।। सा विद्या या विमुक्तये ।।
स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड
"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED
"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)
Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade
ACADEMIC (1-BOARD OF STUDIES) SECTION
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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील द्वितीय वर्षाचे **CBCS Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, **दिनांक २० जून २०२० रोजी संपन्न झालेल्या ४७व्या मा. विद्या परिषद बैठकीतील विषय क्र.११/४७–२०२०**च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या **संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील द्वितीय वर्षाचे** खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्यात येत आहेत.

1. B.Sc.-II Year-Biophysics	2. B.Sc.-II Year-Bioinformatics
3. B.Sc.-II Year-Biotechnology	4. B.Sc.-II Year-Biotechnology (Vocational)
5. B.Sc.-II Year-Food Science	6. B.Sc.-II Year-Botany
7. B.Sc.-II Year-Horticulture	8. B.Sc.-II Year-Agro Chemical Fertilizers
9. B.Sc.-II Year-Analytical Chemistry	10. B.Sc.-II Year-Biochemistry
11. B.Sc.-II Year-Chemistry	12. B.Sc.-II Year-Dyes & Drugs Chemistry
13. B.Sc.-II Year-Industrial Chemistry	14. B.C.A. (Bachelor of Computer Application)-II Year
15. B.I.T. (Bachelor of Information Technology)-II Year	16. B.Sc.-II Year-Computer Science
17. B.Sc.-II Year-Network Technology	18. B.Sc.-II Year-Computer Application (Optional)
19. B.Sc.-II Year-Computer Science (Optional)	20. B.Sc.-II Year-Information Technology (Optional)
21. B.Sc.-II Year-Software Engineering	22. B.Sc.-II Year-Dairy Science
23. B.Sc.-II Year-Electronics	24. B.Sc.-II Year-Environmental Science
25. B.Sc.-II Year-Fishery Science	26. B.Sc.-II Year-Geology
27. B.Sc.-II Year-Mathematics	28. B.Sc.-II Year-Microbiology
29. B.Sc.-II year Agricultural Microbiology	30. B.Sc.-II Year-Physics
31. B.Sc.-II Year Statistics	32. B.Sc.-II Year-Zoology

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.: शैक्षणिक–१/परिपत्रक/पदवी–सीबीसीएस अभ्यासक्रम/२०२०–२१/**३३३**

दिनांक : १५.०७.२०२०.

स्वाक्षरित/–
उपकुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :
१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

Swami Ramanand Teerth Marathwada University
Nanded.

FACULTY OF SCIENCE AND TECHNOLOGY

SYLLABUS

Choice Based Credit System (CBCS) Course Structure

B.Sc. (BIOPHYSICS) SECOND YEAR

SEMESTER III & IV (CBCS Pattern)

[Syllabus Progressively effective from June 2020-21 onward]

B.Sc. Biophysics Second Year Semester III & IV Syllabus[CBC&GS Pattern]

(2020-21)

SEM	Course Code & Paper code	Title of the paper	Section & Hrs./week	Total period	End Semester Exam(ESE)/ External	College Assessment(CA) /Internal	Total Marks	Credits
III	CCBP-V Core Course	Membrane Biophysics	03	45	40	10	50	02
	CCBP-VI Core Course	Molecular Biology	03	45	40	10	50	02
	SECBP-I Skill Enhancement Course	A-Bioengineering: An Interface with Biology & Medicine OR B-Basics of Electronic Instruments	03	45	25 (Report:10 Exam:10, Viva:5)	25 (Test:10; Seminar:10; OJ:5)	50	02
	CCBPP-II Lab Course	Practicals based on theory paper CCBP-VI & VII	03	45 Practical	40	10	50	02
IV	CCBP-VII Core Course	Physiological Biophysics	03	45	40	10	50	02
	CCBP-VIII Core Course	Molecular Enzymology	03	45	40	10	50	02
	SECBP-II Skill Enhancement Course	A-Biomedical Nanotechnology OR B-Pharmacology & Toxicology	03	45	25 (Report:10; Exam:10; Viva:5)	25 (Test:10 ; Seminar:10; OJ:5)	50	02
	CCBPP-III Lab Course	Practicals based on theory paper CCBP-VIII & IX	03	45 Practical	40	10	50	02
		Total for B.Sc. II Year: Sem. I + Sem. II + Lab Course (Annual)						16

Salient features of syllabus

- The Biophysics as optional in III Semester consists of Two Theory papers viz. CCBP-V & VI each of 50 marks [40 External + 10 Internal] and one Practical paper viz. CCBPPII of 50 marks along with one paper on Skill Enhancement course viz. SECBPI of 50 marks [25 External + 25 Internal]
  while in IV Semester consists of Two Theory papers viz. CCBP-VII & VIII each of 50 marks [40 External + 10 Internal] and one Practical paper viz. CCBPPIII of 50 marks along with one paper on Skill Enhancement course viz. SECBPII of 50 marks [25 External + 25 Internal]
- The CA and ESE assessment of SECBP I & SECBPII consist of (Test:10 + Seminar:10+ OJ:5) for CA and (Report:10+Exam:10+Viva:5) for ESE
- Assessment shall consist of College assessment (CA) and End of Semester Examination (ESE) with weightage: 80% for ESE & 20% for CA.
- Candidates should require passing separately in theory and practical examination.
- ESE of CCBPPII, CCBPPIII & SECBPI and SECBPII will be scheduled and evaluated annually.
- It is essential to perform minimum eight experiments in case of lab courses
- For the courses SECBP I & SECBPII when based on Online Courses, students are expected to follow online Courses and qualify the relevant online Examination and be ESE evaluated as per university prescribed norms.
- The paper-wise credits, workload and distribution of assessment with maximum marks prescribed are as per abovementioned table
- Every student has to complete minimum one MOOC(Massive Open Online Courses) of 2 credits from SWAYAM/ NPTEL/ EDX/Coursera/ Any Other source

Swami Ramanand Teerth Marathwada University,Nanded

Choice Based Credit System (CBCS) Course Structure

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

Paper CCBP-VI: Membrane Biophysics

Credit: 2 [Total Marks: 50] (40Ext. +10 Int.) ***[Total Workload: 45 hrs]***

Learning objective:

- To deal with all functional and structural aspects of Membrane.
- To understand membrane dynamics and signal transduction through membrane transport.
- To explore micro domains that formed interactions between lipids and proteins.

Unit I: Membrane structure and Models (10 lectures)

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 (10 lectures)

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 (13 lectures)

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 phospho-transferase 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 hosphorylation, Cytosolic NADH electron feeding into electron transfer

Unit IV: Membrane potentials (12 lectures)

Cell surface charge, Resting membrane potential, Action potential, properties of action potential, Nernst equation, Membrane impedance and capacitance, Trans-membrane potential, Zeta, stern and total electrochemical potential, Patch clamp and Voltage Clamp Technique.

Learning Outcomes: At the end of the course students should

- Student able to understand functional and structural aspects of Membrane.
- Membrane transport understanding with dynamics and signal transduction.
- Able to underlie Physical Properties of membrane.

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. Molecular and Cellular Biophysics, Meyer B Jackson (2006), Cambridge)

Swami Ramanand Teerth Marathwada University,Nanded

Choice Based Credit System (CBCS) Course Structure

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

CCBP-VII: Molecular Biology

Credit: 2 [Total Marks: 50] (40Ext. +10 Int.) ***[Total Workload: 45 hrs]***

Learning objective:

- To understand the fundamental Processes
- To understand the molecular regulations of fundamental Processes within the cell to promote proper growth, division, and development.
- To gain thinking skills necessary for molecular research.

Unit I - Introduction to Molecular biology (10 lectures)

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, Introduction to bacterial genetics.

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

Unit II- Transcriptional Machinery & Processes (10 lectures)

RNA Structure, RNA Types, genetic code, Eukaryotic RNA Polymerases and Their Promoters, General Transcription Factors and Transcription. Messenger RNA Processing: Splicing, Capping and Polyadenylation, Ribozymes, Activators, Inhibitors, RNA phage,Bacterial & Eukaryotic transcriptional Control.

Unit – III Translation Machinery & Processes (12 lectures)

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

Unit – IV Principles Methodology & Applications of r-DNA technology (13 lectures)

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

Learning Outcomes:

- They will gain an understanding of chemical and molecular processes that occur in and between cells.
- They will gain insight into the most significant molecular and cell-based methods used today to expand our understanding of biology
- It will able to provide inspiration among student about basic molecular biology and its applications.

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. Molecular and Cellular Biophysics, Meyer B Jackson (2006), Cambridge)

Swami Ramanand Teerth Marathwada University,Nanded

Choice Based Credit System (CBCS) Course Structure

B.Sc. Second year [Sem-IV] Biophysics Syllabus

CCBP-VIII: Physiological Biophysics

Credit: 2 [Total Marks: 50] (40Ext. +10 Int.) ***[Total Workload: 45 hrs]***

Learning Objectives:

- To understand the Biophysical, chemical, electrical, and structural aspects of biological systems at the cell and organism Level.
- To provide a course of study principally human systems physiology, building on knowledge of basic physiological principles.
- To develop further practical biological skills introduced in Physiology of Human.

Unit I- Digestive & Excretory systems(10 lectures)

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 system (10 lectures)

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(15 lectures)

Central nervous system, Peripheral nervous system, Structure of neuron, Myelinated and unmyelinated nerve fibers. Action potential, 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. Degeneration and Regeneration of neuron-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 (10 lectures)

Endocrine glands – Role of hypothalamus, functions of pituitary, thyroid, adrenal glands, parathyroid and gonads.Reproductive Systems-Structure & physiology, concepts of IVF, IUI, sperm analysis

Learning Outcomes:

- Have an enhanced knowledge and appreciation of Human physiology
- understand the functions of important physiological systems including the cardio-respiratory, renal, reproductive and metabolic systems;
- Understand how these separate systems interact to yield integrated physiological responses to Different Physiological Condition.
- Be able to perform, analyze and report on experiments and observations in physiology.

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. Arthur .C. Guyton & John.E.Hall, "Text Book of Medical Physiology", W. B.Saunders Co.
4. Widmaier, Raff & Strang, "Vander's Physiology- The mechanism of body Function. Mc Graw- Hill.
5 Text Book of Physiology, Guyton & Hall, 11th Ed. 2006

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Choice Based Credit System (CBCS) Course Structure

B.Sc. Second year [Sem-IV] Biophysics Syllabus

CCBP-IX: Molecular Enzymology

Credit: 2 [Total Marks: 50] (40Ext. +10 Int.) ***[Total Workload: 45 hrs]***

Learning Objective:

- To understand a structural and functional features and kinetics about enzymes
- To determine the optimum pH, temperature and concentration of an enzyme for a certain reaction.
- To acquire skill based knowledge in the use of the enzymes
- To learn methods of Enzyme inhibition and their applications.

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, Extraction and purification of enzymes by using various techniques. Tests for purification and characterization-Ion Exchange, gel filtration, affinity chromatography

Unit 2: Kinetics of enzyme& Enzyme Inhibitions

Michaelis-Menton equation, steady state hypothesis, $\mathbf{V_{max}}$, $\mathbf{K_m}$ & turnover number and their significance. Lineweaver-Burk plots and its limitation. Eddie–Hofstee plot, Factors affecting enzyme activity-pH, temperature, pressure,. Nature of enzyme inhibitors and activators, reversible, irreversible, competitive, non-competitive, uncompetitive and mixed types of inhibition, Metallo-enzymes, Metal ions as enzyme inhibitors and activators.

Unit 3: Immobilization of enzymes

Techniques of enzyme immobilization , kinetics of immobilized enzymes, Applications- resolution of racemic mixture, production of syrup, amino acid inter-conversion, productions of precursors of semisynthetic penicillin, production of lactose free milk, production of artificial sweetening agents aspartame, production of acrylamide, fabrication of biosensors

Unit 4: Bio-catalytic Applications

Biotransformation-basic reaction mechanisms, biotransformation of drug steroids in body, biotransformation in production antibiotics and Vit.C, novel enzymes from natural resources, modified enzymes, synzymes, Industrial and clinical applications of enzymes. Use of enzymes in food, Feed, dairy, leather, textile and drug industries. Enzyme electrodes

Learning Outcomes: After completing this course the student will be able to

- Describe elaborately and critically the basic properties of enzymes.
- Understand and discuss the role of enzymes in metabolism.
- Understand and discuss the role of enzymes in industry,medicine

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. Understanding Enzymes Palmer Protein Science - A.M. Lesk (Oxford Univ. Press)

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,
7. Ellis Harwood, New York, 1983.
8. Principles of Protein Structure by G. Schulz and R.H. Schirmer, Springer -Verlag, 1984.
9. Introduction to Protein Structure by C. Branden and J. Tooze, Gar land Publishing, 1991.
10. Proteins Structure and Molecular Properties Thomas E. Creighton, W.H. freeman and Company, New York,
11. Principles of Nucleic acid Structure, W. Saenger, Springer verlag, 1984.
12. Biophysics by W. Hoppe. et. al., Springer - Verlag, 1989.
13. Biophysics by Vasantha Pattabhi and N. Gautham, Narosa publishing house, New Delhi ,2002.

Swami Ramanand Teerth Marathwada University,Nanded

Choice Based Credit System (CBCS) Course Structure

B. Sc. Second y**e**ar [Sem-III] Biophysics Syllabus

Practical Paper: Lab course CCBPP-II

Credit: 2 [Total Marks: 50] (40Ext. +10 Int.) ***[Total Workload: 45 hrs]***

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.

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year [Sem-IV] Biophysics Syllabus

Practical Paper: Lab course CCBPP-III

Credit: 2 [Total Marks: 50] (40Ext. +10 Int.) ***[Total Workload: 45 hrs]***

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 Mg^{2+} 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 [Sem-III] Biophysics Syllabus

Skill Enhancement Paper: SECBP-I [A] & I [B]

Credit: 2 [Total Marks: 50] (25Ext. +25 Int.) ***[Total Workload: 45hrs]***

Skill Enhancement Course SECBP-I (A)

A-Bioengineering: In Biology and Medicine (NPTEL Course)

Learning Objectives: The course intends

- *To explain basic understanding of biological concepts, mechanisms and processes in the light of reason why understanding biology is crucial for several applications.*
- *To reveal the interdisciplinary, trans-disciplinary and multidisciplinary nature of biology.*
- *To understand biology a material science and unveil its medico-engineering principle*
- *To learn biology as a quantitative analytical science and perceive its complexity*
- *To acquaint with bio-tools, complex bio-mechanisms,bio-information trends so as to explore its understanding and utility in terms of bioengineering and biomedicine perspectives*

SL.NO	Week	Module Name
1	1-2	Basics of Cell & Molecular Biology
2	3-4	Genetics & Development
3	5-6	DNA Tools & Biotechnology
4	7-8	Biology for Engineers: Applications in Medicine

Learning Outcomes: After completion the course the learner gains to

- *Acquire the through understanding of biology fundamentals in terms its complexity,trends and its applicability in various fields*
- *Project the quantitative understanding of biology principles and processes in terms of biomedical and bioengineering directions*
- *Account for compiled and stored bioinformation data so as to reveal trends existing in bio-information data using software tools*

References:

1. Campbell Biology (11th Edition) 11th Edition.

2. Molecular and Cellular Biophysics, Meyer B Jackson (2006), Cambridge)

3. Molecular & Cellular Biology, D Roberties

OR

Skill Enhancement Course SECBP-I (B)

B: Basic Electronic Instruments

Learning Objectives:

- *Understanding of basic concepts of electronics and basic circuit elements*
- *Knowledge on basic measurements and various electronic instruments*

UNIT-I Basic Principles of Electronic components (20 hrs)

Electric Field, potential difference, Voltage, Electric current, Difference between charge and current, Power, Electrical Resistance and units, ohm's law, Identification of resistor color code, Inductance, Capacitance and its units, Inductors and Capacitors, concept of impedance, transistors, semiconductor diodes , LED, Op-amps, IC ,microprocessor, Transformers , Operation of transformers: step-up, step-down and auto, AC and DC electricity, Single phase and three phase connections, DC Power sources.

UNIT-II Basic Electronics Instruments: (15 hrs)

Significance and methods of measurements (Direct and Indirect method), Measuring voltage with voltmeters, Current measurement using ammeter, Familiarization with Electronic Multimeters and its use, CRO - Observation of waveforms, Operation of CRO, using CRO measuring of current, voltage and time period. DC power supply, Function generator

Practicals: (10 hrs)

1. To identify and name the electronics components
2. To verify Ohms law
3. To identify the role of components in circuit
4. To familiarize with use of electronic Multimeter
5. To familiarize with CRO & observe wave forms
6. To familiarize with signal generator
7. To measure the DC supply in power supplies
8. To study characteristics of microprocessors
9. To perform a small electronic project

Learning Outcomes:

At the end of the course the students will be able to

- *Identify different circuit elements and understand the functioning of passive components, transformers*
- *Observe waveforms in CRO (calculate various parameters of waveforms)*
- *Understand the operational features of various basic electronic components and instruments*

References:

1. A text book of Electrical Technology (Vol. I) - B.L.Theraja & A.K.Theraja - S.Chand & Co.
2. Electrical and Electronic Measurements and Instrumentation - A.K.Sawhney.
3. Applied Electronics - R.S.Sedha.
4. Electronic components and applications —V.R.Deo
5. Basic Electronics —Grob
6. Basic electronics-B.L.Theraja.

Swami Ramanand Teerth Marathwada University,Nanded

Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year [Sem-IV] Biophysics Syllabus

SEC Paper: SECBP-II [A] & II [B]

Credit: 2 [Total Marks: 50] (25Ext. +25 Int.) ***[Total Workload: 45hrs]***

Skill Enhancement Course SECBP-II (A)

A-Biomedical Nanotechnology (NPTEL Course)

Learning Objectives: The applications of nanotechnology in medicine and biomedical engineering are vast and spans areas such as implant and tissue engineering, diagnosis and therapy. This course is intended

- *To provide a general background in the field of nanotechnology applied to biological systems and biomedical applications.*
- *To understand main physical forces controlling the nucleation and deposition of nanostructures as the design factors at the nano-scale.*
- *To elucidate the novel synthesis/fabrication methods nanostructures in state-of-the-art nano-manufacturing processes and in standard characterization methods*
- *To discuss practical information on the synthesis and characterization of a variety of solution-phase and surface-bound nanomaterials, with examples of how they can be used in sensing, imaging, and therapeutics.*
- *To know applications of these materials and devices so as to interact with cells and tissues at a biomolecular (i.e., subcellular) level with a high degree of functional specificity, thus allowing a degree of integration between technology and biological systems exploring their significance of nano-science and latest nanotechnologies for human health*

Unit I: Introduction to nanotechnology, Nano-biomimicry, Synthesis of nanomaterial by physical and chemical methods, Synthesis of nanomaterial by biological methods, Characterization of nanomaterial

Unit II: DNA nanotechnology, Protein & glyco nanotechnology, Lipid nanotechnology, Bio-nanomachines, Carbon nanotube and its bio-applications.

Unit III: Nanomaterials for cancer diagnosis, Nanomaterials for cancer therapy, Nanotechnology in tissue engineering, Nano artificial cells, Nanotechnology in organ printing.

Unit IV: Nanotechnology in point-of-care diagnostics, Nano pharmacology & drug targeting, Cellular uptake mechanisms of nanomaterial, In vitro methods to study antibacterial and anticancer properties of nanomaterial, Nano toxicology

Learning Outcomes: On successful completion of this course, students should have the skills based Knowledge to:

- *Explain the fundamental principles of nanotechnology and their application to biomedical engineering.*
- *Apply bioengineering and physics concepts to the nano-scale domain and Identify and compare state-of-the-art nanofabrication methods and perform a critical analysis of the state-of-the-art characterization methods for nanomaterial, and determine nanomaterial safety and handling methods required during characterization.*
- *have understood the general structure and working mechanism of biosensors and have acquired a basic knowledge about the preparation and functionalization of different typologies of nanoparticles*
- *have understood the advantages and disadvantages of using different typologies of nanoparticles according to the application*
- *have acquired a general knowledge about the use of nanotechnologies in biomedical applications*
- *and also evaluate current constraints, at various levels encountered when solving problems in living systems.*

References:

1. Alain Nouailhat (2008) An Introduction to Nanoscience and Nanotechnology,John Wiley & Sons, Inc. ISBN 978-1-84821-007-3
2. Amretashis Sengupta, Chandan Kumar Sarkar (Eds) Introduction to Nano: basics to nanoscience & nanotechnology ISBN: 9783662473146
3. Jeremy Ramsden Nanotechnology: An Introduction ISBN: 0323393144
4. Nanotechnology, the Brain, and the Future Sean A. Hays ; Jason Scott Robert; Clark A. Miller; Ira Bennett (Eds) ISBN: 9789400717862
5. Nanotechnology: Principles and Practices by Sulabha K. Kulkarni ISBN: 9783319091716
6. Nanotechnology and Human Health by Malsch Ineke Staff ISBN: 9780849381447
7. Soft Matter Nanotechnology by Xiaodong Chen; Harald Fuchs ISBN: 9783527682157
8. Introduction to Nano-Basics to Nanoscience and Nanotechnology;Sengupta, Amretashis, Sarkar, Chandan Kumar (Eds.) ISBN 978-3-662-47314-6

OR

Skill Enhancement Course SECBP-II (B)

B-Pharmacology and Toxicology

Learning Objective:

- *To provide basic insight into principles of pharmacology and toxicology.*
- *To highlight the pharmacodynamics and pharmacokinetics aspect of drugs in general.*
- *The emphasis will be on evaluation of toxicity and mechanism of toxicity of xenobiotic.*

Unit I: General pharmacology and toxicology (3Lectures)
Nature and source of drugs, routes of drug administration and their advantages, definitions and scope of toxicology. Introduction to ecotoxicology.

Unit II: Mechanism of toxicity (5 Lectures)
Formation of ultimate toxicant of xenobiotics and its interaction with target molecules.

Unit III: Pharmacokinetics (6 Lectures)
Membrane transport, absorption, distribution of xenobiotics. Brief introduction to biotransformation, Phase- I reactions including oxidations, hydrolysis, reductions and phase II conjugation reactions and excretion of drugs.

Unit IV: Pharmacodynamics (6 Lectures)
Mechanism of drug action, receptors and receptors subtypes, Dose response relationship and combined effect of drugs. Concept of LD_{50}, LC_{50}, TD_{50} and therapeutic index.

Unit V: Introduction and classification of the drugs acting on:
a. Central and autonomic nervous system, neurotoxic agents. **(2 Lectures)**
b. Cardiovascular system and cardiotoxic agents. **(2 Lectures)**
c. Kidney and nephrotoxic agents. **(2 Lectures)**

Unit VI: Introduction and classification of drugs
a. Anti-inflammatory and analgesic drugs and their related toxicity. **(2 Lectures)**
b. Endocrine drugs **(1 Lectures)**
c. Antimicrobial chemotherapeutic drugs **(1 Lectures)**

Practicals:
1. Handling of laboratory animals and various routes of drug administration.
2. To study presence of paracetamol/aspirin in the given sample.
3. Separation of a mixture of benzoic acid, beta-napthol and naphthalene by solvent extraction and identification of their functional groups.
4. Determination of Dissolved water (DO) using Winkler's method.
5. To determine the total hardness of water by complexometric method Using EDTA.
6. To determine Acid value of the given oil sample.
7. Calculation of LD50 value of an insecticide from the data provided.

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

Learning Outcome:

At the end of this course the learner will be able to

- *Acquire the knowledge on concepts & mechanisms of pharmacology and toxicology*
- *Understand the pharmacodynamics and pharmacokinetics aspect of drugs in general.*
- *Elucidate the toxicity evaluation and xenobiotic toxicity*

SUGGESTED READINGS

1. Essentials of Medical Pharmacology, 7th edition (2010), K.D. Tripathi, Jaypee Brothers, ISBN-13: 978-8184480856.
2. Pharmacology, 7th edition (2011), H.P. Rang, M.M. Dale, J.M. Ritter and P.K. Moore, Churchill Livingstone, ISBN-13: 978-0702045042
3. Cassarett and Doull's Toxicology "The Basic Science of The Poisons" 7th edition (2008), Curtis D.Klaassen Editor, McGrawHill Medical. ISBN-13: 978-0071470513.
4. Introduction to Toxicology, 3rd edition (2001), John Timbrell, Taylor and Francis Publishers. ISBN-13: 978-0415247627.
5. Cassarett and Doull's "Essentials of Toxicology",2nd edition (2010), Klaassen and Whatkins, McGraw Hill Publisher. ISBN-13: 978-0071622400.
6. Principles of Toxicology, 2nd edition (2006), Stine Karen and Thomas M Brown, CRC Press. ISBN-13: 978-0849328565.
7. Lu's basic toxicology: Fundamentals target organ and risk assessment,5th edition (2009), Frank C Lu and Sam kacow, Informa Health care. ISBN: 9781420093117.

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