JSS Mahavidyapeetha

# JSS COLLEGE FOR WOMEN (Autonomous)

**Saraswathipuram, Mysuru**

**Revised NEP**

**Bachelor of Science Syllabus**

**Department of Biochemistry**

# 2026-2027

# DEPARTMENT OF BIOCHEMISTRY

# PROGRAMME OUTCOMES

After successful completion of the Bachelor of Science programme, students will be able to:

**PO 1: Scientific Knowledge:** Strong foundational understanding of biomolecules, metabolic pathways, cellular processes, and genetic organizations.

**PO 2: Laboratory Skills:** Proficiency in handling modern instruments, performing quantitative/qualitative biochemical assays, and maintaining biosafety.

**PO 3: Analytical Competence:** Ability to interpret experimental data and solve research problems logically.

**PO 4: Industry & Research Readiness:** Preparedness for careers or advanced studies in pharmaceuticals, healthcare diagnostics, agriculture.

**PO5:** Appreciate the relevance of biochemistry in health, diagnostics, biotechnology, and research.

**PO6:** Exhibit ethical values, professional competence, and a commitment to lifelong learning.

# Syllabus for B.Sc. Biochemistry- 1-6 Semesters

## FOR 2026-27 BATCH THE BATCHES WHICH ARE ENTERING 1ST OR 3RD SEMESTER

## DURING JULY-AUGUST 2026

| Semester | Course Code | Title | Theory/ Practical | Credit L:T:P | Hours/ Week | CIE C1 | CIE C2 | SEE C3 | Total Marks | Exam Duration in Hours |
|---|---|---|---|---|---|---|---|---|---|---|
| I | Theory | FOUNDATIONS OF BIOCHEMISTRY | 3:0:0 | 3 | 3 | 10 | 10 | 80 | 100 | 3 |
| | Practical | FOUNDATIONS OF BIOCHEMISTRY | 0:0:2 | 4 | 4 | 05 | 05 | 40 | 50 | 3 |
| II | Theory | BIOMOLECULES | 3:0:0 | 2 | 2 | 10 | 10 | 80 | 100 | 2 |
| | Practical | BIOMOLECULES | 0:0:2 | 4 | 4 | 05 | 05 | 40 | 50 | 3 |
| III | Theory | BIOANALYTICAL TECHNIQUES | 3:0:0 | 3 | 3 | 10 | 10 | 80 | 100 | 3 |
| | Practical | BIOANALYTICAL TECHNIQUES | 0:0:2 | 4 | 4 | 05 | 05 | 40 | 50 | 3 |
| | Theory | CELLULAR BIOCHEMISTRY | 2:0:0 | 2 | 2 | 05 | 05 | 40 | 50 | 2 |
| | Theory | MICROBIAL BIOCHEMISTRY | 2:0:0 | 2 | 2 | 05 | 05 | 40 | 50 | 2 |
| VI | Theory | ENZYMOLOGY AND METABOLISM I | 3:0:0 | 3 | 3 | 10 | 10 | 80 | 100 | 3 |
| | Practical | ENZYMOLOGY | 3:0:0 | 3 | 3 | 10 | 10 | 80 | 100 | 3 |
| | Practical (Compulsory Paper) | NUTRITION | 0:0:2 | 4 | 4 | 05 | 05 | 40 | 50 | 3 |
| | Practical (Compulsory Paper) | PLANT BIOCHEMISTRY | 0:0:2 | 4 | 4 | 05 | 05 | 40 | 50 | 3 |

| Semester | Course Code | Title | Theory/ Practical | Credit L:T:P | Hours/ Week | CIE C1 | CIE C2 | SEE C3 | Total Marks | Exam Duration in Hours |
|---|---|---|---|---|---|---|---|---|---|---|
| V | Theory | METABOLISM II AND CLINICAL BIOCHEMISTRY | 3:0:0 | 2 | 2 | 10 | 10 | 80 | 100 | 2 |
| | Theory | MOLECULAR BIOLOGY AND GENETIC ENGINEERING | 3:0:0 | 2 | 2 | 10 | 10 | 80 | 100 | 2 |
| | Practical | METABOLISM AND CLINICAL BIOCHEMISTRY | 0:0:2 | 4 | 4 | 05 | 05 | 40 | 50 | 3 |
| VI | Theory | HUMAN PHYSIOLOGY | 3:0:0 | 3 | 3 | 10 | 10 | 80 | 100 | 3 |
| VI | Theory | IMMUNOLOGY AND TOXICOLOGY | 3:0:0 | 3 | 3 | 10 | 10 | 80 | 100 | 3 |
| VI | Practical | PHYSIOLOGY AND IMMUNOLOGY | 0:0:2 | 4 | 4 | 05 | 05 | 40 | 50 | 3 |

## SYLLABUS FOR B.SC. BIOCHEMISTRY- 5& 6 SEMESTERS

## FOR 2026-27 BATCH

## THE BATCHES WHICH ARE ENTERING 5TH SEMESTER DURING JULY-AUGUST 2026

| Semester | Course Code | Title | Theory/ Practical | Credit L:T:P | Hours/ Week | CIE C1 | CIE C2 | SEE C3 | Total Marks | Exam Duration in Hours |
|---|---|---|---|---|---|---|---|---|---|---|
| V | Theory | METABOLISM II AND CLINICAL BIOCHEMISTRY | 3:0:0 | 2 | 2 | 10 | 10 | 80 | 100 | 2 |
| | Theory | MOLECULAR BIOLOGY AND GENETIC ENGINEERING | 3:0:0 | 2 | 2 | 10 | 10 | 80 | 100 | 2 |
| | Practical | METABOLISM AND CLINICAL BIOCHEMISTRY | 0:0:2 | 4 | 4 | 05 | 05 | 40 | 50 | 3 |
| VI | Theory | HUMAN PHYSIOLOGY | 3:0:0 | 3 | 3 | 10 | 10 | 80 | 100 | 3 |
| VI | Theory | IMMUNOLOGY AND TOXICOLOGY | 3:0:0 | 3 | 3 | 10 | 10 | 80 | 100 | 3 |
| VI | Practical | PHYSIOLOGY AND IMMUNOLOGY | 0:0:2 | 4 | 4 | 05 | 05 | 40 | 50 | 3 |

| | |
|---|---|
| Program Name: B.Sc | Semester: I |
| Course Title: **FOUNDATIONS OF BIOCHEMISTRY** | |
| Course Code: **DSC-1T SEPBC-101** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Understand basic chemical principles used in biochemistry (acids/bases, buffers, electrodes, photochemistry, and osmotic effects). |
| **CO 2:** Understand colloids and coordination chemistry, important metal-containing biomolecules, and major nutrient cycles (N, P, O, S, Se). |
| **CO 3:** Recognize structures and biological roles of common bioorganic compounds (acids, heterocycles, steroids, terpenes, flavonoids, and alkaloids). |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 1 | 2 | 2 | 2 | 1 |

| Course Content | Hours |
|---|---|
| **Unit 1** | |
| • **Introduction:** Definition, scope and important discoveries of Biochemistry.<br>• **Acids, Bases and Buffer:** Bronsted Lowry concept, Lewis concept of acid and base, ionic product of water, pH scale, Buffers, Henderson- Hasselbalch equation, preparation of acidic and basic buffer solutions, Theory of acid base indicators with an example, pH titration curve of polybasic acid v/s base.<br>• **Electrochemistry and Distribution law:** Electrodes (Hydrogen Electrode & Calomel electrode), applications of electrodes, Distribution law - Distribution law, partition coefficient, Applications of distribution law.<br>• **Photochemistry:** Definition of photochemistry, fluorescence, phosphorescence, chemiluminescence, and bioluminescence with an example.<br>• **Colligative properties**: Definition, types of Osmotic pressure, laws of osmotic pressure (only statement), Hypotonic, hypertonic and isotonic solutions. Effect of osmotic pressure on living cells. | 16 |
| **Unit 2** | |

| | |
|---|---|
| • **Colloids:** Meaning of true solution, colloidal solution and coarse suspension. Differences between lyophilic and lyophobic sols. Fundamental study of Donnan membrane equilibrium-application in biological system. Elementary studies-Tyndal effect, Brownian movement, applications of colloidal chemistry Emulsion and emulsifying agents.<br>• **Co-ordination compounds:** Transition metals, properties (color, oxidation states, magnetic properties)Co-ordinate bond, double and complex salts – differences with examples. Co-ordination number. Porphyrin nucleus and classification. Important metalloporphyrin occurring in nature, structure and their biological importance (Hb, cytochrome, chlorophyll, Vitamin B12). Bilepigments–Types, structure and biological importance.<br>• **Nitrogen:** Fixation of atmospheric nitrogen, symbiotic and non-symbiotic nitrogen cycle, environmental pollution by nitrogenous compounds.<br>• **Phosphorus:** Phosphorus cycle, importance of phosphorus in biological system.<br>• **Oxygen:** Importance of oxygen in biological system, formation and role of ozone layer in maintenance of life on earth, effect of environmental pollutants on ozone layer.<br>• **Sulphur and Selenium**: Importance of compounds of sulphur and selenium in biological system. Effect of sulphur compounds on environmental pollution. | 16 |
| **Unit 3** | |
| • **Hydroxy acids:** Structure, properties and biological importance of Lactic acid (action of heat, oxidation), tartaric acid (salt formation), and citric acid (action of heat and salt formation).<br>• **Dicarboxylic acids and keto acids:** Structure and biological importance of fumaric acid, succinic acid, Pyruvic acid, α-ketoglutaric acid, oxaloacetic acid.<br>• **Heterocyclic compounds:** Occurrence, structural formula and biological importance of furan, pyrrole, thiophene, pyridine, pyran, thiazole, pyrimidine, purine, indole, imidazole.<br>• **Steroids**: Basic ring structure in steroids. Structure and biological importance of cholesterol, biological importance of ecdysone, ergosterol and estradiol.<br>• **Terpenes**: Isoprene rule, classification, occurrence and importance of limonene, Juvenile hormone-I.<br>• **Flavonoids/ Phenolics:** Occurrence and biological importance of Quercetin, Capsaicin anthocyanin and curcumin.<br>• **Alkaloids:** Definition, classification based on their chemical composition with example, physiological action of LSD and Morphine, Biological importance of reserpine, piperine, cocaine, theobromine, caffeine, nicotine& atropine. | 16 |

**REFERENCES:**


- Puri, Sharma, ArunBhal& B S Bhal, Pathania Text Book of Physical Chemistry
- Puri, Sharma, ArunBhal& B S Bhal, Pathania Text Book of Inorganic Chemistry
- A Guide to Organic Reaction Mechanism - P. Sykes

- General &Inorganic Chemistry - R.P.Sarkar
- Inorganic Chemistry - R.L.Dutta
- New Concise Inorganic Chemistry - J.D.Lee
- F.A.Cotton&G.Wilkinson. Basic Inorganic Chemistry, John Wiley (1998)
- Douglas, Mcdaniel and Alexander: Concepts and Models In Inorganic Chemistry, John Wiley, 3rd Edition (1994).
- James E.Huheey, Ellen Keiter and Richard Keiter: Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Public, 4th Edition (2013).
- Pattabhi.V. and Gautham.N. (2002) Biophysics. Narosa Publishing House, India.
- Stereochemistry of Carbon Compounds- D.Nasipuri

**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: I |
| Course Title: **FOUNDATIONS OF BIOCHEMISTRY** | |
| Course Code: **DSC-1P SEPBC-102** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 64 | Duration of SEA/Exam: 04 Hours |
| Hours/Week: 04 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Prepare standard solutions and apply the principles of molarity, molality, normality, dilution, and calibration of volumetric glassware. |
| **CO 2:** Perform standardization and estimation by acid–base, redox, and complexometric titrations using suitable indicators and reagents. |
| **CO 3:** Develop practical skill in quantitative chemical analysis for determining the concentration of unknown samples in laboratory experiments. |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 1 | 1 |

## LIST OF PRACTICAL EXPERIMENTS:

1. Concept of molarity, molality and normality. Calculation and preparation of solutions: Percentage solution, Molar solution, Normal solution, Dilution of stock solutions.
2. Calibration of volumetric glassware (Burette, pipette and volumetric flask).
3. Preparation of standard oxalic acid. Standardization of NaOH and estimation of H2SO4 in the given solution (phenolphthalein).
4. Preparation of standard sodium carbonate solution, standardization of HCl (Methyl orange) and estimation of NaOH in the given solution. (Methyl orange or phenolphthalein).
5. Preparation of standard potassium bipthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).
6. Preparation of ZnSO4. Standardization of EDTA and estimation of total hardness of water using eriochrome black-T indicator.

7. Preparation of standard K2Cr2O7. Estimation of ferric/ferrous mixture using diphenylamine indicator.
8. Preparation of standard oxalic acid. Standardization of NaOH and estimation of acidity in vinegar.
9. Preparation of standard potassium bipthalate. Standardization of NaOH and estimation of alkalinity of given antacid.
10. Preparation of standard K2Cr2O7. Standardization of sodium thiosulphate and estimation of CuSO4

**REFERENCES:**


- Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
- Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
- Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,
- Principles of Practical Chemistry- M. Viswanathan
- Instrumental Methods of chemical Analysis B.K Sharma.
- Experiments in Physical Chemistry R.C. Das and B. Behra, Tata McGraw Hill
- Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House
- Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S. Chand and Co.
- Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
- General Chemistry experiment – Anil J Elias (University press).


**EVALUATION SCHEME FOR PRACTICAL EXAMINATION:**

| **Assessment Criteria** | **Marks** |
|---|---|
| Procedure writing, Marks – 05 | 05 |
| Major Experiment | 20 |
| Minor Experiment-Normality, Molarity calculations | 10 |
| Viva Voce | 05 |
| **TOTAL** | **40** |

| | |
|---|---|
| Program Name: B.Sc | Semester: II |
| Course Title: **BIOMOLECULES** | |
| Course Code: **DSC-2T SEPBC-201** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** provide fundamental insights on the types of Biomolecules; and their unique structural features. |
| **CO 2:** describe the chemical properties and biological importance of each biomolecule. |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 1 | 2 | 1 | 2 | 1 |

| Course Content | Hours |
|---|---|
| **Unit 1- Carbohydrates** | |
| • **Carbohydrates:** Definition, classification, biological importance. Monosaccharides: Configuration relationship of D-aldoses, D-ketoses. General Properties of aldoses and ketoses, oxidation, reduction, reducing property, formation of glycosides, acylation, methylation, condensation-phenyl hydrazine, addition-HCN, Inter-conversion of aldoses and ketoses by chemical method. Stereochemistry of Monosaccharides, (+) and (-), D and L, epimers, anomers,and diastereomers. Mutarotation. Structure of galactose, fructose, mannose and ribose.Elucidation of open chain structure and ring structure of glucose.Structure and biological importance ofaminosugars (Neuraminic acid and Muramic acid).Deoxy sugars, sugar acids.<br>• **Disaccharides:** Occurrence and structures of maltose, isomaltose, sucrose, lactose, and trehalose. Establishment of linkages in maltose. Biological importance of trehalose.<br>• **Polysaccharides:** Classification based on composition and biological role. Partial structure, occurrence and importance of starch, glycogen, inulin, cellulose, chitin, and pectin.<br>• **Glycosaminoglycans:** Occurrence, importance and the structure of the repeating units of heparin, hyaluronic acid, teichoic acid and chondroitin sulphate. Bacterial cell wall polysaccharide, peptidoglycans. | 16 |

| Unit 2- Aminoacids, peptides and proteins | |
|---|---|
| • **Amino acids**:Structure and classification of amino acids based on polarity. Reactions of amino groups acids with HNO2, Ninhydrin, LiAlH4, Phenyl isothiocyanate, Dansyl chloride, Fluorodinirobenzene, Hydrazine. D & L notation Zwitterionic properties. Concept of $P_{ka}$ and pI. Reaction of carboxyl group.D & L notation.<br>• **Peptides:** Formation and characteristic of peptide bond. Structure and biological importance of glutathione. Biological significance of valinomycin, leu-enkephalin and endorphins. Chemical synthesis of dipeptides by Merrifield solid phase synthesis.<br>• **Proteins:** Isolation-salting in and salting out, pH precipitation and solvent precipitation. Methods of purification-dialysis.<br>• Classification of proteins based on solubility, structure and functions with examples. Primary Structure of proteins, methods of determining N- and C-terminal aminoacids, amino acid composition. Sequencing by Edman's degradation method. **Secondary Structure** – α Helix.β-sheet, β-bend. **Tertiary structure:** Forces stabilizing the tertiarystructure. Structureof myoglobin. **Quaternary structure:** 3D structure of haemoglobin. Denaturation and renaturation of proteins.Anfinsen's experiment. | 16 |
| **Unit 3- Lipids and Nucleic acids** | |
| • Lipids: Classification and biological role. Fatty acids – Nomenclature of saturated and unsaturated fatty acids. Physiological properties of fatty acids.<br>• Acylglycerols: Mono, di and triacylglycerol. Saponification, saponification value, iodine value, acid value and their significance. Rancidity, Hydrolysis.<br>• Phosphoglycerides: Structure of lecithin (Phosphotidyl choline), cephalins, phosphotidyl inositol, phosphotidyl serine. Biological role of phopshoglycerides.<br>• Sphingolipids: Structure and importance of sphingomyelin. Glycosphingolipids: Composition, structure and importance of gangliosides and cerebrosides. Eicosanoids: Structure of PGE2, and PGF2α importance of prostaglandins. Biological roles of thromboxane, leukotrienes and prostaglandins.<br>• Plasma lipoproteins: Types-Chylomicrons, VLDL, LDL and HDL. Apolipoproteins and their functions.<br>• Nucleic acids:Composition of DNA and RNA .Structure of Nucleosides and nucleotides.Other functions of nucleotides-sources of energy, components of coenzyme and second messengers. Chargaff's rule. Watson and Crick model of DNA. RNA: Composition, types (mRNA, tRNAandrRNA), secondary structures of tRNA – clover leaf model. Nucleic acid Chemistry-UV absorption, effects of acids and alkali on DNA and RNA. Chemical reactions of DNA and RNA.Melting of DNA (Tm). | 16 |

**REFERENCES**


- Principles of Biochemistry (1982), A.L., Lehninger, Worth Publishers, Inc. New York.

- Outlines of Biochemistry E.E. Conn and P.K. Stumpf. (1976) WileyEastern, New Delhi.
- Biochemistryby L. Stryer (1995) W.H. Freeman Press, San Francisco, USA.
- Biochemistry, by Voet, D. and Voet, J.G. (2004). 3rd Edition, John Wiley & Sons, Inc.USA.
- Biochemistry by U. Sathyanarayana Books and Allied (P) Ltd. Kolkata, ISBN 087893-214-3,(2014).
- Text book of Biochemistry by J.L Jain (2016)
- Medical Biochemistry by Ramakrishnan (2012)
- Text Book of Biochemistry by D.M. Vasudevan (2018)
- Text Book of Biochemistry by A.C. Deb, 9th revised edition (2017)


**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: II |
| Course Title: **BIOMOLECULES** | |
| Course Code: **DSC-2P SEPBC-202** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 64 | Duration of SEA/Exam: 04 Hours |
| Hours/Week: 04 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| CO 1: understand the principles of reactions pertaining to different Biomolecules. |
| CO 2:qualitatively identify the presence of specific biomolecules when provided with solution of a mixture of biomolecules |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 1 | 1 | 1 |

## LIST OF PRACTICAL EXPERIMENTS:

1. Qualitative analysis of monosaccharides (Glucose and Fructose).
2. Qualitative analysis of di and polysaccharides.
    - Lactose, Maltose and Sucrose
    - Starch
3. Reactions of lipids: Triacylglycerol and cholesterol (Solubility, Acrolein, Salkowski and Lieberman-Burchard tests).
4. Precipitation reactions of proteins (Albumin).
5. Colour reactions of proteins (Albumin, Casein and Gelatin)
6. Qualitative analysis of amino acids (Arginine, Tyrosine, Tryptophan, Phenylalanine and Cysteine)
7. Reactions of nucleic acids: Diphenylamine test and orcinol test.

## REFERENCES:


- Practical Biochemistry, GeethaDamodaran, Jaypee, 2011
- Biochemical methods, S. Sadasivam, A. Manickam, 3rd Edition, New Age International Pvt Ltd, 2007
- An Introduction to Practical Biochemistry, David Plummer, 3rd edition 2017

- Laboratory manual in Biochemistry, J. Jayaraman 2011

**EVALUATION SCHEME FOR PRACTICAL EXAMINATION:**

| **Assessment Criteria** | **Marks** |
|---|---|
| Procedure writing | 05 |
| Major Experiment | 20 |
| Minor Experiment- comment on | 10 |
| Viva Voce | 05 |
| **TOTAL** | **40** |

| | |
|---|---|
| Program Name: B.Sc | Semester: III |
| Course Title: **BIOANALYTICAL TECHNIQUES** | |
| Course Code: **DSC-3T SEPBC-301** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| CO 1: Develop competence in handling various chromatographic, electrophoretic and isotopic techniques. |
| CO 2: Able to isolate and characterize different biological molecules. |
| CO 3: Explain principle of centrifugation and radioactivity and understand safety rules for handling radioisotopes in biology samples. |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | 1 | 1 | 2 |
| **CO2** | 3 | 3 | 2 | 2 | 1 | 1 |
| **CO3** | 2 | 3 | 2 | 1 | 1 | 3 |

| Course Content | Hours |
|---|---|
| **Unit 1-** | |
| **Chromatography**: General principles of chromatography – adsorption and partition. Principle, procedure and applications of: Paper chromatography – Ascending, descending and circular, 2D–chromatography, TLC. Column chromatography - gel filtration, ion – exchange chromatography, affinity chromatography, HPLC, FPLC, GLC. | 16 |
| **Unit 2** | |
| **Centrifugation:** Definition, sedimentation, sedimentation coefficient, angular velocity, centrifugal field, relative centrifugal field, Svedberg unit. Types – Preparative, differential, density gradient (Rate zonal and Isopycnic) – principle, procedure and applications. Types of rotors and their design. Ultracentrifugation-construction and applications.<br><br>**Radio isotopic methods:** Radioactivity, definition and types (Natural and artificial), characteristics of radioactive elements, units of radioactivity, Types of radioactive decay, Properties of α, β, γ radiations. Group displacement law, Decay law - decay constant, half-life period and average life of a radioactive element. Detection of | 16 |

| | |
|---|---|
| radioactivity – GM counter and scintillation counters (only principle and working). Applications of radioisotopes – 3H, 14C, 131I, 60Co and 32P. Biological effects of radiations. Safety measures in handling radioisotopes | |
| **Unit 3** | |
| **Electrophoresis:** Supporting media - paper, agarose and polyacrylamide. Chemistry of polymerization of acrylamide gels, procedure and applications of native PAGE, SDS-PAGE and agarose. Visualization techniques- comassive brilliant blue, silver stain, ethidium bromide, Principle and application of capillary electrophoresis and isoelectric focusing.<br>**Spectroscopy:** Dual nature of light, electromagnetic spectrum, electronic transition in spectroscopy. Beer-lambert law and its limitations, principle, design and application of UV-Visible spectrophotometer and colorimeter, determination of molar absorption coefficient of molecules. Principle and application of fluorimeter, IR, Mass and NMR spectroscopy. | 16 |

**REFERENCES**


- Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer2011
- Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology 8thEdn. Andreas Hoffman and Samuel Clockie, Ed., Cambridge University Press, 2018.
- Biochemistry and Molecular Biology; 5th Edn. D. Papachristodoulou, A. Snape, W.H. Elliott, and D. C. Elliott, Oxford University Press 2014
- Biophysical chemistry principle and techniques by Upadhyay and Upadhyay, Himalaya Publishing House
- Bioinstrumentation by L Veerakumari, MJP Publishers, Chennai.
- Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay and Nath – Himalaya Publ. House


**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: III |
| Course Title: **BIOANALYTICAL TECHNIQUES** | |
| Course Code: **DSC-3T SEPBC-301** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 64 | Duration of SEA/Exam: 04 Hours |
| Hours/Week: 04 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| CO 1: to provide experimental practice of analytical techniques in Biochemistry |
| CO 2: develop in handling instruments and understand its application in research work. |

**CO-PO Mapping Matrix**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | 1 | 1 | 1 |
| **CO2** | 2 | 3 | 2 | 2 | 1 | 2 |

**LIST OF PRACTICAL EXPERIMENTS:**

1. Separation of amino acids by circular paper chromatography
2. Separation of amino acids by TLC
3. Separation of carbohydrates by TLC
4. Separation of amino acids by Ascending paper chromatography
5. Separation of amino acids by Descending paper chromatography
6. Separation of plant pigments by column/paper chromatography
7. Verification of Beer's law.
8. Demonstration of absorption spectra for the color pigments.
9. Determination of Molar extinction coefficient of any colored compound.
10. Estimation of glucose by DNS method

**EVALUATION SCHEME FOR PRACTICAL EXAMINATION:**

| **Assessment Criteria** | **Marks** |
|---|---|
| Procedure writing | 05 |
| Major Experiment | 20 |
| Minor Experiment- comment on | 10 |
| Viva Voce | 05 |
| **TOTAL** | **40** |

| | |
|---|---|
| Program Name: B.Sc | Semester: III |
| Course Title: **CELLULAR BIOCHEMISTRY** | |
| Course Code: **DSE-1 SEPBC-303** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 32 | Duration of SEA/Exam: 02Hours |
| Hours/Week: 02 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| CO 1: Understand the basic structure and function of eukaryotic cells. |
| CO 2: Explain membrane transport mechanisms, distinguish apoptosis from necrosis, and describe GPCR and RTK signalling. |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 1 | 2 | 1 | 1 | 1 |

| Course Content | Hours |
|---|---|
| **Unit 1-** | |
| **Introduction to cells: Cells**: Types-Prokaryotic and eukaryotic cells, plant and animal cells. Structure, functions and differences.<br>• **Subcellular Structures:** Structure and Functions: Nucleus, chromosomes, mitochondria, chloroplast, ribosomes, endoplasmic reticulam, golgi complex, lysosomes, glyoxysomes and peroxisomes. Cytoskeletons- Distribution, types, structure and biological importance.<br>• **Plasma membrane :**Chemical composition, Structure (Fluid Mosaic model) and function. Membrane fluidity and factors affecting membrane fluidity | 16 |
| **Unit 2** | |
| • **Membrane transport:**<br>▪ Diffusion: Simple diffusion, Facilitated diffusion- Definition, example (Glucose transporter). Symport, uniport and antiport.<br>▪ Active transport: Primary active transport (Na+- K+ ATPase pump) and Secondary active transport (Na+- glucose transporter). Ion channel (voltage gated and ligand gated- acetyl choline receptors).<br>• **Cell death:** Definition, mechanism and differences between apoptosis and necrosis.<br>• **Cell signaling**: GPCRs, structure and mechanism. Tyrosine Kinase receptors. | 16 |

| | |
|---|---|
| Program Name: B.Sc | Semester: III |
| Course Title: **MICROBIAL BIOCHEMISTRY** | |
| Course Code: **DSE-2 SEPBC-304** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 32 | Duration of SEA/Exam: 02 Hours |
| Hours/Week: 02 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):** |
|---|
| Upon successful completion of this course, students will be able to: |
| **CO 1:** Explain germ theory, Koch's postulates, staining (Gram/acid-fast), sterilization, microscopes, microbial growth and factors. |
| **CO 2:** Identify media and isolation methods, serial dilution, fermentor uses (beer, milk products, penicillin), food preservation and antibiotic action |

**CO-PO Mapping Matrix**

| COs/ POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 1 |

| Course Content | Hours |
|---|---|
| **Unit 1- Study of Micro-organisms** | |
| • Spontaneous generation (abiogenesis), Biogenesis, Germ theory of Disease, Koch's Postulates.Microorganisms in biological world.Whittaker's Five-kingdom and threekingdom concept of living organisms (General characteristics of those groups).<br>• **Classification of Stains:** Simple and differential staining, Staining micro-organisms – principle and procedure of gram stain and acid fast stain.<br>• **Principles and methods of sterilization:** Hot Air Oven. Autoclave, Pressure Cooker. Different types of microscopes, construction and working principles of Simple microscope (dissection microscope)<br>• **Microbial growth and nutrition:** Major nutritional types of microorganisms. Nutritional requirements of microorganisms. Growth curve – phases of growth and their significance.<br>• **Factors affecting growth :** Temperature, Light, pH, Oxygen and Saline requirements. Measurement of growth by cell number (Haemocytometer) and cell mass (Turbidometer, photometer). | 16 |
| **Unit 2- Industrial Microbiology** | |

| | |
|---|---|
| • **Media** – types, cultivation of aerobic and anaerobic bacteria. Pure cultures and cultural characteristics; Serial dilution, Pure cultures by isolation -i) pour plate ii) spread plate iii) streak plate. Batch and continuous culture.Microbial spoilage of food and food preservation techniques. Microbial spoilage of food – Fruits, vegetables, meat, poultry, canned foods.<br>• Important methods of food preservations. Physical method- High temperature, Canning, Low temperature, Drying. Chemical method- Chemical preservatives- Salient features of the chemical preservatives.<br>• **Fermentors –** types and components. Production and importance – Alchoholic beverages (Beer and Wine), Fermented products of milk, antibiotic production ( penicillin).<br>• **Antibiotics:**Definition, Mechanism of action of penicillin, streptomycin, and chloramphenicol, antibiotic resistance in brief. | 16 |

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- Stainer, Ingharam, Wheelis and Painter. General Microbiology. 5th Edition. Macmillan Education, London.1987
- A Text book of Microbiology. Dubey , RC and Maheswari D K . S. Chand & Company Ltd., New Delhi. 2005

| | |
|---|---|
| Program Name: B.Sc | Semester: IV |
| Course Title: **ENZYMOLOGY AND METABOLISM I** | |
| Course Code**: DSC-4T SEPBC-401** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Explain the classification, structure, mechanism of action, and kinetics of enzymes, and analyse the factors affecting enzyme-catalysed reactions, including determination of $K_m$ and $V_{max}$ using the Lineweaver–Burk plot. |
| **CO 2**: Explain the major pathways of carbohydrate metabolism, their regulation, energetics, physiological significance, and their role in maintaining metabolic homeostasis. |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 3 | 2 | 2 | 1 |

| Course Content | Hours |
|---|---|
| **Unit 1- Introduction to Enzymes** | |
| • General characteristics, definition with examples of holoenzyme, apoenzyme, cofactors, coenzymes, metalloenzymes, abzymes, and ribozymes. Classification of enzymes based on IUBMB with examples.<br>• **Units of enzyme activity:** Specific activity and enzyme turnover number.Enzyme specificity, and the concept of an active site.<br>• **Theories of enzyme catalysis**-lock and key model, Koshland's induced fit theory. **Enzyme Kinetics**:Factors affecting the rate of enzyme-catalyzed reactions: Effect of substrate concentration, pH, and temperature. Michaelis-Menten equation (derivation not required). Lineweaver-Burk (L-B) plot.Determination of Km &Vmax from L-B plot and their significance. | 16 |
| **Unit 2- Enzyme inhibition** | |
| • Competitive, noncompetitive, and uncompetitive inhibition with suitable examples.Graphical representation by L-B plot, effect of inhibitor on Km &Vmax using LB plot.**Irreversible inhibition**—suicide inhibition. Allosteric enzymes, Isoenzymes, Multienzyme complex: Allosteric enzymes-characteristics with PFKand ATCase as examples.<br>• **Isoenzymes**-Properties & and biological role of LDH and Creatine Kinase | 16 |

| | |
|---|---|
| • **Multienzyme complex**: Pyruvate dehydrogenase complex and Fatty acyl CoA synthase-subunit composition & biological role. Applications of enzymes: Industrial & Medical applications | |
| **Unit 3- Metabolism I** | |
| • **Introduction to metabolism:** Catabolism, anabolism, compartmentalization of metabolic pathways.<br>• **Metabolism of Carbohydrates**: Reactions and energetics of glycolysis, entry of fructose, galactose, mannose, and lactose into glycolytic pathway. **Fates of pyruvate:** conversion of pyruvate to lactate, alcohol, and acetyl CoA. Cori cycle and futile cycle.Reactions and energetics of the TCA cycle, Amphibolic and integrating roles of the TCA cycle. Anaplerotic reactions. Regulatory steps of glycolysis and the TCA cycle. Gluconeogenesis pathway and significance.**Pentose phosphate pathway** and its significance.**Glycogen metabolism**: Glycogenolysis, glycogenesis & regulation. | 16 |

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- Biochemistry. By LubertStryer, 1- 6th Editions
- Stryer Biochemistry 4th Ed. (1995) W.H. Freeman Co., San Francisco, USA
- G.L. Zubay BIOCHEMISTRY 4th Ed. (1998) W.C. Brown Publishers, USA.
- Voet, D and Voet, J.G, (2009) Biochemistry, John Wiley and Sons, N.Y. USA. 
- Garret, R.H. and Grisham, C.M. (2005) Biochemistry, 3rd Edition. Thomson Learning INC.
- U.Satyanarayana and U.Chakrapani, Biochemistry, CBS Publishers and Disributors, 7th Edition
- DMVasudevan, Srikumari.S, KannanVaidyanathan, Textbook of Biochemistry for Medical students, 11th edition


**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: IV |
| Course Title: **ENZYMOLOGY** | |
| Course Code: **DSC-4P SEPBC-402** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 64 | Duration of SEA/Exam: 04 Hours |
| Hours/Week: 04 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Perform and analyze enzyme assays such as amylase, invertase, urease, and acid phosphatase using standard laboratory techniques. |
| **CO 2:** Determine enzyme activity, specific activity, and kinetic parameters like $K_m$ and $V_{max}$ from experimental data |
| **CO 3:** Study the effect of pH, temperature, substrate concentration, enzyme concentration, and salt concentration on enzyme activity. |

**CO-PO Mapping Matrix**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 3 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 1 | 1 |

## LIST OF PRACTICAL EXPERIMENTS:

Enzyme assay of alpha amylase/ Salivary amylase/β- amylase/ diastase

1. Construction of Maltose/glucose calibration curve by DNS method and determination of activity of amylase
2. Determination of specific activity of amylase
3. Determination of pH optimum of amylase.
4. Determination of Km and Vmax of amylase.
5. Determination of initial velocity [time kinetics] of amylase.
6. Determination of optimum temperature of amylase.
7. Effect of sodium chloride on amylase.
8. Effect of enzyme concentration.
9. Determination of activity of yeast invertase.
10. Isolation of Urease and demonstration of its activity.

11. Isolation of Acid phosphatase and demonstration of its activity.

## EVALUATION SCHEME FOR PRACTICAL EXAMINATION:

| **Assessment Criteria** | **Marks** |
|---|---|
| Procedure writing | 10 |
| Major Experiment | 25 |
| Viva Voce | 05 |
| **TOTAL** | **40** |

| | |
|---|---|
| Program Name: B.Sc | Semester: IV |
| Course Title: **NUTRITION** | |
| Course Code: **SEC-1SEPBC-403** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 64 | Duration of SEA/Exam: 04 Hours |
| Hours/Week: 04 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Perform quantitative analysis of food samples for carbohydrates, proteins, amino acids, lipids, and oils using standard biochemical methods. |
| **CO 2:** Determine important nutritional and quality parameters of food and oil samples, including BMR, protein content, peroxide value, iodine number, and acid value. |
| **CO 3**: Identify common food adulterants and understand their detection using simple qualitative tests. |

**CO-PO Mapping Matrix**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 2 | 3 | 1 | 2 | 1 |
| **CO3** | 3 | 3 | 2 | 1 | 2 | 1 |

## LIST OF PRACTICAL EXPERIMENTS:

1. Working of Bomb calorimeter.
2. Calculation of BMR.
3. Qualitative assessment of reducing sugars, starch, proteins, amino acids in a food sample.
4. Quantitative assessment of proteins in a dietary sample.
5. Quantitative assessment of amino acids in a food sample.
6. Qualitative assessment of lipids.
7. Isolation of oils from food samples using Soxhlet Apparatus.
8. Estimation of peroxide value of an oil sample.
9. Estimation of iodine number of an oil sample.
10. Estimation of acid value of an oil sample.
11. Qualitative assessment of food adulterants (Any two out of: Butter yellow, lead chromate & malachite green).

## EVALUATION SCHEME FOR PRACTICAL EXAMINATION:

| **Assessment Criteria** | **Marks** |
|---|---|
| Procedure writing | 10 |
| Major Experiment | 25 |
| Viva Voce | 05 |
| **TOTAL** | **40** |

| | |
|---|---|
| Program Name: B.Sc | Semester: IV |
| Course Title: **PLANT BIOCHEMISTRY** | |
| Course Code: **SEC-2 SEPBC-404** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 64 | Duration of SEA/Exam: 04 Hours |
| Hours/Week: 04 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Perform qualitative and quantitative analysis of plant tissues and extracts for starch, pigments, enzymes, phenols, flavonoids, tannins, alkaloids, and saponins. |
| **CO 2:** Use standard biochemical and phytochemical techniques such as iodine staining, paper chromatography, DCPIP reduction, catalase test, and Folin–Ciocalteu method for sample analysis |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 1 | 2 | 1 |

## LIST OF PRACTICAL EXPERIMENTS:

1. In situ staining of starch using Iodine, in a leaf section or layer, or plant tissue section.
2. Ascending paper chromatography for plant pigments (test tube method/ beaker method).
3. Reduction of DCPIP by plant tissue or leaf homogenate.
4. Qualitative assessment of Catalase enzyme activity.
5. Effect of pH on anthocyanins (ex. Beet juice, rose flower juice)
6. Qualitative assessment of flavonoids using aluminium chloride method.
7. Quantitative estimation of phenols or polyphenols using FC method.
8. Qualitative assessment of tannins.
9. Qualitative assessment of alkaloids.
10. Qualitative assessment of saponins

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4. Plant Biochemistry and Molecular Biology - P. Lea & Richard C Leegood., John Wiley & Sons. 1999
5. Introduction to Plant Biochemistry - Goodwin and Mercer. CBS Publisher and Distributors. 2005
6. Biochemistry and Molecular Biology of Plants - Buchanan, Greussem and Jones. American Society of Plant Physiologists. 2000
7. Natural Products from plants. Peter B. Kaufman, Leland J. Cseke, Sara Warber, James A. Duke, Harry L. Brielmann, CRC Press, Boca Raton 1999
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9. Plant Cell Tissue and Organ Culture: Fundamental Methods - O.L. Gamborg&G.C. Phillips Narosa Publishers, New Delhi, 1995.
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**EVALUATION SCHEME FOR PRACTICAL EXAMINATION:**

| **Assessment Criteria** | **Marks** |
|---|---|
| Procedure writing | 10 |
| Major Experiment | 25 |
| Viva Voce | 05 |
| **TOTAL** | **40** |

| | |
|---|---|
| Program Name: B.Sc | Semester: V |
| Course Title: **METABOLISM II AND CLINICAL BIOCHEMISTRY** | |
| Course Code: **DSC-5T SEPBC-501** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Explain the principles of bioenergetics and amino acid metabolism, including key pathways and regulatory concepts. |
| **CO 2:** Explain lipid metabolism and nucleic acid metabolism, including key pathways and regulatory concepts. |
| **CO 3:** Describe the biochemical basis, clinical significance, and diagnostic relevance of major metabolic disorders |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 3 | 1 | 1 | 1 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 1 |

| Course Content | Hours |
|---|---|
| **Unit 1- Bioenergetics and amino acid metabolism** | |
| • **Bioenergetics**:I and II laws of thermodynamics, Concept of enthalpy, entropy, freeenergy, equilibrium constant, Standard free energy change. Phosphorylation potential, and phosphoryl group transfers. ATP-ADP cycle. High energy compounds (PEP, 1,3, BPG and Thioesters). Chemical basis of high standard energy of hydrolysis of ATP. Outlines of substrate-level phosphorylation with examples. **Oxidative phosphorylation :** General electron carriers. Electron transport chain. Its, organization and function.Q cycle, and proton pumping, redox loop. Peter Mitchell's chemiosmotic hypothesis and proton motive force. Fo-F1 ATP synthase: Structure and mechanism of ATP synthesis. P/O ratio. Uncouplers and inhibitors of respiration: Rotenone, Antimycin A, Cyanide, and 2,4-DNP.<br>• **Aminoacid Metabolism**: Protein turnover, General mechanism of amino acid metabolism: Deamination- oxidative and non – oxidative deamination, transamination, decarboxylation (biologically important amines) and | 16 |

| | |
|---|---|
| desulphuration. Catabolism of carbon skeleton of amino acids, glycogenic and ketogenic amino acids.Urea cycle and its significance.Synthesis and catabolism of alanine, serine and cysteine. | |
| **Unit 2** | |
| • **Metabolism of Lipids:**<br>▪ Degradation of triacyl glycerol and phospholipids- action of lipases and phosholipases.<br>▪ Fatty acid degradation and types. Transport of fatty acids to mitochondria, β-oxidation of even numbered saturated fatty acid. Energetics of βoxidation with an example.<br>▪ Outline of biosynthesis of even numbered saturated fatty acids, Fatty acid synthase complex.<br>▪ Outline of Biosynthesis of cholesterol. Regulation of cholesterol biosynthesis.(Structures not necessary).<br>▪ Outline of metabolism of lipoproteins.<br>▪ Reverse cholesterol transport.<br>▪ Metabolism of ketone bodies: Formation, utilization and importance.<br>• **Nucleic Acid metabolism:**<br>Degradation of nucleic acids, action of nucleases-DNase I and II, RNase and phosphodiesterases. Catabolism of purines and pyrimidines. Salvage pathway.<br>De novo biosynthetic pathway of purine and pyrimidine nucleotides (Structures not necessary).<br>Conversion of ribonucleotides to deoxyribonucleotides. Inhibitorsof nucleotide biosynthesis: methotrexate,5FU. | 16 |
| **Unit 3** | |
| • **Introduction:** Basic concept of clinical biochemistry - Definition and scope of clinical biochemistry in diagnosis, quality control-external and internal quality controll, accuracy, precision, specificity. Collection and preservation of blood and urine.<br>• **Disorders:**<br>▪ **Carbohydrate metabolism**: Blood sugar level and its clinical significance- Hypo and hyperglycemia. Diabetes mellitus-defintion, clinical features, biochemical and metabolic changes(in brief). Glycogen storage diseases, Frucosuria, Galactosemia.<br>▪ **Lipid metabolism**: Atherosclerosis, Niemann Pick disease, Gaucher's disease.<br>▪ **Amino acid metabolism**-Alkaptonuria and phenylketonuria.<br>▪ **Purine metaboism:** Gout, LeschNyhan syndrome.<br>▪ **Liver**:Jaundice, hemolytic, hepatic and obstructive jaundice. Conjugated and unconjugatedbilirubin, bile pigment levels in blood and urine.<br>• **Clinical Enzymology:**Functionaland non functional plasma enzymes, isozymes and diagnostic tests. Enzyme pattern in health and diseases, LDH, CPK, SGOT&SGPT and Troponin | 16 |

| | |
|---|---|
| | |

**REFERENCES**


- Lehninger Principles of Biochemistry, 1 - 6th Editions,
- Biochemistry. By LubertStryer, 1- 6th Editions
- Stryer Biochemistry 4th Ed. (1995) W.H. Freeman Co., San Francisco, USA
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- Michael Murphy, Rajeev Srivastava, Kevin Deans, Clinical Biochemistry,Elsevier, 7th Edition
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**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: V |
| Course Title: **MOLECULAR BIOLOGY AND GENETIC ENGINEERING** | |
| Course Code: **DSC-6T SEPBC-502** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Explain DNA replication and mutation, including the types, mechanisms, enzymes involved, and the molecular basis of spontaneous and induced mutations. |
| **CO 2**: Explain transcription and translation in prokaryotes, including the transcription and translation machinery, initiation, elongation, termination, and regulation of gene expression |
| **CO 3:** Describe the principles and tools of genetic engineering, including recombinant DNA technology, gene cloning, blotting, PCR, sequencing, and DNA fingerprinting. |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 3 | 1 | 1 | 1 |
| **CO2** | 3 | 1 | 3 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 1 |

| Course Content | Hours |
|---|---|
| **Unit 1-** | |
| **Introduction –**<br>• DNA as a genetic material, Griffith and Hershey, Chase experiment.<br>• Degradation of nucleic acids- pancreatic RNase, phosphodiesterase, DNase I & II.<br>• **DNA Replication** - Types of replications (conservative, semi conservative and dispersive). Experimental verification of semiconservative mode of replication. Enzymes involved in replication. Mechanism of replication in prokaryotes, origin and replication fork, role of DNA polymerase. Discontinuous DNA synthesis.RNA primer in DNA synthesis. DNA ligase and its role.RNA replication- Role of RNA replicase.<br>• **Mutation** - Concepts of mutation, Mutagens (chemical and physical), Molecular basis of mutation: spontaneous and induced mutation, effects of HNO2 and UV- radiations, Point mutations: concept of missense, nonsense and frame shift mutation. | 16 |

| | |
|---|---|
| **Unit 2** | |
| • **Transcription in Prokaryotes:** Transcription factors and machinery, formation of initiation complex, activators and repressors, Role of RNA polymerase, elongation and termination. Post transcriptional modification Reverse transcription<br>• **Genetic code**: General features, coding properties of t-RNA, wobble hypothesis.<br>• **Translation in Prokaryotes:** structure of tRNA(cloverleaf model).A brief account of ribosome's, activation of amino acid. Formation of Initiation complex, elongation and termination. Post translational modification and inhibitors of protein synthesis. Gene regulation: Regulation of gene expression in prokaryotes and its types, Operon concept- Lac operon, Trpoperon. | 16 |
| **Unit 3** | |
| **Genetic Engineering-**<br>• Brief history and principles of genetic engineering, molecular tools of genetic engineering- Enzymes used in Recombinant DNA technology (rDNA) technology - Types, detail account of restriction endonuclease- types and their functions, ligase.<br>• Vectors (cloning vehicles) -Salient features of vectors, plasmids, bacteriophage, cosmid, artificial chromosomal vectors.<br>• Methods of gene transfer- Transformation, Conjugation, Electroporation, Liposome mediated gene transfer and direct transfer of DNA<br>**Gene cloning strategies-**<br>Cloning from genomic DNA - Construction of chimeric DNA.Introduction of chimeric vectors to the host cell.Selection of transformed cell by replica plating. Genomic library and its construction, c-DNA synthesis<br>**Basic techniques in genetic engineering-**<br>• Blotting techniques - Types (Southern, Northern and Western) and their applications. DNA sequencing method-PCR: Principle, procedure and applications. Microarray of gene probes, DNA finger printing, DNA markers in diseases, RFLP, VNTR and SNP's.<br>• **Applications of r-DNA technology-** Insulin in Diabetes, Recombinant vaccines, transgenic animals, transgenic plants, Human genome project, gene therapy. Advantages and disadvantages of r-DNA technology in society | 16 |

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- Molecular Biology–David Friefelder, Narosa Publication House Pvt.Ltd..New Delhi,2020
- Principles of Biochemistry, Donald Voet, Judith G

**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: v |
| Course Title: **METABOLISM AND CLINICAL BIOCHEMISTRY** | |
| Course Code: **DSC-5P SEPBC-503** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 64 | Duration of SEA/Exam: 04 Hours |
| Hours/Week: 04 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Perform quantitative estimation of important biochemical constituents such as proteins, sugars, urea, uric acid, phosphate, keto acids, and RNA using standard analytical methods. |
| **CO 2:** Determine the activity of clinically important enzymes such as SGPT and carry out qualitative analysis of normal and abnormal urine constituents. |
| **CO 3:** Understand the principles and application of routine clinical biochemical tests in diagnosis and disease monitoring |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 1 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 1 |

## LIST OF PRACTICAL EXPERIMENTS:

1. Estimation of protein by Biuret method.
2. Estimation of protein by Lowry's method.
3. Estimation of sugar by Folin-Wu method.
4. Estimation of Urea by DAMO method.
5. Estimation of Keto acid by DNPH method.
6. Determination of Uric acid.
7. Estimation of phosphate by Fiske-Subbarao method.
8. Determination of activity of SGPT.
9. Qualitative tests of urine for normal and abnormal constituents.
10. Estimation of RNA by Orcinol method.
11. Estimation of DNA by DPA method.
12. Report: Visit to scientific / research institute-Tour report. Or, INTERNSHIP, Or, any other alternative assignment decided by the department.

## EVALUATION SCHEME FOR PRACTICAL EXAMINATION:

| **Assessment Criteria** | **Marks** |
|---|---|
| Procedure writing | 05 |
| Major Experiment | 20 |
| Minor Experiment- comment on | 10 |
| Viva Voce | 05 |
| **TOTAL** | **40** |

| | |
|---|---|
| Program Name: B.Sc | Semester: VI |
| Course Title: **HUMAN PHYSIOLOGY** | |
| Course Code: **DSC-7T SEPBC-601** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Understand the structure and functions of major human organ systems. |
| **CO 2**: Explain the physiological processes that maintain homeostasis and normal body functions |

**CO-PO Mapping Matrix**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 1 | 3 | 1 | 1 | 1 |

| Course Content | Hours |
|---|---|
| **Unit 1-** | |
| • **Introduction to Human Physiology** Overview and definition; levels of structural organization and organ system. Homeostasis and control mechanisms (negative and positive feedback mechanisms).<br>• **Nervous system:** Types of neurons, generalized structure of multipolar neuron. Resting membrane potential, Action potential, Transmission of nerve impulse along an axon and across a synapse. Neurotransmitters (Excitatory and inhibitory) and inhibitors of neurotransmission.<br>• **Respiratory system**: Anatomy and functions of respiratory system, structure and functions of lungs, gas exchange mechanism, biochemical events in the transport of gases & factors affecting, Oxygen dissociation curve, Chloride shift, Haldane and Bohr's effect, role of lungs in acid-base balance.<br>• **Cardio-vascular system:** Structure and functions of heart. Blood vessels– types, Overview & functions: Cardiac cycle, cardiac output, regulation of CVS, blood pressure, heart rate, ECG. | 16 |
| **Unit 2** | |
| • **Skeletal system:** Types of muscles. Ultrastructure of skeletal muscle. Contractile and regulatory proteins of muscle. Sliding filament model of skeletal muscle contraction.<br>• **Bone:** Classification of bones; Long bone -Composition and structure of long bone, growth and remodelling of long bone. Factors affecting its growth. | 16 |

| | |
|---|---|
| • **Excretory system:** Structure of the Nephron, formation of urine – Glomerular filtration, tubular reabsorption and secretions. Role of kidney in acid base balance.<br>• **Body fluids:** Blood volume, composition and functions, RBC, WBC and platelets: structure and functions. Types of plasma proteins and their function. Mechanism of blood coagulation (intrinsic and extrinsic pathway).Anticoagulants. Composition and function: Cerebrospinal fluid and Lymph. Blood brain Barrier. Blood buffers-types, composition and function. Sickle cell anaemia and Thalassemia | |
| **Unit 3** | |
| • **Digestive System and GIT:** Anatomy of GIT and accessory organs. Composition and function of saliva, gastric juice, intestinal juice, bile juice, pancreatic juice. Gastric motility-peristalsis, segmentation and sphincter control. Digestion, absorption and transportation of carbohydrates, proteins and lipids. Hormones of GIT.<br>• **Liver:** Structure of a lobule, functions – metabolic, storage and detoxification.<br>• **Endocrine system:** Organisation of endocrine system -Endocrine glands and their secretions, classification of hormones based on structure and site of production. Hierarchy, interplay, dynamic balance and regulation of hormone secretions. Functions of the hormones of Hypothalamus, Pituitary (GH, ACTH, TSH, FSH, LH, oxytocin and ADH), Adrenal (Aldosterone, Cortisol & Cortisone), Thyroid (T3&T4), Pancreas (Insulin and Glucagon) and Gonads (testosterone, estradiol and progesterone).Hypo and hyper production of hormones.General mechanism of peptide and steroid hormone action.Concept of second messengers.Eg: cAMP, DAG, IP3, Gprotein. | 16 |

**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: III |
| Course Title: **IMMUNOLOGY AND TOXICOLOGY** | |
| Course Code: **DSC-8T SEPBC-604** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Understand the structure and functions of the immune system, immunoglobulins, antigens, and the principles of innate and adaptive immunity. |
| **CO 2:** Explain immunological techniques, hypersensitivity, vaccines, autoimmunity, and antibody production. |
| **CO 3:** Describe the basic principles of toxicology, toxicokinetics, mechanisms of toxicity, and antidotal therapy |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 1 | 3 | 1 | 1 | 1 |

| Course Content | Hours |
|---|---|
| **Unit 1-** | |
| • **Introduction:** Cells and Organs of immune system: Primary and secondary lymphoid organs, Bone marrow, Thymus, Spleen. Lymphoid cells, T lymphocytes, types and B lymphocytes, null cells, Mononuclear cells, Macrophages and Granulocytic cells.<br>• **Immunity:** Innate and adaptive immunity. Innate immunity (non-specific), - Anatomic, physical, phagocytic and inflammatory barriers. Adaptive (specific) immunity: Active and Passive immunity. Formation and functions of T and B lymphocytes (In brief). Humoral and cell mediated immunity. Recognition of antigens by T and B lymphocytes, Processing and presentation of antigens.<br>• **Antigens:** Types, characteristics, antigenicity, immunogenicity, Immunogens and factors influencing immunogenicity, epitopes, haptens and adjuvants. | 16 |
| **Unit 2** | |
| • **Immunoglobins:** Generalised structure of antibody, classes and functions of immunoglobulins. Antigenic determinants of immunoglobulins.Theories of | 16 |

| | |
|---|---|
| antibody production, clonal expansion theory. Monoclonal antibodies and its production by any one method and applications. Polyclonal antibodies.<br>• **T and B lymphocytes:** T cell receptors, maturation, activation and differentiation. Bcell receptors, maturation, activation and proliferation. Cytokines- Interferon and Interleukins, importance and functions.<br>• **Immunological techniques:** Antigen antibody reactions-precipitation and agglutination reactions in immunodiffusion (Ouchterlony and Radial Immunodiffusion), immunoelectrophoresis. ELISA, RIA.<br>• **Hypersensitivity reactions:** Definition, Types (I, II, III, IV and V), based on time and symptoms.<br>• **Vaccines-**Types, Active and passive immunization, preparation of vaccines (Rabies vaccine).<br>• **Auto immune disorders:** Definition, Rheumatoid arthritis, Myasthenia gravis, Parkinson disease. | |
| **Unit 3** | |
| • **Toxicology**: Scope of toxicology. Toxins and toxicants. Classification of toxins based on source, target system. Toxicity-influencing factors: Species and strains, age, sex, nutritional status, hormones, circadian rhythms and environmental factors. Dose response relationships, synergism, and antagonism. Determination of ED50 and LD50.Acute and chronic exposure.<br>• **Toxicokinetics:** Absorption and transportation. Mechanism of Toxicity: Organophosphates, Mercury, Aflatoxins . Antidotal Therapy for Toxins: Types. Procedures that decrease the absorption and translocation of toxicants. Physical removal of poisons by emetics, gastric lavage, and cathartics. Drugs for the deactivation of toxins | 16 |

**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: VI |
| Course Title: **PHYSIOLOGY AND IMMUNOLOGY** | |
| Course Code: **DSC-6P SEPBC-603** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 64 | Duration of SEA/Exam: 04 Hours |
| Hours/Week: 04 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Perform quantitative estimation of biochemical constituents such as amino acids, cholesterol, calcium, phosphate, creatinine, iron, and haemoglobin using standard analytical methods. |
| **CO 2:** Understand the principles and applications of biochemical assays and laboratory techniques used in clinical diagnosis and sample analysis. |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 3 | 2 | 2 | 1 |

## LIST OF PRACTICAL EXPERIMENTS:

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of Cholesterol by Zak's method.
3. Estimation of ammonia in urine.
4. Estimation of titrable acidity in urine.
5. Estimation of amino acid by Sorenson's formal titration method.
6. Estimation of Calcium in serum.
7. Estimation of Inorganic phosphorus by Fiske Subbarao method.
8. Estimation of Creatinine by Jaffe's method.
9. Determination of Clotting time and Bleeding time.
10. Blood typing
11. Determination of % of Haemoglobin.
12. Estimation of Iron by Wong's method.
13. Radial immunodiffusion/ Ouchterlony double diffusion.
14. Determination of RBC and WBC count by Haemocytometer.

## EVALUATION SCHEME FOR PRACTICAL EXAMINATION:

| **Assessment Criteria** | **Marks** |
|---|---|
| Procedure writing | 05 |
| Major Experiment | 20 |
| Minor Experiment- comment on | 10 |
| Viva Voce | 05 |
| **TOTAL** | **40** |

**Syllabus for B.Sc. Biochemistry- 5 & 6 Semesters**

**FOR 2026-27 BATCH THE BATCHES WHICH ARE ENTERING 5th SEMESTER**

**DURING JULY-AUGUST 2026**

| | |
|---|---|
| Program Name: B.Sc | Semester: V |
| Course Title: **METABOLISM II AND CLINICAL BIOCHEMISTRY** | |
| Course Code: **DSC-5T SEPBC-501** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):** |
|---|
| Upon successful completion of this course, students will be able to: |
| **CO 1:** Explain the principles of bioenergetics and amino acid metabolism, including key pathways and regulatory concepts. |
| **CO 2:** Explain lipid metabolism and nucleic acid metabolism, including key pathways and regulatory concepts. |
| **CO 3:** Describe the biochemical basis, clinical significance, and diagnostic relevance of major metabolic disorders |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 1 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 1 |

| Course Content | Hours |
|---|---|
| **Unit 1- Bioenergetics and amino acid metabolism** | |
| • **Bioenergetics**:I and II laws of thermodynamics, Concept of enthalpy, entropy, freeenergy,equilibrium constant, Standard free energy change. Phosphorylation potential, and phosphoryl group transfers. ATP-ADP cycle. High energy compounds (PEP, 1,3, BPG and Thioesters). Chemical basis of high standard energy of hydrolysis of ATP.Outlines of substrate-level phosphorylation with examples.**Oxidative phosphorylation:** General electron carriers. Electron transport chain.Its, organization and function.Q cycle, and proton pumping, redox loop.Peter Mitchell's chemiosmotic hypothesis and proton motive force. Fo-F1 ATP synthase: Structure and mechanism of ATP synthesis. P/O | 16 |

| | |
|---|---|
| ratio.Uncouplers and inhibitors of respiration: Rotenone, Antimycin A, Cyanide, and 2,4-DNP.<br>• **Aminoacid Metabolism**: Protein turnover, General mechanism of amino acid metabolism: Deamination- oxidative and non – oxidative deamination, transamination, decarboxylation (biologically important amines) and desulphuration. Catabolism of carbon skeleton of amino acids, glycogenic and ketogenic amino acids.Urea cycle and its significance.Synthesis and catabolism of alanine, serine and cysteine. | |
| **Unit 2 Metabolism of lipids and Nucleic acid** | |
| • **Metabolism of lipid: -** Oxidation of fatty acids – Types - α, β & Ω Oxidation. Carnitine cycle, β – oxidation of Palmitic acid and its energetic. Ketone bodies – Formation and its significance. Biosynthesis of palmitate. Fatty acid synthase complex. Biosynthesis and degradation of triglycerides. Degradation of phospholipids.<br>• **Cholesterol -** Outline of biosynthesis, regulation and its degradation (Structures not necessary), Reverse cholesterol transport**..** Lipoprotein Metabolism.<br>• **Nucleic Acid metabolism:** Degradation of nucleic acids, action of nucleases- DNase I and II, RNase and phosphodiesterases. Catabolism of purines and pyrimidines. Salvage pathway. De novo biosynthetic pathway of purine and pyrimidine nucleotides (Structures not necessary).Conversion of ribonucleotides to deoxyribonucleotides. Inhibitorsof nucleotide biosynthesis: methotrexate, 5FU. | 16 |
| **Unit 3** | |
| **Introduction:** Definition, scope, units, collection & preservation of biological fluids-Blood, urine and CSF<br><br>**Urine:** Normal composition– volume, pH, color, specific gravity. Normal constituents & clinical significance of their variations – Urea, Uric acid, Creatinine & Bile pigments. Abnormal constituents and their clinical significance – Glucose, Albumin & Ketone bodies.<br><br>**Blood:** Anticoagulants. Serum and plasma. Normal constituents of blood & their variation in abnormal conditions – Urea, Uric acid, Creatinine, Glucose, Bilirubin, Total protein and Albumin / Globulin ratio.<br><br>**CSF :** Composition and Biological importance<br>• **Disorders:**<br>▪ **Carbohydrate metabolism**: Blood sugar level and its clinical significance- Hypo and hyperglycemia. Diabetes mellitus-defintion, clinical features, biochemical and metabolic changes (in brief). Glycogen storage diseases, Frucosuria, Galactosemia.<br>▪ **Lipid metabolism**: Atherosclerosis, Niemann Pick disease, Gaucher's disease.<br>▪ **Amino acid metabolism-**Alkaptonuria and phenylketonuria. | 16 |

| | |
|---|---|
| ▪ **Purine metaboism:** Gout, LeschNyhan syndrome.<br>▪ **Liver**:Jaundice, hemolytic, hepatic and obstructive jaundice. Conjugated and unconjugated bilirubin, bile pigment levels in blood and urine.<br>• **Clinical Enzymology:** Functional and non functional plasma enzymes, isozymes and diagnostic tests. Enzyme pattern in health and diseases, LDH, CPK, SGOT&SGPT and Troponin | |

**REFERENCES**


- Lehninger Principles of Biochemistry, 1 - 6th Editions,
- Biochemistry. By LubertStryer, 1- 6th Editions
- Stryer Biochemistry 4th Ed. (1995) W.H. Freeman Co., San Francisco, USA
- G.L. Zubay BIOCHEMISTRY 4th Ed. (1998) W.C. Brown Publishers, USA.
- Voet, D and Voet, J.G, (2009) Biochemistry, John Wiley and Sons, N.Y. USA.
- Garret, R.H. and Grisham, C.M. (2005) Biochemistry, 3rd Edition. Thomson Learning INC.
- U.Satyanarayana and U.Chakrapani, Biochemistry, CBS Publishers and Disributors, 7th Edition
- DMVasudevan, Srikumari.S, KannanVaidyanathan, Textbook of Biochemistry for Medical students, 11th edition
- Thomas M Devlin, Textbook of Biochemistry with Clinical Correlations, Jhon Wiley and Sons inc. 6th Edition
- Michael Murphy, Rajeev Srivastava, Kevin Deans, Clinical Biochemistry,Elsevier, 7th Edition
- Nessar Ahmed, Clinical Biochemistry, OUP Oxford, 2nd Edition


**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: V |
| Course Title: **MOLECULAR BIOLOGY AND GENETIC ENGINEERING** | |
| Course Code: **DSC-6T SEPBC-502** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Explain DNA replication and mutation, including the types, mechanisms, enzymes involved, and the molecular basis of spontaneous and induced mutations. |
| **CO 2**: Explain transcription and translation in prokaryotes, including the transcription and translation machinery, initiation, elongation, termination, and regulation of gene expression |
| **CO 3:** Describe the principles and tools of genetic engineering, including recombinant DNA technology, gene cloning, blotting, PCR, sequencing, and DNA fingerprinting. |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 |
|---|---|---|---|---|
| **CO1** | 3 | 1 | 3 | 1 |
| **CO2** | 3 | 1 | 3 | 1 |
| **CO3** | 3 | 3 | 2 | 2 |

| **Course Content** | **Hours** |
|---|---|
| **Unit 1-** | |
| • **Introduction** - DNA as a genetic material, Griffith and Hershey, Chase experiment. Degradation of nucleic acids- pancreatic RNase, phosphodiesterase, DNase I & II.<br>• **DNA Replication** - Types of replications (conservative, semi conservative and dispersive). Experimental verification of semiconservative mode of replication. Enzymes involved in replication. Mechanism of replication in prokaryotes, origin and replication fork, role of DNA polymerase. Discontinuous DNA synthesis.RNA primer in DNA synthesis. DNA ligase and its role.RNA replication- Role of RNA replicase.<br>• **Mutation** - Concepts of mutation, Mutagens (chemical and physical), Molecular basis of mutation: spontaneous and induced mutation, effects of HNO2 and UV- radiations, Point mutations: concept of missense, nonsense and frame shift mutation. | 16 |
| **Unit 2** | |

| | |
|---|---|
| • **Transcription in Prokaryotes:** Transcription factors and machinery, formation of initiation complex, activators and repressors, Role of RNA polymerase, elongation and termination. Post transcriptional modification Reverse transcription<br>• **Genetic code**: General features, coding properties of t-RNA, wobble hypothesis.<br>• **Translation in Prokaryotes:** structure of tRNA(cloverleaf model).A brief account of ribosome's, activation of amino acid. Formation of Initiation complex, elongation and termination. Post translational modification and inhibitors of protein synthesis. Gene regulation: Regulation of gene expression in prokaryotes and its types, Operon concept- Lac operon, Trpoperon. | 16 |
| **Unit 3** | |
| • **Genetic Engineering-** Brief history and principles of genetic engineering, molecular tools of genetic engineering- Enzymes used in Recombinant DNA technology (rDNA) technology - Types, detail account of restriction endonuclease- types and their functions, ligase. Vectors (cloning vehicles) - Salient features of vectors, plasmids, bacteriophage, cosmid, artificial chromosomal vectors. Methods of gene transfer- Transformation, Conjugation, Electroporation, Liposome mediated gene transfer and direct transfer of DNA<br>• **Gene cloning strategies-** Cloning from genomic DNA - Construction of chimeric DNA.Introduction of chimeric vectors to the host cell.Selection of transformed cell by replica plating. Genomic library and its construction, c-DNA synthesis<br>• **Basic techniques in genetic engineering-** Blotting techniques - Types (Southern, Northern and Western) and their applications. DNA sequencing method-PCR: Principle, procedure and applications. Microarray of gene probes, DNA finger printing, DNA markers in diseases, RFLP, VNTR and SNP's.<br>• **Applications of r-DNA technology-** Insulin in Diabetes, Recombinant vaccines, transgenic animals, transgenic plants, Human genome project, gene therapy. Advantages and disadvantages of r-DNA technology in society | 16 |

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- Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene 6th edition. Cold Spring HarborLab.Press, Pearson Pub.
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- Owen, Judith A., Jenni Punt, and Sharon A. Stranford. Kuby immunology. New York: WH Freeman, 2013.

- Molecular Biology–David Friefelder, Narosa Publication House Pvt.Ltd..New Delhi,2020
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| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: v |
| Course Title: **METABOLISM AND CLINICAL BIOCHEMISTRY** | |
| Course Code: **DSC-5P SEPBC-503** | No of credits: 02 (3:0:0) |
| Total Contact Hours: 64 | Duration of SEA/Exam: 04 Hours |
| Hours/Week: 04 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Perform quantitative estimation of important biochemical constituents such as proteins, sugars, urea, uric acid, phosphate, keto acids, and RNA using standard analytical methods. |
| **CO 2:** Determine the activity of clinically important enzymes such as SGPT and carry out qualitative analysis of normal and abnormal urine constituents. |
| **CO 3:** Understand the principles and application of routine clinical biochemical tests in diagnosis and disease monitoring |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 1 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 1 |

## LIST OF PRACTICAL EXPERIMENTS:

1. Estimation of protein by Biuret method.
2. Estimation of protein by Lowry's method.
3. Estimation of sugar by Folin-Wu method.
4. Estimation of Urea by DAMO method.
5. Estimation of Keto acid by DNPH method.
6. Determination of Uric acid.
7. Estimation of phosphate by Fiske-Subbarao method.
8. Determination of activity of SGPT.
9. Qualitative tests of urine for normal and abnormal constituents.
10. Estimation of RNA by Orcinol method.

11. Estimation of DNA by DPA method.
**12.** Report: Visit to scientific / research institute-Tour report. Or, INTERNSHIP, Or, any other alternative assignment decided by the department**.**

**EVALUATION SCHEME FOR PRACTICAL EXAMINATION:**

| **Assessment Criteria** | **Marks** |
|---|---|
| Procedure writing | 05 |
| Major Experiment | 20 |
| Minor Experiment- comment on | 10 |
| Viva Voce | 05 |
| **TOTAL** | **40** |

| | |
|---|---|
| Program Name: B.Sc | Semester: VI |
| Course Title: **HUMAN PHYSIOLOGY** | |
| Course Code: **DSC-7T SEPBC-601** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Understand the structure and functions of major human organ systems. |
| **CO 2**: Explain the physiological processes that maintain homeostasis and normal body functions |

**CO-PO Mapping Matrix**

| CO / PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 1 | 3 | 1 | 1 | 1 |

| **Course Content** | **Hours** |
|---|---|
| **Unit 1-** | |
| • **Introduction to Human Physiology** Overview and definition; levels of structural organization and organ system.Homeostasis and control mechanisms (negative and positive feedback mechanisms).<br>• **Nervous system:** Types of neurons, generalized structure of multipolar neuron. Resting membrane potential, Action potential, Transmission of nerve impulse along an axon and across a synapse.Neurotransmitters (Excitatory and inhibitory) and inhibitors of neurotransmission.<br>• **Respiratory system**: Anatomy and functions of respiratory system, structure and functions of lungs, gas exchange mechanism, biochemical events in the transport of gases & factors affecting, Oxygen dissociation curve, Chloride shift, Haldane and Bohr's effect, role of lungs in acid-base balance.<br>• **Cardio-vascular system:** Structure and functions of heart. Blood vessels– types, Overview & functions: Cardiac cycle, cardiac output, regulation of CVS, blood pressure, heart rate, ECG. | 16 |
| **Unit 2** | |
| • **Skeletal system:** Types of muscles. Ultrastructure of skeletal | 16 |

| | |
|---|---|
| muscle.Contractile and regulatory proteins of muscle.Sliding filament model of skeletal muscle contraction.<br>• **Bone:** Classification of bones; Long bone -Composition and structure of long bone, growth and remodelling of long bone. Factors affecting its growth.<br>• **Excretory system:** Structure of the Nephron, formation of urine – Glomerular filtration, tubular reabsorption and secretions. Role of kidney in acid base balance.<br>• **Body fluids:** Blood volume, composition and functions, RBC, WBC and platelets: structure and functions. Types of plasma proteins and their function.Mechanism of blood coagulation (intrinsic and extrinsic pathway).Anticoagulants. Composition and function: Cerebrospinal fluid and Lymph. Blood brain Barrier. Blood buffers-types, composition and function. Sickle cell anaemia and Thalassemia | |
| **Unit 3** | |
| • **Digestive System and GIT:** Anatomy of GIT and accessory organs. Composition and function of saliva, gastric juice, intestinal juice, bile juice, pancreatic juice. Gastric motility-peristalsis, segmentation and sphincter control. Digestion, absorption and transportation of carbohydrates, proteins and lipids. Hormones of GIT.<br>• **Liver:** Structure of a lobule, functions – metabolic, storage and detoxification.<br>• **Endocrine system:** Organisation of endocrine system -Endocrine glands and their secretions, classification of hormones based on structure and site of production.Hierarchy, interplay, dynamic balance and regulation of hormone secretions.Functions of the hormones of Hypothalamus, Pituitary (GH, ACTH, TSH, FSH, LH, oxytocin and ADH), Adrenal (Aldosterone, Cortisol & Cortisone), Thyroid (T3&T4), Pancreas (Insulin and Glucagon) and Gonads (testosterone, estradiol and progesterone).Hypo and hyper production of hormones.General mechanism of peptide and steroid hormone action.Concept of second messengers.Eg: cAMP, DAG, IP3, Gprotein. | 16 |

**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: VI |
| Course Title: **IMMUNOLOGY AND TOXICOLOGY** | |
| Course Code: **DSC-8T SEPBC-604** | No of credits: 03 (3:0:0) |
| Total Contact Hours: 48 | Duration of SEA/Exam: 03 Hours |
| Hours/Week: 03 | |
| Formative Assessment Marks: 20 | Summative Assess Marks: 80 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Understand the structure and functions of the immune system, immunoglobulins, antigens, and the principles of innate and adaptive immunity. |
| **CO 2:** Explain immunological techniques, hypersensitivity, vaccines, autoimmunity, and antibody production. |
| **CO 3:** Describe the basic principles of toxicology, toxicokinetics, mechanisms of toxicity, and antidotal therapy |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 1 | 3 | 1 | 1 | 1 |

| **Course Content** | **Hours** |
|---|---|
| **Unit 1-** | |
| • **Introduction:** Cells and Organs of immune system: Primary and secondary lymphoid organs, Bone marrow, Thymus, Spleen. Lymphoid cells, T lymphocytes, types and B lymphocytes, null cells, Mononuclear cells, Macrophages and Granulocytic cells.<br>• **Immunity:** Innate and adaptive immunity. Innate immunity (non-specific), - Anatomic, physical, phagocytic and inflammatory barriers. Adaptive (specific) immunity: Active and Passive immunity. Formation and functions of T and B lymphocytes (In brief). Humoral and cell mediated immunity. Recognition of antigens by T and B lymphocytes, Processing and presentation of antigens.<br>• **Antigens:** Types, characteristics, antigenicity, immunogenicity, Immunogens and factors influencing immunogenicity, epitopes, haptens and adjuvants. | 16 |
| **Unit 2** | |

| | |
|---|---|
| • **Immunoglobins:** Generalised structure of antibody, classes and functions of immunoglobulins. Antigenic determinants of immunoglobulins.Theories of antibody production, clonal expansion theory.Monoclonal antibodies and its production by any one method and applications.Polyclonal antibodies.<br>• **T and B lymphocytes:** T cell receptors, maturation, activation and differentiation. Bcell receptors, maturation, activation and proliferation.Cytokines- Interferon and Interleukins, importance and functions.<br>• **Immunological techniques:** Antigen antibody reactions-precipitation and agglutination reactions in immunodiffusion (Ouchterlony and Radial Immunodiffusion), immunoelectrophoresis. ELISA, RIA.<br>• **Hypersensitivity reactions:** Definition,Types (I, II, III, IV and V), based on time and symptoms.<br>• **Vaccines-**Types, Active and passive immunization, preparation of vaccines (Rabies vaccine).<br>• **Auto immune disorders:** Definition, Rheumatoid arthritis, Myasthenia gravis, Parkinson disease. | 16 |
| **Unit 3** | |
| • **Toxicology**: Scope of toxicology. Toxins and toxicants. Classification of toxins based on source, target system. Toxicity-influencing factors: Species and strains, age, sex, nutritional status, hormones, circadian rhythms and environmental factors. Doseresponse relationships, synergism, and antagonism.Determination of ED50 and LD50.Acute and chronic exposure.<br>• **Toxicokinetics:** Absorption and transportation. Mechanism of Toxicity: Organophosphates, Mercury, Aflatoxins. Antidotal Therapy for Toxins: Types. Procedures that decrease the absorption and translocation of toxicants.Physical removal of poisons by emetics, gastric lavage, and cathartics.Drugs for the deactivation of toxins | 16 |

**Pedagogy:** Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

| **Formative Assessment for Theory** | |
|---|---|
| Internal Assessment C1 (Test) | 10 |
| Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.) | 10 |
| **Total** | **20** |
| Formative Assessment as per guidelines. | |

| | |
|---|---|
| Program Name: B.Sc | Semester: VI |
| Course Title: **PHYSIOLOGY AND IMMUNOLOGY** | |
| Course Code: **DSC-6P SEPBC-603** | No of credits: 02 (2:0:0) |
| Total Contact Hours: 64 | Duration of SEA/Exam: 04 Hours |
| Hours/Week: 04 | |
| Formative Assessment Marks: 10 | Summative Assess Marks: 40 |

| **Course Outcomes (COs):**<br>Upon successful completion of this course, students will be able to: |
|---|
| **CO 1:** Perform quantitative estimation of biochemical constituents such as amino acids, cholesterol, calcium, phosphate, creatinine, iron, and haemoglobin using standard analytical methods. |
| **CO 2:** Understand the principles and applications of biochemical assays and laboratory techniques used in clinical diagnosis and sample analysis. |

**CO-PO Mapping Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 3 | 2 | 2 | 1 |

## LIST OF PRACTICAL EXPERIMENTS:

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of Cholesterol by Zak's method.
3. Determination of ammonia in urine.
4. Determination of titrable acidity in urine.
5. Estimation of amino acid by Sorenson's formal titration method.
6. Estimation of Calcium in serum.
7. Estimation of Inorganic phosphorus by Fiske Subbarao method.
8. Estimation of Creatinine by Jaffe's method.
9. Determination of Clotting time and Bleeding time.
10. Blood typing
11. Determination of % of Haemoglobin.
12. Estimation of Iron by Wong's method.
13. Radial immunodiffusion/ Ouchterlony double diffusion.
14. Determination of RBC and WBC count by Haemocytometer.

## EVALUATION SCHEME FOR PRACTICAL EXAMINATION:

| **Assessment Criteria** | **Marks** |
|---|---|
| Procedure writing | 05 |
| Major Experiment | 20 |
| Minor Experiment- comment on | 10 |
| Viva Voce | 05 |
| **TOTAL** | **40** |