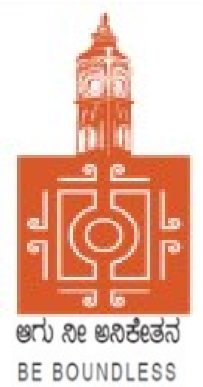

BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM
(As per SEP)

Syllabus for Bio-Chemistry

2025-26

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BENGALURU CITY UNIVERSITY
ಜ್ಞಾನ ಭೀ ಅಪರಿಮಿತ
BE BOUNDLESS

Department of Biochemistry,
Central College Campus, Bangalore -560001

Proceedings of the Meeting of Board of Studies in Biochemistry (UG), held on Tuesday, the 13th May, 2025 in the chambers of the Chairman, Dept. of Biochemistry, Central College Campus, Bangalore -560001

The meeting started with the Chairman welcoming the members and requesting the board to deliberate on the syllabus contents for B.Sc. Biochemistry UG course 3rd and 4th semester under SEP,. After a detailed discussion on the contents, the board finalized the syllabus prepared by members for III and IV semester B.Sc. under the SEP scheme. The meeting concluded with the chairman thanking the members for their valuable inputs and cooperation.

	Members Present		**Signature**
1.	Prof. V. R. Devaraj, Chairman, Dept. of Biochemistry, Bangalore University.	Chairman	13/05/2025
2	Dr. Rajesh, J. Dept. of Biochemistry, Uvaraja's College, University of Mysore	Member	13/5/25
3.	Ms. Vidya, A.S. Dept. of Biochemistry, Seshadripuram College Yalahanka Bangalore -560064.	Member	
4.	Dr. (Mrs.) Shilini Purushothaman Dept. of Biochemistry, Mount Carmel College # 58, Palace Road, Bangalore – 560052	Member	13/5/25

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5. Dr. R. Nagesh Babu, Member
Dept. of Chemistry,
Maharani's Science College for women,
Palace Road, Bangalore-560001

6. Ms. Ramya Kumar, B.S. Member
Dept. of Biochemistry,
M.S Ramaiah College of Arts, Science & Commerce
Bangalore-54

7. Srikanta A.S. Member
Dept. of Chemistry,
Vijaya College
Basavanagudi
Bangalore-560004

8. Dr. Jyothi, S.G. Member
Dept. of Chemistry
B.M.S. College of Women
Basavanagudi
Bengaluru-560004

9. Mr. [redacted]. Manohar, N. Member
Dept. of Biochemistry,
Seshadripuram College
Yalahanka
Bangalore -560064.

SCHEME OF EXAMINATION

Title of the paper	Contact h/week	Exam. hours	I A	Marks	Total Marks	Credits
Third Semester						
Biochemistry-III: BCT-03 Biochemistry of Macromolecules	4	3	20	80	100	3
Biochemistry practical-III: BCP-03 Qualitative and Quantitative analysis of Macromolecules	3	3	10	40	50	2
Biochemistry Elective-1:BCT E-1 Microbiology & Immunology*	2	1.5	10	40	50	2
Fourth Semester						
Biochemistry-IV: BCT-04 Physiology & Cell Biology	4	3	30	70	100	3
Biochemistry practical-IV: Clinical Biochemistry and physiology	3	3	10	40	50	2
Biochemistry Elective-2: BCT E-2 Membrane Biochemistry*	2	1.5	10	40	50	2
Compulsory Practical/Skill-1*	3		10	40	50	2
Fifth Semester						
Biochemistry-V: BCT-05 Biochemical Techniques	4	3	20	80	100	3
Biochemistry practical-V Bio-analytical methods	3	3	10	40	50	2
Biochemistry-VI: BCT-06: Bioenergetics & Metabolism	4	3	20	80	100	3
Compulsory Practical/skill-2*	3		10	40	50	2
Sixth Semester						
Biochemistry-VII: BCT-07: Enzymology	4	3	20	80	100	3
Biochemistry practical-VI:BCP-06 Enzymology	3	3	10	40	50	2
Biochemistry-VIII: BCT-08: Molecular biology	4	3	20	80	100	3
Compulsory Practical/skill-3*	3		10	40	50	2

**The compulsory skill may involve practical experience in an industry /Laboratory/ dissertation/ minor Project providing hands on experience* other than the regular practical of the course.

The student can opt for the skill related to any of the three majors in a semester; the skill requirement may be met with one skill course in all the three majors or all three skills related to any one of the majors to enhance the employability.

Scheme of skill/project/dissertation Examination:

Internal Assessment: 10 Marks

The assessment is based on the performance, punctuality and regular updates of the progress in the project/dissertation. An assigned supervisor will be authorized to assess. If carried out in an industrial set up, the personnel supervising the student shall be authorized to provide internal assessment marks.

End semester Examination: Max. Marks: 40

Report/Dissertation:	Max. Marks: 25
Viva-Voce:	Max. Marks: 15

Syllabus for Biochemistry major for B.Sc. Degree program with three majors under SEP

SEMESTER – III

Course title	Biochemistry of Macromolecules
Course Code	BCT -03
Course credits	3
Total contact hours	56 h
Duration of ESA	3 h
Formative assessment marks	20
Summative assessment marks	80

Learning outcomes:

The course introduces students to chemical nature and biological importance of biological macromolecules. It enables the students become conversant with the basic structures and properties of macromolecules and to understand the concepts of structure–activity relationships in Biochemistry.

UNIT– I CARBOHYDRATES **15 Hrs**

Monosaccharides: Definition, classification, occurrence, structure and functions of monosaccharides (glucose and fructose). General properties with reference to glucose, anomers, epimers, enantiomers and mutarotation. Elucidation of open chain and ring structure of glucose, conformation of glucose (structures only). Structure of galactose, mannose, ribose and fructose.

Disaccharides: Structure, occurrence, properties and biological importance of disaccharides (sucrose, and lactose).

Polysaccharides: Storage polysaccharides (starch, glycogen) with partial structure, Structural polysaccharides (cellulose, chitin). Structure, occurrence, and biological roles of heteropolyasaccharides (hyaluronic acid, heparin) and bacterial cell wall polysaccharides.

UNIT- II AMINO ACIDS AND PROTEINS **16 Hrs**

Amino acids: Structure and classification of amino acids based on polarity. Reactions of the amino groups with HNO2, LiAlH4, ninhydrin, phenyl isothiocyante, dansylchloride, flurodinitrobenzene. Zwitterionic properties. pKa values. Reaction of carboxyl group – hydrazine. Biological importance of D and L amino acids
.

Peptides: Peptide bond, geometry and characteristics, Ramachandran Plot. Structure and biological importance of peptides; glutathione, valinomycin, Leu-enkaphalins and Endorphins. Synthetic peptides- polyglutamic acid, and polylysine.

Proteins: Definition, classification based on solubility, composition and functions. Introduction to structural organization; Primary, Secondary (alpha helix, beta pleated sheet and beta bends), tertiary (including factors stabilizing the structure) and quaternary structure eg. Hemoglobin and myoglobin. Denaturation and renaturation of proteins; Anfinsen's experiment.

UNIT– III LIPIDS **16 Hrs**

Structure, function and classification: Classification and biological role. Fatty acids– Nomenclature of saturated and unsaturated fatty acids. Physical properties of fatty acids. Sources of fats, invisible fat, essential fatty acids and their biological importance. Saponification, saponification value, iodine value, acid value and significance. Acylglycerols: Mono, di and triglycerols**.**

Phosphoglycerides: structure of lecithin (phosphatidyl choline), cephalins, phosphatidyl inositol, plasmalogens, and cardiolipin. Biological role of phosphoglycerides. Sphingolipids; Structure and importance of sphingomyelin. Glycerosphingolipids; Composition and importance of gangliosides and cerebrosides.

Eicosanoids: Types, structure of PGE2, PGI2, PGD2 and PGF2α. Biological roles of thromboxanes, leukotrienes and prostaglandins. Plasma lipoproteins; composition, types and functions, clinical significance.

UNIT– IV NUCLEIC ACIDS **9 Hrs**

Chemistry of nucleic acids: Composition of DNA. Nucleosides and nucleotides. Chargaff's rule. Watson and Crick model of DNA, physical and chemical properties of nucleic acids. RNA: Composition, types (mRNA, tRNA and rRNA), secondary structures of tRNA – clover leaf model. Denaturation and renaturation, melting of DNA (Tm). RNA – types - mRNA, tRNA, rRNA – structure and functions, secondary structure of tRNA – clover leaf model. Isolation of DNA and RNA (from biological sources). UV absorption, hypochromic and hyperchromic effects. Effect of alkali and acid on DNA. Chemical reactions of RNA and DNA.

References

1. Fundamentals of Biochemistry; Jain JL, Sunjay Jain and Nitin Jain, (2020), Updated edition. S. Chand Publishers, New Delhi.
2. Vasudevan DM. Biochemistry. 9th edn. (2018), Aypee Brothers Medical Publishers, New Delhi.
3. Fundamentals of Biochemistry, Ambika Shanmugam, 8th Edn. 2016, Wolters Kluwer India Pvt Ltd
4. Lehninger Principles of Biochemistry, D. Nelson and M. Cox 8th edn, (2021) Macmillan and Co.
5. Biochemistry R. Garrett and C. Grisham 6th Edn (2016) Brooks/Cole.
6. ISE Harper's Illustrated Biochemistry V. Rodwell, D. Bender, et al 31st Edn., (2018) McGraw Hill.
7. Fundamentals of Biochemistry: Life at the Molecular Level, Donald Voet, Judith G. Voet, Charlotte W. Pratt 5th Edn, (2016) Wiley.

8. Biochemistry J. Berg L. Stryer et al 9th edn, (2019) W H Freeman.
9. Biochemistry-the chemical reactions of living cells, David E Metzler, 2nd Edn, Elsevier Academic Press.
10. Zubay's principles of Biochemistry, V. B Rastogi and K. R Aneja revised and enlarged edn (2016) Medtech.
11. Textbook of Biochemistry with Clinical Correlations, Thomas Devlin, 7th Edn, (2022), Wiley.

Semester-III; Biochemistry Practical -3: BCP-03

Course title	Qualitative and Quantitative analysis of Macromolecules Practical
Course Code	BCP -03
Course credits	2
Total contact hours	42 h
Duration of ESA	3 h
Formative assessment marks	10
Summative assessment marks	40

Learning outcomes:

The course introduces students to chemical basis of identification and quantification of biological macromolecules and their component. The emphasis will be on the skills essential to understand the chemistry of macromolecules and relate the chemical principles to biological properties.

List of Experiments

1. Qualitative analysis of carbohydrates: Molisch, Benedict's / Fehling's, picric acid, Barfoed's, Bial's, Seliwanoff's, osazone tests. Colour reactions of Glucose, fructose, lactose, maltose and sucrose.
2. Qualitative analysis of amino acids: Colour reactions of amino acids; tryptophan, tyrosine, cysteine, methionine, arginine, proline and histidine.
3. Qualitative analysis of proteins**:** Colour reactions of proteins– Biuret, xanthoproteic, Millon's. Precipitation reactions of proteins.
4. Qualitative analysis of lipids– solubility, acrolein test, Salkowski test, Lieberman-Burchard test.
5. Qualitative tests for nucleic acids.
6. Determination of moisture content of foods.
7. Identification of adulterants in food.
8. Estimation of calcium in finger millet (ragi).
9. Estimation of iron in drumsticks.
10. Estimation of vitamin-C in lemon and gooseberries.
11. Estimation of amino acid by formal titration.
12. Determination of total sugars by anthrone method.

References

1. Biophysical Chemistry – Principles and Techniques by Upadhaya, Upadhaya and Nath, 2016 Himalaya Publishing House
2. Tools of Biochemistry by T. Cooper Wiley Publishers
3. Principles and techniques in biochemistry and molecular biology by Walker and Wilson 8th edition, Cambridge University Press
4. Biochemical Calculations by I. Segel 2nd edn (1971) Wiley Publishers

5. Analytical biochemistry, David J Holme, Hazel Peck, 3rd Edn. (1998) Prentice Hall.
6. Bioanalysis of Pharmaceuticals, Steen Honoré Hansen and Stig Pedersen-Bjergaard (2015), Wiley.
7. Biochemical Methods, S.Sadasivam and A.Mannickam, (1993) New Age International.
8. Biophysics, Pattabhi. V. and Gautham.N. (2002) Narosa Publishing House, India.
9. L. Finar: *Organic Chemistry* (Vol. I & II), E. L. B. S. (2002)

Semester-III; Biochemistry Elective: BCTE-01

Course title	Microbiology & Immunology
Course Code	BCTDE-1
Course credits	2
Total contact hours	28
Duration of ESA	1.5
Formative assessment marks	10
Summative assessment marks	40

Learning outcomes

The students will become conversant with structure, classification, characteristics of microorganisms, scientific basis of food spoilage and preservation techniques.
The student will gain an overview of immune system, including cells and organs. Learn the functions of antigens, immunoglobulins and importance of immune response.
Exposure to the types of hypersensitivity and importance of vaccines.

UNIT- I: Introduction **9 hours**

History and Scope of microbiology
Scope and Development of microbiology as a discipline. Contributions of Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Alexander Fleming.

Diversity of Microbial world
Differences between prokaryotic and eukaryotic microorganisms. General characteristics of different groups: acellular microorganisms (viruses, viroid) and cellular microorganisms (bacteria, algae, fungi, and protozoa).

Microscopy
Principle and application – light microscope, compound microscope, resolution power, electron microscope- SEM and TEM.

UNIT- II Bacteria and viruses **8 hours**

Bacteria
Morphology and general structure, gram positive and gram-negative organisms, nutritional requirements, and growth curve and characteristics of bacteria. Pure culture techniques, bacterial infections and AMR (antimicrobial resistance)

Viruses
General structure and characteristic features of plant, animal and bacteriophages. HIV- structure and route of transmission. TMV- structure, route of transmission and multiplication cycle. Bacteriophages- T- even, structure and replication cycle.

UNIT- III **3 hours**

Food, Dairy and Industrial microbiology
Food spoilage, food, preservation, fermented foods, probiotics and functional foods. Contamination of milk by microorganisms. Reactions occurring in milk, Pasteurization and sterilization. Industrial production of microbial products- antibiotics (penicillin), enzymes (amylase) and biofuel production.

UNIT- IV: **8 hours**

Immunology; *Organs and cells of the immune system*-Primary and secondary lymphoid organs.

Immunity- Definition, Types, Innate immunity - Mechanism of immune response anatomic, physiological, phagocytic and inflammatory barriers. Adaptive immunity- cell mediated and humoral immunity- Mechanism of immune response.

Immunoglobulins- Definition, Structures and functions: IgG, IgM & IgE. Monoclonal and polyclonal antibodies - production and applications.

Antigens – Definition, Chemical nature of antigens, hapten, antigenicity, immunogenicity, epitopes, paratopes, idiotopes, super antigens.

Antigen-antibody reactions - Agglutination, Precipitation, Neutralisation, Complement fixation and Opsonisation.

Hyper sensitivity reactions- Definition, types and examples, Type-I HS reaction and its mechanism

Immunological techniques: Principle and applications of Immunodiffusion; RIA and ELISA.

Vaccines- Definition, types, methods of preparation of live, attenuated vaccines, toxoids, adjuvants. Modern vaccines -recombinant, peptide and DNA vaccines.

References

1. Microbiology, Pelczer, Reid and Kreig Tata McGraw Hill (1996).
2. Microbiology; Lansing M. Prescot, Hartley and Klein, 6th Edn. McGraw- Hill (2005).
3. Basic and Practical Microbiology, Ronald L. Atlas (1986) McMillan Publication Co.
4. Biology of Microorganisms, Brock Prentice Hall (1996).
5. Roitt's Essential Immunology; Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt Peter J. Delves, 13th Edn., (2017)) John Wiley.
6. Kuby Immunology; Oven, Punt, Stranford, 8" Edn. (2018). W. H. Freeman
7. Lippincott Illustrated Reviews Immunology, Doan T, 3rd Edn., (Pb 2022), Wolters Kluwer (India) Pvt. Ltd.
8. Immunology at a Glance: J.H.L. Playfare [ed.] (1987), Blackwell Science.
9. Immunology; Jan Klein [Ed.], (1990), Blackwell Science.

SEMESTER –IV

Biochemistry -4: BCT-04

Course title	**Physiology & Cell Biology**
Course Code	BCT -04
Course credits	3
Total contact hours	56
Duration of ESA	3
Formative assessment marks	20
Summative assessment marks	80

Learning outcomes:

This course is expected to familiarize students with the structural and functional aspects of cell, the basic unit of life and its different organelles and their interrelationships. Students will be able to understand homeostatic and altered physiology of major systems such as; respiration, renal, nervous, muscular, and cardiovascular system.

UNIT- I **14 hours**

Introduction to Cell Biology: Historical aspects - cell theory, protoplasm theory and organizational theory. Broad classification of cell types: prokaryotic cell and eukaryotic cells and their characteristics; Ultra structure of cell: virus, microbial, plant and animal cells.

Structure and functions of cell: Bacterial cell wall and plant cell wall; Plasma membrane: composition. Intercellular junctions; anchoring junctions, tight junctions, desmosomes, hemidesmosomes.

Cell organelles: Structure and functions – Endoplasmic reticulum, Golgi apparatus, Lysosomes, Endosomes, Microbodies: Peroxisomes and Glyoxysomes. Mitochondria: structure. Chloroplast: structure. Vacuoles, Ribosomes, Centriole and Basal bodies.

UNIT- II **14 hours**

Cell division: Nucleus - Structure of nucleus, nuclear pore complex, internal organization of nucleus – chromosome, nuclear matrix, the nucleolus. Cell cycle – cell division (mitosis and meiosis), checkpoints in cell cycle.

Cytoskeleton: Structure, assembly and function of Microtubules: Dynamics, Axonemal and cytoplasmic microtubules. Microfilaments: Actin and Myosin. Intermediate Filaments: different classes and function.

Tissues and Extracellular matrix: Types and functions of epithelial tissue and connective tissues. ECM components – proteins, polysaccharides and adhesion proteins.

UNIT- III **12 hours**

Cardiovascular system: Histological structure of arteries, arterioles, capillaries & veins. Open and close systems. Blood pressure- systolic, diastolic, mean arterial & pulse pressure. Factors controlling blood pressure. Structure and functions of heart, pulmonary and systemic circulation. Cardiac cycle, Rhythmicity of heart, heart sounds, heart rate, factors affecting heart rate, cardiac output, ECG. Blood – composition – packed cell volumn (PCV) and hematocrit and plasma. Erythropoiesis, blood coagulation - outline of the extrinsic and intrinsic pathway. Cardiovascular diseases: Atherosclerosis, haemorrhage, heart attack and stroke.

Body fluids: Intracellular and extracellular compartments, water balance and its regulation, dehydration, oedema. Composition and function of CSF, Lymph, Blood brain barrier (BBB).

Digestive system: The anatomy of the human alimentary canal. Accessory glands of the digestive system, composition of digestive secretions. The biochemistry of digestion of carbohydrates, proteins and fats in various regions of the alimentary canal in humans. Absorption, and fates of ingested carbohydrates, protein and dietary lipids. Storage and detoxification

UNIT- IV **16 hours**

Respiratory system: Mechanism of respiration. Role of alveolar surfactants. Lung volume and capacity. Transport of gases in blood, Bohr's effect, O_2 and CO_2 dissociation curve. Exchange of gases at lung and tissues. Respiratory failure and artificial respiration. Respiratory acidosis and alkalosis. Hypoxia, asphyxia, dyspnoea, cyanosis, emphysema, acclimatization.

Excretory system: Renal circulation-anatomy, Structure and functions of nephron, glomerular filtration rate (GFR), tubular reabsorption. Passive and active tubular transport. Tubular secretion. Formation of urine - counter-current exchanger and counter multiplier mechanism. Role of kidney in osmoregulation. Regulation of renin-angiotensin system. Kidney failure. Renal stone formation. Dialysis.

Nervous system: Structure and types of neurons; other cells of Nervous system. Autonomic. Neurotransmitters – classification based on chemical nature, adrenergic and cholinergic neurotransmission Membrane potential, resting membrane potential and action potential; IPSP and EPSP. Mechanism of synaptic transmission (acetylcholine).

Muscular system: Ultrastructure of skeletal muscles. Sarcotubular system. Fast and slow muscles. Muscle proteins; contractile and non-contractile. Mechanism and regulation of skeletal muscle contraction and relaxation, neuromuscular junctions, Excitation-contraction coupling. Muscular dystrophies. Calmodulin and its regulatory role.

References

1. Harper's Illustrated Biochemistry, by R.K.Murray & others. Lange Medical Book, International Edition, Mc Graw Hill.
2. Text Book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
3. Lehninger's Principles of Biochemistry. By D.L.Nelson and M.M. Cox, Worth Publishers Inc.
4. Cell Biology: A Short Course, 4th Edn, (2022) S R. Bolsover, A Townsend-Nicholson, G FitzHarris, E A. Shephard, J S. Hyams, Sandip Patel, Wiley.
5. Molecular Biology of the Cell, by B. Alberts and others, Garland.
6. Biochemistry, by L. Stryer, W.H. Freeman and Co.
7. Molecular Cell Biology, by H. Lodish; D. Baltimore & Others. Scientific American Book.
8. The Cell: A Molecular Approach, Geoffrey Cooper and Kenneth Adams R.E. 9th edn., (2022), Oxford University press.
9. Becker's World of the Cell, Jeff Hardin, Lewis Kleinsmith, 10th Edn., (2022), Pearson.
10. Karps Cell and Molecular Biology Concepts and Experiments, Asian Edition IWASA J. 9th Edn. (2022), Wiley.
11. Human Physiology; Vander Sherman & Luciano (2001), McGraw-Hill.
12. Molecular Cell Biology, Lodish et al., (2021) W H Freeman & Co.
13. Biochemistry; Voet, D. and Voet, J.G. [Eds.] (1999) 3rd Ed. Jhon Wiley and sons.
14. Lippincott Illustrated Reviews: Biochemistry, Emine Ercikan Abali, Susan D. Cline , David S. Franklin , Susan M. Viselli, 9th Edn., (2025) Wolters Kluwer.

Semester-IV; Biochemistry Practical -4: BCP-04

Course title	Clinical Biochemistry and physiology Practical
Course Code	BCP -04
Course credits	2
Total contact hours	42 h
Duration of ESA	3 h
Formative assessment marks	10
Summative assessment marks	40

Learning outcomes:

The course is expected to make the students conversant with basic clinical parameters, an idea about the clinical parameters and health status. Along with these, the student is skilled in handling biological samples for laboratory analysis and experience of clinical data generation and analysis.

List of Experiments

1. Determination of ABO blood grouping/Analysis of blood group
2. Determination of Blood clotting time
3. Enumeration of RBC and WBC count using Hemocytometer/ Hemocytometric analysis.
4. Separation of Serum and Plasma from Blood.
5. Estimation of hemoglobin content in blood Sahlin's acid hematin method.
6. Qualitative analysis of normal and abnormal constituents of urine.
7. Estimation of inorganic phosphate by modified Fiske-Subbarow method.
8. Estimation of blood sugar by O-Toluidine /Folin -Wu method.
9. Estimation of urea in blood by Fearson method.
10. Estimation of uric acid by phosphor-tungstic acid.
11. Estimation of serum creatinine by Jaffe's method.
12. Estimation of serum bilirubin by Malloy and Evelyn method.
14. Liver function tests-serum bilirubin test, bile pigment in urine, bromosulphalein test,
15. Determination of bile acids in serum, flocculation test, Bilirubin, SGOT, SGPT,
16. Lipid profile tests- Total cholesterol, Triglycerides in serum and Diabetic profile: Fasting blood sugar,
17. Estimation of serum proteins and determination of ratio of albumin and globulin.

References

1. Clinical Biochemistry: an illustrated color text, 6th edn., (2019) Murphy M J, Srivastava R and Deans K, Edinburgh, Elsevier.
2. Textbook of Biochemistry with Clinical Correlations, Devlin TM, (7th edn.) (2010), John Wiley & Sons,.

3. Textbook of Medical Biochemistry, 8th edn. (2012); Chatterjee M N, Rana Shinde, JPB.
4. Textbook Of Biochemistry For Medical Students, 9th edition, (2019) Vasudevan DM, Sreekumari S, Kannan Vaidyanathan, Jaypee Brothers Medical Publishers.
5. Essentials of Medical Physiology, K. Sembulingam and P.Sembulingam. Jaypee Brothers medical publishers, New Delhi., 2019
6. Text book of Medical Physiology-C, Guyton and John. E. Hall, Miamisburg, O H, U.S.A, 12th Edn., 2011.
7. Hawk's physiological chemistry. 14th Edn. (1966) Bernard L. Oser Ed) McGraw-Hill Book Co.
8. Varleys Practical Clinical Biochemistry Gowenlock A. H. 6th Edn, (2002), CBS.
9. Modern Analytical Chemistry 2.1, David Harvey, (2008), David Harvey.

Semester-IV; Biochemistry Elective-2: BCTE-2

Course title	**Membrane Biochemistry**
Course Code	**BCTE-2**
Course credits	2
Total contact hours	28
Duration of ESA	1.5
Formative assessment marks	10
Summative assessment marks	40

UNIT-I **7 hrs**

Introduction: Historical background, membrane models, Monolayer, planer bilayer and liposomes as model membrane systems. Fluid mosaic model with experimental proof. Salient features of bio-membrane, comparison with model membrane. Role of cholesterol and fatty acid composition in membrane fluidity. Supramolecular membrane structure.

Membrane asymmetry and its significance in membrane structure and function. Various techniques to determine asymmetry. Membrane domains- lipid rafts, composition and implications in health and disease.

UNIT-II **5 hrs**

Molecular assembly of biomembranes; Structures of membrane proteins, classification of membrane proteins- integral and peripheral. Membrane proteins and their role in normal/abnormal cell physiology. Interchange of proteins between membranes and their soluble environment. Membrane receptors and responses. Membrane biology of glycolipids in normal and neoplastic cells.

UNIT-III **4 hrs**

Structural dynamics: Structure and function of various biological membranes. Lipid-protein and protein-protein interactions, dynamics of lipid-protein interactions, driving forces. Molecular and patch-clamp approaches to the structure function relationship of voltage gated channels. Ion channels in cancer cells. Membrane rafts in normal and disease conditions.

UNIT-IV **6 hrs**

Membrane transport: Simple diffusion and facilitated diffusion. Passive transport - glucose transporter, anion transporter and porins. Primary active transporters - P type ATPases, V type ATPases. Secondary active transporters- lactose permease, Na^+-glucose symporter. ABC family of transporters- MDR, CFTR. Ion channels - voltage-gated ion channels (Na^+/K^+ voltage-gated channel). ligand gated ion channels (acetyl choline receptor), aquaporins, and bacteriorhodopsin. Ionophores - valinomycin, gramicidin.

UNIT-V **6 hrs**

Cellular processes: Structure-function interplay of some typical membrane receptors like LDL, Ferritin etc. Membrane biology of receptor-mediated endocytosis. Role of cytoskeletal components in membrane structure/organization.

Liposome: Technology and its application in biotechnology. Preparation and characterization of liposomes. Covalent attachment of protein/ligand to liposome surface. Biophysical study of methods of liposome membrane. Liposome in biological systems and its application in Biotechnology such as targeted drug delivery.

References

1. The Cell: A Molecular Approach, Geoffrey Cooper and Kenneth Adams R.E. 9th edn., (2022), Oxford University press.
2. Becker's World of the Cell, Jeff Hardin, Lewis Kleinsmith, 10th Edn, (2022), Pearson.
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5. Biochemistry; Voet, D. and Voet, J.G. [Eds.] (1999) 3rd Edn. Jhon Wiley and sons.
6. Molecular Biology of Membranes Structure and Function, H.R. Petty. 1993., Plenum Press, New York, USA and London.
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8. Liposomes a Practical Approach, R.R.C. New. (1990). IRL Press, Oxford, New York.
9. Biochemistry of Lipids, lipoproteins and Membranes, 5th Edn, D.E. Vance and J.E. Vance, (2007) Elsevier.
10. Lipid Biochemistry, An Introduction, Michael I. Gurr, John L. Harwood and Keith N. Frayn, 5th Edn., (2002), Blackwell Science Ltd,