THIRUVALLUVAR UNIVERSITY
MASTER OF SCIENCE
(With effect from 2022– 2023)

DEPARTMENT OF BIOCHEMISTRY

PREAMBLE

PG : Course profile and syllabi of courses offered in semester I to IV along with its evaluation components (With effect from 2020 – 2023 batch onwards) are presented in this booklet.

PROGRAMME PROFILE M.Sc. (Bio Chemistry)

COURSE OUTCOMES:

1. Be able to design and Contact Scientific experiments and analyzing the resulting data.
2. Able to work as a member of team.
3. Be knowledge in classical laboratory techniques and be able to use modern instrumentation.
4. Knowledgable of ethical practicals in science.
5. Be able to access search and use the chemical literature.
   Target suills for lead scientific anticles & critical understanding of the contacts.Spouen & written presentation of scientific tapics & research results.

PROGRAMME SPECIFIC OUTCOME

1. Acquire knowledge and skills to undertake a career in research in an academic setup.
2. Apply the knowledge of experimental approaches to save problems of a chemical nature & ability toentered that knowledge to the solution.
3. Drug development and synthesize the knowledge & apply the same for multitude of laboratory applications.
4. Understand and apply the concepts of life Sources, empower the technical knowledge know & practical hands-on braining in the field.
5. Its academic, research, industrial & pharmaceutical applications.

PROGRAMME OUTCOME

1. The students achieved for best computational performance in a specific context.
2. They cultivate the highest level of learning and technological key outcomes.
3. We were choose social welfare oriented skill based subject and its applications in biology, helps to the students & social welfare.

4. We were organizing many extension activities live internship programme, industrial visit, hands on training workshop, project oriented instrumentation programmes. It exposes the students for job opportunity and individual talents.
5. These competence of a course possess upon achieved for course specific goals

The Course of Study and the Scheme of Examination

@ Compulsory Courses don't change this category. Number of core papers & Practical may be changed

Sl. No.	*Study Components* / *Course Title*		*ins. hrs / week*	*Credit*	*Title of the Paper*	*Maximum Marks*		
						CIA	*Uni. Exam*	*Total*
SEMESTER I								
	Core Practical		5	4	Advances in cell biology	25	75	100
			5	4	Chemistry of Biomolecules	25	75	100
			5	3	Human physiology	25	75	100
			5		Isolation and characterization techniques and quantitative analysis.			
			5		Molecular biology and microbial techniques			
Internal Elective for same major students (Choose any one)								
	@ Core Elective	**Paper-1**	3	3	A. Pharmaceutical Biochemistry B. Plant Biochemistry C. Cancer Biology	25	75	100
External Elective for other major students (Inter/multi disciplinary papers)								
	@ Open Elective	**Paper-1**	2	3	A. Bioinstrumentation B. Developmental Biology C. Nanoscience and Technology	25	75	100
			30	**17**		**125**	**375**	**500**
SEMESTER II						*CIA*	*Uni. Exam*	*Total*
	Core Practical		5	4	Analytical Biochemistry	25	75	100
			5	4	Molecular Biology	25	75	100
			5	4	Metabolic Regulation and Disorders	25	75	100
			5	3	Isolation ,Characterization Techniques andQuantitative Analysis,	25	75	100
			5	3	Molecular Biology and Microbiology Practical	25	75	100
Internal Elective For Same Major Students (Choose Any One)								
	@ Core Elective	**Paper-2**	3	3	A.Microbiology B.Bioinformatics C.Biochemical and Environmental Toxicology	25	75	100
External Elective for other major students (Inter/multi disciplinary papers)								
	@ Open Elective	**Paper-2**	2	3	A.Herbal Medicine B.Herbal Drug Development C.Organic Farming	25	75	100

	@ Field Study			2	Summer internship/PG Service learning/Experiential learning/industrial visit	100	-	100
	@ Compulsory Paper			2	**Human Rights & Duties**	25	75	100
			30	**28**		**300**	**600**	**900**

S. No.	***Study Components***		***ins. hrs / week***	***Credit***	***Title of the Paper***	***Maximum Marks***		
	Course Title					***CIA***	***Uni. Exam***	***Total***
SEMESTER III								
	Core Practical		5	4	Molecular endocrinology	25	75	100
			5	4	Enzyme technology	25	75	100
			5	4	Biotechnology	25	75	100
			5	--	Enzymology and clinical diagnostics			
			5	--	Haematological methods and urine analysis			
Internal Elective for same major students (Choose any one)								
	@ Core Elective	**Paper-3**	3	3	A .Phytomedicine B. Genetic engineering C. Diagnostic biochemistry	25	75	100
External Elective for other major students (Inter/multi disciplinary papers)								
	@ Open Elective	**Paper-3**	2	3	A.Mushroom cultivation B. Methods in food preservation C.Human physiology and nutrition.	25	75	100
	@MOOC Courses		-	2	NPTEL/Spoken tutorial /MSME course	25	75	100
			30	**20**		**150**	**450**	**600**

SEMESTER IV						***CIA***	***Uni. Exam***	***Total***
	Core Practical		5	4	Research Methodology	25	75	100
			5	4	Advanced clinical biochemistry	25	75	100
			5	3	Enzymology and clinical diagnostics	25	75	100
			5	3	Haematological methods and urine analysis	25	75	100
	@ Core	**Project Compulsory**	5	7	Project with *viva voce*	100 (75 Project +25 viva)		100
Internal Elective for same major students (Choose any one)								
	@Core Elective	Paper-4	3	3	A. Bioinformatics B. Nanobiotechnology C. Stem cell technology	25	75	100
External Elective for other major students (Inter/multi disciplinary papers)								
	@ Open Elective (Non-Major)	**Paper-4**	2	3	A. Evolutionary biology B. Bioremediation C.Life science – Disease and prevention.	25	75	100
			30	**27**		**175**	**525**	**700**
	TOTAL	**27**	**120**	**92**				**2700**

SEMESTER I

Name of the course: M.Sc.,Biochemistry
Name of the paper : Advances in cell biology
Paper type : Core I

Semester:I
Credits:4 Hours of teaching: 5

Course objectives

1. To study the structure and function of cells
2. To understand about extracellular matrix and cell communication.
3. To Understanding the function of intracellular organelles
4. Understanding the function of cell cycle mechanism
5. Understanding the Division of cells and Cell Death
6. To study the concepts of cell signaling.

Unit-I: Structure and function of cells & Transport mechanism
Structure and function of cells–prokaryotes and eukaryotes, difference**,** Structure and organization of membrane – structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active & passive transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes. Extracellular matrix, cell-cell communication.

Unit–II: Cell components, cell division & cell death
Plasma membrane, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility and cell division: amitosis mitosis; meiosis and genetic recombination; Cell cycle and cancer: Control of the cell cycle-cyclins and CDKs,regulation of cell cycle; factors and genes regulating cell cycle. Mechanisms of cell death: apoptosis; necrosis and autophagy.

UNIT-III Cytoskeletal network
Microfilaments - Action – Structures, Assembly, Myosin, Microtubules - Organisation
And dynamics, Kinesin and dynem, Cilia and Flagella - Structure and functions, Intermediary fi1aments. Striated muscle - structure, excitation - contraction.

UNIT-IV Cell-cell and Cell-matrix adhesion
Cell junctions – Anchoring , tight and gap junctions, Adhesion molecules – selectins, cadherins, integrins, immunoglobulin superfamily. Cell-Cell, interaction:- ECM; Collagen, hyaluronan, proteoglycans, laminin, integrins and fibronectins. Carbohydrates - cell surface carbohydrates - lectins, selectins. Blood group antigens.

UNIT-V Cell signaling
Cell signaling – signaling molecules and their receptor, functions of cell surface receptor, pathways of intra cellular signal transduction, second messengers, G protein coupled receptors, receptor tyrosine kinases, Ras, MAP kinase.

Unit 1

P.S.Verma,V.K.Agarwal,Cell Biology.

Unit 2

Cooper,G.M. and Hausman,R.E. 2013. The Cell: A Molecular Approach, 6th Edition, Sinauer Associates, Inc.

Unit 3

P.S.Verma,V.K.Agarwal,Cell Biology.

Unit 4

Cooper,G.M. and Hausman,R.E. 2013. The Cell: A Molecular Approach, 6th Edition, Sinauer Associates, Inc.

Unit 5

Cooper,G.M. and Hausman,R.E. 2013. The Cell: A Molecular Approach, 6th Edition, Sinauer Associates, Inc.

REFERENCES:

1. Cell and Molecular Biology. De Robertis and De Robertis. Lea and Febiger 8th ed (1987).
2. Molecular Biology of the Cell - Alberts , 4th ed. Garland Sci. 2002.
3. Molecular Biology of the Cell – 2014 by Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, and Keith Roberts; Publisher: W. W. Norton & Company; 6 edition.
4. Molecular Biology of the Gene – 2017 by James D. Watson, A. Baker Tania, P. Bell Stephen, Gann Alexander, Levine Michael and Losick Richard; Publisher: Pearson Education; Seventh edition.
5. Cell Biology – 2013 by Gerald Karp; Publisher: Wiley; Seventh edition.
6. Advances in Cell Biology: Volume 2, 2013 by David M. Prescott; Publisher: Springer; Softcover reprint of the original 1st ed. 1971 edition.
7. The Cell: A Molecular Approach -2013 by Geoffrey M. Cooper, and Robert E. Hausman; Publisher: Sinauer Associates Inc; 6th edition.
8. Cell Biology" by Channarayappa
9. Molecular Cell Biology" by Harvey Lodish and Arnold Berk
10. 10. Cell Biology" by Kimball T W
11. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology" by Verma P S and Agarwal V K
12. Cell Biology" by Gerald Karp

E-Materials

1. https://msu.edu/~potters6/te801/Biology/biounits/cellstructure&function.htm
2. https://www.khanacademy.org/science/biology/cell-signaling/mechanisms-of-cell-signaling/a/introduction-to-cell-signaling
3. https://www.khanacademy.org/test-prep/mcat/cells/transport-across-a-cell-membrane/a/passive-transport-and-active-transport-across-a-cell-membrane-article
4. http://www.edu.pe.ca/gray/class_pages/rcfleming/cells/notes.html
5. https://en.wikipedia.org/wiki/Cell_cycle
6. https://en.wikipedia.org/wiki/Apoptosis
7. https://biologydictionary.net/microfilament/
8. https://en.wikipedia.org/wiki/Intermediate_filament
9. https://www.microscopemaster.com/cilia-and-flagella.html
10. https://en.wikipedia.org/wiki/Striated_muscle_tissue
11. https://en.wikipedia.org/wiki/Cell_junction
12. https://en.wikipedia.org/wiki/Cell%E2%80%93cell_interaction
13. https://www.ncbi.nlm.nih.gov/books/NBK2264/
14. https://courses.lumenlearning.com/suny-wmopen-biology1/chapter/signaling-molecules-and-cellular-receptors/
15. https://en.wikipedia.org/wiki/G_protein-coupled_receptor
16. .http://www.biolchem.ucla.edu/labs/Tim_Lane/CourseMBI297PTKmaterials/PTKfiles/Wk1_2REV_Schlessinger2000.pdf.

Course Outcome:

1. **After studied unit- 1,** the student will be able to
    - Get Knowledge on Structure and function of prokaryotic and eukaryotic cells
    - understand the structure and functions of cells and transport across membrane.
    - Aware of structure of model membrane
    - Well versed on Extracellular matrix, cell-cell communication.
    - Familiar with Sorting and regulation of intracellular transport.

2. **After studied unit- 2**, the student will be able to
    - advance their knowledge in cell cycle events
    - familiar with regulation of cell cycle at molecular level
    - Understand the mechanisms of cell death.
    - Get knowledge on Cell components
    - Get well versed with the mechanism of cancer cells.
3. **After studied unit- 3**, the student will be able to
    - Understand of structure and functions of cytoskeleton.
    - Well versed on Microfilaments –Actin and myosin
    - Familiar with organization and dynamics of microtubules
    - Get knowledge on intermediary filaments.
    - Aware of contraction and excitation of striated muscles
4. **After studied unit- 4**, the student will be able
    - to understand cell junctions
    - Familiar with cell adhesion molecules
    - Well versed with cell-cell interaction
    - Aware of importance of ECM
    - Comprehend the value of blood group antigens
5. **5.After studied unit- 5**, the student will be able to
    - understand of cell signaling process
    - knowledge on signaling molecules
    - get familiar with cell surface receptors and its function
    - comprehend the pathways of intra cellular signal transduction
    - aware of secondary messengers

Name of the course: M.Sc.,Biochemistry
Name of the paper : Chemistry of Biomolecules
Paper type : Core II

Semester:I
Credits:4 Hours of teaching:5

Course objectives:

1. This course emphasizes on various Biomolecules and its significance.
2. To enable students the biological importance of lifeless chemical compounds.
3. To enable the students to learn the basic functions and structures of Biomolecules
4. On successful completion of the course the students should have understood the significance of the complex bio-molecules, polysaccharides, lipids and proteins.
5. To enable the students to learn the basic functions, structures and biological importance of nucleic acids and porphyrins.
6. To study the structure and functions of vitamins and minerals.

Unit- I: Water and Carbohydrates
Water - Unique properties, weak interactions in aqueous systems, ionization of water, buffers. Classification, chemical properties of carbohydrates, Chemistry and biological roles of homo and heteropolysaccharides. Structural elucidation of polysaccharides; Oligosaccharides – lectin interaction in biochemical processes. Structure and role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides).

Unit-II: Lipids
Classification of Lipids, Biological significance of lipids, Fatty acids and their physiochemical properties. Structure and properties of Prostaglandins. Storage lipids - triacyl glycerol and waxes. Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols, structure, distribution and role of membrane lipids. Lipids as signals, cofactors and pigments.

Unit-III: Amino acids and Proteins
Amino acids–classification, structure and physiochemical properties,chemical synthesis of peptides – solid phase peptide synthesis. Proteins – classification, purification, and criteria of homogeneity. Structural organization, sequence determination and characterization of proteins. Conformation of proteins – Ramachandran plots. Denaturation of proteins. Apoprotein and Prosthetic group-Porphyrins – Structure and properties of porphyrins – heme, Chlorophyll and Cytochromes.

Unit-IV Nucleic acids
Nucleotides- structure and properties, physicochemical properties of
nucleicacids, cleavage of nucleic acids by enzymatic methods, non – enzymatic transformation of nucleotides and nucleic acids, methylation, Sequencing, chemical synthesis of DNA. Three dimensional structure of DNA. Different forms of DNA – circular DNA and Supercoiling. Types of RNA mRNA,tRNA, rRNA, Sn RNA,Si RNA,Hn RNA. Structure of t-RNA. Nucleotides as source of energy, component of coenzymes, second messengers.

UNIT-Vitamins and Porphyrins
Water soluble - thiamine, riboflavin, niacin, pyridoxine, folic acid, ascorbic acid sources, structure, biochemical functions, deficiency diseases, daily requirements. Fat soluble - vitamin A, vitamin D2, vitamin E and vitamin K - sources, structure,

biochemical functions, deficiency diseases, daily requirements. Porphyrins the porphyrin ring system, chlorophyll, hemoglobin, myoglobin and cytochrome.

Text Books

Unit-1

Nelson,D.L. and Cox,M.M. 2013**.** Lehninger Principles of Biochemistry, 6th Edition, W.H. Freeman & Co.

Unit-2

Berg,J.M. *et al*., 2012. Biochemistry, 7th Edition, W. H. Freeman & Co.

Unit-3

Biochemistry" by L Stryer

Unit-4

Biochemistry" by V Voet and J G Voet

Unit-5

Biochemistry" by L Stryer

REFERENCES:

1. Voet,D. *et al.,* 2012. Fundamentals of Biochemistry: Life at the Molecular level, 4th Edition, John Wiley and Sons.

2. Zubay,G.L. 1998. Biochemistry, Wm.C. Brown Publishers.

3. Sinden,S.R. DNA structure and function, First Edition, Academic Press, 1994.

4. Carl Branden and John Tooze, Introduction to Protein Structure, Second Edition, Garland Publishing, 1999.

5. Garrett,R. and Grisham,C. 2010. Biochemistry, 4th Edition, Saunders College Publishing.

6 .Chemistry of Biomolecules" by R J Simond

7. "Biomolecules: Chemistry of Living System" by VK Ahluwalia

8. Cell Biology (Cytology, Biomolecules and Molecular Biology)" by Verma P S and Agarwal V K

9.Text book of Biochemistry with clinical correlations by Thomas.M.Devlin,John Wileyliss,Hobokhen NJ Publishers 2006

10.Biochemistry And Molecular Biology Of Antimicrobial Drug Action, 6th Edition Paperback – 2005. by FRANKLIN T.J. ET. AL (Author) ...

E-Materials

1. https://biochimia.usmf.md/sites/default/files/inline-files/Lesson-2-Water.pdf
2. https://www.tuscany-diet.net/carbohydrates/classification-functions/
3. https://www.sciencedirect.com/topics/chemistry/glycoprotein
4. https://byjus.com/biology/lipids/
5. https://chem.libretexts.org/Bookshelves/Biological_Chemistry/Supplemental_Modules_(Biological_Chemistry)/Lipids/Fatty_Acids/Prostaglandins
6. https://en.wikipedia.org/wiki/Membrane_lipid

7. https://www.britannica.com/science/protein/Physicochemical-properties-of-the-amino-acids
8. https://www.britannica.com/science/porphyrin
9. http://www.sakshieducation.com/CSIR/Story.aspx?nid=74427
10. https://www.news-medical.net/life-sciences/-Types-of-RNA-mRNA-rRNA-and-tRNA.aspx
11. https://homepages.rpi.edu/~bellos/new_page_1.htm
12. https://www.chemistryworld.com/features/step-by-step-synthesis-of-dna/3008753.article
13. https://www.healthline.com/nutrition/water-soluble-vitamins#b1
14. https://www.healthline.com/nutrition/fat-soluble-vitamins
15. http://nsdl.niscair.res.in/jspui/bitstream/123456789/762/1/Porphyrins.pdf

Course Outcome

1.After studied unit -1, the student will be able

- understand about the properties of water and buffers.
- knowledge on polysaccharides and its types.
- get familiar with structural elucidation of polysaccharides
- Well versed with proteoglycans, glycoproteins and glycolipids
- aware of oligosaccharides an its interaction in biochemical process

2.After studied unit -2, the student will be able to

- gives a clear understanding about the classifications and biological significanceof lipids.
- Well versed on Fatty acids and their physiochemical properties.
- Get familiar with Structure and properties of Prostaglandins
- Aware of structure, distribution and role of lipids in membranes
- Well known with Lipids as signals, cofactors and pigments.

3.After studied unit -3, the student will be able to

- Clear Knowledge regarding classification and structure of amino acids.
- Familiar with chemical synthesis of peptides.
- Get aware of protein characterization.
- Well known with Conformation of proteins and Ramachandran Plot.
- Understand the porphyrin sand its importance in biochemical reaction.

4.After studied unit -4, the student will be able to

- Understand the structure and properties of Nucleic acids.
- Well known with enzymatic methods for cleavage of nucleic acid.
- Well versed with chemical synthesis of DNA
- Understand the different forms of DNA
- Get awre of types of RNA and its function.

5.After studied unit -5, the student will be able to

- Get an idea about structure and functions of vitamins
- Well known with sources and Daily requirements of various vitamins
- Knowledge of structure and functions of porphyrins
- Aware of Deficiency of vitamins and porphyrins .
- Well versed with Biochemical important porphyrins hemoglobin and chlorophyll

Name of the course/subject: M.Sc Biochemistry Semester: I

Name of the Paper: HUMAN PHYSIOLOGY Credits:4 Hours of teaching: 5
Paper type: Core III

Course Objectives

1. This course provides a comprehensive, balanced introduction to this exciting, evolving and multi-disciplinary field.

2. To understand the circulatory cells, blood and its components.

3. To enable the students to learn or to know the biological, physiological activities of various organs.

4. To understand the functions, anatomy, histology of each organ systems.

5. To understand ho the body works and explains the mechanisms.

6. To understand in depth knowledge of main structure composing human body

Unit-I: Blood and its components

Composition, types and functions of blood and plasma. Blood volume, blood volume regulation, immunity, homeostasis, blood groups. Haemopoiesis. Blood coagulation - mechanism, fibrinolysis, anticoagulants. Hemoglobin - structure, abnormal types, anemia, Blood corpuscles.

Unit-II: Anatomy of heart and functions of sense organs

Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above. Sense organs – Vision, hearing and tactile response.

Unit-III: Digestive and Excretory system

Digestive secretions - composition, functions and regulation of saliva,gastric, pancreatic, intestinal and bile secretions. Digestions and absorption of carbohydrates, lipids, proteins and nucleic acids. Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, electrolyte balance, acid-base balance.

Unit-IV: Respiratory and nervous system

Comparison of respiration in different species, anatomical considerations,transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration. Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture. Muscle physiology.

Unit-V: Endocrine system

Secretion and functions of hormones of thyroid, pituitary and gonads. Role of hormones in reproduction and pregnancy. Mechanism of action of hormones.

Text Books

Unit-1: 1. Guyton,A.C. and Hall,J.E. 1996. Human Physiology and Mechanisms of Disease, 6th Edition, Saunders.

Unit-2: Chatterjee,C.C. 1985. Human Physiology, 11th Edition. Medical Allied Agency.

Unit-3: Bipin Kumar. 2001. Human Physiology. Campus Book International, New Delhi.

Unit-4: Guyton,A.C. and Hall,J.E. 1996. Human Physiology and Mechanisms of Disease, 6th Edition, Saunders.
Unit-5: Chatterjee,C.C. 1985. Human Physiology, 11th Edition. Medical Allied Agency.

REFERENCE

1. Ganong,W.F. 2005. Review of Medical Physiology, 22nd Edition, McGraw-Hill.
2. Vander,A.J. *et al*., 1981. Human Physiology: Tata Mc Graw Hill Publishing Co., New Delhi.
3. Chaudhuri,S.K. 2006. Concise Medical Physiology, New central Book Agency.
4. Principles of Biochemistry- Smith et al. Mammalian Biochemistry. McGraw Hill7th ed. (for unit 3, unit 4) 1983.
5. Guyton, A. C. and Hall, J. E. 2006. Textbook of Medical Physiology. 11th Edition. Saunders, Philadelphia. USA.
6. Martini, F.H. and Nath, J. L. 2009. Fundamentals of Anatomy & Physiology. Pearson Benjamin Cummings. USA.
7. Bipin Kumar. 2001. Human Physiology. Campus Book International, New Delhi.
8. Essentials of Medical Physiology by Sembulingam
9. Handbook Of Human Physiology by Vidya Ratan
10. Human Physiology and Mechanisms of Disease by Arthur C Guyton

E- Materials

1. https://healthengine.com.au/info/blood-function-and-composition
2. https://www.medicalnewstoday.com/articles/319544#hematopoiesis-and-health
3. https://www.sciencedirect.com/topics/chemistry/hemoglobin
4. https://www.webmd.com/heart/picture-of-the-heart#1
5. https://www.healio.com/cardiology/learn-the-heart/ecg-review/ecg-interpretation-tutorial/introduction-to-the-ecg
6. https://www.livescience.com/60752-human-senses.html
7. https://www.britannica.com/science/human-digestive-system/Secretions
8. https://opentextbc.ca/biology/chapter/15-3-digestive-system-processes/
9. https://www.britannica.com/science/excretion
10. https://en.wikibooks.org/wiki/Human_Physiology/The_Muscular_System
11. https://www.britannica.com/science/nervous-system
12. https://healthengine.com.au/info/respiratory-system
13. https://courses.lumenlearning.com/boundless-ap/chapter/hormones/
14. https://www.yourhormones.info/students/topics/hormones-in-human-reproduction/
15. https://www.webmd.com/diabetes/endocrine-system-facts

Course Out Comes

1. **After studied unit-1,** the student will be able to
    - Obtain a deep knowledge regarding blood and its components.
    - Get to know about the haemopoiesis.
    - Get a well versed knowledge on coagulation of blood.
    - Aware of various types of blood groups and its significance
    - Attain an information on Blood corpuscles

2. **After studied unit-2,** the student will be able to
    - know about heart and its regulation.
    - Conclude about the cardiac cycle and anatomy of heart structure
    - Interpret ECG – its principle and significance
    - Infer blood pressure and its complications
    - Understand various sense organs

3. **After studied unit-3,** the student will be able to
    - describe composition, functions and regulation of digestive secretion
    - get well versed on Digestions and absorption of carbohydrates, lipids, proteins and nucleic acids.
    - Infer the mechanism of Urine formation
    - Express the Comparative physiology of excretion in kidneyurine concentration,
    - Fet familiar with regulation of water, electrolyte and acid-base balance.

4. **After studied unit-4,** the student will be able to
    - obtain an insight about respiration in different species
    - Comparison of respiration in different species
    - Well versed in transport and exchange of gases
    - Get familiar with Neurons and gross neuroanatomy of the brain and spinal cord.
    - Get knowledge on Muscle physiology.

5. **After studied unit-5,** the student will be able to
    - provide knowledge about Hormone and its regulation
    - know about Role of hormones in reproduction and pregnancy.
    - Give insight into Mechanism of action of hormones.
    - Get familiar with Thyroid hormones .
    - Get knowledge on Muscle physiology.

ELECTIVE

Name of the course/subject: M.Sc Biochemistry Semester: I
Name of the Paper: Pharmaceutical Biochemistry Credits:3Hours of teaching:3
Paper type: Elective

Course Objectives

1. The main objective of the course is to understand pharmacokinetics
2. It helps the students understanding the pharmascience in a variety of applications in drug therapy.
3. It helps students to understand the metabolism of drug
4. Students are able to understand the adverse reactions to drugs and its complications.
5. It describes the mechanism of action and effect of drugs
6. It gives an idea about chemotherapy and management of drug abuse

UNIT-I: General Principles: Basic principles of drug action-Pharmacokinetics: Absorption, distribution and elimination of drugs, routes of drug administration. Pharmacokinetics. Origin of drug from plants and animals.

UNIT-II: Drug metabolism – general pathways of drug metabolism (different types of reaction in phase I and phase II with examples), metabolism and excretion of drugs. Mechanism of drug action, combined effect of drugs. Factors modifying drug action, tolerance and dependence.

UNIT-III
Pharmacodynamics - receptor concepts, theory, drug receptor interaction (DRI), Factors affecting DRI, Cholinergic and anticholinergic drugs, Adrenergic and adrenergic blockers, General anesthetics, Local anesthetics. Adverse reactions to drugs and common drug receptor interactions.

UNIT-IV
Mechanism of action of drugs used in therapy of: Respiratory system – cough, bronchial – asthma, pulmonary tuberculosis. GIT – Digestants, appetite suppressants. Hypolipidemia agents, vomiting, constipation and peptic ulcer.

UNIT-V
Drugs of plant origin: Drug dependence and abuse – Management of self poisoning cancer. Chemotherapy – Cytotoxic drug. Immuno suppressive drug therapy. New Biological Targets for Drug Development. Novel Drug Screening Strategies.

Text Books

Unit-1:

Basic pharmacology- Foxtercox Bulter Worth's, 1980.

Unit-2

The pharmacology Vol I and II- Goodman And Gillman, Mc Graw Hill

Unit-3

Basic pharmacology- Foxtercox Bulter Worth's, 1980.

Unit-4

The pharmacology Vol I and II- Goodman And Gillman, Mc Graw Hill

Unit-5

Essentials of Pharmaceutical Biochemistry, by Harbans Lal (Author)

References:

1. Pharmacology and pharmacotherapeutics- R.S.Satoskar. S.D.Bhandhakar & S.S.Anilapure Popular Prakashar Bombay.
2. Principles of medicinal chemistry- William O. Foge.B.I. Waverks Pvt Ltd, New Delhi.
3. Oxford textbook of clinical pharmacology and drug therapy. D.G. Burger's medicinal Chemistry & Drug Discovery.
4. Principles and practice- Manfred.E. Wolf John Wiley and sons
5. Pv pharmaceutical biochemistry textbook binding – 2017 By S.S Haque S.S Randhawa
6. Biochemistry For The Pharmaceutical Sciences Paperback – Import, 29 Mar 2011 by Charles P. Woodbury Jr. (Author)
7. Pharmaceutical Biochemistry,**Vyas S. P** and D.V.Kohli **1st edition (1 December 2009)**
8. Pharmaceutical Chemistry - I Kindle Edition by Dr. A. V. Kasture (Author), Late Dr. S. G. Wadodkar (Author)
9. Shargel,L. et al., 2012. Applied Biopharmaceutics and Pharmacokinetics, 6th Edition, McGraw-Hill Medical,
10. Foreman,J.C. and Johansen,T.J. 1996. Text Book of Receptor Pharmacology,2nd Edition, CRC Press

E- Materials

1. https://www.sciencedirect.com/topics/neuroscience/pharmacokinetics
2. https://www.genelex.com/what-is-pharmacogenetics/
3. https://www.merckmanuals.com/home/drugs/administration-and-kinetics-of-drugs/drug-metabolism
4. https://www.sciencedirect.com/science/article/pii/B9780323481106000016
5. https://link.springer.com/chapter/10.1007/978-3-662-38180-9_3
6. https://www.msdmanuals.com/professional/clinical-pharmacology/pharmacodynamics/overview-of-pharmacodynamics
7. https://www.pharmacologyeducation.org/drugs/anaesthetic-drugs
8. https://www.pharmacologyeducation.org/clinical-pharmacology/adverse-drug-reactions
9. https://doctorlib.info/pharmacology/illustrated/31.html
10. https://doctorlib.info/pharmacology/illustrated/32.html
11. https://en.wikiversity.org/wiki/Pharmacology/Gastrointestinal_tract
12. https://www.pharmacologyeducation.org/drugs/respiratory-system
13. https://en.wikipedia.org/wiki/Drug_development
14. https://www.webmd.com/mental-health/addiction/drug-abuse-addiction#1
15. https://www.healthline.com/health/chemotherapy

Course Out Comes

1. **After studied unit-1,** the student will be able to
    - understand about the pharmacokinetics
    - Relate mechanism and origin of drug from plant and animals.
    - Recount the Absorption of drugs
    - Describe Distribution and elimination of drugs
    - Portray Various routes of drug administration
2. **After studied unit-2,** the student will be able to
    - to understand metabolism of drugs,
    - get knowledge on excretion of drugs
    - elucidate mechanism of drug action
    - know the combined effect of drugs
    - well versed with factors modifying drug action, tolerance and dependence.

3. **After studied unit-3,** the student will be able to
    - Get clear idea on Pharmacodynamics
    - Aware of General and local anesthetics and common drug receptor interactions
    - Elucidate Drug receptor interaction and factors affecting DRI
    - get A Clear Knowledge regarding Cholinergic and anticholinergic drugs.
    - Familiar with Adverse reactions to drugs.

4. **After studied unit-4,** the student will be able to
    - Provides an idea on mechanism of action of drugs used in therapy of various diseases- Respiratory and GI Tract
    - Get an overview on Hypolipidemia agents
5. **After studied unit-5,** the student will be able to
    - note about drug dependence
    - aware of drug abuse and its management.
    - Describe Novel Drug Screening Strategies .
    - Familiar with management of self poisoning, cancer
    - Get knowledge on chemotherapy

Name of the course/subject: I M.Sc Biochemistry Semester: I
Name of the Paper: Plant Biochemistry Credits: 3 Hours of teaching: 3
Paper type: Elective

Course objectives:

1. This course presents an Introduction and provides a comprehensive, balanced introduction to this exciting, evolving and multi-disciplinary field.
2. To enable the students to learn or to know the aspects of photosynthesis.
3. To understand the concept of Nitrogen fixation process and interaction between assimilation and metabolism.
4. To understand the plant metabolism, nutrient absorption and its deficiency.
5. To be aware of various plant hormones and its roles.
6. To identify the process of Dormancy- Germination, Reproduction and budding process.

Unit-I: Photosynthesis

Photosynthesis –organization of thylakoid; role of photosynthetic pigments; light absorption and energy conservation. Light absorption by pigment molecules; the reaction centre complex. The photo systems I and II; cyclic and noncyclic photophosphorylation.Carbon reactions in C3, C4 and CAM plants - Calvin cycle; Hatch-Slack pathway. Pathways of glucose oxidation in plants; starch biosynthesis and degradation; Photorespiration: role of photorespiration in plants.

Unit-II: Nitrogen fixation

Nitrogen fixation – symbiotic and non-symbiotic. Symbiotic nitrogen fixation in legumes by Rhizobia-enzymology of nitrogen fixation; regulation of nif and nod genes of nitrogen fixation. Interaction between nitrate assimilation and carbon metabolism.

UNIT-III: Plant metabolism

Plant metabolism - carbohydrates, proteins, sugars, Transport in plants- Transpiration, Stomata, Mineral Nutrition - Biogeo cycles (Carbon, Nitrogen and Sulphur) Nutrient absorption and translocation, Nutrient functions in growth and development, Nutrient deficiency symptoms, toxicity problems.

UNIT-IV: Phytohormones

Phytohormones : Auxins, cytokinins, Gibberellins, ethylene- Structure, Physiological function and metabolism, Plant movement, apical dominance. Stomatal movements and morphogenesis. Photoperiodism and vernalization – flower induction, initiation and development, action of phytohormones.

UNIT-V: Dormancy

Biological rhythm in plants, dormancy, seed germination, development and maturation, bud dormancy, floreign, senescence, aging. Plant defenses, environmental and genetic control. Secondary metabolites- structure and functions.

Text Books

Unit-1: Heldt,H.W. 2004. Plant Biochemistry, 3rd Edition, Academic Press.

Unit-2: Srivastava, H.S. (2006), Plant Physiology, Biochemistry and Biotechnology,Rastogi Publications, Meerut.

Unit-3: A Textbook of Plant Physiology, Biochemistry and Biotechnology" by S K Verma and Mohit Verma

Unit-4: Srivastava, H.S. (2006), Plant Physiology, Biochemistry and Biotechnology,Rastogi Publications, Meerut.

Unit-5: A Textbook of Plant Physiology, Biochemistry and Biotechnology" by S K Verma and Mohit Verma

Reference Books

1. Buchannan,B. *et al*, 2002. Biochemistry and Molecular Biology of Plants, 1st Edition, Wiley.
2. Chawla,H.S. (2004) Introduction to plant Biotechnology, Science Publishers, Plymouth,U.K.
3. Razdan, M.K. (2007), Introduction to Plant Tissue culture, II edition, Oxford and IBA Publications Co Pvt Ltd.
4. Dey, P.M. and Harborne, J.B. 1997. Plant Biochemistry, 1st Edition, Academic Press.
5. Lea, P.J. and Leegood, R.C. 1999. Plant Biochemistry and Molecular Biology, 2nd Edition, Wiley.
6. A Textbook of Plant Physiology, Biochemistry and Biotechnology" by S K Verma and Mohit Verma
7. The New Frontiers in Plant Biochemistry by T Akazawa and T Asahi
8. Introduction To Plant Biochemistry Paperback – 2005 by Goodwin / Mercer
9. Plant Biochemistry Hardcover – Import, 7 Oct 2004 by Hans-Walter Heldt Professor Em (Author), Birgit Piechulla (Author)
10. Introduction to Plant Physiology Hardcover – Import, 25 Nov 1998by William G. Hopkins

E- Materials

1. https://www.britannica.com/science/photosynthesis
2. http://www.biologydiscussion.com/photosynthesis/hatch-slack-c4-pathway-of-co2-fixation/51623
3. https://biodifferences.com/difference-between-photosystem-i-and-photosystem-ii.html
4. https://www.britannica.com/science/nitrogen-fixation
5. https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Boundless)/5%3A_Microbial_Metabolism/5.15%3A_Nitrogen_Fixation/5.15E%3A_Genetics_and_Regulation_of_N%E2%82%82_Fixation
6. https://link.springer.com/chapter/10.1007/978-3-662-04064-5_9
7. https://www.scitechnol.com/plant/plant-metabolism.php
8. http://landresources.montana.edu/nm/documents/NM9.pdf
9. https://www.cropnutrition.com/resource-library/how-vegetable-plant-roots-absorb-nutrients
10. http://www.plantcell.org/content/22/3/tpc.110.tt0310
11. https://biology4isc.weebly.com/plant-movement.html
12. https://www.britannica.com/science/photoperiodism
13. https://www.gardeningknowhow.com/garden-how-to/info/plant-dormancy.htm
14. https://www.apsnet.org/edcenter/disimpactmngmnt/topc/Pages/OverviewOfPlantDiseases.aspx
15. https://www.intechopen.com/books/secondary-metabolites-sources-and-applications/an-introductory-chapter-secondary-metabolites

Course Out Comes

1**. After studied unit-1,** the student will be able to

- know photosynthesis process
- understand the role of photosynthetic pigments
- aware of The photo systems I and II; cyclic and noncyclic photophosphorylation.
- Enumerate the Pathways of glucose oxidation in plants
- Know the role of photorespiration in plants.

2**. After studied unit-2,** the student will be able to

- Know about symbiotic and non-symbiotic nitrogen fixation in plants
- Realize the Interaction between nitrate assimilation and carbon metabolism.
- Well versed in symbiotic nitrogen fixation of legumes.
- Get familiar with regulation of nif and nod genes of nitrogen fixation
- Understand the enzymology of nitrogen fixation

3**. After studied unit-3,** the student will be able to

- know about various plant metabolic pathways and their significance
- explain the Transpiration and Biogeo cycles
- well versed in Nutrient absorption and translocation
- familiar with Nutrient functions in growth and development.
- Aware of Nutrient deficiency symptoms, toxicity problems.

4. **After studied unit-4,** the student will be able to

- learn about various types of plant hormones and their functions
- gain knowledge on Plant movement, apical dominance.
- Realize Stomatal movements and morphogenesis
- Discover more about Photoperiodism and vernalization.
- Gain familiarity with Flower induction, initiation and development

5.**After studied unit-5,** the student will be able to

- learn about dormancy and plant secondary metabolites..
- get well versed on Biological rhythm in plants
- identify the process of Dormancy- Germination, Reproduction and budding process.
- Get knowledge on Plant defenses, environmental and genetic control
- Aware of senescence, aging of plants.

Name of the course: M.Sc.,Biochemistry
Name of the paper : **Cancer Biology**
Paper type : Elective

Semester:I
Credits:3 Hours of teaching: 3

Course objectives:

1. This course presents an Introduction and provides a comprehensive, balanced introduction to this exciting, evolving and multi-disciplinary field.
2. To enable the students to learn or to know the aspects of photosynthesis.
3. To understand the concept of Nitrogen fixation process and interaction between assimilation and metabolism.
4. To understand the plant metabolism, nutriet absorption and its deficiency.
5. To be aware of various plant hormones and its roles.
6. To identify the process of Dormancy- Germination, Reproduction and budding process.

UNIT-I

Introduction: Cancer cell-morphology and growth characteristics. Types of growth-hyperplasia, dysplasia, anaplasia and neoplasia. Types and prevalence of cancer. Nomenclature of neoplasms, classification based on origin/organ.

UNIT-II

Epidemiology of cancer. Endocrinology of cancer. Agents causing cancer-radiation, viruses, chemicals. Multistep carcinogenesis: Initiation, Promotion, Progression. Paraneoplastic syndromes.

UNIT-III

Molecular mechanism of oncogenesis - proto oncogenesis, oncogene, oncoproteins, tumour suppressor genes involved in cancer. Free radicals and antioxidants in cancer. Diet and cancer. Cell cycle and cancer: Control of the cell cycle-cyclins and CDKs

UNIT-IV

Apoptosis and cancer (Intrinsic and extrinsic pathways). Mechanism of apoptosis, signaling pathways. Types and their impact on apoptosis and oncogenesis. Principles and methods of cancer diagnosis-Biochemical, genetic, cytotoxic, cell growth and viability tests.

UNIT-V

Cancer therapy: Different forms of therapy, chemotherapy, radiation therapy, gene therapy, immune therapy, surgical therapy and biologic therapy. Principles of cancer biomarkers and their applications.

Text Books

Unit-1

The Biology of cancer of A new Approach by P R Burch

Unit-2

Franks,L.M. and Teich,N.M. 1991. An introduction to Cellular and Molecular Biology of cancer, 2nd Edition, Oxford University Press.

Unit -3

Vincent,T. *et al*., 2011. Principles and Practice of Oncology: Primer of the Molecular Biology of Cancer, 1st Edition, Lippincott Williams and Wilkins.

Unit -3 and Unit -5

Weinberg,R.A. 2013. The Biology of Cancer, 2nd Edition, Garland Science.

Reference Books

1. McKinnell, R.G. *et al*., 2006. The Biological Basis of Cancer, 2nd Edition, Cambridge University Press.
2. Pelengaris,S. and Khan,M. 2002. The Molecular Biology of Cancer, 2nd Edition,

Wiley Blackwell.
3. Hesketh,R. 2013. Introduction to Cancer Biology, Cambridge University Press.
4. An Introduction To Cellular And Molecular Biology of Cancer" by Peter J Selby Margaret A Knowles

5.Principles of Cancer Biology" by Kleinsmith

6.The Biology of Cancer: A New Approach" by P R Burch

E-Materials:

1. https://www.ncbi.nlm.nih.gov/books/NBK9553/
2. https://accessmedicine.mhmedical.com/content.aspx?bookid=499&sectionid=41568284
3. https://www.wcrf.org/dietandcancer/cancer-trends/worldwide-cancer-data
4. https://webpath.med.utah.edu/NEOHTML/NEOPL103.html
5. https://en.wikipedia.org/wiki/Epidemiology_of_cancer
6. https://www.ncbi.nlm.nih.gov/pubmed/12734426
7. https://www.mayoclinic.org/diseases-conditions/paraneoplastic-syndromes/symptoms-causes/syc-20355687
8. https://www.ncbi.nlm.nih.gov/pubmed/18069259
9. https://en.wikipedia.org/wiki/Tumor_suppressor
10. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5666732/
11. https://en.wikipedia.org/wiki/Cyclin-dependent_kinase
12. http://www.remedypublications.com/open-access/exploiting-the-extrinsic-and-the-intrinsic-apoptotic-pathways-for-cancer-therapeutics-704.pdf
13. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/cytotoxicity-test
14. https://www.webmd.com/cancer/immunotherapy-approach-19/basics/slideshow-cancer-treatments
15. https://en.wikipedia.org/wiki/Cancer_biomarker

Course Out Comes

1. **After studied unit-1, the student will be able to**
    - To know Cancer cell-morphology and growth characteristics.
    - Well versed with growth-hyperplasia.
    - Familiar with Types of cancer
    - Knowledge on Nomenclature of neoplasm.
    - Aware on prevalence of cancer .
2. **After studied unit-2, the student will be able to**
    - Knowledge on Epidemiology of cancer.
    - Familiar with radiation, viruses.
    - To know Multistep carcinogenesis
    - Aware on Paraneoplastic syndromes.
    - Well versed with Endocrinology of cancer

3. After studied unit-3, the student will be able to

- Aware on oncogenesis
- Knowledge on , tumour suppressor
- To know antioxidants in cancer.
- Well versed with Diet and cancer.
- Familiar with Cell cycle

4.After studied unit-4, the student will be able to

- Familiar with Apoptosis and cancer.
- To know oncogenesis
- Well versed with cancer diagnosis
- Knowledge on genetic, cytotoxic.
- Aware on cell growth and viability tests

5.After studied unit-5, the student will be able to

- To know chemotherapy
- Aware on radiation therapy
- Aware on gene therapy and immune therapy
- Familiar with biologic therapy
- Well versed with cancer biomarkers

Course structure
Thiruvalluvar University, Vellore-632115
Course writing format

Name of the course/subject: M.Sc Biochemistry Semester: I Name of the Paper: Bioinstrumentation Credits: 2 Hours of teaching:2
Paper type: Open Elective

Course Objectives

1. It helps the students in understanding the basic science in a variety of applications.
2. It includes the development of different tools and methods for identification, analysis and examination of physical properties of different biochemical compositions to provide better chemical information.
3. To introduce an fundamentals of transducers as applicable to physiology
4. To explore the human body parameter measurements setups
5. To make the students understand the basic concepts of forensic techniques.
6. To give basic ideas about how biomolecules are detected by instrumentation

Unit-I: Microscopy
Principles and application of light phase contrast, fluorescence, scanning and transmission electron microscopy.
Unit-II: Centrifugation Techniques
Centrifugation: Svedberg's constant, sedimentation velocity and sedimentation equilibrium. Differential and density gradient centrifugation, construction of preparative and analytical ultra-centrifuge.
Unit-III: Chromatographic techniques
Chromatographic techniques: Principles and applications of paper, TLC, ion exchange, gel filtration, affinity, GLC and HPLC .
Unit-IV: Electrophoretic techniques
Electrophoretic techniques: Polyacrylamide gel electrophoresis, SDS PAGE, 2D electrophoresis, agarose gel electrophoresis, isoelectric focusing, and pulse field electrophoresis.
Unit-V: Spectroscopic techniques
Spectroscopic techniques: Principles of colorimeter, spectrophotometer,fluorimeter. BeerLambert's Law and its limitations. Extinction coefficient, Atomic absorption spectroscopy, UV-Visible, Spectrofluorimetry, Flame Photometry.

Text Books

Unit-1:
Bioinstrumentation by L Veerakumari

Unit-2
Wilson,K. and Walker,J. 2005. Principles and Techniques of Practical Biochemistry, 6th Edition Cambridge University.Press.

Unit-3
Wilson,K. and Walker,J. 2005. Principles and Techniques of Practical Biochemistry, 6th Edition Cambridge University.Press.

Unit-4

Wilson,K. and Walker,J. 2005. Principles and Techniques of Practical Biochemistry, 6th Edition Cambridge University.Press.

Unit-5

.

Upadhyay,A. Upadhyay,K. and Nath,N. 2009. Biophysical Chemistry: Principles and Techniques, Third Edition, Himalaya Publishing. 11th Edition

References

1. Sharma,B.K. 2004.Instrumental Methods of Chemical analysis, 23rd Edition Goel Publications.
2. Homie,D.J. and Peck,H. Analytical Biochemistry, Third Edition, Longman group,1998.
3. Physical Biochemistry – Principles and Applications, 2nd Edition, John Wiley and Sons, USA.
4. Allen, J.P. (2008) Biophysical Chemistry, 1st Edition, Markono Print Media Limited, Singapore
5. Charles, R., Cantor, I. and Schimmel, P.R. (2004) Biophysical Chemistry, Part II, W.H.Freeman & Co., New York.
6. Hunt, G and Mehta, M. (2007) Nanotechnology Risk, Ethics and Law, Earthscan, London
7. Nolting, B. (2006) Methods in Modern Biophysics, 2nd Edition, Springer Publications, New Jersey.
8. Roshan, J. K. (2008) Advanced Biophysics, Anmol Publications Pvt, Ltd, New Delhi Sheehan, D. (2009)
9. Physical Biochemistry – Principles and Applications, 2nd Edition, John Wiley and Sons, USA.
10. “Principles of Analytical Chemistry” by F W Fifield and D Kealey

E- Materials

1. http://www.biologyreference.com/La-Ma/Light-Microscopy.html
2. https://www.microscopyu.com/techniques/fluorescence/introduction-to-fluorescence-microscopy
3. https://www.fei.com/introduction-to-electron-microscopy
4. https://microbenotes.com/centrifugation-principle-types-and-applications/
5. http://www.labcompare.com/10-Featured-Articles/135690-Analytical-and-Preparative-Ultracentrifuges/
6. http://www.biologydiscussion.com/biochemistry/centrifugation/methods-used-for-separation-of-particles-in-centrifugation-3-methods/12453
7. http://www.biologydiscussion.com/biochemistry/chromatography-techniques/top-12-types-of-chromatographic-techniques-biochemistry/12730
8. http://hiq.linde-gas.com/en/analytical_methods/liquid_chromatography/high_performance_liquid_chromatography.html
9. http://hiq.linde-gas.com/en/analytical_methods/gas_chromatography/index.html
10. https://ruo.mbl.co.jp/bio/e/support/method/sds-page.html
11. https://www.sciencedirect.com/topics/medicine-and-dentistry/two-dimensional-gel-electrophoresis
12. https://www.cleaverscientific.com/applications/agarose-gel-electrophoresis-of-dna/
13. http://www.labcompare.com/Spectroscopy/Atomic-Absorption-Spectrophotometer/
14. http://hiq.linde-gas.com/en/analytical_methods/other_spectroscopy/index.html
15. https://www.sciencedirect.com/topics/medicine-and-dentistry/spectrofluorometry

Course Out Comes

1. **After studied unit-1,** the student will be able to
   - obtain the knowledge about the microscope handling and the basic difference between the ordinary microscope and electron microscope.
     - Obtain a deep knowledge regarding microscopy .
     - Get to know about the light phase contrastmicroscopy.
     - Get a well versed knowledge on fluorescence
     - Aware of scanning and transmission electron microscopy.

2. **After studied unit-1,** the student will be able to
   The student will be able to learn the centrifugation techniques and applications

     - Obtain a deep knowledge regarding Centrifugation .
     - Get to know about the Svedberg's constanty.
     - Get a well versed knowledge on sedimentation equilibrium.
     - Aware of analytical ultra-centrifuge
     - Get a well versed knowledge on Density gradient centrifugation

3. **After studied unit-3,** the student will be able to

     - Learn the chromatographic techniques for the separation of the individual compound from the mixture of compound.
     - Obtain a deep knowledge regarding applications of paper chromatographic techniques, .
     - Get to know about the TLC.
     - Get a well versed knowledge on ion exchange chromatography

     - Aware of HPLC

4. **After studied unit-4,** the student will be able to

     - Learn the electrophoretic techniques for the separation of proteins nucleic acids.
     - Obtain a deep knowledge on nucleic acids .
     - Get to know about the Polyacrylamide gel electrophoresis .
     - Get a well versed knowledge on Agarose gel electrophoresis

     - Aware of pulse field electrophoresis.

5. **After studied unit-5**, the student will be able to

     - obtain knowledge about the different spectroscopic techniques and their applications in detail.
     - Obtain a deep knowledge on Principles of colorimeter .
     - Get to know about the BeerLambert's Law and its limitations .
     - Get a well versed knowledge on Atomic absorption spectroscopy
     - Aware of Flame Photometry

Name of the course/subject: M.Sc Biochemistry Semester: I

Name of the Paper: Developmental Biology Credits: 2 Hours of teaching:2
Paper type: NME

UNIT -IBasic concepts of development :

Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development

UNIT -IIGametogenesis, fertilization and early development:

Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

UNIT-IIIMorphogenesis and organogenesis in animals :

Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis – vulva formation in Caenorhabditis elegans, eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.

UNIT-IV Morphogenesis and organogenesis in plants:

Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum

UNIT-V Apoptosis

Programmed cell death, aging and senescence

Text books

- Developmental Biology- Scott F Gilbert.
- Essential Developmental Biology - Jonathan Slack
- Principles of Development - Lewis Wolpert
- Developmental Biology,-Werner A Muller
- Website: virtual embryo- http://people.ucalgary.ca/~browder/virtualembryo/dev_biol.html

References

- Developmental Biology, Eighth Edition" by Scott F Gilbert.
- Essential Developmental Biology by Jonathan Slack
- Developmental Biology, Werner A Muller
- Principles of Development - Lewis Wolpert

Name of the course: M.Sc.,Biochemistry
Name of the paper : Nanoscience and Technology
Paper type : Open Elective

Semester:I
Credits:2 Hours of teaching:2

Course objectives:

1.The main objective of this course is to introduce about concepts in Nanoscience and technology.
2. This course emphasizes to learn about nanoparticles and its types, synthesis, characterization of nanoparticles and microscopy techniques
3. Nanocarriers and drug delivery system in nanomedicine provides the learner to know about the treatment of diseases using nanoparticles.
4. To understand thecharacterization of Nano material

5.To be aware of Bio mimics.

6 .To identify the active and passive targeting of diseased cells

Unit- I Nanoscience and nanotechnology
Introduction to Nanoscience and Nanotechnology;
Milestones inNanotechnology; Overview of Nanobiotechnology and Nanoscale processes; Physicochemical properties of materials in Nanoscales. Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes); Polymers in nano material synthesis- natural and synthetic polymers.

Unit-II Nanomaterials
Top down and bottom up synthesis -Gas, liquid, and solid phase synthesis of nanomaterials; Polymers in nano material synthesis- natural and synthetic polymers. Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials.-Green synthesis

Unit-III Characterization techniques
Characterization of Nano material**;** Absorption, Fluorescence, and Resonance; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging.

Unit-IV Biomolecules and bio mimics
Reactive groups on biomolecules (DNA & Proteins); Surface modification and conjugation to nanomaterials. Fabrication and application of DNA nanowires;Nanofluidics to solve biological problems. Bio mimics.

Unit-V: Nanocarriers
Properties of nanocarriers; drug delivery systems used in nanomedicine;Enhanced Permeability and Retention effect; Blood-brain barrier; Active and passive targeting of diseased cells; Health and environmental impacts of nanotechnology.

Text books:
Unit-I
Nanotechnology,Fundamentals and Applications by Manasi karkare
Unit-2
1.Hand book of Nanostructured materials and nanotechnology by Nalva
Unit-3 to Unit-4
Nanomaterials By A K Bandyopadhyay
Unit-5
Nanotechnology,Fundamentals and Applications by Manasi karkare

REFERENCES:

1. Nanobiotechnology: Concepts, Applications and Perspectives, Christof M. Niemeyer (Editor), Chad A. Mirkin (Editor), Wiley-VCH; 1 edition, 2004.
2. Nanobiotechnology: Bioinspired Devices and Materials of the Future by Oded Shoseyov and Ilan Levy, Humana Press; 1 edition 2007.
3. Nanobiotechnology Protocols (Methods in Molecular Biology) by Sandra J Rosenthal and David W. Wright, Humana Press; 1 edition, 2005.
4. Bio-nanotechnology Concepts and applications. Madhuri Sharon, Maheshwar Sharon, Sunil Pandey and Goldie Oza, Ane Books Pvt Ltd, 1 edition 2012.
5. Microscopy Techniques for Material Science. A. R. Clarke and C. N. Eberhardt (Editors) CRC Press. 1st Edition, 2002.

E-Materials

1.http://www.ox.ac.uk/sites/files/oxford/field/field_document/Materials%20Science%20Workshop%20presentation.pdf
2. https://copublications.greenfacts.org/en/nanotechnologies/l-2/3-nanoparticle-properties.htm
3. https://www.sciencedirect.com/topics/materials-science/polymer-nanoparticles
4.https://www.sciencedirect.com/topics/materials-science/polymer-nanoparticles
5.https://www.sciencedirect.com/topics/engineering/green-synthesis
6.https://en.wikipedia.org/wiki/Characterization_of_nanoparticles
7.https://www.olympuslifescience.com/en/microscopresource/primer/techniques/confocal/applications/tirfmintro/
8.https://www.slideshare.net/anamikabanerjee92/semtem-afm
9.https://www.sciencedirect.com/topics/engineering/biomolecule
10.https://en.wikipedia.org/wiki/Nanocarriers

Course Outcome

On successful completion of the course, students can able to

1.After studied unit -1, the student will be able to

- Describe history of nanotechnology, Properties of nanoparticles.
- Knowledgeable on Nanoparticles types
- Aware of Physicochemical properties of materials in Nanoscales.
- Well versed on Nanocrystals
- Familiar with synthetic polymers

1.After studied unit -1, the student will be able to

- Describe the bottom up and top down approaches and synthesis of nanoparticles using physical, chemical and biological method
- Knowledgeable on Lithography techniques
- Aware of Thin film deposition
- Well versed on Electrospinning
- Familiar with Green synthesis and Bio-synthesis of nanomaterials

3.After studied unit -1, the student will be able to

- Describe the characterization of nanoparticles using Microscopy techniques
- Knowledgeable on SEM, TEM, AFM,
- Aware of Characterization of Nano material
- Well versed on Fluorescence, andResonance .
- Familiar with Confocal and TIRF imaging.

4.After studied unit -1, the student will be able to

- Design, carry out surface modification of biomolecules and conjugation to nanomaterials and apply nature's nano in biology (Biomimics)
- Aware of conjugation to nanomaterials
- Well versed on nature's nano in biology
- Knowledgeable on Biomimics
- Familiar with application of DNA nanowires

5.After studied unit -1, the student will be able to

- Apply theoretical knowledge to solve the problems in treatment of diseases using nanoparticles in nanomedicine.
- Aware of Properties of nanocarriers
- Well versed on drug delivery systems
- Knowledgeable on Blood-brain barrier
- Familiar with environmental impacts of nanotechnology

SEMESTER II

PAPER-4

Name of the course/subject : M.Sc., Biochemistry. Semester : II
Name of the paper : Analytical Biochemistry Credits : 4 Hours of teaching
Paper type : Core IV

Course objective

- **To**Understand the working principles of analytical instruments.
- **To**Apply and analyze the biochemical samples using analytical instruments
- To make the student familiar with the basic concepts *of* chromatography and spectroscopy utilized for food analysis
- To acquired some technical knowledge of, and some practical experience with, analysis in electrophoresis
- To promote capacity building and research biodiversity use and conservation worldwide through the application of molecular markers

UNIT I - ELECTROCHEMICAL TECHNIQUES AND ELECTROPHORESIS

Electrochemical techniques – principles, electrochemical cells – pH, Henderson – Hasselbalch equation, buffer capacity, pH measurement, glass electrode. Oxygen electrode – principle and application. Biosensors.

Separation of DNA fragments – Agarose gel electrophoresis of DNA, Pulsed field gel electrophoresis. Autoanalyser – principal, instrumentation and applications. Isoelectric point-2D gel electrophoresis. Electrophoresis of proteins: SDS-PAGE, Native gels, Gradient gel, Isoelectric focusing,cellulose acetate elecrophoresis, continuous flow electrophoresis; Detection, estimation and recovery of proteins.

UNIT II - ENZYME ASSAY, CENTRIFUGATION AND RADIOCHEMICAL TECHNIQUES

Enzyme monitoring technique – Assay methods, Immobilized enzymes.

Centrifugation: Preparative and Analytical ultracentrifuges. Analytical centrifugation -Schlieren optical system - applications - determination of molecular mass and purity of macromolecules

Radiochemical methods – Basis concepts, counting methods and application. Autoradiography. Applications of radioisotopes in the biological sciences.

UNIT III – CHROMATOGRAPHY AND SPECTROSCOPY TECHNIQUES

GC, HPLC – principle, components, limitations and applications. Optical rotatory dispersion, Circular dichroism, X-ray diffraction, Nuclear magnetic resonance, Electron spin resonance and Mass spectrometry – basic principle and application principle and applications of trubidimetry and nephelometry. Flow cytometry and cell separation. Use of lasers for spectroscopy.

UNIT IV – MOLECULAR TECHNIQUES

Restriction endonucleases, Restriction mapping, Nucleic acid probes – cloned probes, oligonucleotide probes and labelling of nucleic acid probs. Membrane blotting and hybridization of nucleic acids – Southern, Northern, Western, dot-plot and Fluorescent

insitu hybridization. RFLR – Technique & applications.

PCR basic principle, technique, diagnostic and laboratory applications of PCR, RAPD

Construction of DNA and Oligonucleotide microarray.

UNIT V–MOLECULAR MARKERS ANALYSIS

Diagnostic applications of nucleic acid probes – sickle cell anaemia, thalassemia, haemophilia and lymphoid malignancy. Mutagenicity testing – Ames test. Comet assay and DNA fragmentation assay. Identifying protein – DNA interactions – DNA foot printing, DNA finger printing – Technique and applications. HLA typing – applications.

Text Books

- Wilson K. & Walker, "*Practical Biochemistry",* Cambridge University press, 5th edition, 2000 Wilson, K. and Walker, J. (2012)
- David T. Plummer. "*An introduction toPractical Biochemistry",* 2005.
- Keith Wilson and John Walker - Principles and techniques of Biochemistry and Molecular Biology, Cambridge University Press, 6th Edition,2006.
- Boyer R. - Experimental Biochemistry, Addison Wesley, 3rd Edition, 2002.
- Bernard R. Glick and Jack.J. Pasternak - Molecular Biotechnology, ASM Press Washington 3rd Edition, 2003.

References Books

- David Frifelder. *Physical Biochemistry*, W. H. Freeman; 3 edition, 2005
- Galen Wood Ewing Mcgraw, *"Instrumental Methods of Chemical Analysis"* by -Hill College , Fifth edition .
- D W Brown - Organic Spectroscopy, Wiley New York 1st Edition, 1998.
- M.Valcatcel - Principles of analytical chemistry-A Text book. Springer, 2000.
- David James Holme and Hazel Pack - Longman, 1994
- Robert D. Braun, "*Introduction to Instrumental Analysis"*, Pharma Book Syndicate,2006.
- Serdyuk, I.N., Zaccai, N.R. and Zaccai, J. (2007) Methods in Molecular Biophysics – Structure, Dynamics and Function, Cambridge University Press, India

. E- Resources

- www.kau.edu.sa › Files › Subjects › principals and techiniques of bioche...
- https://epdf.pub/analytical-biochemistry.html
- https://www.scribd.com/document/262054613/Analytical-Biochemistry-3rd-Ed-David-Holme-Hazel-Peck

Course outcomes:

1. **After studied unit – 1, the student will be able to**

- gain Practical knowledge , hands on tools and techniques for the characterization of bio-molecules will help the students in advanced research programs.
- Choose and plan the use of suitable electrophoretic techniques for actual analytical problems.
- understand the Role of pH and buffers in biological system.
- Identify and quantify variousbiomolecules..
- Well versed on autoanalyser and its roles.

2. **After studied unit – 2, the student will be able to**

- appreciate the role of radioisotopes in biology
- Understand the principle and applications of Centrifugation techniques.
- Explain the principle, operation and applications of various centrifuges
- Understand separation of proteins based on mass and charge.
- Distinguish the process of identifying the sub-units in a protein.

3. **After studied unit – 3, the student will be able to**

- Understand the strengths, limitations and creative use of techniques for problem-solving.
- Describe how a spectrophotometer operates, and give examples of their uses
- Characterize certain functionalities of biomolecules by using spectroscopic techniqueques.
- Explain the principles of the most important liquid and gas chromatographic techniques
- Report and discuss chromatographic analyses in a scientifically methods

4. **After studied unit – 4, the student will be able to**

- gain laboratory skills in molecular biology techniques such as micropipetting, PCR andRFLR
- understand the fundamental molecular tooland their applications
- update knowledge on analytical instruments by visiting laboratories
- describe the use of nucleic acids as tools in molecular research
- decide and apply appropriate tools and techniques in molecular biology.

5. **After studied unit – 5, the student will be able to**

- familiar with the different types of molecular markers most used in genetic studies and has experience in the construction and comparison of genetic maps.

- Understands the main applications of molecular markers in genetic studies and breeding programmes.
- Acquire practical experience in DNA extraction and in the use of markers.
- Has practical experience in the use of computer software for the construction of genetic maps.
- gain insight of molecular biology techniques that are instrumental in analysis of genes at DNA level

PAPER-5

Name of the course/subject : M.Sc., Biochemistry. Semester : II
Name of the paper : Molecular Biology Credits : 4 Hours of teaching
Paper type : Core V

Objectives
To enable the students

- Understand the history and scope of molecular biology.
- Acquire working knowledge of gene & to know how genes are expressed.
- Appreciate how genetic engineering & biotechnology influence a health care in the next century.
- Gain knowledge of biological and/or medicinal processes through the investigation of the underlying molecular mechanisms.
- learn about DNA, RNA and their replication, mutations, DNA repair mechanism

UNIT-I : DNA REPLICATION

Types of replication, evidence for semiconservative replication - Meselson and Stahl experiment, Replication in prokaryotes and inhibitors of replication, replication bubble, bidirectional replication, replicon, action of SSB, primase, DNA gyrase, topoisomerases, DNA polymerase I, II, and III, lagging and leading strand synthesis, Okazaki fragments, replication in RNA virus, retroviruses,. Eukaryotic replication and inhibitors of replication,

UNIT-II : TRANSCRIPTION

Transcription - definition, coding strand, template strand, sense strand and antisense strand, promotor, foot-printing experiment, DNA - dependent RNA polymerase role of Prinbnow box, template binding, prokaryotic transcription, Rho - dependent and independent transcription, posttranscriptional processing in prokaryotes, split genes, overiapping genes, housekeeping genes, biosynthesis of rRNA and tRNA, eukaryotic transcription, RNA editing - post-transcriptional modifications of eukaryotic RNAs, RNA splicing,

UNIT-III : GENETIC CODE AND TRANSLATION

Genetic code - definition, deciphering of the genetic code, codon dictionary, salient features of genetic code. structure of tRNA, activating enzymes, binding of amino acids to tRNA, wobble mechanism and its significance, composition of prokaryotic and eukaryotic ribosomes, leader region, Shine-Dalgarno sequence, reading frameshift, prokaryotic and eukaryotic protein biosynthesis - initiation, elongation, translocation and termination, polysomes, post-translational modifications in prokaryotes and eukaryotes, inhibitors of protein synthesis.

UNIT-IV : PROTEIN TRANSPORT AND GENE EXPRESSION

Protein targeting, translocation, heat shock proteins, glycosylation, SNAPs and SNAREs, bacterial signal sequences, heat shock proteins, mitochondrial, chloroplast and nuclear protein transport, endocytosis-viral entry, ubiquitin TAG protein destruction, Protein folding- models, molecular chaperones.

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Regulation of gene expression , Regulation of transcription in prokaryotes– the lac, trp, Arab,Gal operon, DNA methylation in prokaryotes, DNA methylation in eukaryotes- cytosine methylation, CpG islands. gene amplifications.

UNIT-V : MUTAGENESIS, DNA DAMAGE AND REPAIR

Mutagenesis and replication fidelity, misincorporation of nucleotides during DNA synthesis, transient and spontaneous chemical changes in DNA, frameshift mutagenesis, DNA damage - different types, DNA repair - direct reversal repair, direct repair of nicks, excision repair, nucleotide excision repair, mismatch repair, long and short patch mismatch repair, recombination error, SOS response and mutagenic repair.

Course outcomes:

After studied unit – 1, the student will be able to

- Know about genome organization or living organisms, study of genes genome, chromosome etc.
- Learn structural levels of nucleic acids- DNA and RNA and genome organization in prokaryotes
- Learn molecular events in the DNA replication and role of different enzyme
- acquire knowledge related to discovery of DNA as genetic material, DNA replication
- Learning structural levels of nucleic acids- DNA and RNA and genome organization in prokaryotes and eukaryotes

After studied unit – 2, the student will be able to

- learn expressed genes or transcripts can be translated into proteins following acentral dogma
- . describe how gene expression is regulated at the transcriptional and post-transcriptional level.
- Describe how pre-rRNAs and pre-tRNAs are processed into mature rRNAs and tRNAs.
- Learn structural levels oftranscription, posttranscriptional processing in prokaryotes
- The student can predict how a change in a specific DNA or RNA sequence can result in changes in gene expression.

After studied unit – 3, the student will be able to

- Understand the strengths, limitations and creative use of techniques for problem-solving.

- Identify the major features of proteins - peptide bond, amino and carboxyl terminals, side chains, alpha carbon
- Describe the mechanisms of protein transport tovarious sub cellular sites and process of protein degradation
- Understand the processes of transcription and translation, including how they are both similar and different in prokaryotic and eukaryotic organisms.
- Understanding the principles and applications of Polymerase Chain Reaction

After studied unit – 4, the student will be able to

- gain laboratory skills in molecular biology techniques such as micropipetting, PCR andRFLR
- Learn about the Molecular markers and its classification and applications
- Learn the methods of DNA sequencing and various tools and techniques of molecular biology
- Compare the structure of eukaryotic cells with the structure of simpler prokaryotic cells and with the structureof viruses
- understands the process of Genetic Recombination – and the elements of recombination in E. coli

After studied unit – 5, the student will be able to

- familiar with the different types of molecular markers most used in genetic studies.
- understand the biology and application of antisensetechnologies and biology of cancer
- gives in-depth knowledge of biological and/or medicinal processes through the investigation of the underlying molecular mechanisms.
- make students learn mutation and mutagenesis
- acquire knowledge related to discovery of DNA as genetic material, DNA replication, transcription, DNA repair and translation

Text Books

- Alberts, "*Molecular Biology of the Cell"*, 4th ed, Garland Sci, 2002.
- Lodish et al, "*Molecular Cell Biology"*, 4th ed, Freeman, 2000..
- Cell and molecular biology - G. Karp, John Wiley & Sons Inc, 2002
- Principles of Biochemistry – 7th edition, Lehninger, Nelson & Cox, Macmillanworth Publishers, 2013
- Principles of Cell and Molecular Biology. (2nd edn.)., Kleinsmith, L. J. & Kish, V.M. 1995
- Molecular Biology of the Cell. (3rd edn.)., Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D. (eds.) 1994. Garland Publishing, Inc., New York
- Genetics: Analysis and Principles by Robert J Brooker, (2017), 6th Edition, McGraw Hill Education.
- Genetics: A Conceptual Approach by Benjamin Pierce, (2017), 6th Edition, WH Freeman
- Concepts of Genetics by William S. Klug, (2013), 10th edition, Pearson Publishers

Reference Books

- Stansfield et al. "*Molecular Cell Biology, 2nd edition",* Schaum's Outlines, McGraw Hill, 2002.
- Lewin. "*Genes VII"*, 2nd edition, Oxford University Press, 2000.
- Biochemistry - D.Voet and J. Voet. John Wiley and Sons Ltd, 1990
- Genes VII - B. Lewin Oxford University Press, Cell Press, London, 2000
- Twyman. "*Advanced Molecular Biology"*, 3rd ed, Viva Publ, 2005
- Genetics: A Molecular Approach by peter J. Russell (2016), Pearson Education
- The Cell: A Molecular Approach by Geoffery M Cooper, (2013), 6th Edition, Sinauer3.Associates Inc
- .Karp's Cell and Molecular Biology: Concepts and Experiments by Janet Iwasa (2016), John Wiley & Sons Inc; 8 edition
- Cell Biology by Thomas D Pollard (2017), 3rd Revised edition, Elsevier -Health Sciences Division.
- Principles of Genetics by Peter Snausted (2011), 6th Edition, John Wiley & Sons Inc.
- Principles of Genetic by Tamarin, (2017), 7th Edition, McGraw Hill Education.

E- Resources

- http://www.freebookcentre.net/Biology/Molecular-Biology-Books.html
- https://www.amazon.in/Molecular-Biology-N-Vidyavathi-ebook/dp/B078KWF9BN
- https://pothi.com/pothi/book/ebook-kaushlendratripathi-introduction-molecular-biology
- https://www.worldcat.org/title/molecular-biology/oclc/1062496183
- https://www.us.elsevierhealth.com/medicine/molecular-biology

PAPER-7

Metabolic Regulation and Disorders

Name of the course/subject : M.Sc., Biochemistry. Semester : II
Name of the paper : Metabolic Regulation and DisordersCredits : 4 Hours of teaching
Paper type : Core VI

Objectives:
To enable the students

- Understand the rate of acceleration of the biochemical reactions in the presence of the biocatalyst (enzymes).
- Enhance the knowledge about the key biochemical pathways in metabolism and their regulations.
- Analyze the importance of biochemical metabolic pathways.
- acquire the concept of anabolism, catabolism and role of high energy compounds in the cell.
- Ability to relate various interrelated physiological and metabolic events

UNIT-I : BIOENERGETICS AND BIOLOGICAL OXIDATION

Free energy and entropy.Phosphoryl group transfers and ATP. Enzymes involved in redox reactions. The electron transport chain - organization and role in electron capture.

Oxidative phosphorylation - Electron transfer reactions in mitochondria. F_1F_0 ATPase - Structure and mechanism of action. The chemiosmotic theory. Inhibitors of respiratory chain and oxidative phosphorylation - Uncouplers and ionophores.Regulation of oxidative phosphorylation.Mitochondrial transport systems - ATP/ADP exchange, malate / glycerophosphae shuttle,. Mitochondrial diseases

UNIT-II : CARBOHYDRATE METABOLISM

Glycolysis and gluconeogenesis– pathway, key enzymes and co-ordinate regulation. The citric acid cycle and regulation. The pentose phosphate pathway. Metabolism of glycogen and regulation. Glycogen storage diseases. Blood glucose homeostasis– role of tissues and hormones. Metabolism of alcohol.

UNIT-III : LIPID METABOLISMAND ASSOCIATED DISORDERS

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Oxidation of fatty acids- α,β and ω.Biosynthesis of fatty acids. Metabolism of triglycerides, phospholipids and sphingolipids. Metabolism of Cholesterol and associated disorders. Ketogenesis. Metabolic adaptations in starvation and obesity. lipoproteins and associated disorders

UNIT-IV : AMINO ACID, PURINE AND PYRIMIDINE METABOLISM

Overview of biosynthesis of nonessential amino acids Catabolism of amino acid nitrogen -

Transamination, deamination, ammonia formation and the urea cycle. Disorders of the urea cycle. Disorders of amino acid metabolism– phenylketonuria, alkaptonuria and albinism Metabolism of purines and pyrimidines ,catabolism of purines and pyrimidines. Disorders associated with abnormalities in the metabolism of purines and pyrimidine

UNIT-V PORPHYRINS,PHOTOSYNTHESIS,METABOLIC INTEGRATION AND HORMONAL REGULATION 13 Hrs

Biosynthesis and degradation of heme. Disorders associated with defects in biosynthesis of heme .Integration of metabolism - Interconversion of major foodstuffs.Metabolic profile of the liver, adipose tissue and brain. Metabolic inter relationships in various nutritional and hormonal states– obesity, aerobic, anaerobic endurance, exercise, pregnancy, lactation, IDDM, NIDDM and starvation

Course outcomes:

After studied unit – 1, the student will be able to

- learn basic concepts of Bioenergetics, mechanisms of oxidative phosphorylation and photophosphorylation
- understand composition and structure of biomembranes, transport mechanisms across biological membranes
- Get a mechanistic overview of enzyme activity and regulation in cells.
- Understand the metabolic pathways, the energy yielding & energy requiring reactions in biological system.

After studied unit – 2, the student will be able to

- Describe the synthesis and degradation of carbohydrates, lipids and proteins and also their interrelations.
- Gain knowledge about the carbohydrate metabolism.
- Understand the diseases related to carbohydrate metabolism
- Acquire knowledge related to regulation of various pathway
- gain knowledge about the fine-tuning of metabolism by means of enzyme regulation

After studied unit – 3, the student will be able to

- Get a knowledge about how energy can be derived from fat
- Understand the synthesis of saturated, unsaturated fatty acids and triacyl glycerides.
- Acquire knowledge for the purpose and the process of lipogenesis
- Gain knowledge about the purpose and process of ketogenesis.
- Describe the Cholesterol is kept in balance by homeostatic mechanisms: higher dietary intake leads to reduced synthesis in the body.

After studied unit – 4, the student will be able to

- Know the inborn errors associated with amino acid metabolism
- Gain knowledge on urea cycle and its importance
- Get a knowledge about Amino acid synthesis depends on the formation of the appropriate alpha-keto acid, which is then transaminated to form an amino acid.
- Understand the metabolic defects in different enzymes of urea biosynthesis, although distinct at the molecular level, present similar clinical signs and symptoms.

After studied unit – 5, the student will be able to

- Think laterally and in an integrating manner and develop interdisciplinary approach.
- Gain knowledge of metabolic pathways to biotechnological and biochemical research
- learn the hormonal regulation of metabolism and discuss the role of Metabolic inter relationships in various nutritional and hormonal states.
- Understand the nucleotide metabolism
- assess the crucial role of some hormones with regard tothe integration of metabolic pathways

Text Books

- Principles of Biochemistry – 7th edition, Lehninger, Nelson & Cox, Macmillanworth Publishers, 2013
- Stryer, "*Biochemistry"*, 5th edition, Freeman, 2002.
- Murray et al., "*Harper's Biochemistry"*, 29th edition, Mc. GrawHill, 2012
- Primer for the Exercise and Nutrition Sciences: Thermodynamics, Bioenergetics,Metabolism, Christopher B. Scott. 2010.
- Bioenergetics (Biochemistry Research Trends), Jeffrey W. Berkin, 2011.
- Bioenergetics: Energy Conservation and Conversion (Results and Problems in Cell Differentiation), Günter Schäfer, 2008

References Books

- Donald Voet, J.G. Voet, John Wiley," *Biochemistry"*, 4th edition, 2006.
- Davidson & Sittman, "*Biochemistry NM., 3rd edition",* Lippincott. Willams and Wilkins, 2005
- Champe P.C and Richard A Harvey, *Lippincotts Biochemistry,* Williams & Wilkins Publishers, 2004.

. E- Resources

- https://www.kobo.com/us/en/ebook/enzymes-6
- https://www.elsevier.com/books/the-enzymes/dalbey/978-0-12-373916-2
- https://www.kobo.com/us/en/ebook/metabolic-regulation
- https://www.kobo.com/us/en/ebook/hepatic-de-novo-lipogenesis-and-regulation-of-metabolism
- https://www.elsevier.com/books/metabolic-regulation/vogel/978-0-12-299255-1

MAIN PRACTICAL

PAPER-1

A. ISOLATION AND CHARACTERIZATION STUDIES

1. Isolation and estimation of glycogen from liver.

2. Isolation and estimation of DNA from liver and spleen.

3. Isolation and estimation of RNA from plant tissues or yeast.

4. Denaturation of DNA and UV absorption studies. (demonstration).

B. QUANTITATIVE ANALYSIS

1. Estimation of Ascorbic Acid

2. Estimation of inorganic phosphorus by Fiske and SubbaRao method.

3. Determination of pyruvate or lactate

4. Determination of tryptophan.

5. Determination of protein by Lowry's method.

6. Estimation Of Iron

C. TECHNIQUES

1. Preparation of buffers and measurement of pH using indicators and pH meter.

2. Separation of amino acids sugars and lipids by thin layer chromatography.

3. Separation of plant pigments by column chromatography.

4. Separation of serum proteins by PAGE.

5. PCR Technique - Demonstration

References

1. Practical Biochemistry - K. Wilson and I. Walker. 5th edition, Cambridge University press, 2000.

2. Practical Biochemistry – Shawney.

3. Biochemical Methods - S.Sadasivam & A.Manickam, New Age International.

MAIN PRACTICAL

PAPER -2

MOLECULAR BIOLOGY AND MICROBIOLOGY PRACTICAL

A. IMMUNOLOGICAL AND MOLECULAR BIOLOGY TECHNIQUES

1. Grouping of blood and Rh typing.
2. Latex agglutination test for rheumatoid factor and pregnancy.
3. ELISA - demonstration.
4. Extraction of genomic DNA and electrophoresis in agarose gel. (Demonstration)
5. Determination of molecular size of DNA. (Demonstration)
6. Restriction enzyme digestion and electrophoresis. (Demonstration)
7. Immunodiffusion
8. Production of antisera

B. MICROBIAL TECHNIQUES

1. Handling and maintenance of microscopy.
2. Sterilization techniques - principles, methods, moist heat, dry heat, filter types CDC, safety levels.
3. Preparation of media - liquid, solid, agar deep. Slant and plate.
4. Staining techniques - simple, differential and special staining.
5. Pure culture techniques - streak plate, pour plate.
6. Growth curve - non-visual method turbidity method.
7. Identification and enumeration of microorganisms from soil - streak plate, pour plate.
8. Identification and enumeration of microorganisms from water - standard plate count, MPN test and membrane filtration technique.

References

1. Practical Biochemistry For Medical Students - Raghu, JAYPEE, 2006
2. Practical Clinical BiochemistryHardcover–Harold Varley,Sixth Edition, Alan H Gowenlock.
3. An Introduction to Practical Biochemistry - David T. Plummer Third Edition, Tata Mc Graw Hill
4. Medical laboratory Technology Volume I, II & III - KL Mukherjee
5. Haematology for students Practitioners - Ramnik Sood
6. Biochemical Methods - S.Sadasivam & A.Manickam, New Age International.
7. Medical laboratory Technology Volume I, II & III - KL Mukherjee

ELECTIVE

PAPER-1

(to choose 1 out of 3)

Name of the course/subject : M.Sc., Biochemistry. Semester : II
Name of the paper : MicrobiologyCredits : 3 Hours of teaching
Paper type : Elective 1

UNIT - I GENERAL MICROBIOLOGY

Introduction and scope of microbiology. Brief study of structure andorganization of major groups of microorganisms - archaebacteria,cyanobacteria, eubacteria, fungi, algae, protozoa and viruses. Culture ofmicroorganisms - batch, continuous and pure cultures. Control ofmicroorganisms - physical, chemical and chemotherapeutic agents.Preservation of microorganisms.

UNIT - II ENVIRONMENTAL MICROBIOLOGY

Microbiology of soil - soil microflora, role of soil microbes in biogeochemicalcycles (C,N,S) - Marine and fresh water microbiology. Contamination ofdomestic and marine waters. Water purification and sewage treatment.Microbes in waste water treatments. Microbiology of air.

UNIT - III INDUSTRIAL MICROBIOLOGY

Selection of industrially useful microbes. Fermentors and fermentationtechnology. Industrial production of alcohol, vinegar, lactic acid,enzymes and amino acids. Microbiology of food: sources of contamination,food spoilage and food preservation methods.

UNIT - IV MEDICAL MICROBIOLOGY

Disease reservoirs; Epidemiological terminologies.Infectious disease transmissions. Respiratory infections caused by bacteria and viruses; Tuberculosis, sexually transmitted diseases including AIDS; Vector bone diseases, water borne diseases, Public health and water quality. Pathogenic fungi, Antimicrobial agents, Antibiotics.Penicillins and cephalosporins, Broad spectrum antibiotics.Antibiotics from prokaryocytes, antifungal antibiotics - mode of action, Resistance to antibiotics.

UNIT - V APPLIED MICROBIOLOGY

Role of microbes in the manufacture of antibiotics and vaccines.Microorganisms as biofertilizers. Microbes as foods - SCP production. Roleof microbes in biogas production, petroleum industry and mining. Microbialdegradation of lignin, cellulose and pesticides. Microbial immobilization.Microbes in biological warfare.

Text Books

- Pelczar et al.,"*Microbiology",* 3rd edition, Tata McGraw-Hill, New Delhi, 2004.
- Prescott et al.,"*Microbiology"*,2nd edition,WMC Brown Publishers, USA, 2003.

Reference Books

- Martin Alexander ,"*Introduction to soil microbiology",* 4th edition, WileyInternational, NY, 2004
- Gladwin & Trattler, "*Clinical Microbiology Made RidiculouslySimple"*, 6th edition, Medmaster, UK,2013

Text Books

1. Medical Microbiology- Jawetz, Melnick and Adelberg's, Lange Med. Brooks, et al 1998.
2. Microbiology. 4th ED - Davis, et al. Lippincott Williams and Wilkins, 1989.
3. Microbiology -Joklik, et al. Zinsser's McGraw Hill Professional, 1995.
4. Brack Biology of Microorganisms, 10th ed- Madigan, et al. Prentice Hall, 2002.
5. Microbiology, 5th Ed. - Pelczar et al. McGraw Hill, 2000.
6. Microbiology -Prescott et al. Mcgraw Hill, 1999.

General Microbiology. 5thed,Stainer RY, et al. Prentice Hall, 1986

PAPER – 2

Name of the course/subject : M.Sc., Biochemistry. **Semester : II**
Name of the paper : Bioinformatics **Credits : 3 Hours of teaching**
Paper type : Elective II

Objectives:
To enable the students

- Understand the impact of Bioinformatics methodology in Biological Sciences.
- Distinguish between the commercial and research perspectives of Bioinformatics.
- Assess the interface between computational and Biological Science.

UNIT-I INTRODUCTION TO BIOINFORMATICS

Bioinformatics-an overview and definition, objectives and scope-genomics, proteomics and computer aided drug design. Bioinformatics and internet – challenges and applications

UNIT-II BIOLOGICAL DATABASE AND ITS TYPES

Introduction to data types and source. General introduction of biological database; Nucleic acid databases-NCBI, DDBJ,SWISS-PROT and EMBL. Protein databases – primary, composite and secondary. Specialized genome databases ; SGD, TIGR and ACeDB, structure databases – CATH, SCOP and PBD sum.
Lab demo class-NCBI, EMBL and DDBJ

UNIT –III DNA SEQUENCE ANALYSIS

DNA sequence analysis- DNA sequence, features of DNA sequence analysis, EST-differential approaches to EST analysis and c-DNA libraries.

UNIT – IV PROTEIN DATA BANK

Protein information resources- Biological databases, primary sequence databases, composite protein sequence databases, secondary databases- PROSITE, PRINTS, PROFILES and IDENTITY.

UNIT –V SEQUENCE ALIGNMENT

Pair wise alignment – database searching (Needleman algorithm), comparing two sequence - identity and similarity, FASTA and BLAST, Multiple sequence alignment - Definition - Clustal W.

Lab demo class- FASTA, BLAST and Clustal W

Text Books

- Attwood T.K and D.J Parry, *Introduction to Bioinformatics*, Pearson Education Ltd., New Delhi 2014.
- N. Gautham, *Bioinformatics-Database and Algorithm*, Narrosa publishing house 2007

Reference Books

- Andreas D Baxevanis and Francis Quellette B F,*Bioinformatics-A Practical guide to the analysis of genes and proteins*, Willey publication, New Delhi 2016.
- Arthur M. Lesk, *Introduction to Bioinformatics*, second edition, oxford university press, UK 2006.
- Jerry Gu, Phlip E Bowrne, *Structural Bioinformatics*, Willey- blockwell publication, New Delhi 2009

e- Resources

- https://www.lehigh.edu/~inbios21/PDF/Fall2008/Lopresti_11142008.pdf
- www.aun.edu.eg/.../Procedure%20**Bioinformatics**22.../Xiong%20-%20Es...
- www.iasri.res.in/**ebook**/CAFT_sd/Concepts%20of%20**Bioinformatics**.pdf
- goldenhelix.com/.../**ebooks**/Teaching-**Bioinformatics**-Concepts-Practical-...
- nptel.ac.in

ELECTIVE

PAPER-3 (to choose 1 out of 3)

Name of the course/subject : M.Sc., Biochemistry. Semester : II
Name of the paper : Molecular Biology Credits : 3 Hours of teaching
Paper type : Elective III

C. BIOCHEMICAL AND ENVIRONMENTAL TOXICOLOGY

UNIT-I

Definition and scope of toxicology: Eco-toxicology and its environment significance toxic effects. Basis for general classification & nature, dose - response relationship.Synergism and Antagonism, Determination of ED 50 & LD 50.

Acute and chronic exposures. Factors influencing toxicity.Pharmacodynamics &Chemodynamics.

UNIT-II

Principles & procedures of testing for acute toxic effects. Regulators guidelines, mammalian systems affected & the clinical signs of systemic toxicity. Factors affecting acute toxicity studies.Biochemical basis of toxicity.Mechanism of toxicity: Genotoxicity.Tissue specific toxicity.

UNIT-III

Toxicity testing : Test Protocol, Genetic Toxicity Testing & Mutagenesis Assays: *Invivo* test systems- Bacterial Mutation Tests: Reversion Tests, Ames test, Fluctuation Tests & Eukaryote Mutation Tests In Vivo Mammalian Mutation Tests – host mediated assay & dominant lethal test. Use of drosophila in toxicity testing. DNA repair assays. Chromosome damage test.

UNIT-IV

Food toxicology: Toxicology of food additives. Metal toxicity: Toxicology of Arsenic, Mercury, Lead and Cadmium. Environmental Factors Affecting Metal Toxicity- Effect of Light, Temperature & PH. Diagnosis of toxic changes in liver and kidneys: Metabolism of Haloalkanes. Haloalkenes&Paracetomol with their toxic effects on tissues.

UNIT-V

Air pollution: common air pollutants and their sources. Air pollution & ozone.Air pollution due to chloroflurocarbons (CFCS) and asbestos. Occupational toxicology and assessment of occupational hazards: industrial effluent toxicology & environmental health. An overview of regulatory agencies: responsibilities of regulatory agencies. Management of toxicological risks. Regulatory approaches. Regulatory systems and organizations.

References:

1. Casarett and Doull's Toxicology, III rd edition - Klaassen C D, Amdur M O &Doull J (1986), Macmillan publishing company, New York. 26

2. Industrial Toxicology - Williams P L&Burson J L Van- Nostrand Reinhold, New York,1985

3.Principles and methods of toxicology, II nd edition -Hayes A W, Raven press New York, 1988

4. Toxicology, Vol I - Stewart C P&Stolman A Academic press, New York, 1960

NON MAJOR ELECTIVE

PAPER-1 (to choose 1 out of 3)

Name of the course/subject : M.Sc., Biochemistry. Semester : II

Name of the paper : Herbal Medicine Credits : 3 Hours of teaching

Paper type : NME

Unit I Ethnomedicine

Ethnomedicine: Definition, history and scope. Collection of ethnic information.Importance of medicinal plants: Role in human health care.Introduction to basic concepts of folk medicine and Ayurveda, Naturopathy and Yoga: methods of disease diagnosis and treatment.

Unit II Importance of medicinal plants – role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids and vitamins).

Unit III Tribal medicine – methods of disease diagnosis and **t**reatment – Plants in folk religion – Aegle marmelos, Ficus benghalensis, Curcuma domestica, Cyanodon dactylon and Sesamum indicum.

Unit IV Traditional knowledge and utility of some medicinal plants in Tamilnadu – Solanum trilobatum, Cardiospermum halicacabum, Vitex negundo, Adathoda vasica, Azadirachta indica, Gloriosa superba, Eclipta alba, Aristolochia indica and Phyllanthus fraternus.

Unit V Plants in day today life – Ocimum sanctum, Centella asiatica, Cassia auriculata, Aloe vera. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and vegetables - Greens (Moringa, Solanum nigrum Cabbage).

References

- Ethnobiology – R.K.Sinha & Shweta Sinha. Surabhe Publications – Jaipur. 2001
- Tribal medicine – D.C. Pal & S.K. Jain Naya Prakash, 206,
- Bidhan Sarani, Calcutta , 1998
- Contribution to Indian ethnobotany – S.K. Jain, 3rd edition, Scientific publishers, B.No. 91, Jodhpur, India. 2001
- A Manual of Ethnobotany – S.K.Jain, 2nd edition, 1995.

PAPER-2 (to choose 1 out of 3)

Name of the course/subject : M.Sc., Biochemistry. Semester : II
Name of the paper : Herbal Drug Development Credits : 3 Hours of teaching
Paper type : NME

UNIT 1GENERAL METHODS OF PROCESSING OF HERBS:
Definition, sources, identification and authentification of herbs. Different methods of processing of herbs like collection, harvesting, garbling, packing and storage conditions. Methods of drying – Natural and artificial drying methods with their merits and demerits.

UNIT II METHODS OF PREPARATION AND STANDARDIZATION OF HERBAL RAW MATERIALS AND EXTRACTS
Principles of extraction and selection of suitable extraction method with their merits and demerits.Standardization of herbal raw materials including Pharmacognostical, physical, chemical and biological methods with examples

UNIT III. ISOLATION AND ESTIMATION OF PHYTOCONSTITUENTS
Different methods (including industrial) for isolation and estimation of phytoconstituents from the following drugs (with special emphasis on HPLC and HPTLC).Alicin from Garlic.Piperine from Piper nigram / Piper longum. Bacosides from Bacopa monnier.Berberine from Berberis aristata.

UNIT IV HERBAL FORMULATION DEVELOPMENT:
Selection of herbal ingredients. Different dosage forms of herbal drugs. Evaluation of different dosage forms. Stability studies of herbal formulations

UNIT V HERBAL COSMETICS
Cosmetics preparations: Incorporating the herbal extracts in various cosmetic formulations like Skin care preparations (Creams and Lotions), Sunscreens and Sunburn applications, Hair care preparations (Hair oils and Hair shampoos) and Beautifying preparations(Lipsticks, Face powders and Nail polish).

Text Books

- Herbal drug industry by R.D. Choudhary, Ist edition, eastern publisher, New Delhi: 1996.
- GMP for Botanicals - Regulatory and Quality issues on Phytomedicine Business horizons, New Delhi, First edition, 2003. Robert Verpoorte, Pulok K Mukharjee.
- Indian Herbal Pharmacopoeia, Vol.1&2, RRL, 1DMA, 1998, 2000.
- Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae, 4th edition, Nirali Prakashan, 1996.
- Text book of Pharmacognosy and Phytochemistry by rangare.
- Biological standardization by J.N.Barn, D.J.Finley and L.G. Good win

References

- Herbal Cosmetics - H.Pande, Asia Pacific Business press, New Delhi.
- H.Pande, “The complete technology book on herbal perfumes and cosmetics”, National Institute of Industrial Research, Delhi.
- Quality control of herbal drugs by Pulok K Mukarjee, Ist edition, Business horizons Pharmaceutical publisher, New Delhi, 2002.
- PDR for herbal medicines, 2nd edition, medicinal economic company, New Jersey, 2000.
- Plant drug analysis 2nd edition by Wagner, Bladt.

PAPER-3 (to choose 1 out of 3)

Name of the course/subject : M.Sc., Biochemistry. Semester : II
Name of the paper : Organic Farming credits : 3 Hours of teaching
Paper type : NME

UNIT I Conceptof organicfarming

Introduction:Farming,organicfarming, concept and development of organic farming. Principles and Typesoforganicfarming3. Benefitsoforganic farming.

UNIT IIOrganicplantnutrientmanagement1.

Organicfarmingsystems- Soiltillage- Landpreparationand mulching Watermanagement

UNIT IIIOrganicplantprotection

Plantprotection-cultural-mechanical--biopesticide- biocontrolagents-organic vermicompost.

UNIT IV Organiccrop productionpractices

Organiccrop productionmethods-rice-vegetables-amaranthus-medicinal and aromatics plants , Income generationactivities:Apiculture,Mushroomproduction,Terracefarming .Quality of Organic Food,-natural source for antioxidants for health defence-antioxidant capacity of fruits and vegetables

UNIT V EntrepreneurshipDevelopment

Organic food and human health -organic certification process -marketing of organic product to increase Entrepreneurship -Dates Processing & Packaging - production of Fruit Juices, Making of Organic Jams, Production of Organic Honey

Reference

- Ahlawat, I.P.S., Om Prakash and G.S.Saini. 1998. Scientific Crop Production in India. Rama Publishing House,
- Meerut.Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- ICAR 2006. Hand book of Agriculture. Indian Council of Agricuture, New Delhi.
- Crop Production Guide. 2005. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
- Rajendra Prasad. 2004. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.
- K Annadurai and B Chandrasekaran. 2009. A Text Book Of Rice Science. Scientific Publisher

E-References:

www.irri.org
www.crri.nic.in
www.drrindia.org

SEMESTER III

Name of the course/subject: M.sc., Biochemistry.
Semester : Semester III
Name of the paper : Molecular Endocrinology.
Credits : 4 Hours of teaching.
Paper type : core – 7
Course objective :

- To impart knowledge on molecular mechanism and Endocrine system.
- To provide knowledge on hormonal action and metabolic functions.
- To create awareness on hormonal imbalance and regulations.
- To impart basic knowledge on hormone cascade system.
- To develop sound knowledge on steroids and its importance.

UNIT-I : CLASSIFICATION AND MECHANISM

Hormones - definition, classification based on receptors, hormone cascade system involving CNS, hypothalamus, anterior pituitary, target gland, feedback mechanisms, classification of hormones (polypeptides, glycoproteins and POMC peptides), genes and formation of polypeptide hormones - POMC peptides and vasopressin, insulin, Parathyroid.

UNIT-II : AMINO ACID DERIVED HORMONES

Synthesis of amino acid derived hormones-epinephrine and thyroxine, inactivation and degradation of hormones, signal transduction and second messengers - adenylate cyclase system, cAMP, adrenalin and glycogen degradation. G-protein as cellular transducer, inositol triphosphate and calcium release, glycogen phosphorylase kinase, DAG and protein kinase C-pathway.

UNIT-III : CYCLIC HORMONAL CASCADE SYSTEM AND PROTEIN KINASES

Cyclic hormonal cascade system - chronotropic control, melatonin and serotonin - light and dark cycle, ovarian cycle and role of hormones, hormone - receptor interactions, multiple hormone subunits Sactchard analysis, structure beta -adrenergic receptor and insulin receptor, internalization of receptors, intracellular action - protein kinases, insulin receptor - transduction through tyrosine kinase, vasopressin - protein kinase A, GnRH-protein kinase C, atrial natriuretic factor - protein kinase G.

UNIT-IV : HORMONE RECEPTORS AND REGULATION

Steroid hormone receptors, intracellular protein receptors, structural organization of receptor protein, hormone binding domain, antigenic domain and DNA binding domain,organizations of functional elements - hormone response elements, positive and negative transcriptional effects of S.R, receptor activation - upregulation and down regulation, apoptosis - steroid hormone action at cell level, multiple endocrine neoplasia - different types.

UNIT-V : STEROID HORMONES

Structure, biosynthesis, transport of steroid hormones in blood and metabolic inactivation of steroid hormones, control of synthesis and release of steroid hormones, Hormones that directly stimulate synthesis and release of steroid hormone with reference to the second messengers and the signal pathway (cortisol, aldosterone, testosterone, 17B - estradiol, progesterone and calcitriol)

Text Books

- Textbook of biochemistry (with clinical correlation) by Devlin, Wiley-Liss; 6 edition (2005) .
- Wilson and Foster," *Endocrinology"*, 4th edition, W.B. Saunders Co, 2005.
- Textbook of endocrinology by Wilson and Foster, W.B. Saunders Co.
- Lohar, S.Prakasa, *Endocrinology- Hormones & human health*, MJP Publishers, 2006.

Reference Books

- R.K. Murray et al. "*Harper's Biochemistry",*27 edition, McGraw-Hill Medical, 2006.
- Austin and Short,prema Jaypee brothers, "*Mechanism of hormone action"*, 3rd edition, 2005.
- Sembulingam.K and Sembulingam, "*Essential of Medical Physiology",*4th Edition, *P*rema Jaypee brothers,Delhi, 2006.

E- Resources

- https://www.elsevier.com/books/molecular-endocrinology/bolander/978-0-12-111232-5
- https://www.amazon.in/Molecular-Endocrinology-Franklyn-Bolander-ebook/dp/B01D4CI1AQ
- https://www.amazon.in/Molecular-Endocrinology-Human-Genetics-ebook/dp/B01E3EUF8U
- https://www.kobo.com/us/en/ebook/molecular-endocrinology-1
- https://www.ebooks.com/en-ao/297039/molecular-endocrinology/franklyn-f-bolander/

Course outcomes:

After studied unit – 1, the student will be able to

- Familiar with classification of hormone cascade system.
- Well versed with basic hormonal action and classification.
- Knowledgeable on cyclic hormone cascade system.
- Aware of Hormone regulations and Insulin.
- Well versed on pituitary hormones and its roles.

6. **After studied unit – 2, the student will be able to**

- Familiar with thyroid hormones .
- Well versed with signal transduction.
- Knowledgeable on G protein.
- Aware of Hormone regulations.
- Well versed on secondary messengers.

7. **After studied unit – 3, the student will be able to**

- Familiar with cyclic hormone casade system .
- Well versed with ovarian cycle.
- Knowledgeable on Scatchard analysis.
- Aware of protein kinase enzyme regulations.
- Well versed on light and dark cycle.

8. **After studied unit – 4, the student will be able to**

- Familiar with hormone receptor system.
- Well versed with receptor proteins.
- Knowledgeable on up regulation and down regulation.
- Aware of multiple endocrine neoplasia.
- Well versed on hormone response.

9. **After studied unit – 5, the student will be able to**

- Familiar with steroid hormones structure and classification.
- Well versed with signal transduction.
- Knowledgeable on second messengers.
- Aware of steroid Hormone regulations.
- Well versed on synthesis and release of calcitriol.

Name of the course/subject: M.sc., Biochemistry.
Semester : Semester III
Name of the paper : Enzyme Technology.

Credits : 5 Hours of teaching.
Paper type : core – 8
Course objective :

- To impart knowledge on classification and active sites of enzymes.
- To provide knowledge on enzyme kinetics.
- To create awareness on role of inhibitors and catalytic enzymes.
- To impart basic knowledge on coenzymes and isoenzymes.
- To develop sound knowledge on Industrial and clinical enzymology.

UNIT-I : CLASSIFICATION, PURIFICATION AND ACTIVE SITE

Nomenclature and classification of enzymes, isolation and purification of enzymes – enzymeprotein determination by different methods, criteria of purity - specific activity.Enzyme units - Katal, IU. Measurement of enzyme activity - two point assay, kinetic assay, using radiolabelled substrates. Active site - determination of active site amino acids - chemical probe, affinity label, and site-directed mutagenesis, intrinsic and extrinsic regulations.Investigation of 3-D structure of active site.A brief account of nonprotein enzymes - ribozymes and DNA enzymes.

UNIT-II : ENZYME KINETICS

Kinetics of single substrate enzyme - catalysed reactions - Michaelis - Menten equation, importance of Vmax, Km, MM equation, and turnover number; Lineweaver - Burk plot, Eadie - Hofstee plot, and Hanes - Woolf plot .

Presteady - state kinetics and relaxation kinetics.Kinetics of Allosteric enzymes - MWC and KNF models Hill' equation coefficient. Kinetics of multi - substrate enzyme - catalysed reactions - Ping-pong bi-bi, random order and compulsory order mechanism.

UNIT-III : ENZYME CATALYSIS AND INHIBITION

Mechanism of enzymicaction , mechanism of serine proteases - chymotrypsin, lvsozyme, carboxy peptidase A and ribonuclease.

Reversible inhibition - competitive, uncompetitive, noncompetitive, mixed, substrate and allosteric inhibition.Irreversible inhibition.

UNIT-IV : COENZYMES AND ISOENZYMES

Coenzymes - prosthetic group, classification - vitamin and nonvitamin coenzymes, thiamine pyrophosphate - mechanism of oxidative and nonoxidative decarboxylation, transketolase reaction, PALP and PAMP - role of PALP in transamination and decarboxylation reaction, folate coenzymes and vitamin C, metabolite and nonvitamin coenzymes, lipoic acid, coenzyme Q, nucleoside triphosphate and S-adenosyl methionine. Isoenzymes.

UNIT-V : INDUSTRIAL AND CLINICAL USES OF ENZYMES

Industrial uses of enzymes - sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheesed production.

Clinical enzymology - Enzymes as thromblytic agents, anti-inflammatory agents.Immobilization of enzymes and their applications.

Text books

- Trevor Palmer, Philip Bonner *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry*2nd edition, Horwood Publishing Limited, 2007
- Dixon and Webb,*Enzymes*, 3rd edition, Academic Press, New York, 2000.
- Understanding enzymes - Palmer. Prentice Hall; 4 Sub edition, 1995
- Enzymes - Boyer. Academic Press; 3rd edition, November 1983
- Biochemistry - Metzler. Academic Press, 2000.
- Champe P.C and Richard A Harvey, *Lippincotts Biochemistry,* Williams & Wilkins Publishers, 2004

Reference books

- E.S. West, W.R. Todd, H.S. Mason and J.T. van Bruggen, *A Text Book of Biochemistry,* 4th edition, Oxford and IBH Publishing Co., New Delhi, 2000
- Nicholas C. Price, Lewis Stevens, and Lewis Stevens, *Fundamentals of Enzymology: the Cell and Molecular Biology of Catalytic Proteins*, 3rd edition, Oxford University Press, USA, 2000.
- David L. Nelson Michael M. Cox Lehninger *Principles of Biochemistry*, W. H. Freeman; 4th edition, 2004
- Biochemistry - Stryer. W. H. Freeman; 6 edition, 2006.

e- Books

- https://storeiyta.firebaseapp.com/.../enzymes-biochemistry-biotechnology-clinical-che.
- https://quacktradition4ahz.files.wordpress.com/.../fundamentals-of-enzymology-the-ce.

Course outcomes:

1. **After studied unit – 1, the student will be able to**

- Familiar with classification of enzyme system.
- Well versed with isolation of enzymes and criteria of putiry.

- Knowledgeable on 3D structure of active site.
- Aware of non protein enzymes.

2. After studied unit – 2, the student will be able to

- Familiar with Enzyme kinetics .
- Well versed with importance of km and Vmax.
- Knowledgeable on presteady state kinetics.
- Aware of multi order reactions.
- Well versed on sigmoidal kinetics.

3. After studied unit – 3, the student will be able to

- Familiar with serine proteases.
- Well versed with chymotrypsin.
- Knowledgeable on mode of action of lysozyme.
- Aware of protease carboxy peptidase.
- Well versed on Inhibitors and inhibition.

4. After studied unit – 4, the student will be able to

- Familiar with coenzymes.
- Well versed with classification of coenzymes.
- Knowledgeable on non vitamin coenzymes.
- Aware of coenzyme Q.
- Well versed on Isoenzymes.

5. After studied unit – 5, the student will be able to

- Familiar with Industrial uses of enzymes.
- Well versed with thermolytic enzymes.
- Knowledgeable on isomerases.
- Aware of proteolytic enzymes.
- Well versed on clinical enzymology

Name of the course/subject: M.sc., Biochemistry.
Semester : Semester III
Name of the paper : Biotechnology.

Credits : 5 Hours of teaching.
Paper type : core – 9
Course objective :

- To impart knowledge on basic tools in genetic engineering.
- To provide knowledge on cloning vectors and DNA sequencing.
- To create awareness on gene transfer and its applications.
- To impart basic knowledge on Industrial biotechnology.
- To develop sound knowledge on Bio safety and bio hazards.
- To develop sound knowledge on Bio safety and bio hazards

UNIT-I : TOOLS OF GENETIC ENGINEERING

Basic principles - mechanism of natural gene transfer by Agrobacterium, generation of foreign DNA molecules, restriction enzymes, their types and target sites, cutting and joining DNA molecules, linkers, adapters, homopolymers, enzymes used in genetic engineering, cloning vehicles and their properties, natural plasmids, i*nvitro* vectors, cosmids and T-DNA based hybrid vectors.

UNIT-II : DNA CLONING AND SEQUENCING

Cloning strategies - cloning with single strand DNA vectors, cDNA cloning and gene libraries, recombinant selection and screening methods, expression of cloned genes, shuttle vectors, DNA sequencing strategies - Sanger's and Maxam Gilbert's methods, PCR-types and applicationsand DNA hybridization, Southern, Northern andWestern blotting.

UNIT-III : GENE TRANSFER METHODS

Methods of gene recombination - Bacterial Conjugation, Transformation, Transduction. Gene transfer methods - Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication, Liposome fusion. Competence, identification of transformed colonies/clones – Blue white screening,

UNIT-IV : INDUSTRIAL BIOTECHNOLOGY

Applications of biotechnology-industrial biotechnology-fermentors, principle, types product recovery and purification of ethanol, citric acid, vitamin B 12, streptomycin, enzyme biotechnology-production and uses of industrially important enzymes such as protease.

UNIT – V APPLICATIONS OF GENETIC ENGINEERING 15 Hrs

Genetic engineering in animals - Production of transgenic mice, Therapeutic products produced by genetic engineering- plasma proteins, human hormones, Genetic engineering in plants: Use of Agrobacterium tumefaciens and A.rhizogenes, Ti plasmids, Strategies for gene transfer to plant cells – Herbicide resistant, Drought tolerant, pest resistant, salt tolerant transgenic plants and related ethical issues

OUTCOMES:

Upon completion of the course, the student

- Will be familiar with basics of gene cloning tools.
- Will be well versed with cloning technique and various vectors.
- Will be knowledgeable on gene transfer and its applications.
- Will be aware of industrial biotechnology.
- Will be well versed on controversies of gene cloning and human genome project.

Text books

- Satyanarayana U, Biotechnology, 2nd edition, Books & Allied (P) Ltd, 2008.
- Bernard R. Glick, Jack J. Pasternak, and Cheryl L. Patten, Molecular biotechnology: Principles and applications of recombinant DNA, 4th edition, By ASM press. 2010
- Singh. K., "Intellectual property rights on Biotechnology", Springer, 7th edition, 2015
- R.C.Dubey, A text book of Biotechnology, 5th revised edition, S.Chand Publications, 2014
- Basic Biotechnology - Ratledge & Kristianeen, Cambridge University press 2nd ed.
- Srivastava A K, Singh R K, *Animal biotechnology*, Oxford and IBH Publishers, 2005
- John E Smith, *Biotechnology*,Fifth edition,Cambridge university press, 2009

Reference books

- J. Sambrook, E.F. Fritsch and T. Maniatis, Molecular Cloning: a Laboratory Manual, , 3rd edition, Cold Spring Harbor Laboratory Press, New York, 2000
- Brown, T.A, "Gene Cloning and DNA Analysis- An Introduction, 6th edition, John Wiley & Sons, 2010
- Strickberger. M.W., "Genetics", 3rd edition, Pearson India, 2015.
- Molecular Biotechnology, 2nd ed - Glick & Pasternak, Panima Publications
- Sambamurthy K, Ashoush Kar, *Pharmaceutical Biotechnology , fundamentals and applications*, New Age international publishers, 2016

Course outcomes:

1. **After studied unit – 1, the student will be able to**

- Familiar with gene transfer system.
- Well versed with restriction enzymes.
- Knowledgeable on plasmids and cosmids.
- Aware of hybrid vectors in genetic engineering.

2. **After studied unit – 2, the student will be able to**

- Familiar with cloning technique .
- Well versed with gene library.
- Knowledgeable on DNA sequencing methods.
- Aware of PCR and blotting techniques.

3. **After studied unit – 3, the student will be able to**

- Familiar with Explants.
- Well versed with protoplast fusion.
- Knowledgeable on electroporation.
- Well versed on xenografting.
- Aware of GM foods.

4. **After studied unit – 4, the student will be able to**

- Familiar with fermentors.
- Well versed with purification of vitamin B12.
- Knowledgeable on proteases enzymes.
- Well versed on industrial uses of enzymes.

5. **After studied unit – 5, the student will be able to**

- Familiar with Biowepons
- Well versed with food safety measures.
- Knowledgeable on human genome project.
- Aware of IPR.
- Well versed on pattenting.

Name of the course/subject: M.sc., Biochemistry.
Semester : Semester III
Name of the paper : A. Phytomedicine.

(To choose 1 out of 2)
Credits : 2 Hours of teaching.
Paper type : Elective
Course objective :

To provide the acquire knowledge on medicinal use of plants and plant extracts for therapeutic purposes.

UNIT – I : PHARMACOGNOSY
Definition and history, Indian systems of medicine - Siddha, ayurvedha, and Unani systems. Taxonomy of locally available medicinal plants, their chemical constituents and medicinal uses - Classification of Crude drugs - Chemistry of Drugs - Future of pharmacognosy.

UNIT – II : CLASSIFICATION OF MEDICINAL PLANTS
Vernacular name and family - Geographical source, cultivation, collection, and processing for market and commerce in crude drugs. Morphological and histological studies, chemical constituents - Therapeutic and other pharmaceutical uses. Underground stem - ginger, Alpinia - Roots - Rauolfia - Belladona - Aerial parts - Bark - Cinchona.

UNIT – III : BIOMEDICAL IMPORTANCE OF MEDICINAL PLANTS
Leaves - Adathoda, Eucalyptus - Flower - Clove fruits seeds - Nux vomica Nutmegs, Gooseberry - unorganized drugs - Gum - Acacia - Resin - Turpentine, fixed oil - castor oil.

UNIT – IV : HERBAL MEDICINES FOR HUMAN AILMENTS
Drugs Acting on Cardiac Diseases, Cerebral Diseases, Nasal diseases - Blood pressure Drugs acting on Nervous system – Depressants, Stimulants. Respiration and Drugs - Urogenital system and drugs - Psychoactive plants.

UNIT – V : PROPAGATION OF MEDICINAL PLANTS
Micro and macro propagation, conservation of rare medicinal plants, Role of biotechnology in medicinal plant's banks,cultivation of medicinal and aromatic plants. Drug adulteration - methods of Drug evaluation. Herbal food - Food processing - packaging - Herbal sale and Export of medicinal plants - marketing - Intellectual property rights - Export laws.

Text Books :

Unit 1 to unit 5:

1. George Edward Trease and W.C. Evans - Pharmacognosy 12th edition, English Language Books Society, Baelliere Tindall.
2. Handa, S.S. and Kapoor, V.K. Pharamcognosy - 2nd Edition, Vallabh Prakashan Publishers, New Delhi.
3. Indian Medicinal plants - Jain, S.K,1980.
4. Kokate, C.K., Durohit, A.P. and Gokhale, S.R., Pharmacognosy - 12th edition - Nirali Prakasham Publishers, Pune.

References:
Unit 1 to unit 5:

1. An Introduction to Medical Botany and Pharmacognosy - Kumar N.C., 1993.
2. Indian Materia Medica – Nadkarni, 1981.
3. A text book of Pharmacognosy - Shah, S.C. and Qudary, 1990.
4. Text book of pharmacognosy , 5th edition -Wallis, T.E, CBS publishers and distributors, New Delhi.

Course outcomes:

1. **After studied unit – 1, the student will be able to**

- Familiar with Indian system of medicine.
- Well versed with plant toxonamy.
- Knowledgeable on medicinal plants.
- Aware of chemistry of drugs.

1. **After studied unit – 2, the student will be able to**

- Familiar with crude drugs.
- Well versed with Therapeutical drugs.
- Knowledgeable on pharmacology.
- Well versed on root plants.

2. **After studied unit – 3, the student will be able to**

- Familiar with roots and flowers.
- Well versed with nutmegs.
- Knowledgeable on castor oil.
- Well versed on unorganised drugs.

3. **After studied unit – 4, the student will be able to**

- Familiar with cardiac diseases.
- Well versed with cerebral diseases.
- Knowledgeable on drugs on nervous systems.
- Well versed on psychoactive drugs.

4. **After studied unit – 5, the student will be able to**

- Familiar with micro and macro propogations
- Well versed with rare medicinal plants.
- Knowledgeable on aromatic plants.
- Aware of drug adulteration.
- Well versed on pattenting.

Name of the course/subject: M.sc., Biochemistry.
Semester : Semester III
Name of the paper : Genetic engineering.

Credits : 2 Hours of teaching.
Paper type : Elective
Course objective :

- To impart knowledge on basics in genetics and intellectual property rights.
- To provide knowledge on cloning vectors and DNA sequencing.
- To create awareness on DNA enzymes and its applications.
- To impart basic knowledge on DNA in biotechnology.
- To develop sound knowledge on blotting techniques.

UNIT-I

Introduction to gene cloning: Early development of Genetics - Gene cloning - Specialized tools and techniques - Importance of gene cloning

Intellectual property rights and types, Patenting, Isolation and Purification of DNA; Preparation of total cell DNA, Plasmid DNA, Bacteriophage DNA, Plant cell DNA.

UNIT-II

Cloning And Expression Vectors : Plasmids- Bacteriophages (M13 and λ) PUC vectors yeast vectors, agrobacterium, medicated gene transfer, YAC, BAC, Human artificial chromosomes, Ti plasmid, SV40, baculoviruses, adenoviruses, papilloma viruses and retroviruses.

UNIT-III

Multipulation of purified DNA: DNA manipulative enzymes – Nucleases, Ligases, polymerases, Topoisomerases, Restriction enzymes performing restriction digests, Ligation-joining DNA molecules together – Random labeling Nick translation and End filling.

UNIT-IV

Introduction to DNA into living cells: Biolistics, Electroporation, Microinjection, Liposome – mediated method and Calcium phosphate method.

UNIT-V

Construction of libraries – Studying gene and genome structure – Blotting techniques, PCR, Insitu hybridization, DNA Sequencing, Chromosome Walking and Jumping, DNA foot printing, Restriction analysis of DNA, RFLP, RAPD –Principles, Procedures and Applications.

Text books :
Unit 1 to unit 5:

1. Molecular cloning, vol. I, II, III, II nd edition, Sambrook J, Fritsch E. F. and Maniatis, 1989 Cold spring harbor laboratory press, New York.
2. DNA Cloning : A practical approach D.M. Glover and D.B. Hames, RL Press, Oxford, 1995.
3. Molecular and cellular methods in Biology and Medicine, P.B. Kaufman, W. Wu , D. Kim and L.J. Cseke, CRC Press Florida, 1995.
4. Methods in Enzymology Guide to Molecular Cloning Techniques, Vol. 152 S.L. Berger and A. R. Kimmel, Academic Press Inc, San Diego, 1996.
5. Methods in Enzymology Gene Expression Technology, Vol. 185D. V. Goedel, Academic Press Inc, San Diego, 1990.

References:
Unit 1 to unit 5:

1. DNA Science: A First Course in Recombinant Technology, D. A. Mickloss and G. A Freyer, Cold Spring Harbor Laboratory Press, New York, 1990.

2. Molecular Biotechnology, 2nd Ed. S. B. Primrose, Blackwell Scientific publishers, Oxford, 1994.

3. Milestones in Biotechnology, Classic Papers on Genetic Engineering, J. A. Davis and W. S. Reznikoff, Butterworth-Heinemann Boston, 1992.

4. Route Maps in Gene Technology, M. R. Walker, and R. Rapley, Blakwell Science, Oxford, 1997.
5. Genetic Engineering: An Introduction to Gene Analysis and Exploitation in Eukaryotes, S. M. Kingsman, Blackwell Scientific Publications, Oxford, 1998.

Course outcomes:

1. **After studied unit – 1, the student will be able to**

- Familiar with gene cloning.
- Well versed with tools and techniques.
- Knowledgeable on isolation and purification of enzymes.
- Aware of isolation of plant cell DNA.

2. **After studied unit – 2, the student will be able to**

- Familiar with cloning vectors.
- Well versed with plasmids.
- Knowledgeable on Ti plasmids.
- Well versed on papilloma viruses.

3. **After studied unit – 3, the student will be able to**

- Familiar with DNA manipulative enzymes.
- Well versed with nucleases.
- Knowledgeable on nick translation.
- Well versed on DNA ligation.

4. **After studied unit – 4, the student will be able to**

- Familiar with basic techniques.
- Well versed with biolistics.
- Knowledgeable on electro poration techniques.
- Well versed on liposome mediated transfer.

5. **After studied unit – 5, the student will be able to**

- Familiar with DNA sequencing.
- Well versed with blotting.
- Knowledgeable on chromosome walking and jumping.
- Aware of DNA foot printing.
- Well versed on DNA analysis.

Name of the course/subject: M.sc., Biochemistry.
Semester : Semester III
Name of the paper : Diagnostic biochemistry.

Credits : 2 Hours of teaching.
Paper type : Elective
Course objective :

- To impart knowledge on basics in inborn errors.
- To provide knowledge on enzymology.
- To create awareness on heart disease.
- To impart basic knowledge on anaemia.
- To develop sound knowledge on hormones.

UNIT - I

Inborn errors of metabolism - Alkaptonuria, Phenyl ketonuria, Cystinuria, Galactosemia, Fanconi's syndrome and Albinism.

UNIT - II

Plasma enzymes in diagnosis - Functional and non functional plasma enzymes - Isoenzymes. Myocardial Infarction, acute pancreatitis, liver diseases and muscle wasting.

UNIT - III

Cholesterol - importance, Lipoproteins - Factor affecting blood cholesterol - Atherosclerosis, Risk factor.

UNIT - IV

Iron absorption and excretion - Anemia - classification. Sickle cell anemia and Talassemia .

UNIT - V

Hormones - Definition and classification- Thyroid hormone- thyroid function test, male sex hormones and female sex hormone.

Text books :

Unit 1 to unit 5:

1. Clinical chemistry in Diagnosis & Treatment - P.D. Mayne, ELBS/ Arnold, N.Delhi.
2. Clinical chemistry - W.J. Marshall and S.K. Bangert [1995]
3. Textbooks of medicine - K.V. Krishnedas [1996], Jaypee Brothes.
4. Principles of internal medicine [1998] - Harrison, T.R. Fauci, Branuwalad and Isselbaeher, McGraw Hills.
5. Clinical Biochemistry with clinical correlation - Devin, Wiley.

References:

Unit 1 to unit 5:

1. Practical clinical biochemistry - Harold Varley, CBS, New Delhi.
2. Medical Laboratory technology - kanai L. Mukherjee, Tata McGraw Hill Publication and Co. ltd., vol. I, II, III.
3. Clinical chemistry in diagnosis and treatment, Joan F. ZilvaA, PR Pannall, Llyods - Luke [medical Books ltd., Lon
4. Biochemistry - U.Sathyanarayana & U. Chakrapani, Third edition, Book and Allied (p) ltd.
5. Text book of medical biochemistry - Fourth edition- MN. Chatterjee, Rana Shine, jaypee Publisher.

Course outcomes:

1. **After studied unit – 1, the student will be able to**

- Familiar with Inborn errors.
- Well versed with cysteinuria.
- Knowledgeable on falconi sysndrome.
- Aware of albinism.

2. **After studied unit – 2, the student will be able to**

- Familiar with enzymology.
- Well versed with plasma enzymes.
- Knowledgeable on Isoenzymess.
- Well versed on myocardial infractions.

3. **After studied unit – 3, the student will be able to**

- Familiar with atherosclerosis.
- Well versed with lipoproteins.
- Knowledgeable on risk factors of cholesterol.
- Well versed on lipids.

4. **After studied unit – 4, the student will be able to**

- Familiar with iron absorbtion.
- Well versed with anaemia.
- Knowledgeable on sickle cell anaemia.
- Well versed on talasemia.

5. **After studied unit – 5, the student will be able to**

- Familiar with Endocrine system.
- Well versed definition and classification of enzymes.
- Knowledgeable on thyroid hormones.
- Aware of sex hormones.

Name of the course/subject: M.sc., Biochemistry.
Semester : Semester III
Name of the paper : Mushroom cultivation.

Credits : 2 Hours of teaching.
Paper type : Non major Elective
Course objective :

- To impart knowledge on types of mushrooms.
- To provide knowledge on cultivation process.
- To create awareness on edible mushrooms.
- To impart basic knowledge on mushroom storage.
- To develop sound knowledge on mushroom nutritive values and recepies.

UNIT I: EDIBLE AND NONEDIBLE MUSHROOM

History of mushroom cultivation. Morphology of common edible mushroom, nutritional, medicinal value of mushroom, spawn, types of spawn, spawning. Edible and non-edible mushrooms.

UNIT II : CASING

Casing raw material used for casing, preparation of casing material, important sanitation during various stages of mushroom cultivation. Mushroom bed preparation and factors affecting mushroom bed preparation.

UNIT III: CULTIVATION OF MUSHROOM

Cultivation technology : Infrastructure(Mushroom House) ,equipment and substrates in mushroom cultivation. Mass cultivation of *Agaricusbisporous, Volvariellavolvaceae,* Preparation ofsubstrates (compost), casing, harvesting.

UNIT IV : STORAGE

Methods of storage of mushrooms.Long term short term storage of mushrooms.National and regional level mushroom research centers in india.

UNIT V: DISEASES AND RECIPES OF MUSHROOM

Diseases (Bacterial, fungal, viral and pests) and recipes of mushrooms – soup, omlette, samosa, pickles, curry.

Text books :

Unit 1 to unit 5:

1. Kanniyan, "Handbook of Edible Mushrooms" TNAU Publication, 4th Edition, (2001).
2. Kale Radha, D, Earthworm: Cinderella of organic farming. Prism Books Pvt. Ltd., Bangalore, 4th Edition, (1998).

References :

Unit 1 to unit 5:

1. Changs. T. & W.A. Hayanes, "Biology and cultivation of mushrooms" Acad Press, New York, 5th Edition, (1978).

Course outcomes:

1. After studied unit – 1, the student will be able to

- Familiar with history of mushrooms.
- Well versed with nutritional values.
- Knowledgeable on medicinal values.
- Aware of types of spawn.

2. After studied unit – 2, the student will be able to

- Familiar with casing.
- Well versed with casing methods.
- Knowledgeable on sanitation methods.
- Well versed on mushroom bed preparation methods.

3. After studied unit – 3, the student will be able to

- Familiar with mushroom cultivation technology.
- Well versed with mushroom house.
- Knowledgeable on mass cultivation.
- Well versed on harvesting.

4. After studied unit – 4, the student will be able to

- Familiar with basic techniques.
- Well versed with methods of storages.
- Knowledgeable on long term storages .
- Well versed on mushroom research in india.

5. After studied unit – 5, the student will be able to

- Familiar with mushroom diseases.
- Well versed with infections.
- Knowledgeable on fungal and pest control.
- Aware of mushroom foods.
- Well versed on mushroom cooking.

Name of the course/subject: M.sc., Biochemistry.
Semester : Semester III
Name of the paper : Methods in food preservation.

Credits : 2 Hours of teaching.
Paper type : Non major Elective
Course objective :

- To impart knowledge on basics in food processing.
- To provide knowledge on food preservation process.
- To create awareness on preservation techniques.
- To impart basic knowledge on food drying and storage.

UNIT 1

Food processing and preservation principles, method of preservation: pasteurization (definition, time-temperature combination and equipments) sterilization (definition, time-temperature combination and equipments), canning , packaging.

UNIT 2

Food Freezing and thawing process: Introduction, freezing point and freezing rate, comparison of Freezing and thawing process; freezing methods: Air freezing, plate freezing, liquid immersion freezing and cryogenic freezing. Freezer selection. Advantages and disadvantages of freezing.

UNIT 3

Food Drying/Dehydration: Definition, free and bound moisture, factors affecting drying, moisture content , equilibrium moisture content, Drying methods and equipments: sun/solar drying, Cabinet drying, tunnel dryer, spray dryer, freeze dryer, fluidized bed dryer, Nutritional, physico-chemical changes during drying.

UNIT 4

Food Concentration: Evaporation- Definition, types of evaporator (single effect, double effect and multiple effect evaporator); Freeze concentration- General principles and applications.

UNIT 5

Membrane Processing: General principles and advantages, dead end and cross flow, Classification of membrane system: Reverse Osmosis, Membrane performance, and Limitation of membrane processes.

Text Books :

Unit 1 to unit 5:

1. Food Processing: Principles and Applications by Ramaswamy H. & Marcotte M. Taylor & Francis.

2. Food Science by Norman N Potter and Joseph H. Hotchkiss, CBS Publishers and Distributors.

References:

Unit 1 to unit 5:

1. Novel Food Processing Technologies by Barbosa-Canovas, Tapia & Cano CRC Press, 2004.

Course outcomes:

1. After studied unit – 1, the student will be able to

- Familiar with basic food processing techniques.
- Well versed with methods of food preservation.
- Knowledgeable on pasteurisation.
- Aware of types of packaging.

2. After studied unit – 2, the student will be able to

- Familiar with food freezing.
- Well versed with freezing methods.
- Knowledgeable on cryogenic freezing methods.
- Well versed on advantages and disadvantages of freezing methods.

3. After studied unit – 3, the student will be able to

- Familiar with food drying.
- Well versed with moisture content.
- Knowledgeable on dryer usage.
- Well versed on dryer types.

4. After studied unit – 4, the student will be able to

- Familiar with basic techniques.
- Well versed with evaporation methods.
- Knowledgeable on evaporators and its types.
- Well versed on general applications.

5. After studied unit – 5, the student will be able to

- Familiar with membrane processing.
- Well versed with reverse osmosis.
- Knowledgeable on basic techniques.
- Aware of membrane performances.

Name of the course/subject: M.sc., Biochemistry.
Semester : Semester III
Name of the paper : Human physiology and nutrition.

Credits : 2 Hours of teaching.
Paper type : Non major Elective
Course objective :

- To impart knowledge on basics human physiology and nutrition.
- To provide knowledge on food digestion and absortion.
- To create awareness on blood groups and anaemia.
- To impart basic knowledge on BMR and trace elements.

UNIT-I : DIGESTION, ABSORPTION AND EXCRETION

Digestive secretions - composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids and proteins.

Excretory system - structure of nephron. Formation of urine .

UNIT-II : BLOOD AND CIRCULATION

Composition and functions of blood and plasma. Blood groups. Blood coagulation - mechanism, Hemoglobin - structure, abnormal types, anemia. E.C.G (elementary knowledge), blood pressure, spleen, lymph.

UNIT-III : RESPIRATION AND REPRODUCTION

Structure of lungs, mechanism and regulation of respiration. Transport of blood gases - O_2 and CO_2. Acid-base balance - role of buffers, erythrocytes, respiratory system and kidneys.

Structure and function of reproductive organs, physiology of pregnancy, parturition and lactation.

UNIT-IV : NUTRITION

Basal metabolism, basal metabolic rate, factors affecting BMR, RQ determination of BMR - direct and indirect method, respiratory quotient. Role of fiber in diet, role of essential amino acids and fatty acids.

UNIT-V : TRACE ELEMENTS

Trace elements - macro andmicro, daily requirements, functions, deficiency manifestations. Nutrition at different stages of life - during infancy, adolescence, pregnancy and old age.

Text Books :

Unit 1 to unit 5:

1. Review of Medical Physiology - William. F. Ganong. McGraw-Hill Medical; 22 edition, 2005.
2. Human Physiology and Mechanisms of Disease - Guyton. Saunders Publications; 6th edition, 1996.
3. Human physiology - C.C. Chatterjee. 11th edition, 1985.

References :

Unit 1 to unit 5:

1. Human Nutrition and Dietetics - Davidson and Passmore. Churchill Livingstone; 8th edition, 1986.
2. Principles of Nutrition - M.S.Swaminathan
3. Modern Nutrition and Health Diseases - M.E. Skilis and V.R. Young .

Course outcomes:

1. After studied unit – 1, the student will be able to

- Familiar with basic food digestions.
- Well versed with salaiva and bile secretions.
- Knowledgeable on carbohydrates, lipids and proteins.
- Aware of excretory system.

2. After studied unit – 2, the student will be able to

- Familiar with blood circulation.
- Well versed with blood grouping.
- Knowledgeable on Hb and anemias.
- Well versed on ECG.

3. After studied unit – 3, the student will be able to

- Familiar with respiratory system.
- Well versed with transport of gases.
- Knowledgeable on kidney and formation of urine.
- Well versed on physiology of pregnancy.

4. After studied unit – 4, the student will be able to

- Familiar with basal metabolic rate.
- Well versed with BMR and RQ.
- Knowledgeable on essential fattyacids and aminoacids.
- Well versed on fiber content in diet.

5. After studied unit – 5, the student will be able to

- Familiar with Trace elements.
- Well versed with daily requirements.
- Knowledgeable on diet for adolescence and old people.
- Aware of diet for pregnance.

MOOCS COURSES:

SWAYAM, NPTEL, COURSERA, EDX, UDEMY, LEARN DIGITAL.

1. Cell designing.
2. Sustainable management of Biodiversity.
3. Principles of biotechnology.
4. Principles of seed technology.
5. Genetics and genomics.
6. Food law and standards.
7. Certificate course in environmental biology.
8. Analytical techniques.
9. Applied entomology.
10. Biomass characterisation.

SEMESTER-IV

Name of the course/subject	**:**	**M.Sc., Biochemistry.**
Semester	**:**	**Semester IV**
Name of the paper	**:**	**Research Methodology .**
Credits	**:**	**4**
Hours of teaching	**:**	**5/Week**
Paper type	**:**	**Core – X**

COURSE OBJECTIVES:

- To impart knowledge on research problem and finding scientific articles with Internet.
- To provide knowledge on collection and analysis of data using statistical tools.
- To create awareness on bioinformatics and biological databases.
- To impart basic knowledge on animal experimentation and intellectual property rights.
- To develop sound knowledge on preparation of research reports.

UNIT- I: INTRODUCTION TO RESEARCH METHODOLOGY

Identifying a research problem and searching relevant literature. Boolean Searching. Use of Search Engines. Finding Scientific Articles – Google, PubMed, DELNET, INFLIBNET**.**

Role of Computers in Biology. Evolution of Internet. World Wide Web. Internet Addresses, Internet protocols and Web Browsers.Operating Systems and their types.

UNIT-II : BIOSTATISTICS

Collection and classification of data - diagrammatic and graphic representation of data- measurement of central tendency - standard deviation - normal distribution - test of significance based on large samples - small samples - Student t test -correlation and regression - Chi square test for independence of attributes - ANOVA.

UNIT- III :BIOINFORMATICS AND BIOLOGICAL DATABASES

Bioinformatics – Introduction, Objective, Scope and Applications. Biological databases: Sequence databases – Nucleic acid databases (EMBL, GenBank and DDBJ) and Protein (SWISS-PROT, TrEMBL and PIR); Structure databases – Protein (PDB, SCOP and CATH).

Biological sequence analysis: Alignment – Sequence, Global, Local, Pair-wise and Multiple sequence. Database similarity search tools – BLAST and FASTA.

UNIT-V : BIOETHICS AND PATENTING

Ethics in animal experimentation. CPCSEA guidelines - Animal care and technical personnel environment, animal husbandry, feed, bedding, water, sanitation and cleanliness, waste disposal,

anesthesia and euthanasia.

Composition of (Human) institutional Ethical Committee (IEC) - General ethical issues. Specific principles for chemical evaluation of drugs, herbal remedies and human genetics research, Ethics in food and drug safety. Environmental release of microorganisms and genetically engineered organisms Ethical issues in human gene therapy and human cloning.

Patenting - definition of patent. Product and process patents. Patenting multi cellular organisms. Patenting and fundamental research.

RESEARCH REPORTS

Components of a research report - Title, Authors, Abstract, Synopsis, Keywords, Introduction, Materials and Methods, Results, Discussion, Acknowledgement, Summary or Conclusions, References. Plagiarism. Significance of Impact Factor. Preparation of a research proposal for funding. Indian funding agencies for research. Importance of NET examination by CSIR.

Literature Citation: Name-Year System (Harvard System), Citation-Sequence System, Alphabet Number System; Journal Abbreviations. Format and use of Tables and figures in a research report.

Text books :

Unit 1 to unit 5:

1. Gurumani, N. Research Methodology for Biological Sciences. MJP Publishers, Chennai 2006.
2. CPCSEA Guidelines for Laboratory Animal Facility, CPCSEA, 2003.
3. Lesk, A.M. Introduction to Bioinformatics, 3rd Edition. Oxford University Press. 2009.
4. Day, R.A, Gastel B. How to Write and publish a Scientific Paper. Cambridge University Press, 8th Edition. 2017.
5. Gupta, S.P. Statistical Methods. Sultan.Chand & Sons, 2011.

References :

Unit 1 to unit 5:

1. Kothari. C.R, Research Methodology, methods and techniques, new age International (P) limited, publishers, 2004.
2. Gurumani, N. An Introduction to Biostatistics. MJP Publishers, Chennai 2011.
3. Rastogi, S.C., Mendiratta, N. and Rastogi, P. Bioinformatics - Methods and Applications, 4th Edition. Prentice Hall of India Private Limited, 2013.
4. R. Panneerselvam., Research methodology, Second Edition, PHI learning Private Ltd, 2014.

E-Materials:

1. https://research.phoenix.edu/blog/how-identify-appropriate-research-problem
2. https://www.sciencebuddies.org/science-fair-projects/competitions/finding-and-accessing-scientific-papers
3. https://www.geeksforgeeks.org/types-of-operating-systems/
4. https://www.researchgate.net/figure/Classification-of-data-collection-methods_fig1_240591073
5. https://www.mathsisfun.com/data/standard-deviation.html
6. https://en.wikipedia.org/wiki/Analysis_of_variance
7. https://www.enago.com/academy/biological-databases-an-overview-and-future-perspectives/
8. http://ndbserver.rutgers.edu/
9. https://www.ncbi.nlm.nih.gov/books/NBK550342/
10. https://www.enago.com/academy/important-ethical-considerations-animal-studies/
11. https://www.jli.edu.in/blog/role-of-institutional-ethics-committee-iec-in-clinical-trials/
12. https://www.wipo.int/sme/en/ip_business/importance/reasons.htm
13. https://myathleticlife.com/components-of-a-research-report/
14. https://en.wikipedia.org/wiki/Plagiarism
15. https://www.aicte-india.org/opportunities/students/research-funds

COURSE OUTCOMES:

1. **After studied unit – 1, the student will be able to**
    - Identify a research problem by searching relevant literature.
    - Write an effective research articles.
    - Familiar with search engines.
    - Knowledgeable on World Wide Web and internet protocols.
    - Well versed with basic approaches to qualitative research.

2. **After studied unit – 2, the student will be able to**
    - Well versed with data collection.
    - Familiar with analysis of data using statistical tools.
    - Knowledgeable on data representation.
    - Aware on standard deviation
    - Well known on ANOVA.

3. **After studied unit – 3, the student will be able to**
    - Familiar with bioinformatics.
    - Well versed with different types of database.
    - Knowledgeable on biological sequence analysis.
    - Aware of BLAST and FASTA.
    - Identify the protein structure using bioinformatics tools.
4. **After studied unit – 4, the student will be able to**
    - Familiar with ethics in animal experimentation.
    - Well versed with CPCSEA guidelines.
    - Knowledgeable on instituitional ethical committee.
    - Aware of ethics in food and drug safety.
    - Well known on patenting and fundamental research.
5. **After studied unit – 5, the student will be able to**
    - Familiar with components of research report.
    - Well versed with plagarism.
    - Knowledgeable on literature citation.
    - Aware of writing an effective research proposal.
    - Well known on importance of NET examination.

Name of the course/subject: M.Sc., Biochemistry.

Semester : Semester IV

Name of the paper : Advanced Clinical Biochemistry.

Credits : 4

Hours of teaching : 5/Week

Paper type : Core – XI

COURSE OBJECTIVES:

- To know the abnormal constituents in urine and CSF, Aminiotic fluid collections.
- To impart knowledge on the disorders of carbohydrate metabolism, nucleic acid metabolism, lipid metabolism and amino acid metabolism.
- To develop an understanding of organ function tests.
- To develop knowledge on the concepts on diagnostic enzymology tests.
- To understand the basic concepts of antioxidants and cancer.

UNIT-I: SPECIMEN COLLECTION AND ANALYSIS

Concepts of accuracy, precision, reproducibility, reliability, and other factors in quality control. Normal values. Clinical significance of sugars, proteins, ketone bodies, bilirubin and porphyrins. CSF - collection, composition and analysis. Amniotic fluid - Origin, collection, composition.

UNIT-II : DISORDERS OF CARBOHYDRATE AND LIPID METABOLISM

Disorders of carbohydrate metabolism - blood sugar levels, hyper and hypoglycemia, regulation of blood glucose, renal threshold, diabetes mellitus - etiologic classification and diagnostic criteria, glucose tolerance test, metabolic complications - acute and late complications. Hypoglycemic agents. Glycogen storage diseases, galactosemia, fructosuria.

Disorders of lipid metabolism - plasma lipids and lipoprotein abnormalities, lipidosis, Xanthomatoses, hypocholestremic agents, fatty liver. Atherosclerosis. Tay Sach's disease, Niemann Picks disease, Gaucher's disease, inherited disorders of familiar hyper and hypolipoproteinemias.

UNIT-III: DISORDERS OF PROTEIN METABOLISM AND CLINICAL ENZYMOLOGY

Disorders of protein metabolism - non-protein nitrogenous constituents in blood - urea, uric acid and creatinine. Plasma protein abnormalities - deficiency, agammaglobulinemia, multiple myeloma, proteinuria, glomerulonephritis, nephrotic syndrome. Haemoglobinopathies - sickle cell anaemia and thalassimia. Phenylketonuria, tyrosinosis, alkaptonuria, maple syrup urine disease, Hartnup disease, homocystinuria, albinism.

Serum enzyme activities in diseases - Principle and assay of aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, acid phosphatase, streptokinase, asparaginase, isocitrate dehydrogenase, ceruloplasmin, y -glutamyl transpeptidase, creatine kinase and lactate dehydrogenase.

UNIT-IV : ORGAN FUNCTION TESTS

Liver function tests. Liver diseases: Jaundice; Cirrhosis; Alcoholic liver disease; Hepatic tumor; Bilary tract diseases; Gall stones; Crigler-Najjar syndrome; Dubin Johnson syndrome.

Renal function tests. Acute and chronic renal failure; Glomerulonephritis; Nephrotic syndrome; Urinary tract obstruction; Nephrolithiasis. Gastric function tests - Fractional test meal. Pentagastrin test; Insulin stimulation test. Gastritis

UNIT-V: FREE RADICALS, CANCER AND DISORDERS OF NUCLEIC ACID METABOLISM

Free radicals in health and disease - Endogenous and exogenous free radicals. Oxidative damages to lipids, proteins and DNA. Role of enzymatic and non-enzymatic antioxidants. Cancer: Morphological and metabolic changes in tumor cells. Tumor markers - AFP, CEA, hCG. Carcinogenic agents.

Inborn errors of nucleic acid metabolism - Lesch Nyhan syndrome, immunodeficiency diseases associated with defects in purine nucleotide metabolism, gout, oratic aciduria, xanthinuria. Serology: C-reactive protein.

Text books :

Unit 1 to unit 5:

1. *T.M. Devlin. Textbook of Biochemistry with clinical correlations, 7th Edition. John Wiley & Sons, 2010.*
2. K.V. Krishna Das, Text Book of Medicine - Jaypee Brothers Medical Publishers (P) Ltd, 1996.
3. *M.N. Chatterjee and Rana Shinde, Textbook of Medical Biochemistry, 8th Edition. Jaypee Brothers Medical Publishers (P) Ltd., 2012.*

References :

Unit 1 to unit 5:

1. P.D.Mayne., Chemistry in diagnosis and treatment - A Hodder Arnold Publication; 6 Rev Ed edition, 1994.
2. P. Asokan, Enzymes, Chinnaa Publications, 2003.
3. W.J. Marshall and S.K. Bangeit, Clinical biochemistry - Metabolic concepts and clinical aspects, Churchill Livingstone, 1995.

E-Materials:

1. https://www.thoughtco.com/difference-between-accuracy-and-precision-609328
2. https://en.wikipedia.org/wiki/Quality_control
3. https://www.stanfordchildrens.org/en/topic/default?id=amniocentesis-procedure-92-P07762
4. https://www.healthline.com/health/diabetes
5. https://en.wikipedia.org/wiki/Glycogen_storage_disease
6. https://ghr.nlm.nih.gov/condition/gaucher-disease
7. https://en.wikipedia.org/wiki/Non-protein_nitrogen
8. https://en.wikipedia.org/wiki/Hemoglobinopathy
9. https://www.medicinenet.com/phenylketonuria/article.htm
10. https://www.healthline.com/health/liver-function-tests
11. https://www.ncbi.nlm.nih.gov/books/NBK507821/
12. https://www.webmd.com/digestive-disorders/digestive-diseases-gastritis#1
13. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3614697/
14. https://www.cancer.gov/about-cancer/diagnosis-staging/diagnosis/tumor-markers-fact-sheet
15. https://rarediseases.info.nih.gov/diseases/7226/lesch-nyhan-syndrome

COURSE OUTCOMES:

1. **After studied unit – 1, the student will be able to**
    - Well known on accuracy and precision.
    - Familiar with normal constitutents present in urine.
    - Knowledgeable on Cerebrospinal fluid collection and analysis.
    - Well versed with amniotic fluid.
    - Aware on abnormal constitutents and its problem related with different organs.

2. **After studied unit – 2, the student will be able to**
    - Well known on blood sugar level and its regulation.

- Familiar with glycogen storage diseases.
- Knowledgeable on carbohydrate disorder.
- Well versed with atherosclerosis
- Aware on fatty liver.

3. **After studied unit – 3, the student will be able to**
    - Well known on non-protein nitrogenous constituents in blood .
    - Familiar with Plasma protein abnormalities.
    - Knowledgeable on Haemoglobinopathies.
    - Well versed with inborn errors of metabolism.
    - Aware on serum enzyme activities in diseases.

4. **After studied unit – 4, the student will be able to**
    - Well known on liver diseases.
    - Familiar withbilary tract diseases.
    - Knowledgeable on glomerulonephritis..
    - Well versed with Urinary tract obstruction.
    - Aware on Gastric function tests.

5. **After studied unit – 5, the student will be able to**
    - Well known on role of free radicals in health and diseases.
    - Familiar with enzymatic and non-enzymatic antioxidants.
    - Knowledgeable on Cancer.
    - Well versed with Inborn errors of nucleic acid metabolism.
    - Aware on C-reactive protein.

Name of the course/subject	**:**	**M.Sc., Biochemistry.**
Semester	**:**	**Semester IV**
Name of the paper	**:**	**Bioinformatics.**
Credits	**:**	**3**
Hours of teaching	**:**	**3 Hours / Week**
Paper type	**:**	**Elective**

COURSE OBJECTIVE:

1. To provide the strong knowledge on computer peripherals and hardware description.
2. To impart basic knowledge on operating system.
3. To understand about basics in bioinformatics and different types of database.
4. To develop sound knowledge on structural prediction of RNA and protein
5. To understand about 3-D Structural analysis of bio molecules.

UNIT-I

Computer peripherals and hardware description: computer system design. Recognition and Structure of Different Components of A Computer System And Their Respective Usage. I/O and Storage Devices with Data Communication with Introduction of Internet. Connections to the internet, internet service requirements and applications – e-mail - World Wide Web, URL, HTML, TCP/IP

UNIT-II

Operating systems: system and applications software, evolution of operating systems, layered structure of operating system, CUI and GUI's DOS internet and external commands, batch files: WIN 95/98: Anatomy of windows and features, multitasking.

Office applications : MS-Office 95/97/2000/2003 including MS-Word, MS-Excel, MS Power point.

Logic developments: generation of programming languages, emulation of common DOS commands using C and C++, data structures in C objects and classes, pointers arravasi one and two dimensional) normal string and file handling in C.

UNIT-III

Introduction to bioinformatics – biological data bases- sequence analysis-need and importance-pairwise alignments – dot plot, dynamic programming – global(needle man- wunsch) and local (smith-waterman) alignment algorithms- scoring and substitution matrix – data base searching. Basics of Entrez, BLAST, and FASTA search procedures- multiple alignment. CLUSTAL – Njplot - Phylogenetic trees.

UNIT-IV

Secondary structure prediction of RNA and protein – detecting ORFs- restriction maps, algorithm for Tm calculations, primer design and probe synthesis – structural classification of proteins (SCOP and CATH) – structural genomics-functional genomics and proteomics – DNA microarrays – present status and future prospects.

UNIT-V

3-D Structural analysis of bio molecules – Molecular Visualization Tools – rasmol, Chime, weblab Viewer, Deep View, ISIS Draw, chemdraw, molmol, etc – computer modeling of proteins. Simulation studies and virtual reality – Simulation Of ES Complex Interaction and stereodynamic concept- structural studies of substrate – Ligand Binding – Drug Designing- introduction to PERL and BIOPERL to facilitate Biological Analysis.

Text books :

Unit 1 to unit 5:

1. Lesk, A.M. Introduction to Bioinformatics. Oxford, 2002.
2. Baxevanis & Ouellette. Bioinformatics: A practical guide to analysis of genes and proteins. 2nd Edition, Wiley-Inter Sci, 2001.
3. Bergeron BP. Bioinformatics computing, 1st Edition, Printice Hall, 2002.

References:

Unit 1 to unit 5:

1. Campbell and Heyer. Discovering Genomics, Proteomics and Bioinformatics. Cold Spring Harbour Laboratory Press & Benjamin Cummings, 2002.
2. Gibas and Per Jambeck. Developing Bioinformatics Computer Skills. O'Reilly & Associates, 2001.
3. Krane et al. Fundamental concepts of bioinformatics. Benjamin Cummings, 2002.

E-Materials:

1. https://researcher.watson.ibm.com/researcher/view_group.php?id=6757
2. http://oer.nios.ac.in/wiki/index.php/INTERNET_APPLICATION_AND_SERVICES
3. https://www.webopedia.com/TERM/O/operating_system.html
4. https://docs.microsoft.com/en-us/office365/servicedescriptions/office-applications-service-description/office-applications
5. https://www.includehelp.com/basics/generations-of-programming-language.aspx
6. https://en.wikipedia.org/wiki/Biological_database
7. https://en.wikipedia.org/wiki/BLAST_(biotechnology)

8. https://en.wikipedia.org/wiki/FASTA
9. https://en.wikipedia.org/wiki/Secondary_structure_prediction
10. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4011503/
11. https://www.ncbi.nlm.nih.gov/books/NBK21841/
12. https://www.bioinformatics.org/wiki/Molecular_visualization
13. https://bitesizebio.com/38005/computation-protein-modeling/
14. https://www.pharmatutor.org/articles/drug-designing-review
15. https://en.wikipedia.org/wiki/Phylogenetic_tree.

COURSE OUTCOMES:

1. **After studied unit – 1, the student will be able to**
   - Well known on computer system design.
   - Familiar with components of a computer system and their respective usage.
   - Knowledgeable on Storage Devices with Data Communication.
   - Well versed with internet.
   - Aware on World Wide Web, URL, HTML.
2. **After studied unit – 2, the student will be able to**
   - Well known on Operating systems.
   - Familiar with MS-Word, MS-Excel, MS Power point.
   - Knowledgeable on generation of programming languages.
   - Well versed with C and C++.
   - Aware on data structures in C objects.
3. **After studied unit – 3, the student will be able to**
   - Well known on bioinformatics.
   - Familiar with biological data bases.
   - Knowledgeable on BLAST, and FASTA.
   - Well versed with Phylogenetic trees.
   - Aware on pairwise alignments and local alignment algorithms.
4. **After studied unit – 4, the student will be able to**
   - Well known on structure prediction of RNA.
   - Familiar with structure prediction of protein.
   - Knowledgeable on restriction maps.
   - Well versed with structural and functional genomics.
   - Aware on DNA microarrays.
5. **After studied unit – 5, the student will be able to**
   - Well known on molecular visualization tools.
   - Familiar with computer modeling of proteins.
   - Knowledgeable on simulation Of ES Complex Interaction.
   - Well versed with structural studies of substrate – Ligand Binding.
   - Aware on drug designing.

Name of the course/subject: M.Sc., Biochemistry.

Semester : Semester IV

Name of the paper : Nanobiotechnology

Credits : 3

Hours of teaching : 3 Hours / Week

Paper type : Elective

COURSE OBJECTIVE:

1. To provide the strong knowledge on nanobiomaterials.
2. To impart basic knowledge on nanobiotechnology.
3. To understand about nanomedicines.
4. To develop sound knowledge on protein microarrays.
5. To understand about nanoparticle synthesis.

UNIT I: NANOBIOMATERIALS

Introduction – Biocompatibility - Antibacterial activity- Principles involved - Applications. Biomaterial Nano circuitry: Protein based nano circuity: Neurons for network formation. DNA nanostructures for mechanics and computing and DNA based computation: DNA based nano mechanical devices.

UNIT II: NANOBIOTECHNOLOGY

Interaction between Bio molecules and Nano particle surface, Different types of inorganic materials used for the synthesis of Hybrid Nano-bio assemblies, Application of Nano in biology, Nanoprobes for analytical applications- A new methodology in medical diagnostics and biotechnology, Current status of Nano biotechnology, Future perspectives of Nanobiology, Nanosensors.

UNIT III: NANOMEDICINES

Developing of Nanomedicines, Nanosystems in use, Protocols for Nanodrug administration, Nanotechnology in Diagnostics applications, Materials used in diagnostics and therapeutic applications - Molecular Nano mechanics, Molecular devices, Nanotribology, Studying Tribology at Nanoscale, Nano tribology applications.

UNIT IV: MOLECULAR AND CELLULAR BIOLOGY

Molecular and cellular biology applications, 2-D electrophoresis and mass spectrometry of proteins, Protein Microarrays (Fabrication – Fluorescence detection) - Binding Assays and Immuno sensors- Integrated Nano biotechnology Systems.

UNIT V: BIOLOGICAL METHODS OF SYNTHESIS

Use of Bacteria, Fungi, Actinomycetes for Nanoparticle Synthesis, Magnetotactic Bacteria for Natural Synthesis of Magnetic Nanoparticles: Mechanism of Formation: Viruses As Components for the Formation of Nanostructured materials: Synthesis Process and application, Role Of Plants in Nanoparticle Synthesis.

Text books :

Unit 1 to unit 5:

1. Subbiah Balaji. Nanobiotechnology, MJP Publishers, 2010.
2. Nanomaterials - A.K.Bandyopathy: New Age International Publishers
3. Nano biotechnology: ed - C.M. Niemeyer, C.A.Mirkin.
4. Handbook of Nanostructured Biomaterials and their applications in nanobiotechnology – Harisingh Nalwa

References:

Unit 1 to unit 5:

1. Nanotechnology - Mark Ratner and Daniel Ratner, Pearson education.
2. Nanobiotechnology: ed. C.M.Niemeyer, C.A.Mirkin.
3. Introduction to Nanoscale Science And Technology (Nanostructure Science And Technology) – Massimiliano Diventra
4. Nanosystems: molecular : Molecular Machinery, Manufacturing And Composition- K.Eric Drexler.

E-Materials:

1. https://link.springer.com/chapter/10.1007/978-1-4020-6829-4_1
2. https://en.wikipedia.org/wiki/Nanocircuitry
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3471994/
4. https://en.wikipedia.org/wiki/Nanoparticle%E2%80%93biomolecule_conjugate
5. https://jnanobiotechnology.biomedcentral.com/articles/10.1186/1477-3155-2-3
6. https://www.azonano.com/article.aspx?ArticleID=1840
7. https://www.frontiersin.org/articles/10.3389/fchem.2018.00360/full
8. https://www.understandingnano.com/nanotechnology-medical-diagnosis.html
9. https://en.wikipedia.org/wiki/Nanotribology
10. https://www.futuremedicine.com/doi/full/10.2217/nnm.15.81
11. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6316038/
12. https://www.tsijournals.com/articles/bacterial-synthesis-and-applications-of-nanoparticles-13485.html
13. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3999464/
14. https://copublications.greenfacts.org/en/nanotechnologies/l-2/2-uses.htm
15. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4126476/

COURSE OUTCOME:

1. **After studied unit – 1, the student will be able to**
    - Well known on Biocompatibility.
    - Familiar with Antibacterial activity.
    - Knowledgeable on Protein based nano circuity.
    - Well versed with DNA nanostructures.
    - Aware on DNA based nano mechanical devices.

2. **After studied unit – 2, the student will be able to**
    - Well known on bio molecules and nano particle surface interaction.
    - Familiar with synthesis of Hybrid Nano-bio assemblies.
    - Knowledgeable on Nanoprobes used for analytical applications.
    - Well versed with Current status of Nano biotechnology.
    - Aware on Nanosensors.

3. **After studied unit – 3, the student will be able to**
    - Well known on nanomedicines.
    - Familiar with nanodrug administration.
    - Knowledgeable on nanotechnology in diagnostics applications.
    - Well versed with molecular nano mechanics.
    - Aware on nano tribology applications.
4. **After studied unit – 4, the student will be able to**
    - Well known on 2-D electrophoresis and mass spectrometry of proteins.
    - Familiar with protein microarrays.
    - Knowledgeable on immuno sensors.
    - Well versed with integrated nano biotechnology Systems.
    - Aware on applications of nanotechnology in molecular level.
5. **After studied unit – , the student will be able to**
    - Well known on synthesis of nanoparticles using bacteria.
    - Familiar with magnetotactic bacteria for natural synthesis of magnetic nanoparticles.
    - Knowledgeable on role Of plants in nanoparticle synthesis.
    - Well versed with viruses as a components for the formation of nanostructured materials.
    - Aware on different methods used for nanoparticle synthesis.

Name of the course/subject: M.Sc., Biochemistry.

Semester : Semester IV

Name of the paper : Stem cell technology

Credits : 3

Hours of teaching : 3 Hours / Week

Paper type : Elective

COURSE OBJECTIVE:

1. To provide the strong knowledge on stem cells and its types.
2. To impart basic knowledge on in vivo and invitro differentiation of stem cells.
3. To understand about limitations of cloning.
4. To develop sound knowledge on hematopoietic stem cells.
5. To understand about skeletal muscle stem cells.

UNIT-I

Stem cells -Introduction, Definition and basics of stem cells. Classification of stem cells- different types of stem cells- Human embryonic stem cells, Adult stem cells. Sources of stem cells - Fetus and various adult tissues – Advantages of stem cells.

Blastocyst culture- Various stages of embryonic development. In vitro fertilization. Xeno-free derivation of stem cells – Alternative feeder cells and feeder free culture. Cryopreservation of stem cells – Conventional slow- freezing method and Vitrification method. Properties of stem cells - self renewel, clonality and plasticity. Pluripotent nature of stem cells - Extrinsic and Intrinsic factors. Characterization of human embryonic stem cells – Expression of cell surface marker, Karyotyping.

UNIT-II

Stem Cells and their developmental potentials, Characteristics of stem cells- Transdifferntiation of stem cells. Controlled differentiation of human embryonic stem cells. In vivo and invitro differentiation of stem cells. Application of stem cells.

UNIT-III

Therapeutic cloning strategies, derivation and propagation of human embryonic stem cells. Reproductive cloning by SCNT. Use of SCNT. Limitations of cloning – Hurdles to improve the efficiency of therapeutic cloning. Stem cell research and ethics – translational medicine ethics.

UNIT-IV

Hematopoietic stem cells (HSC) - Basics, Development and Regulation of HSC. Clinical Application of HSC – Gene Therapy – using haematopoietic stem cells HSC for Leukemia.Mesenchymal stem cells (MSC) - Differentiation and Identification. Characteristics of mesenchymal stem cells. Clinical applications of stem cells. Stem cells and regenerative medicine. Ips –induced pluripotent stem cells.

UNIT-V

Skeletal Muscle Stem Cells – Development and functions. Liver stem cells – Organization and functions. Tumor stem cells – Basics differences and Similarities of cancer stem cells and stem cells. Cancer stem cell signaling – NOTCH pathway. Canonical wnt signaling pathways in hematopoietic stem cells. Stem cell therapies in animal models. Use and benefits of stem cell for human beings.

Text books :

Unit 1 to unit 5:

1. Anthony Atala and Robert Lanza., Handbook of stemcells., 2013.
2. Yanhong Shi and Dennis O. Clegg., Stem cell research and therapeutic., SPRINGER (SIE)., 2009.

References:

Unit 1 to unit 5:

1. C.S. Potten., Stem cells., Academic Press., 1996.
2. Kursad Turksen., Adult stem cells.,2nd ed., 2014.

E-Materials:

1. https://stemcells.nih.gov/info/basics/1.htm
2. https://www.scireslit.com/Pharmacology/AJPT-ID11.php
3. https://www.londonwomensclinic.com/fertility-treatments/blastocyst-culture-implantation/
4. https://www.nature.com/articles/cr200761
5. https://www.nature.com/scitable/topicpage/karyotyping-for-chromosomal-abnormalities-298/
6. https://www.ncbi.nlm.nih.gov/pubmed/11177611
7. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2633984/
8. https://www.ncbi.nlm.nih.gov/pubmed/15010323
9. https://en.wikipedia.org/wiki/Somatic_cell_nuclear_transfer

10. https://www.bbvaopenmind.com/en/science/research/the-limits-of-cloning/
11. http://www.aabb.org/aabbcct/therapyfacts/Pages/hsc.aspx
12. https://en.wikipedia.org/wiki/Mesenchymal_stem_cell
13. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC305326/
14. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3496019/
15. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3752464/

COURSE OUTCOME:

1. **After studied unit – 1, the student will be able to**
    - Well known on basics of stem cells.
    - Familiar with human embryonic stem cells.
    - Knowledgeable on xeno-free derivation of stem cells.
    - Well versed with properties of stem cells.
    - Aware on karyotyping.
2. **After studied unit – 2, the student will be able to**
    - Well known on stem cells and their developmental potentials.
    - Familiar with characteristics of stem cells.
    - Knowledgeable on transdifferntiation of stem cells.
    - Well versed with in vivo and invitro differentiation of stem cells.
    - Aware on application of stem cells.
3. **After studied unit –3, the student will be able to**
    - Well known on therapeutic cloning strategies.
    - Familiar with propagation of human embryonic stem cells.
    - Knowledgeable on reproductive cloning by SCNT.
    - Well versed with limitations of cloning.
    - Aware on stem cell research and ethics.
4. **After studied unit –4, the student will be able to**
    - Well known on development and regulation of hematopoietic stem cells.
    - Familiar with clinical application of hematopoietic stem cells.
    - Knowledgeable on gene therapy using haematopoietic stem cells.
    - Well versed with mesenchymal stem cells.
    - Aware on –induced pluripotent stem cells.
5. **After studied unit –5, the student will be able to**
    - Well known on skeletal muscle stem cells.
    - Familiar with liver stem cells.
    - Knowledgeable on tumor stem cells.
    - Well versed with stem cell therapies in animal models.
    - Aware on benefits of stem cell for human beings.

Name of the course/subject: M.Sc., Biochemistry.

Semester : Semester IV

Name of the paper : Evolutionary Biology

Credits : 3

Hours of teaching : 2 Hours / Week

Paper type : Non major Elective

COURSE OBJECTIVE:

1. To provide the strong knowledge on historical review of evolutionary concept.
2. To impart basic knowledge on Current concept of chemogeny.
3. To understand about Fossils.
4. To develop sound knowledge on plant and fungi evolution.
5. To understand about theories of human migration.

UNIT I: Historical Review of Evolutionary Concept

Pre-Darwinian ideas – List of contributors influencing Darwin indicated as a *timeline.* Lamarckism – Merits and demerits. Darwinism – Merits and demerits, Post-Darwinian era – Modern synthetic theory; biomathematics and the theory of population genetics leading to Neo-Darwinism

UNIT II: Life's Beginnings

Chemogeny – An overview of pre-biotic conditions and events; experimental proofs to abiotic origin of micro- and macro-molecules. Current concept of chemogeny – RNA first hypothesis. Biogeny – Cellular evolution based on proto-cell models (coacervates and proteinoid micro-spheres). Origin of photosynthesis – Evolution of oxygen and ozone buildup.

Endosymbiotic theory – Evolution of Eukaryotes from Prokaryotes

UNIT III: Evidences of Evolution

Fossils as direct evidences, Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse as an example, Molecular evidences (Globin gene families as an example), Molecular clock concept.

UNIT IV: Evolution of Plants and Fungi

Origin of land plants – Terrestrial algae and Bryophytes; alternation of generations. Early vascular plants – Stelar evolution; Sporangium evolution. Angiosperms – Phylogeny of major groups. Fungi

UNIT V: Human Ancestry and Phylogeny

Primate characteristics and unique Hominin characteristics. Primate phylogeny leading to Hominin line. Human migration – Theories. Brief reference to molecular analysis of human origin – Mitochondrial DNA and Y-chromosome studies

Text books :

Unit 1 to unit 5:

1. Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach 7th Edition , Thomson Books/Cole
2. Campbell & Recce(2005). Biology, Pearson Education, (Singapore) Pvt.Ltd.
3. Smith, T.M.and Smith, R.C. (2006) Elements of Ecology I st editon Pearson Publications
4. Miller,G.T (2006) Environmental Science 11 th edition Brooks/Cole
5. Raven, P.H. et al (2006) biology 7 th edition Tata McGrawIIill Publications, New Delhi.

References:

Unit 1 to unit 5

1. Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
2. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H., (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
3. Hall, B. K. and Hallgrimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers.
4. Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.
5. Minkoff, E. (1983). *Evolutionary Biology*. Addison-Wesley.

E-Materials:

1. https://plato.stanford.edu/entries/evolution-before-darwin/
2. https://en.wikipedia.org/wiki/Lamarckism
3. http://www.preservearticles.com/education/what-are-the-merits-and-demerits-of-darwanism/28368
4. http://www.yourarticlelibrary.com/biology/origin-of-life-chemical-evolution-formation-of-primitive-life-and-its-evolution-theories/27304
5. http://www.yourarticlelibrary.com/biology/origin-of-life-chemical-evolution-formation-of-primitive-life-and-its-evolution-theories/27304
6. http://www.plantphysiol.org/content/154/2/434
7. https://www.biology.iupui.edu/biocourses/N100/2k2endosymb.html
8. https://en.wikipedia.org/wiki/Fossil
9. https://sciencing.com/describe-types-fossils-8147260.html
10. https://evolution.berkeley.edu/evolibrary/article/molecclocks_01
11. https://en.wikipedia.org/wiki/Evolutionary_history_of_plants
12. http://www.biologydiscussion.com/plant-tissues/tissue-system/stelar-system-of-plant-definition-and-types-with-diagrams/20313
13. https://www.britannica.com/topic/hominin
14. https://en.wikipedia.org/wiki/Human_migration
15. https://en.wikipedia.org/wiki/Molecular_anthropology

COURSE OUTCOME:

1. **After studied unit –I, the student will be able to**
    - Well known on Pre-Darwinian ideas.
    - Familiar with Lamarckism – Merits and demerits.
    - Knowledgeable on Post-Darwinian era.
    - Well versed withModern synthetic theory.
    - Aware on Neo-Darwinism

2. **After studied unit –2, the student will be able to**
    - Well known on overview of pre-biotic conditions.
    - Familiar with experimental proofs to abiotic origin of micro- and macro-molecules.
    - Knowledgeable on biogeny.
    - Well versed withorigin of photosynthesis.
    - Aware on endosymbiotic theory.

3. **After studied unit –3, the student will be able to**
    - Well known on fossils and its types.
    - Familiar with incompleteness of fossil record
    - Knowledgeable on dating of fossils.
    - Well versed withPhylogeny of horse.
    - Aware on Molecular clock concept.

4. **After studied unit –4, the student will be able to**
    - Well known on Terrestrial algae and Bryophytes.
    - Familiar with Stelar evolution.
    - Knowledgeable on Sporangium evolution.
    - Well versed withAngiosperms.
    - Aware on Fungi.

5. **After studied unit –5, the student will be able to**
    - Well known on hominin.
    - Familiar with human migration theories
    - Knowledgeable on primate phylogeny.
    - Well versed withmolecular analysis of human origin.
    - Aware on primate characterisitics.

Name of the course/subject: M.Sc., Biochemistry.

Semester : Semester IV

Name of the paper : Bioremediation

Credits : 3

Hours of teaching : 2 Hours / Week

Paper type : Non major Elective

COURSE OBJECTIVE:

1. To provide the strong knowledge on bioremediation and its types.
2. To impart basic knowledge on xenobiotics.
3. To understand about bioleaching and bio mining.
4. To develop sound knowledge on wastes management.
5. To understand about theories of environmental nanotechnology.

UNIT - I

Introduction to Bioremediation, types of Bioremediation, Bioremediation of surface soil and sludges, Bioremediation of subsurface material, In situ technologies, Ex-situ technologies, phytoremediation, Bioaugmentation of naturally occurring microbial activities. Environmental modification. Use of co-substrates, oxygen supplementation (Composting and aerobic bioreactors, in situ aeration).

UNIT – II

General microbial strategies for initiating attack on xenobioties – Biodegradation strategies for key classes of compounds – factors affecting biodegradation.

UNIT– III

Use of genetically altered microorganisms for field biodegradation of hazardous materials. Bio leaching and Bio mining. Bioremediation technologies to remove heavy metals and radionuclides using iron Fe(III), Sulphate and sulphur reducing bacteria.

UNIT – IV

Introduction – Hazardous wastes – biodegradation of Hazardous wastes – biological detoxification of cyanide – market for hazardous wastes management – biotechnology application to hazardous wastes management – source and management safety.

UNIT – V

Environmental Nanotechnology Research – Nanotechnology for Bioremediation of Heavy metals – Bioremediation of Petroleum sludge using Bacterial Consortium and Biosurfactant – Biofilms in Porous Media. Mathematical molding and Numerical simulations – Biosensor Technology for Monitoring pollutants.

Text books :

Unit 1 to unit 5:

1. Environmental biotechnology, 1995 S.N.Jogdand, Himalaya Publishing House, Bombay, delhi, Nagpur.
2. Molecular biology of the gene IV edition Watson, JD. Hopkins, N.H.,Roberts, J.W.,Steritz. J.A.,Weiner, A.M.The Benjamin – cummings Publications company Inc.
3. Crawford R.L.Crawford D.L.Bioremediation. Principles and Applications Cambridge Units, Press, 1996.

References:

Unit 1 to unit 5

1. Bioremediation 1994 Baker, K.H.and Herson, D.S.McGraw Hill, Inc. New York.
2. Biotechnology biology 1997 P.K.Gupta, rastogi Publications, meerut.
3. Environmental Bioremediation technologies by Shree N.Singh. rudra Tripathi.

E-Materials:

1. https://en.wikipedia.org/wiki/Bioremediation
2. https://www.aftermath.com/content/types-of-bioremediation/
3. https://en.wikipedia.org/wiki/Bioaugmentation
4. https://link.springer.com/chapter/10.1007/978-981-10-8390-7_1
5. https://www.intechopen.com/books/biodegradation-life-of-science/biodegradation-involved-microorganisms-and-genetically-engineered-microorganisms
6. https://en.wikipedia.org/wiki/Biodegradation
7. https://www.azomining.com/Article.aspx?ArticleID=1095
8. https://www.americangeosciences.org/critical-issues/faq/what-biomining
9. https://www.semanticscholar.org/paper/New-Bioremediation-Technologies-to-Remove-Heavy-and-Bruschi-Goulhen/cc4d5f8a32f75e9f087d2f1f39fcb041a91455f5
10. https://www.researchgate.net/publication/15010980_Biodegradation_of_hazardous_wastes

11. https://www.ncbi.nlm.nih.gov/pubmed/3073060
12. https://en.wikipedia.org/wiki/Waste_management
13. https://www.researchgate.net/publication/278715251_Nanotechnology_for_Bioremediation_of_Heavy_Metals
14. https://en.wikipedia.org/wiki/Biofilm
15. https://www.researchgate.net/publication/315829853_Biosensors_for_the_Detection_of_Environmental_and_Urban_Pollutions

COURSE OUTCOME:

1. **After studied unit –1, the student will be able to**
   - Well known on bioremediation and its types.
   - Familiar with phytoremediation
   - Knowledgeable on bioaugmentation of naturally occurring microbial activities.
   - Well versed with bioremediation of surface soil and sludges.
   - Aware on bioremediation of subsurface material.
2. **After studied unit –2, the student will be able to**
   - Well known on xenobiotics.
   - Familiar with microbial strategies for initiating attack on xenobiotics
   - Knowledgeable on factors affecting biodegradation.
3. **After studied unit –3, the student will be able to**
   - Well known on biodegradation of hazardous materials.
   - Familiar with Bio leaching
   - Knowledgeable on Bio mining.
   - Well versed with removal of heavy metals using bioremediation technologies.
   - Aware on removal of radionuclides using bioremediation technologies
4. **After studied unit –4, the student will be able to**
   - Well known on hazardous wastes.
   - Familiar with biodegradation of hazardous wastes
   - Knowledgeable on biological detoxification of cyanide.
   - Well versed with waste management.
   - Aware on application to hazardous wastes management.
5. **After studied unit –5, the student will be able to**
   - Well known on nanotechnology used for bioremediation of heavy metals.
   - Familiar with bioremediation of petroleum sludge using bacterial consortium.
   - Knowledgeable on biosurfactant.
   - Well versed with mathematical molding and Numerical simulations.
   - Aware on biosensor technology for monitoring pollutants.

Name of the course/subject: M.Sc., Biochemistry.

Semester : Semester IV

Name of the paper : Life style – Disease and Prevention.

Credits : 3

Hours of teaching : 2 Hours / Week

Paper type : Non major Elective

COURSE OBJECTIVE:

1. To provide the strong knowledge on obesity, cardiac disease and diabetes.
2. To impart basic knowledge on hypertension.
3. To understand about cancer.
4. To develop sound knowledge on age related diseases.
5. To understand about gallstone.

UNIT – I

Obesity – prevalence causes, consequences, symptoms – coronary heart disease and type 2 diabetes mellitus – lifestyle and dietary management of obesity.

UNIT - II

Hypertension- blood pressure- normal level of blood pressure, dietary management of hypertension, stroke and chronic renal failure due to hypertension Kidney stone – causes, types, symptoms and treatment (only Lithotropy), dietary management for prevention of kidney stones.

UNIT – III

Cancer – types of cancer, etiology of breast cancer diagnosis (Self examination, Mammography) and treatment (radiation, chemotherapy, surgery). Cervical cancer causes. Types, symptoms, diagnosis and treatment (radiation, chemotherapy, surgery). Cigarette smoking and symtoms, diagnosis and treatment (chemotherapy).

UNIT – IV

Aging – Factors influencing again. Age related diseases – dementia, osteoporosis, Osteo arthritis – causes sign and symptoms, preventive measures of again with special reference to antioxidants.

UNIT – V

Gallstones – causes, factors, aetiology of gall stones. Types of gall stones. Symptoms, preventive aspects of gall stone. Drug therapy – ursodeoxy cholic acid, surgical treatment and dietary management – Ulcer – causes and prevention.

Text books :

Unit 1 to unit 5:

1. Tietz., Fundamentals of Clinical chemistry. A Clinically oriented approach – Churchill. Livingstone Inc., India.
2. M.N.Chatterjee and Rana shinde (2007). Textbook of Biochemistry (7^{th} ed)

References:

Unit 1 to unit 5

1. Thomas m.Devlin (2014). Textbook of Biochemistry with clinical Correlations (7^{th} ed)
   John Wiley & Sons.
2. Montgomery R.Conway TW, spector AA (1996) Biochemistry. A Case – Oriented Approach (6^{th} ed), Mosby Publishers, USA.

E-Materials:

1. https://www.mayoclinic.org/diseases-conditions/obesity/symptoms-causes/syc-20375742
2. https://www.medicalnewstoday.com/articles/184130
3. https://www.webmd.com/diabetes/type-2-diabetes
4. https://en.wikipedia.org/wiki/Hypertension
5. https://www.webmd.com/hypertension-high-blood-pressure/guide/dash-diet#1
6. https://my.clevelandclinic.org/health/articles/13486-eating-well-after-a-stroke
7. https://www.healthline.com/health/cancer

8. https://www.medicinenet.com/cervical_cancer/article.htm
9. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/index.htm
10. https://en.wikipedia.org/wiki/Ageing
11. https://www.verywellhealth.com/age-related-diseases-2223996
12. https://www.healthline.com/health/osteoarthritis
13. https://www.healthline.com/health/gallstones
14. https://timesofindia.indiatimes.com/life-style/health-fitness/health-news/ulcer-causes-signs-symptoms-prevention/articleshow/61834483.cms
15. https://en.wikipedia.org/wiki/Ursodeoxycholic_acid

COURSE OUTCOME:

1. **After studied unit –1, the student will be able to**
    - Well known on Obesity.
    - Familiar with coronary heart Disease.
    - Knowledgeable on chronic renal failure due to hypertension.
    - Well versed with kidney stone.
    - Aware on dietary management for kidney stones prevention

2. **After studied unit –2, the student will be able to**
    - Well known on hypertension.
    - Familiar with dietary management of hypertension.
    - Knowledgeable on stroke.
    - Well versed with dietary management of obesity.

3. **After studied unit –3, the student will be able to**
    - Well known on Cancer and its types
    - Familiar with diagnosis of breast cancer.
    - Knowledgeable on Cervical cancer causes.
    - Well versed with Cigarette smoking.
    - Aware on radiation, chemotherapy, surgery treatment for cancer.

4. **After studied unit –4, the student will be able to**
    - Well known on aging.
    - Familiar with dementia.
    - Knowledgeable on osteoporosis.
    - Well versed with Osteo arthritis.
    - Aware on factors affecting aging.

5. **After studied unit –5, the student will be able to**
    - Well known on gallstones.
    - Familiar with types of gall stones.
    - Knowledgeable on drug therapy for gallstone.
    - Well versed with causes and prevention of ulcer.
    - Aware on dietary management of gallstone.

PRACTICAL – III

ENZYMOLOGY AND CLINICAL DIAGNOSTICS(BIOCHEMICAL ANALYSIS OF BLOOD)

A. ENZYMOLOGY - PURIFICATION AND KINETIC STUDIES

1. a. Purification of acid phosphatase from potato.

   b. Effect of activator and inhibitor of acid phosphatase activity by EDTA.

   c. Effect of substrate concentration and acid phosphatase activity.

   d. Determination of optimum temperature.

   e. Determination of optimum pH.

2. Clinical Enzymology :

1. Assay of SGOT.

2. Assay of SGPT.

3. Assay of LDH.

4. Assay of CPK.

5. Assay of Alkaline phosphatase.

6. Assay of Serum acid phosphatase.

BIOCHEMICAL ANALYSIS OF BLOOD

1. Estimation of blood glucose by o-toluidine method.
2. Estimation of serum proteins by Bradford's Method.
3. Estimation of blood urea by DAM method.
4. Estimation of serum uric acid by phosphor tungstate method.
5. Estimation of serum phospholipids.

References:

1. J. Jayaraman. Laboratory Manual in Biochemistry. New Delhi : New Age International Publishers, 2nd edition, 2011.

2. H. Varley. Practical Clinical Biochemistry, 4th Edition, CBS Publishers, 2008.

3. Practical Biochemistry For Medical Students - Raghu, JAYPEE, 2006

4. Practical Clinical BiochemistryHardcover–Harold Varley,Sixth Edition, Alan H Gowenlock.

5. An Introduction to Practical Biochemistry - David T. Plummer Third Edition, Tata McGraw Hill

PRACTICAL – IV

HAEMATOLOGICAL METHODS AND URINE ANALYSIS.

HAEMATOLOGICAL METHODS

1. Collection, storage of blood and anticoagulants
2. Total RBC count
3. Total WBC count
4. Total platelet count
5. Differential WBC count
6. Absolute eosinophil count
7. Determination of hemoglobin content
8. Determination of clotting time.
9. Determination of prothrombin time
10. Determination of ESR.
11. Prothrombin time

B. URINE ANALYSIS

1. Collection and preservation of urine
2. Qualitative analysis of normal and pathological constituents in urine.
3. Microscopic analysis of urine
4. Estimation of titrable acidity of urine.
5. Estimation of protein in urine by biuret method
6. Analysis of urinary calculi.
7. Estimation Urea in urine
8. Estimation uric acid in urine.
9. Estimation of calcium in urine.

References:

1. A. Sadasivam and A. Manickam. Biochemical Techniques, 2nd Edition, New Age International Publishers, 2003.
2. J. Jayaraman. Laboratory Manual in Biochemistry. Wiley Eastern, 1981.
3. H. Varley. Practical Clinical Biochemistry, 4th Edition, CBS Publishers, 2008.

MOOCS courses : SWAYAM PORTAL.

Web Links:

Coursera

Coursera tops many lists for good reason: With more than 25 million learners, 149 university partners, and 2000+ courses (at the time of this writing), it's the largest MOOC provider on the market.

Like most MOOC providers, Coursera courses cover a broad range of disciplines and skills, from neural networks and deep learning, to web development and even painting. Courses are generally free.

Unlike most MOOC providers, Coursera also hosts online Masters degrees from accredited universities, such as the University of Illinois or HEC Paris. Imagine picking up a Master of Science in Accounting (iMSA) as you prepare to leave a traditional 9-to-5 job forever and launch a freelance accounting business. With Coursera, that's a real possibility.

edX

Eager to learn from top universities and industry leaders like Harvard, MIT, and Microsoft? edX is a non-profit open-source educational platform with 1600+ free online courses, 100+ university/industry partnerships, and more than 12 million learners (at the time of this writing).

Courses are free and upon completion you have the option to pay for a verified certificate. edX also has Micro Masters programs, which provide a series of graduate-level courses you can take to earn credentials for your resume or to use as credit for participating universities. Whether learning web development from the W3C (World Wide Web Consortium) or earning a MicroMasters in marketing analytics from UC Berkeley, edX is a portal to top-tier courses taught by world-renowned experts.

Udacity

Founded in 2012 by Sebastian Thrun, the brain behind Google's Self Driving Car, Udacity bills itself as a place where "lifelong learners come to learn the skills they need, to land the jobs they want, to build the lives they deserve." If you want to learn from industry professionals from tech companies like Amazon, Google, and GitHub, Udacity is the MOOC for you.

Targeting working professionals, they are best known for their nanodegrees — paid certificates that are accepted by major tech companies as credentials for industry-specific skillsets such as data analyst, Android developer, or even machine learning engineer. While you'll need to pay for graded projects and certificates, all the courses that make up a nanodegree are free.

FutureLearn

FutureLearn is the largest MOOC in the United Kingdom, with more than seven million learners, 400+ courses, and 130+ partnerships with universities and institutions around the world. It's owned and backed by Open University, a public distance learning and research university that pioneered the concept of a location independent education long before MOOCs became a buzzword.

FutureLearn uses the standard model of offering a wide variety of free courses with an option to buy a Certificate of Achievement at the end of the course. Students can gain academic credit at participating universities. They also provide fully online masters degrees in fields such as cybersecurity, information technology, and real estate via a partnership with Deakin University.

Khan Academy

Khan Academy's founder Salman Khan is quick to point out that his nonprofit is not a MOOC. Founded in 2006, Khan Academy's mission is to provide a place where "you can learn anything. For free. For everyone. Forever." Khan Academy does not offer certificates, college credit, or paid programs. But they do have 6,500+ video lessons teaching a wide range of academic subjects for students of all ages, from kindergarten through college to

adult learners.You'll find high-quality educational videos that cover everything from multivariable calculus to personal finance, to introductory courses on web development and data science.

Saylor Academy

If you're looking for something like Khan Academy that's a little more friendly for those looking for actual credits, Saylor Academy might be the online university for you. With 100+ courses, featured learning pathways (some leading to credits), and 22 full credit aligned courses, Saylor Academy is structured like a university with quizzes, assignments, and final exams.From art history, to political science, to microbiology, there's plenty to sate your intellectual curiosity. If you want to stick to programs best suited for business development, check out courses such as business administration, project management, and computer science.

iversity

Berlin-based iversity collaborates with universities, companies, and non-governmental organizations to provide high-quality educational content to more than 750,000 learners. Initially founded in 2011 (its MOOC service was launched in 2013), they are best known for being the first online educational platform to offer ECTS (European Credit Transfer and Accumulation System) credits.

Courses at iversity are available in both English and German, with some courses even supporting subtitles. There is a free Audit Track that gives students access to all course materials, access to the learner community forums, and a free statement of participation at the completion of any course. ECTS track, pro courses, and bundles are all paid, but can lead to a certificate of accomplishment and actual ECTS credits.

Open2Study

Open2Study is brought to you by Open Universities Australia, an educational platform that provides accredited online courses through a collaboration with Australian universities. The website divides courses into paid accredited courses that follow a traditional university

curriculum structure, and free courses geared more toward freelancers and professionals looking to pick up new skills.

Courses consist of video lectures, supplementary reading materials, assessments, and quizzes. There's an online classroom for interacting with other students, gamification via a reward badge system to encourage participation, and free certificates of completion for free courses. Whether you're looking to learn to write for the web, polish up on your UX design, or even pick up an associate degree in engineering, Open2Study has the courses to help you reskill.

Udemy

Initially launched in 2010, Udemy bills itself as a "global marketplace for learning and teaching online." While most MOOC providers source content through corporate and university partners, Udemy also allows individuals to create their own courses and submit them for review. Udemy boasts an impressive library of more than 55,000 courses.

Udemy is a true marketplace, with both free and paid courses that range from $20 to $200. The variety of coursework is also not to be understated: You can learn everything from military hand-to-hand combat to playing the piano. Whether you're looking to pick up a new programming language like Python, retrain for a career in digital marketing, or brush up on your copywriting, there's a course for everyone at Udemy.

Cognitive Class

Cognitive Class (formerly known as Big Data University) is an IBM-backed MOOC provider that specializes in data science and cognitive computing. Blockchain, deep learning, natural language processing (NLP), and machine learning were among some of the fastest growing skills for freelancers in 2017.

Cognitive Class courses are completely free, awarding IBM recognized badges and a certificate upon completion. Courses are organized into learning paths covering essential skills like Hadoop, Scala, Spark, and other data science fundamentals.