## B.Sc., BIOCHEMISTRY

### PREAMBLE

- Biochemistry is the study of chemistry and relating to, biological organisms.
- Biochemistry is sometimes viewed as a hybrid branch of organic chemistry which specializes in the chemical processes and chemical transformations that take place inside of living organisms.
- All life forms alive today are generally believed to have descend from a single proto-biotic ancestor, which could explain why all known living things naturally have similar biochemistries.
- Biochemistry essentially remains the study of the structure and functions of cellular components (such as enzymes and cellular organelles) and the processes carry out both on and by organic macromolecules - especially proteins, but also carbohydrates, lipids, nucleic acids and other biomolecules.
- Biochemistry is most simply put, the chemistry of life.

# KARPAGAM ACADEMY OF HIGHER EDUCATION
## Coimbatore – 641 021
## DEPARTMENT OF BIOCHEMISTRY
### FACULTY OF ARTS ,SCIENCE AND HUMANITIES
### UG PROGRAM (CBCS)-B.Sc., Biochemistry
**(2018–2019 and onwards)**

| Course code | Name of the course | Objectives and out comes | | Instruction hours / week | | | Credit(s) | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | PEOs | POs | L | T | P | | CIA | ESE | Total |
| | | | | | | | | 40 | 60 | 100 |
| **SEMESTER – I** | | | | | | | | | | |
| 18LSU 101 | Language -I | I | a | 4 | - | - | 4 | 40 | 60 | 100 |
| 18ENU101 | English | I | a | 4 | - | - | 4 | 40 | 60 | 100 |
| 18BCU101 | Molecules of Life | I | b | 3 | 1 | - | 4 | 40 | 60 | 100 |
| 18BCU102 | Cell biology | I | d | 4 | - | - | 4 | 40 | 60 | 100 |
| 18BCU103 | Membrane Biology and Bioenergetics | I | d | 4 | - | - | 4 | 40 | 60 | 100 |
| 18BCU111 | Molecules of Life- Practical | III | d | - | - | 3 | 2 | 40 | 60 | 100 |
| 18BCU112 | Cell biology - Practical | III | d | - | - | 3 | 2 | 40 | 60 | 100 |
| 18BCU113 | Membrane Biology and Bioenergetics - Practical | III | d | - | - | 4 | 2 | 40 | 60 | 100 |
| **Semester Total** | | | | **19** | **1** | **10** | **26** | **320** | **480** | **800** |
| **SEMESTER – II** | | | | | | | | | | |
| 18LSU 201 | Language - II | I | a | 4 | - | - | 4 | 40 | 60 | 100 |
| 18BCU201 | Proteins | III | e | 3 | 1 | - | 4 | 40 | 60 | 100 |
| 18BCU202 | Enzymes | III | e | 4 | - | - | 4 | 40 | 60 | 100 |
| 18BCU203 | Human Physiology | I | e | 4 | - | - | 4 | 40 | 60 | 100 |
| 18BCU211 | Proteins - Practical | III | e | - | - | 3 | 2 | 40 | 60 | 100 |
| 18BCU212 | Enzymes- Practical | III | e | - | - | 3 | 2 | 40 | 60 | 100 |
| 18BCU213 | Human Physiology - Practical | III | e | - | - | 4 | 2 | 40 | 60 | 100 |
| 18AEC 201 | Environmental Studies | IV | h | 4 | - | - | 4 | 40 | 60 | 100 |
| **Semester Total** | | | | **19** | **1** | **10** | **26** | **320** | **480** | **800** |

**ABILITY ENHANCEMENT COMPULSORY COURSE**

AECC-1: English communication

AECC-2: Environmental Studies

**PROGRAMME OUTCOME (POs).**

The Biochemistry graduate will be able to acquire

a. **Critical Thinking and Language Training:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. To train them to communicate science by improving their English vocabulary. Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

b. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

c. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings. Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

d. **Understanding cellular function:** To equip them with basic and advanced knowledge in cell biology in order to get entry/placed in cell based research and development institution/laboratories.

e. **Protein based skills:** To make them understand protein, enzymes and human physiology to lay solid foundation and to get through competitive examinations. To equip them to get placed in recombinant protein production industries/laboratory.

f. **Understanding of endocrine system and metabolism:** To train them on the regulatory role of hormone on the metabolism of carbohydrates, lipids, amino acids and nucleic acid.

g. **Molecular and Genetic understanding:** To train them on the genetic regulation of immune system and to use computational tools.

h. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

i. **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

j. **Skill development:** To gain hands on experience on various biochemical experiments and to equip them to interpret the data.

**PROGRAMME SPECIFIC OUTCOME (PSOs)**

k. Be able to demonstrate foundation knowledge in the areas of Biochemistry like cell biology, biomolecules, protein biochemistry, molecular biology, Pharmaceutical chemistry and hormonal biochemistry

l. Be able to integrate knowledge learned in discipline specific courses like Microbiology, Plant Biochemistry, Nutritional biochemistry, Biostatistics, Drug Biochemistry and biotechnology

m. To use standard laboratory protocols in biochemistry, modern instrumentations, proper laboratory safety protocols and classical techniques to carry out experiments and also use computers in data acquisition and processing and use available software as a tool in data analysis.

n. To understand the applications of biological sciences in genetics, biochemical correlations of diseases, micro biology, Genetic engineering and biotechnology

**PROGRAMME EDUCATIONAL OBJECTIVE (PEO)**

I. To give students a basic knowledge in biochemistry and to teach on ethics.

II. To develop analytical and critical-thinking skills that allows independent exploration of biological phenomena through the scientific methods.

III. To acquaint knowledge on modern methods of biochemical experimentation to implement for future studies.

IV. To motivate students for social responsibilities and to educate them on ethical values in addition to inculcating environmental awareness.

V. To enable them to execute a research objective through experimentation.

**Mapping of PEOs and POs**

| POs | a | b | c | d | e | f | g | h | i | j | k | l | m | n |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PEO I | X | X | | X | | X | X | | | | X | | | |
| PEO II | | | X | | | X | X | | | | X | X | X | X |
| PEO III | | | X | X | X | | X | | | | X | X | X | X |
| PEO IV | | | | | | | | X | | X | | | | X |
| PEO V | | | | X | X | | | | X | X | X | X | X | X |

**பகுதி - I தமிழ்ப் பாடத்திட்டம் (2018-2019)**

**Instruction Hours / week: L:4 T:0 P:0 Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**பகுதி** – I, **தமிழ்** **பருவம்** I

**18LSU101 : தமிழ் முதல் தாள்** 4-H,4-C

**(இளநிலை அறிவியல் பட்ட வகுப்புகளுக்குரியது)**

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**அலகு – I : இக்கால இலக்கியம்:** **(10 மணிநேரம்)**

**கல்வி :** மகாகவி பாரதியார் – சுயசரிதை - ஆங்கிலக் கல்வி.

**இன்றைய நிலை :** கவிமணி தேசிக விநாயகம் பிள்ளை – ஒற்றுமையே உயிர்நிலை.

**மனிதநேயம் :** கவிஞர் சிற்பி பாலசுப்பிரமணியன் –மலையாளக் காற்று.

**சூழலியல் :** கவிஞர் வைதீஸ்வரன் - விரல் மீட்டிய மழை.

**பெண்ணியம் :** கவிஞர் சுகந்தி சுப்பிரமணியம் – புதையுண்ட வாழ்க்கை.

**அலகு – II : அற இலக்கியம்:** **(8 மணிநேரம்)**

கொன்றை வேந்தன்: 1-50 பாடல்கள்

திருக்குறள்: பண்புடைமை, வினைத்திட்பம் – 20 குறள்கள்

பழமொழி நானூறு: 5 பாடல்கள்

**அலகு - III : சிற்றிலக்கியம்: ( 8 மணிநேரம்)**

மூவருலா: 1-26 கண்ணிகள்

திருச்செந்தூர் முருகன் பிள்ளைத்தமிழ்: 2 பாடல்கள்

கலிங்கத்துப் பரணி: போர்பாடியது - 9 பாடல்கள்

**அலகு – IV : கட்டுரை: ( 8 மணிநேரம்)**

1. உயர்தனிச் செம்மொழி - பரிதிமாற்கலைஞர்
2. கட்டிடக்கலை - அ. இராசமாணிக்கனார்
3. வாழ்க்கை - இளவழகனார்
4. ஆளுமைத்திறன் அறிவோம் - ஸ்ரீகண்ணன்
5. மணற்கேணி - நெ.து.சுந்தரவடிவேலு

**அலகு- V : மொழிப்பயிற்சி:** **(6 மணிநேரம்)**

1. பொருத்தமான தமிழ்ச் சொற்களைப் பயன்படுத்துதல்
2. செய்யுள் பொருளுணர் திறன்
3. மொழிபெயர்ப்புப் பயிற்சிகள்
4. கடிதங்கள் மற்றும் விண்ணப்பங்கள் எழுதுதல்

**பாட நூல்: கற்பகச்சோலை – தமிழ் ஏடு.** கற்பகம் பல்கலைக்கழகத் தமிழ்த் துறை வெளியீடு.

**Semester I**

**18ENU101** **ENGLISH** **4H- 4C**

**(For all undergraduate students admitted from 2018 onwards)**

**Instruction hours/week: L:4 T:0 P:0** **Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course Objectives:**

- To train students to acquire proficiency in English by reading different genres of literature and learning grammar.
- To provide aesthetic pleasure through literature.

**Course outcomes (CO's):**

- Communication skills will get developed.
- Genres of literature will give moral values of life.

**UNIT - I: Prose**

1. Morals in the Indian Context - Francis Nicholas Chelliah
2. How Comic Books help us to relive our Childhood - Benoit Peeters
3. Let's Do What India Needs From Us -Dr.A.P.J. Abdul Kalam

**UNIT - II: Poem**

1. The Stolen Boat - William Wordsworth
2. Telephone Conversation- Wole Soyinka
3. A River - A.K. Ramanujan

**UNIT - III: Short stories**

1. Rapunzel - Brothers Grimm
2. The Ant and The Grasshopper- W. Somerset Maugham
3. The Nightingale and the Rose - Oscar Wilde.

**UNIT - IV: Drama**

1. The Merchant of Venice- Act 4-Scence 1
2. The Death Trap- Saki

**UNIT - V: Grammar and Composition**

Grammar:
1. Tenses
2. Articles
3. Auxiliaries (Primary and Modal)
4. Tag Questions

Composition:
1. Reading to Comprehend
2. Letter Writing
3. Resume Writing
4. General Essay

**Prescribed Text**: Reminisce, Published by the Department of English,KarpagamAcademy of Higher Education.

**Suggested Reading**: Hewings Martin,1999 Advanced English Grammar, Cambridge University Press.

**18BCU101** **MOLECULES OF LIFE** **4H-4C**

**Instruction hours/week: L: 3 T: 2 P: 0** **Marks:** Internal: **40** External: **60** Total: **100**
**End Semester Exam:** 3 Hours

**Course objectives**

- To understand the properties and importance of water in biological system
- To know the various biomolecules present in biological system
- To introduce the importance of vitamins in human body

**Course outcomes (CO's)**

1. Recognize water as a universal solvent and elixir of life by knowing its importance
2. Identify the properties and classification of carbohydrates
3. Recall the role of various lipids in biomembrane including signal transduction
4. Categories the aminoacids and know their properties
5. Differentiate the structure, properties and functions of DNA and RNA
6. List the functions and deficiency disease of fat and water soluble vitamins

**Unit I: The foundations of biochemistry and water**

Cellular and chemical foundations of life. Unique properties, weak interactions in aqueous systems, ionization of water, buffers, water as a reactant and fitness of the aqueous environment.

**Unit II: Carbohydrates and glycobiology**

Monosaccharides - structure of aldoses and ketoses, ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers, structure of biologically important sugar derivatives, oxidation of sugars. Formation of disaccharides, reducing and non-reducing disaccharides. Polysaccharides – homo- and heteropolysaccharides, structural and storage polysaccharides. Structure and role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides). Carbohydrates as informational molecules, working with carbohydrates

**Unit III: Lipids**

Building blocks of lipids - fatty acids, glycerol, ceramide. Storage lipids - triacyl glycerol and waxes. Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols, structure, distribution and role of membrane lipids. Plant steroids. Lipids as signals, cofactors and pigments.

**Unit IV: Amino acids and Nucleic acids**

Structure and classification, physical, chemical and optical properties of amino acids.Nucleotides - structure and properties. Nucleic acid structure – Watson-Crick model of DNA. Structure of major species of RNA - mRNA, tRNA and rRNA. Nucleic acid chemistry - UV absorption, effect of acid and alkali on DNA. Other functions of nucleotides - source of energy, component of coenzymes, second messengers.

**Unit V: Vitamins**

Structure and active forms of water soluble and fat soluble vitamins, deficiency diseases and

symptoms, hypervitaminosis

## SUGGESTED READING


1. Ambika, S, (2004). Fundamentals of Biochemistry for Medical Students, CIT Chennai.

2. Deb, C., (2011). Fundamentals of Biochemistry, 9th edition New Central Book Agency, Calcutta.

3. Jain, J.L., Jain, S and Jain, N., (2005). Fundamentals of Biochemistry, S. Chand and Company Ltd, New Delhi.

4. Nelson, D., and Cox, M. W.H. (2012) Lehninger Principles of Biochemistry (4th Ed.) New York, Freeman and Company.

5. Stryer, L., (2009). Biochemistry, W.H. Freeman and Company, New York.

6. Murray, R.K., Bender, D.A., Botham, K.M., and Kennelly, P.J., (2012). Harper's illustrated Biochemistry, 29th Edition. McGraw-Hill Medical. London.

**Semester I**

**18BCU102** **CELL BIOLOGY** **4H-4C**

**Instruction hours/week: L:4 T:0 P:0** **Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course objectives**

- To understand the basic structure of cell and model organism for its study
- To know the tools required for studying cell morphology
- To enlight the students with structure and functions of various organelle
- To understand the cytoskeletal network and extracellular matrix
- To introduce the cell cycle, cell division and cell death process

**Course outcomes (CO's)**

1. Differenttiate the prokaryotic and eukaryotic cell
2. Understand the pricnciple behind studying the cell morphology using various microscope
3. Identify the structure and functions of each organelle in cell
4. Recognise the mechanism behind the protein sorting and transport to their destinations like lysosome, mitochondria and chloroplast
5. Maintenance of cytoskeleton structure and function of micro, macro and intermediary filaments
6. Identify the proteins involved in cell cell interaction
7. Enumerate the phases of cell cycle, events in cell division and mechanism of cell death

**Unit I: Introduction to cell biology**

Prokaryotic (*archaea and eubacteria*) and eukaryotic cell (animal and plant cells), cells as experimental models.

Plasma membrane: Composition, Fluid mosaic model

**Tools of cell biology:** Light microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy, electron microscopy, FACS. Centrifugation for sub-cellular fractionation.

**Unit II: Structure of different cell organelles**

Structure of nuclear envelope, nuclear pore complex. Selective transport of proteins to and from the nucleus. Regulation of nuclear protein import and export.

ER structure. Targeting proteins to ER, smooth ER and lipid synthesis. Export of proteins and lipids from ER and into ER. Protein folding in ER

Peroxisomes and Zellweger syndrome.

**Unit III: Protein trafficking**

Organization of Golgi. Lipid and polysaccharide metabolism in Golgi. Protein sorting and export from Golgi. N and O-linked glycosylation.

Lysosome. – Acid hydrolases, phagocytosis and autophagy**.**

Mitochondria-Structure and functions, protein import and mitochondrial assembly, protein export from mitochondrial matrix.

Chloroplasts- Import and sorting of chloroplast proteins.

**Unit IV: Cytoskeletal proteins**

Structure and organization of actin filaments. Treadmilling and role of ATP in microfilament polymerization, organization of actin filaments. Non-muscle myosin. Intermediate filament proteins, assembly and intracellular organization. Assembly, organization and movement of cilia and flagella.

**Unit V: Cell wall and extracellular matrix**

Prokaryotic and eukaryotic cell wall, cell matrix proteins. Cell-matrix interactions and cell-cell interactions. Adherence junctions, tight junctions, gap junctions, desmosomes, hemidesmosomes, focal adhesions and plasmodesmata.

**Cell cycle, cell death and cell renewal :** Eukaryotic cell cycle, restriction point, and checkpoints. Cell division. Apoptosis and necrosis - brief outline. Salient features of a transformed cell.

**SUGGESTED READING**


1. Paul, A., (2007). Text Book of Cell and Molecular Biology,1st edition. Books and Allied (P) Ltd, Kolkata.

2. Verma, P.S., and.Agarwal, V.K., (2005). Cell Biology Molecular Biology and Genetics, VII Edition, S.Chand and company Ltd, New Delhi.

3. Shukla, R.M., (2013). A textbook of Cell Biology, Dominant Publishers and Distributors.

4. Powar, C.B., (2001). Cell Biology, 3rd edition, Himalaya Publishing House, New Delhi

5. Lodish, H., Berk, A., Kaiser, C.A., and Krieger, M., (2012). Molecular Cell Biology, 7th edition. W.H. Freeman & Company, London.

6. Garret, R. H. and Grisham, C.M., Biochemistry (2010) 4th ed., Cengage Learning (Boston), ISBN-13: 978-0-495-11464-2.

7. Cooper, G.M., and Hausman, R.E., (2013). Cell-A Molecular Approach, 6th Edition.. Sinauer Associates. USA

8. Karp, G., (2013). Cell and Molecular Biology, 7th edition. John Wiley and Sons, Inc, Hoboken, United States.

9. Alberts, B., Johnson,A., Lewis, J., and Enlarge, M., Molecular Biology of the Cell (2008) 5th ed., Garland Science (Princeton), ISBN:

**Semester I**

**18BCU103 MEMBRANE BIOLOGY AND BIOENERGETICS 4H-4C**

**Instruction hours/week: L:4 T:0 P:0** **Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course objectives**

- This course elucidates in detail the structural and functional importance of biomembranes in cellular existence.
- The course provides an in-depth understanding on the concept of sub-cellular compartmentalization within a cell and its biological implications.

**Course outcomes (CO's)**

1. The course gives a sound knowledge on structure, organization and constitutional dynamics of biomembrane.
2. The course lights the importance of photosynthetic system in Biomembranes.

**Unit I: Biomembranes, membrane structures and membrane dynamics**

Composition of biomembranes- prokaryotic, eukaryotic, neuronal and sub-cellular membranes. Study of membrane proteins. Fluid mosaic model with experimental proof. Monolayer, planer bilayer and liposomes as model membrane systems. Polymorphic structures of amphiphilic molecules in aqueous solutions- micelles and bilayers. CMC, critical packing parameter. Membrane asymmetry. Macro and micro domains in membranes. Membrane skeleton, lipid rafts, caveolae and tight junctions. RBC membrane architecture. Lateral, transverse and rotational motion of lipids and proteins. Techniques used to study membrane dynamics - FRAP, TNBS labeling etc. Transition studies of lipid bilayer, transition temperature. Membrane fluidity, factors affecting membrane fluidity.

**Unit II: Membrane transports**

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

**Unit III: Vesicular transport, membrane fusion and bioenergetics**

Types of vesicle transport and their function- clathrin, COP I and COP II coated vesicles. Molecular mechanism of vesicular transport. Membrane fusion. Receptor mediated endocytosis of transferrin. Laws of thermodynamics, state functions, equilibrium constant, coupled reactions, energy charge, ATP cycle, phosphorylation potential, phosphoryl group transfers. Chemical basis of high standard energy of hydrolysis of ATP, other phosphorylated compounds and thioesters. Redox reactions, standard redox potentials and Nernst equation. Universal electron carriers.

**Unit IV: Oxidative phosphorylation**

Mitochondria. Electron transport chain- its organization and function. Inhibitors of ETC

and uncouplers. Peter Mitchell's chemiosmotic hypothesis. Proton motive force. Fo F1ATP synthase, structure and mechanism of ATP synthesis. Metabolite transporters in mitochondria. Regulation of oxidative phosphorylation. ROS production and antioxidant mechanisms. Thermogenesis. Alternative respiratory pathways in plants.

**Unit V: Photophosphorylation**

General features of photophosphorylation, historical background, Hills reaction, photosynthetic pigments, light harvesting systems of plants and microbes and resonance energy transfer. Bacterial photophosphorylation in purple bacteria, Green sulfur bacteria and *Halobacterium salinarum*. Photophosphorylation in plants - structure of chloroplast, molecular architecture of Photosystem I and Photosystem II, Z-scheme of photosynthetic electron flow, oxygen evolving complex and action of herbicides. Cyclic photophosphorylation and its significance. Photo inhibition. Evolution of oxygenic photosynthesis.

## SUGGESTED READING


1. Nelson, D.L. and Cox, M.M., W.H.Freeman., Lehninger: Principles of Biochemistry (2013) 6th ed., and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4641-0962-1.

2. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A. and Scott, M.P., Molecular Cell Biology (2013) 7th ed., W.H. Freeman & Company (New York), ISBN:13: 978-1-4641-0981-2.

3. Garret, R. H. and Grisham, C.M., Biochemistry (2010) 4th ed., Cengage Learning (Boston), ISBN-13: 978-0-495-11464-2.

4. Voet, D.J., Voet, J.G. and Pratt, C.W., (2008) Principles of Biochemistry 3rd ed., John Wiley & Sons, Inc. (New York), ISBN:13: 978

**Semester I**

**18BCU111** **MOLECULES OF LIFE PRACTICAL** **3H-2C**

**Instruction hours/week: L:0 T:0 P:3** **Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course Objectives**

- To know the safety measures to be followed in laboratory
- To give hands on experience on the preparation of buffers and various solutions.
- To identify and separate the biomolecules
- To quantify the vitamin in a sample

**Course outcomes (CO's)**

1. Gain knowledge on lab safety
2. Trained on preparation of reagents and solution
3. Able to analyse biomolecules and vitamins qualitatively and quantitatively
4. Handle the instruments associated with the practical

1. Safety measures in laboratories.
2. Preparation of normal and molar solutions.
3. Preparation of buffers.
4. Determination of pKa of acetic acid and glycine.
5. Qualitative tests for carbohydrates, lipids, amino acids, proteins and nucleic acids.
6. Separation of amino acids/ sugars/ bases by thin layer chromatography.
7. Estimation of vitamin C.
8. Estimation of vitamin E.

**SUGGESTED READING**

1. Nelson, D.L. and Cox, M.M., W.H.Freeman., Lehninger: Principles of Biochemistry (2013) 6th ed., and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4641-0962-1.

2. Devlin, T.M., (2011) Textbook of Biochemistry with Clinical Correlations 7th ed., John Wiley & Sons, Inc. (New York), ISBN:978-0-470-28173-4.

3. Jayaraman, J. (2007). Laboratory Manual in Biochemistry, New Age International Publishers, New Delhi.

4. Sadasivam, S., and Manickam, A., (2009). Biochemical Methods, New Age International Publishers, New Delhi.

**Semester I**

**18BCU112** **CELL BIOLOGY PRACTICAL** **3H-2C**

**Instruction hours/week: L:0 T:0 P:4** **Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course Objectives**

- To train the students in the preparation of biological material for staining, staining procedure and visualization of stained slides
- To identify the different stages of cell division in a biological material
- To acquire knowledge in the techniques involved with the sub cellular fractionation of cell organelles

**Course outcomes (CO's)**

1. Able to prepare slides for staining procedure and visualization of materials
2. Interpret various stages of cell division
3. Understand the principle behind the sub cellular fractionation of organelles and the techniques involved.

1. Preparation of onion root squash and observation of cell
2. Visualization of animal and plant cell by methylene blue staining
3. Identification of different stages of mitosis in onion root tip.
4. Identification of different stages of meiosis in grasshopper testis.
5. Cell size determination using ocular stage micrometer
6. Micrographs of different cell components (dry lab).
7. Sub-cellular fractionation.
8. Visualization of nuclear fraction by acetocarmine stain.
9. Staining and visualization of mitochondria by Janus green stain.

**SUGGESTED READING**

1. Cooper, G.M. and Hausman, R.E., (2009). The Cell: A Molecular Approach 5th ed., ASM Press & Sunderland (Washington DC), Sinauer Associates, MA, ISBN:978-0-87893-300-6.

2. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell. J., (2012) Molecular Cell Biology 7th ed., W.H. Freeman & Company (New York), ISBN:13:978-1-4641-0981-2 / ISBN:10: 1-4641-0981-8.

3. Alberts, B., Johnson,A., Lewis, J., and Enlarge, M., (2008) Molecular Biology of the Cell 5th ed., Garland Science (Princeton), ISBN:

**Semester I**

**18BCU113 MEMBRANE BIOLOGY AND BIOENERGETICS PRACTICAL** **4H-2C**

**Instruction hours/week: L:0 T:0 P:4** **Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course objectives**

- To introduce and to explain the basic concepts in Membrane biology and Bioenergetics.
- To develop more adequate understanding of cellular and biotechnological processes.
- In practical training students learn the principal research methods in Membrane biology and Bioenergetics, develop skills for problem solving.

**Course outcomes (CO's)**

1. The aim of course is to deepen student's knowledge on structure, function and pathology of biological membranes with particular emphasis on principles of energy transformation (bioenergetics).
2. The practical course gives a complete hands-on understanding of the functions of membranes.
3. The practical sessions gives practical understanding of basis membrane related experiments.

1. Effect of lipid composition on the permeability of a lipid monolayer.
2. Determination of CMC of detergents.
3. RBC ghost cell preparation and to study the effect of detergents on membranes.
4. Separation of photosynthetic pigments by TLC.
5. Isolation of mitochondria from liver and assay of marker enzyme SDH.
6. Study photosynthetic $O_2$ evolution in hydrilla plant.
7. Isolation of chloroplast from spinach leaves, estimation of chlorophyll.

**SUGGESTED READING**

1. Nelson, D.L. and Cox, M.M., (2013) Lehninger: Principles of Biochemistry 6th ed., W.H.Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4641-0962-1.

2. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A. and Scott, M.P., (2013). Molecular Cell Biology 7th ed., W.H. Freeman & Company (New York), ISBN:13: 978-1-4641-0981-2.

3. Garret, R. H. and Grisham, (2010). Biochemistry 4th ed., C.M., Cengage Learning (Boston), ISBN-13: 978-0-495-11464-2.

4. Voet, D.J., Voet, J.G. and Pratt, C.W., (2008). Principles of Biochemistry 3rd ed., John Wiley & Sons, Inc. (New York), ISBN:13: 978

பகுதி - I தமிழ்ப் பாடத்திட்டம் (2018 - 2019)

**Instruction hours/week: L:4 T:0 P:0 Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**பகுதி – I, தமிழ்** **பருவம் II**

**18LSU201 : தமிழ் இரண்டாம் தாள்** 4-H,4-C

**(இளநிலை அறிவியல் பட்ட வகுப்புகளுக்குரியது)**

**அலகு – I : பக்தி இலக்கியம் (10 மணிநேரம்)**

சைவ, வைணவ இலக்கியங்கள் - தோற்றம் ,வளர்ச்சி, வரலாறு.

1. **சைவம் -** பெரியபுராணம் - திருமூலநாயனார் புராணம்.
2. **வைணவம் -** பெரியாழ்வார் திருமொழி: 10 பாடல்கள்.

**அலகு – II : சங்க இலக்கியம் : (15 மணிநேரம்)**

சங்க இலக்கியங்கள் அறிமுகம்

**அ). எட்டுத்தொகை**

**நற்றிணை :** பிரசம் கலந்த – பாலை -110

**குறுந்தொகை :** கருங்கட்டாக் கலை – குறிஞ்சி- 69

**ஐங்குறுநூறு :** நெய்தல்-தொண்டிப்பத்து:

திரைஇமிழ் இன்னிசை-171

**பதிற்றுப்பத்து :** சிதைந்தது மன்ற - 27

**பரிபாடல்:** பரிபாடல் திரட்டு-மதுரை நகர்ச்சிறப்பு –

உலகம் ஒரு நிறையாத்தான்-6, மாயோன் கொப்பூழ்-7, செய்யாட்கு இழைத்த-9, கார்த்திகை காதில்-10, ஈவாரைக் கொண்டாடி-11.

**கலித்தொகை :** சுடர்தொடீ கேளாய்: குறிஞ்சிக்கலி- 36

**அகநானூறு :** அன்னாய் வாழி வேண்டன்னை - குறிஞ்சி - 48

**புறநானூறு :** யாதும் ஊரே யாவருங் கேளிர் –பொதுவியல்-192

**ஆ). பத்துப்பாட்டு**

**திருமுருகாற்றுப்படை - பழமுதிர்ச்சோலையின் சிறப்பு**

**முருகன் இருப்பிடங்கள்** – 'சிறுதினை மலரொடு' என்பதிலிருந்துதொடங்கி,

'அறிந்தவாறே' என்பது வரையிலான தொடர்கள்: 218-249.

**முருகன் அருள்புரிதல்** – 'தெய்வம் சான்ற' என்பதிலிருந்து தொடங்கி, 'நல்குமதி' என்பது வரையிலான தொடர்கள்: 286-295.

**அலகு - III : காப்பியம் (6 மணிநேரம்)**

**சிலப்பதிகாரம்:**

**மங்கல வாழ்த்துப் பாடல்: (21-29) – கண்ணகியின் சிறப்பு:** 'நாகநீள் நகரொடு' என்பதிலிருந்து தொடங்கி, 'கண்ணகி என்பாண் மன்னோ' என்பது வரையிலான தொடர்கள்.

**நடுகற்காதை: (207-234) - சேரன் செங்குட்டுவன் கண்ணகிக்குக் கோயில் எடுத்தல்:** 'அருந்திறலரசர்' என்பதிலிருந்து தொடங்கி, 'மன்னவரேறென்' என்பது வரையிலான தொடர்கள்.

**வாழ்த்துக்காதை: (482-485) - செங்குட்டுவனுக்குக் கண்ணகி காட்சியளித்தல்:** 'என்னே' என்பதிலிருந்து தொடங்கி, 'விசும்பில் தோன்றுமால்' என்பது வரையிலான தொடர்கள்.

**வழக்குரை காதை: பத்தினிப் பெண்டிர் எழுவர் கதை:** 'நீர்வார் கண்ணை' என்பதிலிருந்து தொடங்கி, 'புகாரென் பதியே' என்பது வரையிலான தொடர்கள்.

**வஞ்சினமாலை:** 'வன்னி மரமும்' என்பதிலிருந்து தொடங்கி, 'பதிப்பிறந்தேன்' என்பது வரையிலான தொடர்கள்.

**அலகு – IV : சிறுகதை (10 மணிநேரம்)**

1. **குளத்தங்கரைஅரசமரம்– வ.வே.சு.ஐயர்**
2. **காட்டில் ஒரு மான் - அம்பை**
3. **நாற்காலி – கி.ராஜநாராயணன்**
4. **நகரம்– சுஜாதா**

**அலகு- V : மொழிப்பயிற்சி (7 மணிநேரம்)**

படைப்பிலக்கியப் பயிற்சிகள் (கதை, கவிதை, கட்டுரை, உரைநடை)
மொழிபெயர்ப்பு

**பாட நூல்: கற்பகச்சோலை – தமிழ் ஏடு.** கற்பகம் பல்கலைக்கழகத் தமிழ்த் துறை வெளியீடு.

**Semester II**

**18BCU201** **PROTEINS** **4H-4C**

**Instruction hours/week: L:3 T:1 P:0** **Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course Objectives**

- The main objective of the course explains about the physical and chemical properties of proteins.
- The course exhibits in depth knowledge on its structural organization, separation, purification and characterization of proteins by adopting various methods and techniques.
- The course also describes about some applications of specialized proteins.

**Course outcomes (CO's)**

1. The student gathers information on protein structure, its separation techniques and other latest developments.
2. Information on specialized proteins and its application will be known to the students.

**Unit I: Introduction, Extraction and Separation of Proteins**

Introduction - Amino acids and their properties - hydrophobic, polar and charged amino acids. Biologically important peptides - hormones, antibiotics and growth factors. Multimeric proteins, conjugated proteins and metallo proteins. Diversity of function. Extraction of proteins for downstream processing - Solubilization of proteins from their cellular and extracellular locations. Use of simple grinding methods, homogenization, ultrasonication, French press and centrifugation. Separation techniques - Ammonium sulphate fractionation, solvent fractionation, dialysis and lyophilization.

**Unit II: Purification and Characterization of proteins**

Chromatographic Techniques - Ion-exchange chromatography, molecular sieve chromatography, hydrophobic interaction/reverse phase chromatography, affinity chromatography, HPLC (Normal and Reverse phase) and FPLC. Characterization of proteins - Determination of purity, molecular weight, extinction coefficient and sedimentation coefficient, IEF, SDS-PAGE and 2-D electrophoresis.

**Unit III: Structural Organization and Analysis of proteins**

Organization of protein structure into primary, secondary, tertiary and quaternary structures. N-terminal and C-terminal amino acid analysis. Sequencing techniques - Edman degradation. Generation of overlap peptides using different enzymes and chemical reagents. Disulfide bonds and their location. Mass spectrometric analysis, tandem MS. Solid phase peptide synthesis

**Unit IV: Three dimensional structures of protein and Protein Structure Database**

Nature of stabilizing bonds - covalent and non covalent. Importance of primary structure in folding. The peptide bond - bond lengths and configuration. Dihedral angles psi and phi. Helices, sheets and turns. Ramachandran map. Techniques used in studying 3-D structures - X-ray diffraction and NMR. Motifs and domains. Tertiary and quaternary structures. Structures of myoglobin and haemoglobin. Denaturation and

renaturation of Ribonuclease A. Introduction to thermodynamics of folding and molten globule. Assisted folding by molecular chaperones, chaperonins and PDI. Defects in protein folding. Diseases –Alzheimer's and Prion based. Protein sequence and structure databases (PDB). Use of sequence and domain information. Viewing protein structures using *in silico* tools.

**Unit V: Specialized Proteins and its Applications**

Myoglobin and haemoglobin - Oxygen binding curves, influence of 2,3-BPG, CO2 and $Cl^-$ Hill plot. Cooperativity between subunits and models to explain the phenomena – concerted and sequential models. Haemoglobin disorders. Antibodies - Antibody structure and binding to antigens. Actin-myosin motors - ATP activated actin - myosin contractions. Membrane Proteins - Integral and membrane associated proteins. Hydropathy plots to predict transmembrane domains. Significance of membrane proteins - bacteriorhodopsin.

**SUGGESTED READING**


1. Nelson, D.L. and Cox, M.M., (2013). Lehninger: Principles of Biochemistry 6th ed., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.

2. Sheehan, D., (2009). Physical Biochemistry 2nd ed., Wiley-Blackwell (West Sussex), ISBN: 9780470856024 / ISBN: 9780470856031.

3. Cooper, T.G., (2011). The Tools of Biochemistry Wiley India Pvt. Ltd. (New Delhi), ISBN: 978-81-265-3016-8.

**Semester II**

**18BCU202 ENZYMES 4H-4C**

**Instruction hours/ week: L:4 T:0 P:0** **Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course objectives**

- To understand the basic concepts of enzymes
- To study the kinetics of enzyme catalysed reactions
- To learn the mechanism of action of enzymes and enzyme inhibition concepts
- To understand various modes of enzyme regulation
- To learn the application of enzymes in health and diseases

**Course outcomes (CO's)**

1. Understand the basic concepts on enzymes
2. Relate the initial velocity and substrate concentration of enzymes and be able to understand the kinetics of inhibition reactions
3. Able to understand the regulation pattern of various enzymes
4. Relate the regulation pattern of enzymes for its application in health and diseases
5. Understand the application of enzymes as marker in various disease conditions

**Unit I: Introduction to enzymes and enzyme catalysis**

Introduction - Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes. Features of enzyme catalysis- Factors affecting the rate of chemical reactions, collision theory, activation energy and transition state theory, catalysis, reaction rates and thermodynamics of reaction. Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis.

**Unit II: Enzyme kinetics**

Relationship between initial velocity and substrate concentration, steady state kinetics, equilibrium constant - monosubstrate reactions. Michaelis-Menten equation, Lineweaver-Burk plot, Eadie-Hofstee and Hanes plot. Km and Vmax, Kcat and turnover number. Effect of pH, temperature and metal ions on the activity of enzyme. Bisubstrate reactions - Types of bi bi reactions (sequential – ordered and random, ping pong reactions). Differentiating bi substrate mechanisms (diagnostic plots, isotope exchange).

**Unit III: Mechanism of action of enzymes and Enzyme inhibition**

Mechanism of action of enzymes - General features - proximity and orientation, strain and distortion, acid base and covalent catalysis (chymotrypsin, lysozyme). Metal activated enzymes and metalloenzymes, transition state analogues. Enzyme Inhibition - Reversible inhibition (competitive, uncompetitive, non-competitive, mixed and substrate). Mechanism based inhibitors - antibiotics as inhibitors.

**Unit IV: Regulation of enzyme activity**

Control of activities of single enzymes (end product inhibition) and metabolic

pathways, feedback inhibition (aspartate transcarbomoylase), reversible covalent modification phosphorylation (glycogen phosphorylase). Proteolytic cleavage-zymogen. Multienzyme complex as regulatory enzymes. Occurrence and isolation, phylogenetic distribution and properties (pyruvate dehydrogenase, fatty acyl synthase) Isoenzymes - properties and physiological significance (lactate dehydrogenase).

**Unit V: Coenzymes**

Coenzymes in enzyme catalysed reactions and Applications of enzymes. Structure and Functions of TPP, FAD, NAD, pyridoxal phosphate, biotin, coenzyme A, tetrahydrofolate, lipoic acid. Applications of enzymes - Application of enzymes in diagnostics (SGPT, SGOT, creatine kinase, alkaline and acid phosphatases), enzyme immunoassay (HRPO), enzyme therapy (Streptokinase). Immobilized enzymes – Preparation techniques and its applications.

## SUGGESTED READING


1. Nelson, D.L. and Cox, M.M., (2013). Lehninger: Principles of Biochemistry 6th ed., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.

2. Donald, V. and Judith G.V., (2011). Biochemistry 4th ed., John Wiley & Sons Asia Pvt. Ltd. (New Jersey), ISBN:978-1180-25024.

3. Nicholas C.P., and Lewis S., (1999). Fundamentals of Enzymology 3rd ed., Oxford University Press Inc. (New York), ISBN:0 19 850229 X.

**Semester II**

**18BCU203** **HUMAN PHYSIOLOGY** **4H-4C**

**Instruction hours/week: L:4 T:0 P:0 Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course objectives**

- Human Physiology aims to promote mechanistic advances in human integrative and translational physiology.
- Human Physiology provides a forum for many physiological areas.

**Course outcomes (CO's)**

1. The purpose of this course is to promote knowledge in the integration of theories, methods and research in human physiology.
2. It gives and exposure about human anatomy and physiology.
3. Student would know about their own body system and its functions.

**Unit I: Homeostasis and the organization of body fluid compartments**

Intracellular, extracellular and interstitial fluid. Homeostasis, control system and their components. Plasma as an extracellular fluid, RBC, molecular mechanism of blood coagulation, role of vitamin K in coagulation, anticoagulant and fibrinolytic systems. Anemias, polycythemia, haemophilia and thrombosis.

**Respiration** : Organization of the pulmonary system. Mechanism of respiration, pulmonary ventilation and related volumes, pulmonary circulation. Principles of gas exchange and transport. Regulation of respiration. Pulmonary oedema and regulation of pleural fluid. Hypoxia, hypercapnea, pulmonary distress, emphesema, ARDS.

**Unit II: Cardiovascular physiology**

Pressure, flow and resistance. Anatomy of heart. Physiology of the cardiac muscle, automacity of the cardiac muscle contraction, excitation contraction coupling, relationship between cardiac cycle, heart sound, ventricular volumes and the ECG, control of cardiac function and output. The arterial system, venous system, the microcirculation and mechanics of capillary fluid exchange. Control of blood flow to the tissues. Portal circulations. Arterial pressure and its regulation. Hypertension, congestive heart disease, atherosclerosis and myocardial infarction.

**Unit III: Renal physiology**

Anatomy of the kidney and the nephron. Regulation of renal blood flow. Cell biology of the Bowmans' capsule. Physiology of glomerular filtration and GFR. Tubular processing of the glomerular filtrate. Micturition reflex and voluntary control of micturition. Regulation of ECF electrolyte and water content, blood volume and long term blood pressure. Blood buffer systems, renal and pulmonary control of blood pH, renal clearance. Assessment of kidney function. Acidosis and alkalosis. Glomerular nephritis, renal failure, dialysis and diuretics.

**Unit IV: Gastrointestinal and hepatic physiology**

Histology of the gastrointestinal tract. Propulsion and motility of food and digested

material. Enteric reflexes, secretory functions of the gastrointestinal tract, digestion and absorption of macro and micronutrients. Peptic ulcer, Sprue, celiac disease, IBD, regurgitation, diarrhoea and constipation. Anatomy of the hepatic lobule and blood flow into the liver. Formation and secretion of bile. enterohepatic cycle, reticuloendothelial system, metabolic importance of liver. Liver function tests. Jaundice, liver cirrhosis and fatty liver.

**Musculosketetal system** :Bone structure and formation. Physiology of muscle contraction in striated and non-striated muscle.

**Unit V: Reproductive physiology**

Sex determination and differentiation. Development of female and male genital tracts. Spermatogenesis, capacitation and transport of sperm, blood testis barrier. Ovarian function and its control. Uterine changes, fertilization and implantation. Placenta as a feto- maternal unit, gestation and parturition.

**Neurochemistry and neurophysiology:** Central Nervous system. Peripheral Nervous system. Blood brain barrier and CSF. Membrane potentials. Synaptic transmission. Neurotransmitters. Sensory receptors and neural pathways. Somatic sensation, EEG, sleep, coma, learning and memory**.**

## SUGGESTED READING


1. Chatterjee, C.C., (2012). Human Physiology, 11th edition, Mical Alli Agency, Calcutta.

2. Saradha, S., (2004). Textbook of Human Physiology, S. Chand and Company, New Delhi.

3. Guyton, C., and Hall, J.E., (2010). Textbook of Medical Physiology, 12th Editon. Prism Indian edition, W.B. Saunders Company, New Delhi.

4. Murray, R.K., Bender, D.A., Botham, K.M., and Kennelly, P.J., (2012).Harper's illustrated Biochemistry, 29th edition.. McGraw-Hill Medical. London.

**Semester II**

| **18BCU211** | **PROTEINS PRACTICAL** | **3H-2C** |
|---|---|---|

**Instruction hours/week: L:0 T:0 P:3 Marks:** Internal: **40** External: **60** Total: **100**
**End Semester Exam:** 3 Hours

**Course Objective:**
This practical course on proteins describes about the qualitative and quantitative analysis, as well as its purification and characterization.

**Course outcomes (CO's):**
By the end of the course, students can be able to demonstrate the importance of the protein chemistry and their wide applications.

1. Estimation of proteins using UV absorbance and Biuret method.
2. Microassay of proteins using Lowry/Bradford method.
3. Isoelectric pH of casein.
4. Ammonium sulphate fractionation of serum proteins.
5. Separation of albumin from serum using anion-exchange chromatography.
6. SDS-PAGE analysis of proteins.

**SUGGESTED READING**

1. Nelson, D.L. and Cox, M.M., (2013). Lehninger: Principles of Biochemistry 6th ed., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.

2. Sheehan, D., (2009). Physical Biochemistry 2nd ed., Wiley-Blackwell (West Sussex), ISBN: 9780470856024 / ISBN: 9780470856031.

3. Cooper, T.G., (2011). The Tools of Biochemistry Wiley India Pvt. Ltd. (New Delhi), ISBN: 978-81-265-3016-8.

**Semester II**

**18BCU212** **ENZYMES PRACTICAL** **3H-2C**

**Instruction hours/week: L:0 T:0 P:3 Marks:** Internal: **40** External: **60** Total: **100**
**End Semester Exam:** 3 Hours

**Course Objectives**

- To know the sources of enzymes and study the extraction and partial purification of enzyme acid phosphatase
- To standardize the optimum pH, optimum substrate concentration required for the maximum activity of acid phosphatase
- To analyse the inhibition pattern by various competitive inhibitors for the enzyme acid phosphatase purified from germinated mung bean
- To assay the activity of Lactate dehydrogenase and glucose – 6 – phosphate dehydrogenase enzymes

**Course outcome (CO's)**

1. The students will be expertise in extraction of protein from germinated mung bean.
2. Understand the purification process of enzyme.
3. Analyze the optimum pH, substrate concentration for the maximum enzyme activity.
4. Gain hands on training in assay of enzymes acid phosphatase, Lactate dehydrogenase and Glucose – 6- phosphate dehydrogenase.

1. Partial purification of acid phosphatase from germinating mung bean.
2. Assay of enzyme activity and specific activity, e.g. acid phosphatase.
3. Effect of pH on enzyme activity
4. Determination of $K_m$ and $V_{max}$ using Lineweaver-Burk graph.
5. Enzyme inhibition - calculation of $K_i$ for competitive inhibition.
6. Continuous assay of lactate dehydrogenase.
7. Assay of glucose-6-phosphate dehydrogenase.

**SUGGESTED READING**

1. Nelson, D.L. and Cox, M.M., (2013). Lehninger: Principles of Biochemistry 6th ed., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.
2. Donald, V., and Judith G.V., (2011). Biochemistry 4th ed., John Wiley & Sons Asia Pvt. Ltd. (New Jersey), ISBN:978-1180-25024.

3. Nicholas C.P. and Lewis S., (1999). Fundamentals of Enzymology 3rd ed., Oxford University Press Inc. (New York), ISBN:0 19 850229 X.

**B.Sc., Biochemistry** **2018-2019**

**Semester II**

**18BCU213** **HUMAN PHYSIOLOGY PRACTICAL** **4H-2C**

**Instruction hours/week: L:0 T:0 P:4** **Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course objective**

- The course gives a depth practical knowledge on different physiological examinations.

**Course outcomes (CO's)**

1. The course exposes to significant human physiological measurements.
2. Students would get an opportunity to view their own blood cells, their grouping, and separation of isoenymes.
3. Students are exposed to histological viewing of different organs under a microscope.

1. Hematology.
   a. RBC and WBC counting
   b. Differential leucocyte count.
   c. Clotting time.
   d. Bleeding time
2. Estimation of haemoglobin.
3. Determination of blood groups
4. Separation of plasma proteins (Group Experiment).
5. Determination of total iron binding capacity.
6. Pulmonary function tests, spirometry and measurement of blood pressure.
7. Separation of isoenzymes by electrophoresis (Group Experiment).
8. Histology of connective tissue, liver and/ brain - permanent slides.
9. Case studies (Renal clearance, GFR, ECG).

**SUGGESTED READING**


1. Rajan, S., (2012) Manual for Medical laboratory technology, First edition. Anjana Book House, Chennai.

2. Rao, B.S. and Deshpande, V., (2005). Experimental Biochemistry: A Student Companion IK International Pvt. Ltd. (New Delhi), ISBN:81-88237-41-8.

**Semester II**

**18AEC201 ENVIRONMENTAL STUDIES 4H-4C**

**Instruction hours/week: L: 4 T:0 P:0** **Marks:** Internal: **40** External: **60** Total: **100**

**End Semester Exam:** 3 Hours

**Course objective**

- To develop an attitude of concern for the environment.
- To know the social issues of the environment.
- To understand the core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- To know about the various renewable and nonrenewable resources of the region.

**Course outcomes (CO's)**

1. Make appropriate judgments and decisions for the protection and improvement of the earth.
2. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
3. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.

**UNIT I: Introduction- Environment**

Environment Definition, scope and importance, components, Ecosystem Definition, Concept, Scope, importance, Structure and functions of ecosystem. Energy flow, Ecological succession Food chains and food webs. Classification of ecosystem.

**Unit II: Natural Resources - Renewable and Non-renewable Resources**

Natural resources and associated problems. Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources : Use and over-utilization, exploitation. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Ill-effects of fireworks.

**Unit III: Biodiversity and Its Conservation**

Introduction, definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

**Unit IV: Environmental Pollution**

Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution , Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: Foods, earthquake, cyclone and landslides.

**Unit V: Social Issues and the Environment**

From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Population growth, variation among nations. Population explosion—Family Welfare Programme. Environment and human health. Human rights. Value education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in environment and human health.

## SUGGESTED READING


1. Singh, M.P., Singh, B.S., and Dey, S.S., (2004). Conservation of Biodiversity and Natural Resources. Daya Publishing House, Delhi.

2. Botkin, D.B., and Keller, E.A., (1995). Environmental Science, John Wiley and Sons, Inc., New York.

3. Uberoi, N.K., (2005). Environmental Studies, Excel Books Publications, New Delhi, India.

4. Tripathy, S.N., and Panda, S., (2004). Fundamentals of Environmental Studies; 2nd Edition, Vrianda Publications Private Ltd., New Delhi.

5. Kumar, A., (2004). A Textbook of Environmental Science; APH Publishing Corporation, New Delhi.

6. Verma, P.S., Agarwal, V.K., (2001). Environmental Biology (Principles of Ecology); S.Chand and Company Ltd., New Delhi.

7. Kaushik, A., Kaushik, C.P., (2004). Perspectives in Environmental Studies, New Age International Pvt. Ltd. Publications, New Delhi.