COURSE OUTLINE

B.Sc. WITH MAJOR IN BIOCHEMISTRY CBCS-2013

HIMACHAL PRADESH UNIVERSITY

SHIMLA

Effective from session 2013-14

HIMACHAL PRADESH UNIVERSITY

SUMMER-HILL, SHIMLA-171005

B. Sc. WITH MAJOR IN BIOCHEMISTRY

GENERAL INSTRUCTIONS/GUIDELINES FOR EXECUTION OF CURRICULUM

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

Semester	Courses to be opted	Course name	Credits	
			Course	Cumulative
I [ODD]	Compulsory Course-I	Select from the listed compulsory courses	3	Compulsory: 03 Core: 08 Elective: 08 GI & H: 01 **Total: 20**
	Major Core Course-I BSCBC101	**Basic Biochemistry**	**4**	
	Major Core Course-II BSCBC102	**Introductory Cell Biology**	**4**	
	Minor Elective Course-I (a)	To be selected from the list of minor elective courses	4	
	Minor Elective Course-I (b)	To be selected from the list of minor elective courses	4	
	GI & H Course-I	To be selected from the list of GI & H courses	1	
II [EVEN]	**Major Core Course-III BSCBC201**	**Bioenergetics and Enzymology**	**4**	Compulsory: 03 Core: 08 Elective: 08 GI & H: 01 **Total: 20**
	Major Core Course-IV BSCBC202	**Concepts in Immunology**	**4**	
	Compulsory Course-II [Skill based]	To be selected from the list of compulsory courses	3	
	Minor Elective Course-II (a)	To be selected from the list of minor elective courses	4	
	Minor Elective Course-II (b)	To be selected from the list of minor elective courses	4	
	GI & H Course-II	To be selected from the list of GI & H courses	1	
III [ODD]	**Major Core Course-V BSCBC301**	**Metabolism of Carbohydrates, Lipids and their Regulation**	**4**	Compulsory: 03 Core: 08 Elective: 08 GI & H: 01 **Total: 20**
	Major Core Course-VI BSCBC302	**Metabolism of Proteins, Amino acids, Nucleic Acids, porphyrins and their Regulation**	**4**	
	Compulsory Course-III	To be selected from the list of compulsory courses	3	
	Minor Elective Course-III (a)	To be selected from the list of minor elective courses	4	
	Minor Elective Course-III (b)	To be selected from the list of minor elective courses	4	
	GI & H Course-III	To be selected from the list of GI & H courses	1	
IV [EVEN]	**Major Core Course-VII BSCBC401**	**Biochemical and Biophysical Techniques**	**4**	Compulsory: 03 Core: 08 Elective: 08 GI & H: 01 **Total: 20**
	Major Core Course-VIII BSCBC402	**Introduction to Bioinformatics**	**4**	
	Compulsory Course-IV [Skill based]	To be selected from the list of compulsory courses	3	
	Minor Elective Course-IV (a)	To be selected from the list of minor elective courses	4	
	Minor Elective Course-IV (b)	To be selected from the list of minor elective courses	4	
	GI & H Course-IV	To be selected from the list of GI & H courses	1	
V [ODD]	**Major Core Course-IX BSCBC501**	**Basics of r-DNA Technology**	**4**	Core: 12 Elective: 08 **Total: 20**
	Major Core Course-X BSCBC502	**Fundamentals of Plant Biochemistry**	**4**	
	Major Core Course-XI BSCBC503	**Fundamentals of Molecular Biology**	**4**	
	Minor Elective Course-V (a)	To be selected from the list of minor elective courses	4	
	Minor Elective Course-V (b)	To be selected from the list of minor elective courses	4	
VI [EVEN]	**Major Core Course-XII BSCBC601**	**Nutritional Biochemistry**	**4**	Core: 12 Elective: 08 **Total: 20**
	Major Core Course-XIII BSCBC602	**Medicinal Biochemistry**	**4**	
	Major Core Course-XIV BSCBC603	**Endocrinology and neurobiology**	**4**	
	Minor Elective Course-VI (a)	To be selected from the list of minor elective courses	4	
	Minor Elective Course-VI (b)	To be selected from the list of minor elective courses	4	

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] **L: Lecture T: Tutorial P: Practical C: Total Credits**		
Code	**Hard core courses**	**L-T-P-C**
BSCBC101	Basic Biochemistry	3-0-1-4
BSCBC102	Introductory Cell Biology	3-0-1-4
BSCBC201	Bioenergetics and Enzymology	3-0-1-4
BSCBC202	Concepts in Immunology	3-0-1-4
BSCBC301	Metabolism of Carbohydrates, Lipids and their Regulation	3-0-1-4
BSCBC302	Metabolism of Proteins, Amino acids, Nucleic Acids, porphyrins and their Regulation	3-0-1-4
BSCBC401	Biochemical and Biophysical Techniques	3-0-1-4
BSCBC402	Introduction to Bioinformatics	3-0-1-4
BSCBC501	Basics of r-DNA Technology	3-0-1-4
BSCBC502	Fundamentals of Plant Biochemistry	3-0-1-4
BSCBC503	Fundamentals of Molecular Biology	3-0-1-4
BSCBC601	Nutritional Biochemistry	3-0-1-4
BSCBC602	Medicinal Biochemistry	3-0-1-4
BSCBC603	Endocrinology and neurobiology	3-0-1-4

Minor (elective) Biochemistry courses

Code	Courses	L-T-P-C
BSCBC101	Basic Biochemistry	3-0-1-4
BSCBC201	Bioenergetics and enzymology	3-0-1-4
BSCBC301	Metabolism of Carbohydrates, Lipids and their Regulation	3-0-1-4
BSCBC302	Metabolism of Proteins, Amino acids, Nucleic Acids, porphyrins and their Regulation	3-0-1-4
BSCBC401	Biochemical and Biophysical Techniques	3-0-1-4
BSCBC503	Fundamentals of Molecular Biology	3-0-1-4
BSCBC602	Medicinal Biochemistry	3-0-1-4

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

L	T	P	C
3	0	1	4

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

Water and its property: Physico chemical properties of water, dissociation and association constants. pH and buffers, pI, pka, Henderson-Hasselbalch equation and its implication.

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.**
2. Principles of Biochemistry- **Lehninger, A.L. Nelson, D.L. and Cox, M.M**
3. Biochemistry- **Stryer, L.**
4. Principles of Biochemistry: Student Study Art Notebook- **Zubay, G.L, Parson, W.W. and Vance, D.E.**
5. Carbohydrate Biotechnology Protocols- **Bucke C.**
6. Principles of Biochemistry- **Horton *et al.***
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

L	T	P	C
3	0	1	4

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

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, hotspring, 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 lipsomes.

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.**
2. Molecular Cell Biology- **Lodish, H., Baltimore, D., Berk, A., Zipursky, S.L.Matsudaira, P. and Darnell**
3. The Cell: A Molecular Approach- **Geoffrey, M**
4. Cell Biology: A Laboratory Handbook- **Celis, J.E.**

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)
3. Microtomy: Introduction of the instrument, its use, care, section cutting and stretching.
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 ENZYMOLOGY

L	T	P	C
3	0	1	4

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

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 ΔG 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 potentials 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 ΔG.

Unit-II

Introduction to Enzymology : Definition of enzymes. The nature of enzyme molecules. Experimental evidence to the proteion 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, turn over 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. Criteira of enzyme purity.

Unit-III

Enzyme kinetics: Order of reaction and its improtance in enzymology. Effect of substrate concentration on enzyme catalyes reactions. One –substarte 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, coenzymeA, biocytin, cobalamide, lipoamide,TPP, pyridoxal phosphate and tetrahydrofolate, metal ions in enzyme catalysis, covalent catalysis, acid-base catalysis, proximity and orientation effects, strain and distortation theory. Structure and mehanism of chymotrypsin, carboxypeptidases, ribonuclease, lysosyme, glutathione reductase, aconitase 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 coformational changes in enzymes. Control of metabolic pathway- General consideration. Amplification of signals. Theories for the control of metabolic pathways.

Suggested books:

1. Fundamentals of Enzymology, 2 edition, By **Nicholas C. Price and Lewis Stevens.**
2. Principle of Enzymology for food science By **J.R.Whitaker, Marcel Dekkers Inc., New York**
3. Biochemistry- **Stryer, L**
4. Enzyme structure and mechanisms By **Alan Ferst., W.N. Freeman and Company, New York.**
5. Understanding enzymes By **Trevor Palmer Prentice Hall/ Ellis Horwwod**

List of Practical:

1. Assay of salivary amylase.
2. Assay of serum phosphotase.
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

L	T	P	C
3	0	1	4

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 immunoelectrphoretic 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.**
3. Principles of Cellular and Molecular Immunology- **Austyn, J.M. and Wood, K.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- **Steverns, C.D.**
8. Cell Biology: A Laboratory Handbook- **Celies, J.E.**

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.

COURSE: BSCBC301
METABOLISM OF CARBOHYDRATES, LIPIDS AND THEIR REGULATION

L	T	P	C
3	0	1	4

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 to metabolism.important metabolic principles. Methods used for studying metabolism.digestion and absorption of carbohydrates and lipids in the human body.

Metabolic pathways for the regulation of carbohydrates: glycolysis,alcoholic fermentation, tricarboxyli acid cycle, phosphogluconate pathway,glycogenolysis,glucuronate pathway and glyoxylate cycle. Major pathways for the metabolism of carbohydrates: Gluconeogenesis and glycogenesis.metabolism of fructose and galactose.biosynthesis of diasacharides, cell wall polymers and mucopolysacccharides.

UNIT-II

Various mechanisms of metabolic regulation. Kinetic factors. Feed back(End product) Inhibition and Feed forward stimulation. Reversible and irreversible covalent modification of regulatory enzymes. Monocyclic cascades systems.cyclic AMP or (Camp) and Ca^{2+} ions as bioregulators.

Regulation of key regulatory enzymes of glycolysis,T.C.A. Cycle and H.M.P. pathway.regulation of Glycolysis and Glycogenoolysis, Key regulatory enzymes of Gluconeogenesis and reciprocal regulation of glycolysis and gluconeogenesis.

UNIT-III

Catabolism of saturated and unsaturated fatty acids.ketone bodies formation and their oxidation. Degradation of triglycerides and other major classes of lipids.regulation of fatty acid oxidation and triacylglycerol-hydrolysis

Biosynthesis of saturated and unsaturated fatty acids and their regulation. Biosynthesis of triglyceries and complex lipids. Biosynthesis of cholesteroland its regulation.biosynthesis of prostaglandins, leukotrienes, thromboxanes and prostacyclins. Metabolism of phospholipids.metabolism of lipoproteins. Lipid transport, structure and function of liposomes.

UNIT-IV

Mitochondrial electron transport chain components and biochemical basis for their arrangement.Substrate level and mitochondrial oxidative phosphorylation.Critical evaluation of various hypothesis of mitochondrial oxidative phosphorylation.Inhibitors and uncouplers of mitochondrial oxidative phosphorylation.Transport of metabolites through mitochondrial memberane.

Suggested Books:

1. Biochemistry by **Lubert Stryer**, 4th edition. 1995, W. F. Freeman and Co., New York.
2. Biochemistry by **Geoffry Zubay**, 4th edi. 1998, MacMillan publishing Company, New York.
3. Principles of Biochemistry by **E.L. Smith; R. L. Hill; I.R. Lehman; R.J. Lefkowly,P. Handler and A. White,** 7th edi., 1987, MacGraw Hill Inc.
4. Outlines of Bichemistry **by E.C. Conn., P.K. Stumpf, G. Bruening and R. H. Doi,** 5th edi., 1987 John Wiley and Sons.
5. Biochemistry by **A.L. Lehninger**. 2nd Ed.
6. Text book of Biochemistry with clinical correlations by **Devlin, Thomas** 3rd Ed., 1997.

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.
6. Separation of sugars by paper chromatography.
7. Solubility test for lipids.
8. Separation of lipids by thin layer chromatography.

COURSE: BSCBC302
METABOLISM OF PROTEINS, NUCLEIC ACIDS, PORPHYRINS AND THEIR REGULATION

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

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

Biosynthesis of nutritionally non-essential Amino Acids, Biosynthesis of essential Amino Acids-Histidine , Lysine, Tryptophan, Tyrosine, Phenyalanine.anabolism of branched chain Amino acids. Precursor functions of Amino acids. Regulation of amino acid metabolism and Anaplerotic reactions. Mechanism of Gluatmine synthesis and regulation.

Unit-IV

Degradation of purines and pyrimidines. Biosynthesis of purines and pyrimidines. – salvage pathway. Biosynthesis of deoxy-ribonucleotides. Biosynthesis of nucleotide co- enzymes. Regulation of purines and pyrimidines metabolism. Comparative biochenmistry of nitrogen excretion. Metabolism of prophyrins. Formation of heme and bile pigments. Integration of major metabolic pathways and its significance.

Suggested books:

1. Biochemistry by **Lubert Stryer**, 4th edition. 1995, W. F. Freeman and Co., New York.
2. Principles of Biochemistry by **E.L. Smith; R. L. Hill; I.R. Lehman; R.J. Lefkowly,P. Handler and A. White**, 7th edi., 1987, MacGraw Hill Inc.
3. Outlines of Bichemistry by **E.C. Conn., P.K. Stumpf, G. Bruening and R. H. Doi,** 5th edi., 1987 John Wiley and Sons.
4. Biochemistry by **A.L. Lehninger.** 2nd Ed.
5. Harper's Biochemistry by **R.K.Murray, P.A. Mayes; D.R. Graner and V.W. Rodwall**, 24th Ed., 1995.

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 colorometic 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

L	T	P	C
3	0	1	4

Theory: 36 credit hours 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

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

Unit II

Spectrophotometry (UV & Visible) and spectroflourimetry, 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

Crystallography and X-Ray diffraction, Electron diffraction, Neutron diffraction.

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.)**
3. Molecular Fluorescence: Principles and Application- **Bernard Valeur**
4. Protein NMR for the Millennium (Biological Magnetic Resonance)- **N. Rama Krishna, Lawrence J. Berliner (Eds.)**

List of Practical:

1. Verification of Beer – Lambert Law by Biuret Method.
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

COURSE: BSCBC402
INTRODUCTION TO BIOINFORMATICS

L	T	P	C
3	0	1	4

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

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-BLST, 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:

1. Bioinformatics: The Machine Learning Approach-**Pierre Baldi and Soren Brunak**
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

L	T	P	C
3	0	1	4

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, 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:

1. Molecular cloning: A Laboratory Manual- **J.Sambrook, E.F. Fritsch and T.Maniatis**
2. Principles of Gene Manipulation: An introduction to Genetic Engineering- **R.W. Old and S.B. Primrose**
3. Gene Probes I.A. Practical Approach- **B.D.Hames and S.J.Higginis**
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
9. Transformation of competent cells.

COURSE: BSCBC502
FUNDAMENTALS OF PLANT BIOCHEMISTRY

L	T	P	C
3	0	1	4

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

Photosynthesis: Photosynthetic pigments. Pigment system I and II. Mechanism of pigment system function. Generation of NADPH and ATP by non- cyclic electron flow, cyclic electron flow. Reagents which effect photosynthetic electron flow. Dark phase of photosynthesis- calvin cycle, regulation of calvin cycle. Photo-respiration, C4 pathway of CO2 fixation, regulation of gas exchange by stomata. Crassulacean acid metabolism(CAM).

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

Unit-II

Nitrogen and Sulphur metabolism: Nitrogen ans Sulphur cycles. Nitrogen fixation, molecular biology of nitrogen fixation. Nitrate reduction. Assimilation of ammonia. Sulphate reduction. Incorporation of sulphur into organic compounds. Biosynthesis of glutathione, an agent for detoxification of pollutants.

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 lipooxygenase, 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**
2. Plant Biochemistry and Molecular Biology by **Hans- Walter- Heldt, 1997**.
3. Plant Biochemistry By P.M. Dey and J.B. Harborne, 1997.
4. Molecular Biotechnology – Principles and Applications of Recombinant DNA By Glick and Pasternak.

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

L	T	P	C
3	0	1	4

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

DNA, Genes and Genomes: Genetic significance of Nucleic acids. Strucure and properties of DNA. Topology of DNA. Topoisomerases. Types of DNA. Chromosome structure. Molecular definition of gene.Organization of genes on chromosomes.Repetitive DNA. Simple sequence DNA. Immediate-repeat DNA and mobile DNA elements.Functional rearrangements in chromosomal DNA.Nucleosomes. Organization of DNA into chromosomes. Changes in chromosomes.Morphology and fuctional characteristics of Eukaryotic chromosome. Sex detemination and sex linked inheritance.Molecular maps of the genome. Extra- nuclear Genomes.

Unit-II

DNA Replication and Mutations: Semiconservative replication.Replication in viruses, Bacteria and Eukaryotic cells.Types and Biochemical basis of mutations in DNA.Reversions. RFLP. Mechnisms of DNA repair and recombination.RNA directed DNA polymerases (reverse transcriptase and telomerase), Inhibitors of replication.

RNA and Transcription: Types of RNA. Details of RNA structure. Molecular apparatus and events during prokaryotic and Eukaryotic RNA synthesis. Transcription of extranuclear genes. RNA- containing viruses and their multiplication. Post- transcriptional modifications of transcripts. Processing of different types of RNA. RNA editing. Inhibitors of RNA metabolism and their mechanism of action.Degradation and modifications of DNA and RNA by enzymes(Nucleases, Methylases, Kinases and phosphatases etc.)

Unit-III

Genetic Code, Translation and protein targeting: Cellular machinery of protein synthesis(mRNA, tRNA and ribosomes). Structure of ribosomes- their dissembly and assembly. Genetic code- its deciphering, degeneracy and general features. Codon -anticodon pairing(Wobble hypothesis). Protein synthesis- Molecular details of activation, editing, initiation, elongation and termination processes in Prokaryotes and Eukaryotes.Biochemical roles of ribosomes and chaperones. Targetting and post-translational modifications of protein. Signal hypothesis. Inhibitors of protein biosynthesis and their mode of action.

Gene Cloning: DNA cloning with plasmid vectors.Synthetic DNA- phage cloning vectors and genomic library, c-DNA library.Identification of clones in libraries.Analysing cloned DNA. Analysis of nucleic acids in complex mixtures.Designing expression systems to get abundant specific proteins.

Unit-IV

Regulation of Gene Expression in Prokaryotes: Control at initiation of transcription. Lac Operon, trp and his operons. Regulation of genes for ribosomes and bacterial viruses(Lytic and Lysogenic modes). Interaction between DNA and proteins(helix-turn- helix and β- sheet motifs). Locating position of DNA binding sites in the genome. Co-crystal studies. Roles of small molecules and RNA in gene controls.

Regulation of Gene Expression in Eukaryotes: Gene regulation in yeast (Galactose metebolism, Gal-4 protein, mating type).Gene regulation in eukaryotes(including roles of histones and enhancers). DNA- binding proteins (Homeodomain, Zinc-fingers, Leucine Zippers, Helix- loop- Helix). Post transcriptional regulation. Controls at translational levels.Details of molecular events in the development of Drosophila (Cascade of regulatory events) and similaritites to vertibrates.Isolation and characterization of mutants gene replacement and transgenic animals.

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

L	T	P	C
3	0	1	4

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

Energy metabolism, Physiological forms of energy, Caloric value & energy content of various foods.Measurement of energy expenditure: Direct and indirect Calorimetery, Respiratory quotient (RQ), Potein and non-protein RQ and its calculations.Basal metabolic rate (BMR): Factors affecting BMR, calculation of BMR.Specific dynamic action of food, energy requirement in various physiological and pathological conditions.Thermogenesis and the effect in various physiological processes.Theory of satiety and hunger. Calorimal nutrition and over- nutrition.

UNIT-II

Proteins :- Sources and chemical nature, Digestibility of proteins, protein as a source of energy, protein reserves.Nitrogen balance and various factors affecting Nitrogen balance. Endogenous and exogenous fecal and urinary nitrogen and their importance. Methods of estimating endogenous nitrogen. Dynamic stste of nitrogen metabolism. Biological value of protein (B.V), protein efficiency ratio (PER), protein quality and its amino acid make up. Chemical score as a measure of protein quality. Nitrogen balance, index and other methods foe assessing protein quality. Essential amino acids. Protein requirements for various age groups. Individuals amino acid deficiency. Amino acid imbalance, antagonism and toxicity. Role of dipeptides in clinical nutrition.

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, disbetes, coronary heart disease. Possible adverse effects.

Fats:- Chemical composition and distribution, essential fatty acids. Role of polyunsaturated fatty acids in various disease; composition, dietary lipids and lipoproteins, n-3 PUFA and plasma lipids. Effects of n-3 PUFA on liproproteins, thromboxane, prostaglandins and leukotrienes.**Vitamins:** Sources, functions, and deficiency disease of vitamins A,D,E,K. And vitamin B complex. Function of choline, carnitine, inositol and taurine, carotenoids, glutamine and arginine.

UNIT-IV

Food Toxins and additives

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.

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

1. Modern Nutrition in Health and Disease **by M.E.Shils, J.A. Olson, M.Shike and A.C.Rose.**
2. Human Nutrition and dietetics by **Davidson and Passmore,** Longman Group Ltd., Hong Kong.

List of practical:

1. Saponification Value of fat.
2. Assay of food Enzyme.
3. Estimation of preservatives and antioxidants.
4. Analysis of lipids; acid value and iodine value.
5. Determination of tannins, chemical residues and alfatoxins.
6. Estimation of vitamins- ascorbic acids.
7. Determination of food constituents like sugars, amino acids, fat, minerals like Calcium, phosphorus and iron.

COURSE: BSCBC602
MEDICINAL BIOCHEMISTRY

L	T	P	C
3	0	1	4

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

Importance of clinical biochemistry in diagnosis and monitoring of disease. Modern diagnostic methods in various biochemical investigations. Acid Base Balance: Role of body buffers, respiratory and renal mechanisms in regulation of acid base balance, Acid- base disorders.

Unit II

Types of assays, enzyme determination in serum/plasma, urine, Introduction to clinically important enzymes, Myocardial infarction: Case study. Functional tests: based on carbohydrates, lipids, proteins metabolism, bile pigments.

Unit III

Classification and biochemical parameters for differential diagnosis of jaundice, RFT for determination of concentration ability of kidneys, Nephrotic syndrome. investigation of gastric secretory activity and peptic activity. Pancreatic: Invasive and Non- invasive tests, Serum enzymes (amylase, lipase, and trypsin).

Unit IV

Inborn errors of metabolism: Glycogen storage disease, Galactosemia, Pentosuria, Diabetes mellitus, Hypoglycemia. Disorders of Amino Acids Metabolism: Disorders of glycine, sulfur containing amino acids, aromatic amino acids, Disorders in urea Biosynthesis. Disorders of lipid metabolism: Tay-Sachs Disease, Gaucher's Disease , Krabb's Disease, Metachromatic leukodystrophy and Fadry's Disease, Women's Disease. Disorders of purine metabolism: Gout, Lesch-Nyhan Syndrome.

List of Books:

1. Textbook of Biochemistry with Clinical Co-relations by **Thomas M. Devlin**, John Wiley and Sons, New York
2. Tietz Textbook of Clinical Chemistry by **Carl A. Butis and others**, W. B. Saunders Company, London Clinical Biochemistry by **Abraham Cantarow and Max Trumper, W. B.** Saunders Company London.
3. The Metabolic and Molecular Basis of inherited Disease by **Charles R. Scriver** and others, McGraw Hill New York.

List of practical:

1. Blood analysis: Blood group, Hb,. Blood glucose, Blood urea
2 Uric acid, creatine chloride, Glucose tolerance test.
3. Billirubin in Blood.
4 Serum enzymes: acid and alkaline Phosphates, LDH, GOT,
5 Cholesterol, Triglycerides.
6 Urine Protein, pigments and sugar.

COURSE: BSCBC603
ENDOCRINOLOGY AND NEUROBIOLOGY

L	T	P	C
3	0	1	4

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
ENDOCRINOLOGY

Functional organization and general characteristics of endocrine system. The target gland concept, Negative and Positive feed back control, Assay and ineasurement 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.

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, 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 opiods).

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.**
2. Harper's Review of Biochemistry **David W. Martin, Jr. MD et al**

List of practical:

1. **Blood analysis:** Serological studies T.C, D.C, ESR, Blood group, Hb. Blood glucose,Blood urea, Uric acid, creatine chloride, cholesterol, Triglycerides and phospholipids.
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.