, Neuroactive peptides (Substance P and opioids).

UNIT – IV
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.
Sensory system: Taste, smell, hearing and vision.Learning and 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
1. Elements of Molecular Neurobiology by Smith, C.U.M.

List of practical:
2. Determination of pI of glycine and alanine
3. Determination of pKa of ethanoic acid
4. The effect of insulin on the transport of glucose into isolated fat cells.