Swami Ramanand Teerth Marathwada University Nanded.

FACULTY OF SCIENCE

SYLLABUS

B.Sc. (BIOPHYSICS)

SECOND YEAR (CBCS Pattern)

SEMESTER III & IV

[Syllabus progressively effective from June 2017-18 onward]

B.Sc. Biophysics Second Year Syllabus
(2017-18)
Semester III & IV

SEM	Code & Paper Code	Title of the paper	Section & Hrs/week	Total period	External (ESE)	Internal (CA)	Total Marks	Credits
III	CCBP-VI	Membrane Biophysics	A/03	45	40	10	50	02
	CCBP-VII	Molecular Biology	B/03	45	40	10	50	02
	Lab Course CCBPP-II	Practical's based on theory paper VI & Practical's based on theory paper VII (CCBP-VI & VII)	03 03	Practical 08 08	20 20	05 05	25 25	01 01
	SECBP-I	SEC I (A-Membrane physiology/ B-Molecular studies of Biomolecules)	02+01	45	25	25	25 25	(02)*
IV	CCBP-VIII	Physiological Biophysics	A/03	45	40	10		02
	CCBP-IX	Molecular Enzymology	B/03	45	40	10		02
	SECBP-II	SEC II (A-Human Physiology/ Enzyme Biophysics Laboratory Techniques)	03	45	25	25		(02)*
	Lab Course CCBPP-III	Practical's based on theory paper VIII & Practical's based on theory paper IX (CCBP-VIII & IX)	03 03	Practical 08 08	20 20	05 05	25 25	01 01
		Total for B.Sc. II Year: Sem. I + Sem. II + Lab Course (Annual)						12(04)*

Note – ESE of CCBPPII, CCBPPIII & SECBPI, and SECBPII should be evaluated at annual

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure
B. Sc. second year (Semester- III)
Semester Pattern effective from June -2017

Biophysics

CCBP-VI: Membrane Biophysics

Credits: 02 (Marks: 50) Periods: 45

Swami Ramanand Teerth Marathwada University,Nanded

B.Sc. Second year sem-III [Biophysics]Syllabus

Paper CCBP-VI: Membrane Biophysics

[Total Marks: 50] (40Ext.+10 Int.) *[Total Workload:45 hrs]*

Unit I: ***Membrane structure and Models***:

Membrane architecture, Lipid vesicles and planar Bilayer membrane, Membrane permeability, Membrane Channels, transmembrane helices,hydropath Plot, Membrane Asymmetry, Membrane fluidity,Functional reconstitution of membranes. Models of membrane fusion: bilayer fusion,viral fusion, cellular fusion, cell-cell fusion, fusion in mitochondria, Lipid bilayer and early models, Fluids mosaic model, Evidence from model system and biomembranes.

Unit II: ***Physical Properties of membrane***:

Elastic properties, Elastic constants, Charge-induced microstructures and domain. Hysteresis of domain formation. Lateral phase separation. Critical concentrations fluctuation, selective lipid protein interactions, Membrane melting.

Unit III: ***Membrane transport***:

Transport system with non-electrolytes and electrolytes. Transport with chemical reaction system: Primary and secondary active transport. Transports of molecules by simple and facilitated diffusion Transport by flux coupling. Transport by phosphotransferase system, Transport by vesicle formation

Electron Transport & Oxidative phosphorylation: Reduction potentials and free energy changes in redox reaction, organization of electron transport chain, chemiosmotic coupling, proton gradient drive and synthesis of ATP, P/O ratio for oxidative phosphorylation, Cytosolic NADH electron feeding into electron transfer

Unit IV: Membrane potentials:

Cell surface charge, Resting membrane potential, Action potential, properties of action potential,Nernst equation, Membrane impedance and capacitance, Transmembrane potential, Zeta, stern and total electrochemical potential.

Books Recommended:

1. Molecular & Cellular Biology, D Roberties,
2. Biophysical Aspects of Transmembrane signaling, Sandor D (2005), Springer
3. Biophysics, Vasant Pattabhi, Gautam (2002), Narosa .
4. Biomembrane structure and Function, Chapman D.
5. Introduction to Biological Membrane, Jain R K
6. Biophysics, Hopp, Lohman, Mark and Ziegler
7. Advances in Biophysics, Vol 18, 15
8. Molecular and Cellular Biophysics, Meyer B Jackson (2006), Cambridge)
9. Text Book of Physiology, Guyton & Hall, 11th Ed. 2006

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure
B. Sc. second year (Semester- III)
Semester Pattern effective from June -2017

Biophysics

CCBP-VII: Molecular Biology

Credits: 02 (Marks: 50) Periods: 45

Unit 1 - Introduction to molecular biology

The Central Dogma, DNA Structure and Chemistry, The Molecular Nature of Genes & Organization, Gene Function, Protein-DNA Interactions (prokaryote and eukaryote), DNA Topology and the Nucleosome, Inrtroduction to bacterial genetics.

DNA Replication: The Replication Fork, Origins and Telomeres, Enzymes of DNA synthesis, DNA Repair, DNA Recombination.

Unit II- Transcriptional Machinery

RNA Structure, RNA Types, genetic code, Eukaryotic RNA Polymerases and Their Promoters, reverse transcriptase, General Transcription Factors and Transcription. Activators in Eukaryotes Messenger RNA Processing: Splicing, Capping and Polyadenylation , Ribozymes, and Regulatory RNA Phage, Bacterial & Eukaryotic transcriptional Control.

Unit – III Transcriptional Machinery

The Mechanism of Translation: Initiation, Elongation and Termination, Post Translational processing, Translational Control, Posttranslational modifications.
Control of genetic expression, Lac, Trp, operons, regulation of protein synthesis.

Unit – IV Principles of r-DNA technology

Steps involved in r-DNA Technology, Restriction enzymes and its applications in medicine, agriculture, and in the production of commercially important proteins.

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure
B. Sc. second year (Semester- IV)
Semester Pattern effective from June -2017

Biophysics

CCBP-VIII: Physiological Biophysics

Credits: 02 (Marks: 50) Periods: 45

Unit I- Digestive & Excretory systems

Digestive system – oesophagus, stomach and small and large intestine and liver. Process of digestion.

Excretary system – structure of kidney, ureter, urinary bladder urethra, functions of kidney, formation of urine and its composition.

Unit II- Cardivascular & Respiratory sytem

Circulatory system. Heart as a pump, cardiac cycle, Composition of blood and lymph, blood vessels. Structure of arteries, veins and capillaries, Haemodynamic principles.

Respiratory system – Respiratory tract, lungs. Process of respiration.Transport and exchange of oxygen and carbon dioxide in body.

Unit III- Nervous system & Sence organs

Central nervous system., brain and spinal cord. Functions of cerebrum, cerebellum and medulla oblongata, Peripheral nervous system, Structure of neuron, Neuroglia. Myelinated and unmyelinated nerve fibers. Polarisation and depolarisation of the cell, Conduction velocity of nerve impulse in relation to various factors, Properties of nerve fibers –excitability, conductivity, all-or none law, accommodation, adaptation, summation, refractory period, synaptic potentials, synaptic transmission of the impulse, neurotransmitters. Motor unit. Injury to peripheral nerves-degeneration and regeneration-brief idea.The neuromuscular junctions – structure, events in transmission, end-plate potential.

Sense organs -Physiology of Vision, audition, olfaction, taste,tactile sensation

Unit IV- Endocrine & Reproductive systems

Endocrine glands – Role of hypothalamus, functions of pituitary, thyroid, adrenal glands, parathyroid and gonads.

Reproductive Systems-Structure & physiology, concepts of IVF, IUI, sperm analysis

Books Recommended:

1. Boobeck. J R (Ed), “Best and Taylor’s Physiological basis of Medical Practice”, The Williams & Wilkins Co.

2. Howell- Fulton,“Physiology and Biophysics”,T.C.Iwch & H.D. Palton,W.B.Saunders Co.23

3. Berne.R.M & Levy. M.N (Eds), “Physiology”, The C.V. Moshy Co. St. Louis,Toronto.
4. Hamilton.W.F, “ Hand Book of Physiology”, Section 2, Circulation Vol II,American Physiological Society.

5. Arthur .C. Guyton & John.E.Hall, “Text Book of Medical Physiology”, W. B.Saunders Co.
6. Widmaier, Raff & Strang, “Vander’s Physiology- The mechanism of body Function. Mc Graw-Hill.

Reference Books:-

1. Principles of Biochemistry by A.L. Lehninger, D.L. Nelson and M.M. Cox, CBS Publishers, New Delhi, 1993.
2. Biochemistry by L. Stryer, W.H. Freeman and Co., Newyork 1997.
3. Conformation of Carbohydrates by V.S.R. Rao, P.K. Qasba, P.V. Balaji and R. Chandrasekaran, Harwood Academic Publishers, 1998.
4. Steno Chemistry of Carbohydrates J.F. Stoddart , Wiley Interscience 1971.
5. Complex Carbohydrates their Chemistry by N. Sharon, Biosynthesis and Functions, Addison-Wesley, London, 1975.
6. Bio active carbohydrates in Chemistry, Biochemistry and Biology by J.F.Kennedy and C.A.White, Ellis Harwood, New York, 1983.
7. Principles of Protein Structure by G. Schulz and R.H. Schirmer, Springer -Verlag, 1984.
8. Introduction to Protein Structure by C. Branden and J. Tooze, Gar land Publishing, 1991.
9. Proteins Structure and Molecular Properties Thomas E. Creighton, W.H. freeman and Company, New York, 1993.
10. Principles of Nucleic acid Structure, W. Saenger, Springer verlag, 1984.
11. Biophysics by W. Hoppe. et. al., Springer - Verlag, 1989.
12. Biophysics by Vasantha Pattabhi and N. Gautham, Narosa Publishmg House, New Delhi,2002.
13. Essentials of Biophysics by P. Narayanan, New Age International (P) Ltd. Publishers, New Delhi, 2000.

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure
B. Sc. second year (Semester- IV)
Semester Pattern effective from June -2017

Biophysics

CCBP-IX: Molecular Enzymology

Credits: 02 (Marks: 50) Periods: 45

Unit 1:Introduction to Enzymes

General and unique features of enzyme, nomenclature and classification of enzymes, Enzyme commission code, Catalysis,Acid-base catalysis and covalent catalysis, characteristics and mechanism of enzyme action, lock & key hypothesis, induced fit hypothesis, Active site structure, Enzyme specificity & selectivity, Co-enzymes and cofactors, Role of various cofactors in enzyme catalysis, Measurement of enzyme activity and its expression as Enzyme units, specific activity, katal, Intracellular localization of enzymes,

Unit 2: Kinetics of enzyme

Michaelis-Menton equation, steady state hypothesis, Vmax , Km & turnover number and their significance. Line Weaver-Burk plots and its limitation. Eddie– Hofstee plot, Factors affecting enzyme activity-pH,temperature,pressure,.

Unit 3: Enzyme Inhibitions

Nature of enzyme inhibitors and activators, Reversible, irreversible, competitive, non-competitive, uncompetitive and mixed types of inhibition, Metalloenzymes ,Metal ions as enzyme inhibitors and activators.

Unit 4: Use of Enzymes

Extraction and purification of enzymes by using various techniques. Tests for purification and characterization . . Immobilization of enzymes,Industrial and clinical applications of enzymes. Use of enzymes in food, Feed, dairy, leather, textile and drug industries. Enzyme electrodes

Books Recommended:

1. Principles of Biochemistry - L. Stryer (W.H. Freeman & Co.)
2. Principles of Biochemistry - A.L.Lehninger, D.W.Nelson & M.M.Cox(Macmillan)
3. Biochemistry - D.Voet & J.G.Voet (John Willey)
4. Harper's Illustrated Biochemistry - R.K.Murray et al. (McGraw Hill)
5. Outline of Biochemistry - Conn & Stump (John Willey & Sons)
6. Protein Science - A.M. Lesk (Oxford Univ. Press)
7. DNA Structure & Function - R.R. Sinden (Academic Press)
8. The Enzyme – Dixon & Webb .
9. Enzymes:The Machines of Life-
11. Understanding Enzymes Palmer

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure
B. Sc. Second year Semester Pattern effective from June -2017

Biophysics

Practical Paper: Lab course CCBPP-II

Credits: 02 (Marks: 50)

Membrane Biophysics Practicals

1. Study of membrane fluidity.
2. Effect of hypertonic/ hypotonic/isotonic on RBC membrane.
3. Purification of substances by dialysis
4. Study of volume regulation of erythrocyte and osmotic fragility.
5. Ionophore effect on erythrocyte.
6. Osmolarity: Determination of osmotic pressure of salts.
7. Verification of fick's law of diffusion.
8. Study of phase transition of membrane phospholipids.
9. To study of membrane potential using fluorescence spectroscopy.

Molecular Biology Practicals(Practicals based on BP-VII)

1. UV spectra of DNA
2. Isolation of chromosomal DNA from *E.coli*.
3. Isolation of plasmid DNA from transformed *E.coli*
4. Characterization of isolated DNAs by agarose gel electrophoresis.
5. Extractions of nucleic acids from gels.
6. Artificial transformation of *E.coli* by plasmid DNA.
7. Study of bacterial conjugation.
8. SDS-PAGE of protein.

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure
B. Sc. Second year Semester Pattern effective from June -2017

Biophysics

Practical Paper: Lab course CCBPP-iII

Credits: 02 (Marks: 50)

Physiological Biophysics Practicals (Practical's based on BP-VIII)

1. Study of Neubauer's Counting Chamber.
2. Red blood cell count/µl of blood
3. White blood cell count/ µl of blood
4. Haemoglobin content estimation
5. Differential count of White blood cells
6. Determination of ESR
7. Determination of Clotting time
8. Determination of Bleeding time
9. Determination of Blood groups
10. Determination of fragility of erythrocytes
11. Oscilloscope Experiments
12. Spirometry- Measurement of vital capacity, tidal volume, different timed volumes, peak flow rate.
13. Anatomical study of different body systems by using virtual CD Rom/ DVDs(Educational Software).
14. Research laboratory / Clinical laboratory visits to observe neurophysiology and Cardiovascular experiments and instrumentation**.**
15.Blood pressure measurement
16. Pulse measurement .
17. Interpretation of kymograph records.

Molecular Enzymology Practicals (Practicals based on BP-IX)

1. Kinetic characteristics of alkaline phosphatase: (i) Progress curve; (ii) pH optima; (iii) temperature optima (iv) Km and Vmax ; (v) specific activity.
2. Effect of Mg2+ ion on the activity of alkaline phosphatase
3. Effect of metal ion on the activity of alkaline phosphatase
4. Kinetic & Clinical Assay of lactate dehydrogenase (LDH).
5. Kinetic Assay of α-amylase.
6. Kinetics Assay of invertase.
7. Immobilization of enzyme
8. Preparation of enzyme crystals & their microscopic analysis

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure
B. Sc. second year (Semester- III)
Semester Pattern effective from June -2017
Biophysics

Skill Enhancement Course SECBP-I (A)

Membrane physiology **2 Credits**

Objectives :

- To create interest about membrane in biological world.
- To impart the essential skills for membrane based laboratory experimentation.
- To increase the scope.

Syallabus :

Definition, areas covered in Membrane Biophysics, Overview of membrane

Biological membrane : Colloidal solution, Micelles, reverse micelles, bilayers, liposomes, phase transitions of lipids, Transport of solutes and ions.

Overview Membrane characterization Osmosis, Dialysis, Bubble pressure, hydropathy plot, Fick's laws of diffusion, ionophores, transport equation, membrane potential.

Skill in Membrane characteration:
Overview of patch-plamp technique, Scanning Electron Microscopy (SEM).Transmission Electron Microscopy (TEM)

Practical:- Isolation of membrane, membrane topology, Osmosis and Dialysis.

References :

1. Physical Biochemistry: Principles and Applications, 2nd edition (2009), David Sheehan, John Wiley. ISBN-13: 978-0470856031.
2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology, 2nd edition (1982), David Freifelder, W.H. Freeman and Company. ISBN-13: 978-0716714446.
3. Physical Chemistry: Principles and Applications in Biological Sciences, 4th edition (2001), I. Tinoco, K. Sauer, J.C. Wang and J.D. Puglisi, Prentice Hall, ISBN-13: 978-0130959430.
4. Molecular Biology of the Gene, 7th edition (2007), Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R, Benjamin Cummings Publishers, ISBN-13: 978-0805395921.
5. Biophysics, 1st edition (1983), W. Hoppe, W. Lohmann, H. Markl and H. Ziegler, Springer-Verlag, ISBN-13: 978-3540120834.

OR

Skill Enhancement Course SECBP-II (B)

Molecular studies of Biomolecules **2 Credits**

Objectives

- To *study and understanding of the execution of central dogma..*
- To impart the essential skill for Molecular isolation
- To develop entrepreneurial skills

Theory :

Chemistry of DNA synthesis, General principles - bidirectional replication, Semi-conservative, discontinuous. RNA priming, Various models of DNA replication, The mutability and Repair of DNA, Information Transfer –I: Mechanism of Transcription, Split Genes, Concept of introns and exons, RNA splicing, Spliceosomes and Self splicingintrons, alternative splicing and exon shuffling, mRNA transport., Features of genetic code and exceptions in some systems, Ribosome structure- rRNA and proteins,

Practicals: Isolation , estimation and detection of DNA and RNA.

References

1. Molecular Biology of the Gene, 6th edition (2007), Watson, J. D., Baker T. A., Bell, S. P., Gann, A., Levine, M., and Losick, R; Benjamin Cummings Publishers, ISBN-13: 978-0805395921.

2. Cell and Molecular Biology: Concepts and Experiments, 7th edition (2013), Gerald Karp. ; Wiley Publishers ISBN-13: 978-1118206737.

3. Molecular Cloning: A Laboratory Manual, 4th edition (2012), Michael R. Green and Joseph Sambrook; Cold Spring Harbor Laboratory Press, ISBN-13: 978-1936113422.

4. The World of the Cell, 7th edition (2008), Becker, Kleinsmith, Hardin and Bertoni. Benjamin Cummings, ISBN-13: 978-0805393934.

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure
B. Sc. second year (Semester- III)
Semester Pattern effective from June -2017

Biophysics

Skill Enhancement Course SECBP-II (A)

Human Physiology **2 Credits**

Objectives

- To create awareness about physiological abnormality.
- To develop the essential skills among students in physiological diagnostic techniques
- To increase the job opportunities related to medical.
- *The prime concern of this syllabus is to integrate the individual functions of all the cells and tissues and organs into functional whole, the human body.*

Theory:

Body organization and Integumentary system :

General Anatomy of the body, Introduction to various kinds of body planes, cavities their membranes, Tissues level of organization (Types, origin, function & repair). Anatomy and histology of human skin. Function of skin temperature regulation by ski, Basic concepts about Anemia, abnormal hemoglobin, Polycythemia, Thalassemia, Leukemia.

Practicals : General Anatomy of the body, Tissues, histology of human skin with the help of permanent slides/ models and determination of Haemoglobin in blood.

References

1. Guyton and Hall Textbook of Medical Physiology, 11th edition (2006), J. E. Hall; W B Saunders and Company, ISBN-13: 978-1416045748.

2. Human Physiology, 9th edition (2006), Stuart I. Fox; Tata McGraw Hill, ISBN-13: 978-0077350062.

3. Lab Manual on Blood Analysis and Medical Diagnostics, 1st edition (2012), Dr. Gayatri Prakash; S. Chand, ISBN: 81-219-3967.

4. Manual of Practical Physiology, 4th edition (2012), A. K. Jain; Arya Publication, ISBN: 8178553155.

OR

Skill Enhancement Course SECMB-II (B)

Enzyme Biophysics Laboratory Techniques **2 Credits**

Objectives

- To develop interest in paramedical sciences
- To train students for the essential skills in Medical laboratory techniques
- To increase the job opportunities.

Syllabus :

Basic concept of enzyme technology and enzyme substrate reactions.
Identification techniques of common toxins, drugs, pesticides, Volatile poisons,vegetable poisons etc. in given biological samples, Drug life cycle, stages of drug discovery and strategic issues in drug discovery. Drug life cycle, stages of drug discovery and strategic issues in drug discovery.

Practical : Detection of toxins, drugs, pesticides, Volatile poisons, vegetable poisons from given biological Samples.

References

1.Bioinformatics: Sequence and Genome analysis, 2nd edition (2004), David W. Mount, Cold Spring Harbour Laboratory Press. ISBN-13: 978-0879697129.

2. Bioinformatics: A practical guide to the analysis of genes and proteins, 3rd edition (2004), Andreas D. Baxevanis and B.F. Francis Ouellette, John Wiley and Sons. ISBN-13: 978-0471478782.

3. Introduction to Medicinal Chemistry, 4th edition (2009), Graham l. Patrick, Oxford University Press. ISBN-13: 978-0199234479.

4. The Process of New Drug Discovery and Development, 2nd edition (2006), C.G. Smith and J.T. O'Donnell, Informa Healthcare, ISBN-13: 978-0849327797.

5. Cheminformatics (2003), J. Gasteiger, Thomas Engel; Wiley-VCH. ISBN: 9783527618279.