BHARATHIDASAN UNIVERSITY TIRUCHIRAPPALLI - 620 024.

B.Sc. BIOCHEMISTRY

CHOICE BASED CREDIT SYSTEM –

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)

(Applicable to the candidates admitted from the academic year 2022-23 onwards)

Updated on 23.07.2024

Sem.	Part	Course	Title	Hrs/ week	Credit	Exam Hours	Marks		Total
							Int.	Ext.	
I	I	Language Course – I (Tamil $ / Other Languages + #)		6	3	3	25	75	100
	II	English Course – I		6	3	3	25	75	100
	III	Core Course – I (CC)	Cell Biology	5	5	3	25	75	100
		Core Practical – I (CP)	Cell Biology	4	4	3	40	60	100
		First Allied Course – I (AC)	General Chemistry	4	4	3	25	75	100
		First Allied Practical - I (AP)	General Chemistry	3	-	-	-	-	-
	IV	Value Education		2	2	3	25	75	100
	TOTAL			**30**	**21**	**-**	**-**	**-**	**600**
II	I	Language Course – II (Tamil $ / Other Languages + #)		6	3	3	25	75	100
	II	English Course – II		4	3	3	25	75	100
	III	Core Course – II (CC)	Molecules of Life	5	5	3	25	75	100
		Core Practical – II (CP)	Molecules of Life	4	4	3	40	60	100
		First Allied course - II (AC)	Organic Chemistry	4	4	3	25	75	100
		First Allied Practical (AP)	General Chemistry	3	2	3	40	60	100
		Add on Course – I ##	Professional English – I	6*	4	3	25	75	100
	IV	Environmental Studies		2	2	3	25	75	100
	VI	Language Proficiency for Employability (NM) @@	Effective English	-	2	3	25	75	100
	TOTAL			**30**	**29**	**-**	**-**	**-**	**900**

III	I	Language Course – III (Tamil $ / Other Languages + #)		6	3	3	25	75	100
	II	English Course – III		6	3	3	25	75	100
	III	Core Course – III (CC)	Biochemical Techniques	5	5	3	25	75	100
		Core Practical – III (CP)	Biochemical Techniques	4	4	3	40	60	100
		Second Allied Course – I (AC)	Basic Microbiology	4	4	3	25	75	100
		Second Allied Practical (AP)	Basic Microbiology	3	-	-	-	-	-
		Add on Course – II ##	Professional English - II	6*	4	3	25	75	100
	IV	Non-Major Elective – I @ Those who choose Tamil in Part I can choose a non-major elective course offered by other departments. Those who do not choose Tamil in Part I must choose either a) Basic Tamil if Tamil language was not studied in school level or b) Special Tamil if Tamil language was studied upto 10^{th} & 12^{th} std.	Nutritional Biochemistry	2	2	3	25	75	100
	TOTAL			**30**	**25**	**-**	**-**	**-**	**700**
IV	I	Language Course –IV (Tamil $ / Other Languages + #)		6	3	3	25	75	100
	II	English Course – IV		6	3	3	25	75	100
	III	Core Course – IV (CC)	Biophysical Chemistry	5	5	3	25	75	100
		Core Practical – IV (CP)	Biophysical Chemistry	4	4	3	40	60	100
		Second Allied Course – II (AC)	Medical Microbiology	4	4	3	25	75	100
		Second Allied Practical (AP)	Basic Microbiology	3	2	3	40	60	100
	IV	Non-Major Elective II @ - Those who choose Tamil in Part I can choose a non-major elective course offered by other departments. Those who do not choose Tamil in Part I must choose either a) Basic Tamil if Tamil language was not studied in school level or b) Special Tamil if Tamil language was studied upto 10^{th} & 12^{th} std.	Clinical Biochemistry	2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NM) Digital Skills for Employability @@	Microsoft office fundamentals	-	2	3	25	75	100
	TOTAL			**30**	**25**	**-**	**-**	**-**	**800**

V	III	Core Course –V (CC)	Enzymes	5	5	3	25	75	100
		Core Course – VI (CC)	Molecular Biology	5	5	3	25	75	100
		Core Course – VII (CC)	Intermediary Metabolism	5	5	3	25	75	100
		Core Practical –V (CP)	Enzyme Kinetics and Molecular Biology	4	4	3	40	60	100
		Major Based Elective – I (Any one)	1. Human Physiology 2. Basic Biotechnology	5	4	3	25	75	100
	IV	Skill Based Elective I	Bio-Instrumentation	4	2	3	25	75	100
		Soft Skills Development		2	2	3	25	75	100
	TOTAL			**30**	**27**	**-**	**-**	**-**	**700**
VI	III	Core Course – VIII (CC)	Immunology	6	5	3	25	75	100
		Core Course – IX (CC)	Clinical Biochemistry	6	5	3	25	75	100
		Core Practical – VI (CP)	Clinical Biochemistry and Immunology	4	4	3	40	60	100
		Major Based Elective - II (Any one)	1. Endocrinology 2. Food and Nutrition	5	4	3	25	75	100
		Project		4	3	-	20	80	100
	IV	Skill Based Elective – II	Medical Lab Technology	4	2	3	25	75	100
	V	Extension Activities **		-	1	-	-	-	-
		Gender Studies		1	1	3	25	75	100
	VI	Naan Mudhalvan Scheme (NM) Employability Readiness @@		-	-	-	-	-	-
	TOTAL			**30**	**25**	**-**	**-**	**-**	**700**
GRAND TOTAL				**180**	**152**	**-**	**-**	**-**	**4400**

$ For those who studied Tamil upto 10^{th} +2 (Regular Stream).

+ Syllabus for other Languages should be on par with Tamil at degree level.

Those who studied Tamil upto 10^{th} +2 but opt for other languages in degree level under Part- I should study special Tamil in Part – IV.

The Professional English – Four Streams Course is offered in the 2^{nd} and 3^{rd} Semester (only for 2022-2023 Batch) in all UG Courses. It will be taught apart from the Existing hours of teaching / additional hours of teaching (1 hour /day) as a 4 credit paper as an add on course on par with Major Paper and completion of the paper is must to continue his / her studies further. (As per G.O. No. 76, Higher Education (K2) Department dated: 18.07.2020).

* The Extra 6 hrs / cycle as per the G.O. 76/2020 will be utilized for the Add on Professional English Course.

@ Biochemistry students have to choose non-major elective papers offered by other department, NCC Course is one of the Choices in Non-Major Elective Course. Only the NCC cadets are eligible to choose this course. However, NCC Course is not a Compulsory Course for the NCC Cadets.

** Extension Activities shall be outside instruction hours.

@@ Naan Mudhalvan Scheme.

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	No. of Credits	Marks
1.	I	Language Courses	4	12	400
2.	II	English Courses	4	12	400
3.	III	Core Courses	8	40	800
4.		Core Practical	7	29	700
5.		Allied Courses I & II	4	16	400
6.		Allied Practical	2	4	200
7.		Major Based Elective Courses	2	8	200
8.		Add on Courses	2	8	200
9.		Project	1	3	100
10.	IV	Non-Major Elective Courses (Practical)	2	4	200
11.		Skill Based Elective Courses	2	4	200
12.		Soft Skills Development	1	2	100
13.		Value Education	1	2	100
14.		Environmental Studies	1	2	100
15.	V	Gender Studies	1	1	100
16.		Extension Activities	1	1	--
17.	VI	Naan Mudhalvan Scheme	2	4	200
	Total		**44**	**152**	**4400**

PROGRAM OBJECTIVES:

The B.Sc. Biochemistry program describe accomplishments that graduates are expected to attain within five to seven years after graduation

- An ability to apply fundamental knowledge related to sciences in an interdisciplinary manner for providing innovative solutions to need based problems for global impact
- An ability to critically analyze scientific data, draw objective conclusions and apply this knowledge for human welfare. Students should be able to demonstrate expertise and ethical perspective on areas related to Biochemistry
- An ability to gain domain knowledge and know-how for a successful career in academia, industry and research. Promoting lifelong learning to meet the ever evolving professional demands by developing ethical, inter personal and team skills.

PROGRAM OUTCOMES:

After the successful completion of B.Sc. Biochemistry program, the students are expected to

- Broad based knowledge in biochemistry

- Ability to understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by humankind. Ability to contribute effectively in the development of the ethical practices, societal contributions, and leading to responsible and competent professionals
- Ability to contribute effectively in the development of the ethical practices, societal contributions, and leading to responsible and competent professionals
- Acquiring the ability of leadership skills to manage projects in multidisciplinary environments
- To compete globally with confidence in all the sectors of life science.

EMPLOYMENT OPPORTUNITY:

After the successful completion of B.Sc. Biochemistry program, the students are expected to

- Biotechnology Firms
- Diagnostics Centres
- Colleges and Universities
- Pharma Companies
- Medical Equipment manufacturing Companies

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First Year	CORE COURSE I CELL BIOLOGY	Semester I
Code:	(Theory)	Credit: 5

COURSE OBJECTIVES:

- To understand the basics and fundamentals of cell biology and biogenesis of cell organelles.
- To study the cellular processes and mechanisms that lead to physiological functions in normal as well as in pathological state.
- To make them understand the organization of cells and cell cycle.

UNIT – I BASICS OF CELL BIOLOGY:

Discovery of Cell and Cell theory, Chemical Components of Cell. Structure of prokaryotic and eukaryotic cell and its differences, Comparison between Plant and animal cell.

UNIT – II CELL ORGANELLES:

Structure and function of cell organelles **–** Nucleus, Endoplasmic Reticulum: RER and SER, Golgi complex, Chromosomes, Mitochondria, Ribosomes, Lysosomes, peroxisomes, Vacuoles, plastids, chloroplast. Microtubules and microfilaments.

UNIT – III CELL MEMBRANE:

Cell Membrane: Composition, structure, models, Functions –Role in Transport. Specialized structures – Cell Junctions – Occulating, Anchoring and Gap, Ion channels.

UNIT – IV CELL CYCLE, CELL DEATH AND CELL RENEWAL:

Cell Cycle –Cell division – Mitosis – Prophase, Metaphase, Anaphase, Telophase and Meiosis. Brief overview of apoptosis and necrosis; Aging and Senescence.

UNIT – V TOOLS OF CELL BIOLOGY:

Cell Fractionation techniques: Principle of centrifugation, Sedimentation Coefficient, Differential and Density Gradient centrifugation. Cell Visualization techniques: Principle of Light microscope and Electron microscope. Staining techniques – dye and fluorescent based techniques.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Discussion on recent advancements like Crispr-Cas 9, recently developed cell imaging techniques, freeze fracturing technique, advanced microscopy techniques and recent noble prize awards in the field of medicine and physiology. Cellular abnormalities in various disorders like cancer.

REFERENCES:

1. Cooper, G.M. and Hausman, RE. 2009. The Cell .A Molecular Approach. (5" ed) Sunderland
2. Krebs.JE, Kilpatrick.S.T and Goldstein. E.S,2013, Lewin GENES XI, JONES & Bartlett Learning, Burlington, Massachusetts.
3. Lodish.H,.A , Berk.C.A, Kaiser.M, Krieger.MP, Scott.A Bretscher.H, Ploegh and p. Matsudaira, 2007, Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, New York, USA.
4. PS Verma and VK Agarwal 2004 Cell Biology, Genetics, Molecular Biology Evolution and Ecology (14" ed), S.Chand and Company Ltd.
5. Watson. JD, TA.Basker and Sp.Bell, 2008 , Molecular Biology of the Gene, 5th Edition. Dorling Kindersley Pvt., Ltd., New Delhi.
6. Bruce Alberts and Dennis Bray 2013, Essential Cell Biology.(4" ed).Garland Science, New ork.
7. De Robertis, EDP, and De Robertis, EM.F. 2010, Cell and Molecular Biology (8thed). Lippincott Williams and Wilkins, Philadelphia.
8. Geoffrey M. Cooper and Robert. E. Hausman, 2009 The Cell: A Molecular Approach:, Sinauer Associates, 5thEd, USA.
9. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiment (6th ed) John Wiley & Sons, Inc, United Kingdom.
10. Wayne M. Baker ,2008 The World of the Cell. (7th" ed). Pearson Benjamin Cummings Publishing, San Francisco.
11. https://www.pdfdrive.com/biochemistry-books.html
12. https://drive.google.com/file/d/1tghNWPyuqPiqKlrlllZzUrFwcoMiuoMa/
13. https://www.freebookcentre.net/biology-books-download/BASIS-ON MOLECULAR-BIOLOGY-(PDF-52P).html.
14. https://www.freebookcentre.net/biology-books-download/Basis-ofmolecular-cell-biology-(PDF-36P).html.
15. https://agrilif.org/gold/files/2012/09/Lecture-26.pdf

Course Outcomes:

Upon successful completion of this course the students would be able:

Understand the cell theory and basic cell structure

- Acquire knowledge on cell fractionation and cell visualization techniques
- Illustrate the structure and function of various cell organelles in cell.
- Describe the structure, function and composition of cell membrane.
- Understand the mechanism of cell division and cell death.

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First Year	CORE PRACTICAL I CELL BIOLOGY	Semester I
Code:	(Practical)	Credit: 4

COURSE OBJECTIVES:

- To know handling of microscope
- To study practically the plant and animal cells, the cell organelles and components with the help of microscope
- To study staining techniques and study different stages of mitosis and meiosis

1. Handling of Microscope
2. Cytochemical staining of proteins by Methylene blue
3. Cytochemical staining of RNA by Methyl Green Pyronin
4. Cytochemical staining of polysaccharides by PAS
5. To study different stages of mitosis by temporary preparation in onion root tip
6. To study different stages of meiosis by temporary preparation in onion flower buds
7. Isolation of mitochondria from cabbage.
8. Staining of mitochondria
9. Separation of plant pigments by paper/Thin Layer chromatography.

REFERENCES:

1. Bruce Alberts and Dennis Bray. 2013, Essential Cell Biology. (4"ed). Garland Science.
2. Cooper, G.M. and Hausman, R.E. 2009. The Cell. A Molecular Approach. (5" ed) Sunderland.
3. Ganesh M.K. and Shivashankara A.R. 2012. Laboratory Manual for Practical Biochemistry Jaypee publications, 2nd Edn.
4. LodishH.A ,Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Ploegh and Matsudaira. 2007. Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, New York, USA.
5. Watson J.D, Basker T.A. and Bell S.P. 2008. Molecular Biology of the Gene, 5th Edition. Dorling Kindersley Pvt., Ltd., New Delhi.
6. Bruce Alberts, 2008, Molecular Biology of the cell: Garland Publishing, 5th Ed.
7. Cooper, G.M. and Hausman, RE. 2009. The Cell .A Molecular Approach. (5" ed) Sunderland
8. Geoffrey M. Cooper and Robert. E. Hausman, 2009. The Cell: A Molecular Approach:,Sinauer Associates, 5thEd, USA.
9. Lodish.H,.A , Berk.C.A, Kaiser.M, Krieger.MP, Scott.Abretscher.H, Ploegh and p. Matsudaira, 2007. Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, New York, USA.
10. Watson. JD, TA.Basker and Sp.Bell, 2008, Molecular Biology of the Gene, 5th Edition. Dorling Kindersley Pvt., Ltd., New Delhi.
11. http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1
12. https://www.microscopemaster.com/organelles.html
13. https://www.pdfdrive.com/biochemistry-books.html

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Gain the knowledge about handling of microscope
- Identify the microscopic examination of cell organelles
- Obtain hands on training in basic separation techniques in Cell biology
- Differentiate the stages of mitosis and meiosis
- Evaluate the cellular biomolecules by staining techniques.

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First Year **FIRST ALLIED COURSE I** **Semester I**

GENERAL CHEMISTRY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

Students will gain an understanding of

- Chemical reactions and strategies to balance them
- The relative quantities of reactants and products
- The fundamental properties of atoms, molecules, and the various states of matter
- The electronic structure of atoms and its influence on chemical properties
- Molecular geometries of selected molecular species

UNIT – I CONCEPTS OF CHEMISTRY:

Matter, States of matter, laws of chemical combination: Law of conservation of Mass, Law of definite proportions, Law of multiple proportions, Gay Lussac law of multiple proportions. Dalton's atomic theory, concept of elements, atoms and molecules. Atomic and molecular masses, mole concept and molar mass. percentage composition, empirical and molecular formula, chemical reactions, stoichiometry and calculations based on stoichiometry

UNIT – II ATOMIC STRUCTURE:

Discovery of Electron, Proton and Neutron, atomic number and atomic mass number, Isotopes, Isobars and Isotones. Thomson's model and its limitations. Rutherford's model and its limitations, Bohr's model and its limitations, concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in orbitals - Aufbau principle, Pauli's exclusion principle and Hund's rule, electronic configuration of atoms, stability of half-filled and completely filled orbitals

UNIT – III PERIODIC CLASSIFICATION OF ELEMENTS:

Need for classification, early attempts at classification of elements (Dobereiner's Triads, Newland's Law of Octaves, Mendeleev's Periodic Table), Modern periodic table, gradation in properties, valency, atomic number, metallic and non-metallic properties. Properties of elements -atomic radii, ionic radii, inert gas radii, Ionization enthalpy, electron gain enthalpy, electronegativity, valency. Nomenclature of elements with atomic number greater than 100.

UNIT – IV CHEMICAL BONDING:

Causes of chemical combination – stability and nobel gas configuration, Ionic bond, covalent bond, coordinate Bond, polar covalent Bonds, Electronegativity, Electron affinity, localized and Delocalised Bonding, resonance effect , Inter Molecular forces, Intramolecular forces Vanderwaals and dipole forces. geometry of covalent molecules, VSEPR theory, concept of hybridization, involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only), Hydrogen bond.

UNIT – V OXIDATION-REDUCTION:

Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions, in terms of loss and gain of electrons and change in oxidation number, Standard electrode potential and its applications in redox reactions

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Latest research and news: Discussion on Topics awarded Nobel prize in Chemistry Short talk presenters and detailed discussion of their research contributions and articles in class.

REFERENCE:

1. Principles of Inorganic Chemistry, B.R. Puri L.R. Sharma, S.Chand & Co.
2. Inorganic Chemistry, P.L.Soni, Sultan Chand & Sons.
3. Dr. Veeriyan V., Text Book of Ancillary Chemistry, Highmount publishing house, Chennai – 14 Edition 2006. 2. Vaithyanathan S. and others, Textbook of Ancillary Chemistry, Priya Publications, Karur – 2- Edition –2006.
4. Soni P.L. and others, Textbook of Inorganic chemistry, Sultan Chand and Company, New Delhi, Edition – 2006
5. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
6. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970 Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006.
7. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962.
8. Greenwood, N.N. & Earnshaw. Chemistry of the Elements, Butterworth Heinemann. 1997.
9. Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH, 1999.
10. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 4th Ed., Pearson, 2010.
11. Shriver & Atkins, Inorganic Chemistry 5th Ed.
12. https://canvas.harvard.edu/courses/4068/files/1078510?module_item_id=81183
13. http://www.cpacollege.ac.in/assets/uploads/16186445741ST_SEM_COMPLEMENTARY_CHEMISTRY_PDF__pdf.pdf

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Demonstrate an understanding of basic principles of chemistry and how they relate to everyday experiences.
- Demonstrate problem solving and critical thinking skills
- Apply methods of scientific inquiry.
- Apply problem solving techniques to real-world problems.
- Demonstrate an understanding of the chemical environment and the role that organic molecules play in the natural and the synthetic world.

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First Year **FIRST ALLIED PRACTICAL I** **Semester I**

GENERAL CHEMISTRY

(Practical)

Code: **Credit: 2**

COURSE OBJECTIVES:

- To understand the preparation of reagents.
- To understand and analysis the identification of various chemicals
- To study quantitatively various kinds of molecules essential for life.

VOLUMETRIC ANALYSIS

1. Estimation of Sodium hydroxide using standard Sodium Carbonate.
2. Estimation of Hydrochloric acid using standard Oxalic acid.
3. Estimation of Ferrous sulphate using standard Mohr's salt
4. Estimation oxalic acid using standard Ferrous Sulphate.
5. Estimation of Potassium permanganate using standard Sodium hydroxide.
6. Estimation of Magnesium using EDTA.
7. Estimation of Ferrous iron using diphenylamine as internal indicator.

ORGANIC ANALYSIS

1. Dectection of Elements (N,S, Halogens)
2. To distinguish between aliphatic and aromatic Saturated and unsaturated compounds.
3. Functional group tests for phenol, acids (mono, di) aromatic primary amine, amide, aldehyde & Carbohydrate Glucose.
4. Systematic analysis of organic compounds containing one functional group and characterization by confirmatory test.(Phenol/cresol, cinnamic acid, benzoic acid, phthalicacid, Succinicacid, benzamide, urea, glucose, benzaldehyde & aniline).

REFERENCES:

1. Basic Principles of practical Chemistry: Venkateswaran, Veerasamy & Kulandaivel, S.Chand & Co.
2. N. S. Gnanapragasam, G. Ramamurthy Organic Chemistry Lab Manual , S. Viswanathan Printers & Publishers Pvt. Ltd. Reprint 1996
3. A. I. Vogel, A Text Book of Quantitative Inorganic Analysis, Longman Publishers 6th Edn., 2009

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Acquire skills of performing basic chemical tests important in laboratory investigations
- Learn how to standardise various chemical reactions
- Develop skills to prepare useful organic compounds in the laboratory
- Apply the properties of functional groups of organic compounds to carry out selective organic reactions.

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First Year | **CORE COURSE II MOLECULES OF LIFE (Theory)** | **Semester II**

Code: | **Credit: 5**

COURSE OBJECTIVES:

- To expose the importance of biological macromolecules
- To study the influence and role of structure in reactivity of biomolecules
- To understand the role of biomolecules and their functions.

UNIT – I CARBOHYDRATES:

Definition, classification – monosaccharide, oligosaccharides and polysaccharides; occurrence, structure and functions of monosaccharide (glucose and fructose). General properties with reference to glucose, anomer, epimer, enantiomer and mutarotation. Structure, occurrence, properties and biological importance of disaccharides (sucrose, lactose, maltose) and Polysaccharides- Storage polysaccharides (starch, glycogen), Structural polysaccharides (cellulose, chitin), Heteropolyasaccharides (hyaluronic acid, heparin).

UNIT - II AMINO ACIDS AND PROTEINS:

Amino acids- Definition, Structure, properties and classification based on structure, chemical nature. Essential and non essential amino acids. Proteins - Definition, classification based on shape, solubility, chemical composition, Properties and functions. Structure- Primary, Secondary, tertiary and quaternary.

UNIT – III LIPIDS:

Structure, function and classification of lipids- simple, compound–glycolipids, phospholipids, spingo lipids and derived lipids - steroids. Fatty acids-Definition, structure, classification– saturated fatty acids, unsaturated fatty acids. Essential and non essential fatty acids. Physical and Chemical properties-emulsification, saponification number, rancidity, acid number, iodine number and Reichert – Meissl number.

UNIT – IV NUCLEIC ACIDS:

Bases, nucleosides and nucleotides, phosphodiester linkage. Types of Nucleic acids –DNA and RNA; DNA – types-A, B, Z, double helical structure, properties and functions. Denaturation and renaturation. RNA – types-mRNA, tRNA, rRNA – structure and functions.

UNIT – V VITAMINS AND MINERALS:

Source, classification, structure, daily requirement, deficiency manifestation and biological significances of fat soluble vitamins - A,D,E, K andwater soluble vitamins-ascorbic acid, thiamine, riboflavin,pantothenic acid, niacin,

pyridoxine,biotin, folic acid and cyanocobalamine. Minerals- Iron, Sodium, Potassium, Calcium, Phosphorus, Iodine, Zinc, Copper, Selenium.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

The RNA World and the Origins of Life**.**

REFERENCES:

1. Deb AC. 2016. Fundamentals of Biochemistry. 7th edition, NCBA Publishers, New Delhi.
2. Jain JL, Sunjay Jain and Nitin Jain. 2018. Fundamentals of Biochemistry. Updated edition. 2020. S.Chand Publishers, New Delhi.
3. Poonam Agarwal. 2020. Review of Biochemistry. 5th edition. CBS Publishers, New Delhi.
4. Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 2003. Harper's Illustrated Biochemistry, 26th edition, McGraw-Hill Medical Publishers, New York.
5. Vasudevan DM. 2018. Biochemistry. 9th edition. Aypee Brothers Medical Publishers, New Delhi.
6. AmbikaShanmugam, 2016. Fundamendals of Biochemistry, 8th Edition. Wolters Kluwer India Pvt Ltd
7. Nelson, D. L. and Cox, M. M. 2008. Lehninger Principles of Biochemistry. Freeman, 5th edn.
8. Harper's Illustrated Biochemistry.30th edition -McGraw Hill
9. Sathayanarayana, U. 2006. Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.
10. Donald Voet and Judith Voet. 2017. Biochemistry, 2nd edition, John Wiley & Sons Inc, Newyork.
11. https://www.pdfdrive.com/biochemistry-books.html
12. https://www.pdfdrive.com/biochemistrystrayer-e25312085.html
13. https://static1.squarespace.com/static/6019d0bc7dff866728d961d3/t/601a68429c231608a9b8f2a0/1612343363359/biochemistry_satyanarayana_ebook_free.pdf

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Gain the knowledge about the classification, structure, properties and functions of carbohydrates
- Understand the classification, structure, properties and importance of amino acids
- Acquire knowledge about the classification of proteins, levels of structural organization of proteins and its properties
- Gain insights about the types, structure and properties of nucleic acids
- Acquire knowledge about the classification, structure and properties of different types of lipids

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First Year **CORE PRACTICAL II** **Semester II**

MOLECULES OF LIFE

(Practical)

Code: **Credit: 4**

COURSE OBJECTIVES:

- To understand the preparation of reagents.
- To understand and analysis the identification of various biomolecules
- To study quantitatively various kinds of molecules essential for life.

QUALITATIVE ANALYSIS

Weighing, reagents preparations – Normal, Molar and Percentage solutions, dilution (serial and Stock to working).

1. Qualitative analysis of carbohydrates (glucose, fructose, galactose, maltose, sucrose, lactose), Identification of both monosaccharides and disaccharides in mixtures.
2. Qualitative analysis of amino acids (Tryptophan, Tyrosine, Arginine, Proline, Phenylalanine and Histidine)
3. Qualitative analysis of Lipids-Solubility, Emulsification test, Saponification test, Acrolein test for Unsaturation, Test for Cholesterol-Salkowski test and Lieberman-Burchard test.

QUANTITATIVE ANALYSIS

1. Estimation of reducing sugar by Benedict's quantitative method.
2. Estimation of amino acid by formal titration
3. Estimation of ascorbic acid by titrimetric method using 2,6-dichlorophenol indophenol dye.
4. Estimation of acid number of edible oil.
5. Determination of saponification number of edible oil.
6. Estimation of iodine value of edible oil.

REFERENCES:

1. Manuals in Biochemistry – Dr. J. Jayaraman, New Age International Pub, Bangalore 2011.
2. Practical Biochemistry – Plummer, New Delhi: Tata McGraw Hill Publishing Company, 2000.
3. Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nd ed, 2005.

4. Biochemical methods – S.Sadasivam, V.A Manickam 2 ed New Age international Publishers, 2006.
5. Biochemical Tests – Principles and Protocols. Anil Kumar, SarikaGarg and NehaGarg.Vinod Vasishtha Viva Books Pvt Ltd, 2012.
6. Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.
7. Keith Wilson and John Walker. Principles and Techniques of Practical Biochemistry, 4thedition, Cambridge University press, Britain.1995.
8. https://www.pdfdrive.com/instant-notes-analytical-chemistry-e912659.html
9. https://www.pdfdrive.com/analytical-biochemistry-e46164604.html
10. https://www.pdfdrive.com/biochemistry-books.html

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Acquire skills of performing basic biochemical tests important in clinical investigations
- Learn how to standardize various biomolecules
- Develop skills to prepare useful organic compounds in the laboratory
- Apply the properties of functional groups of organic compounds to carry out selective organic reactions
- Analyse common organic reagents and compounds based on their properties

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First Year **FIRST ALLIED COURSE II ORGANIC CHEMISTRY** **Semester II**

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

Students will gain an understanding of

- The hybridization and geometry of atoms and the three-dimensional structure of organic molecules
- The reactivity and stability of an organic molecule based on structure, including conformation and stereochemistry
- An understanding of nucleophiles, electrophiles, electronegativity, and resonance
- The prediction of mechanisms for organic reactions
- How to use their understanding of organic mechanisms to predict the outcome of reactions

UNIT – I ORGANIC COMPOUNDS:

Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Classification of reactions: Addition, Substitution, Elimination, Condensation, and Polymerization. Oxidation Reduction – Elementary ideas only.

UNIT – II STEREOCHEMISTRY OF CARBON COMPOUNDS:

Different types of isomerism, enatiomers and diastereoisomers; Fischer, Sawhorse, and Newman Projection formulae of simple molecules containing one and two asymmetric carbon atom. Asymmetric carbon atom, chirality, optical activity.Elements ofsymmetry, E and Z nomenclature, D and Lnomenclature (for carbohydrates and aminoacids only). R and S nomenclature of one stereogenic centre.

UNIT – III Aliphatic& Aromatic Hydrocarbons:

Aliphatic Hydrocarbons (Alkanes, Alkenes and Alkynes) Aromatic Hydrocarbons: Nomenclature, structure, physical properties and chemical reactions. Electrophliic addition reactions to C=C, mechanism of bromination and hydrohalogenation; Markownikoff's addition, peroxide effect. Hydration, hydroboration, ozonide formation, epoxidation, hydroxylation, General mechanism of electrophilic substitution reactions of benzene. Synthesis of aromatic compounds using nitration, suplhonation, Halogenation, Friedel-craftalkylations and acylation reactions. Halogenated Hydrocarbons.

UNIT – IV ALCOHOLS, PHENOLS AND ETHERS:

Alcohols, Phenols, Ethers and Epoxide: Nomenclature, methods of preparation, physical and chemical properties (primary alcohols only) and uses (methanol and ethanol only).

UNIT – V ALDEHYDES, KETONES AND CARBOXYLIC ACIDS:

Aldehydes and Ketones: Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes, uses. Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Discussion on Topics awarded Nobel prize in Chemistry Short talk presenters and detailed discussion of their research contributions and articles in class.

REFERENCES:

1. A text book of Oranic Chemistry – Arun Bhal and B.S.Bhal, S.Chand and Company.
2. Organic Chemistry vol.1 (.l.Finar, ELBS Longman, V. Edn. (1975) Reprint (1982)
3. Organic Chemistry, vol.2, I.L. Finar ELBS/ Longaman,V. Edn. (1975) Reprint (1982)
4. Stereochemistry, Conformation & Mechanism,P.S.Kalsi,Whiley 383 Eastern Ltd., (1993)
5. Morrison R.T, Boyd R.N.,Organic Chemistry ,7th edition,Prentice Hall,New Delhi, 2008.
6. Soni. P.L, Chawala H.M., Text book of Organic Chemistry, 26th edition, Sultan Chand, Delhi 1994.
7. Raj.K.Bansal, Organic Reaction Mechanisms , 3rd edition, Tata MCGraw-Hill.
8. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
10. Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.
11. https://warwick.ac.uk/fac/sci/chemistry/research/wills/willsgroup/teaching_materials/basic_organic_chemistry_and_mechanisms_revision_from_m_wills_for_when_you_are_lost_and_confused.pdf
12. https://profiles.uonbi.ac.ke/sderese/classes/sch-102-introduction-organic-chemistry-chemistry-alkanes-and-cycloalkanes/material-1
13. http://sites.tufts.edu/andrewrosen/files/2012/05/Orgo-I-Review-Packet1.pdf

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Demonstrate an understanding of basic principles of organic chemistry and how they relate to everyday experiences.
- Demonstrate problem solving and critical thinking skills
- Apply methods of scientific inquiry.
- Apply problem solving techniques to real-world problems.
- Demonstrate an understanding of the chemical environment and the role that organic molecules play in the natural and the synthetic world.

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Second Year **CORE COURSE III** **Semester III**

BIOCHEMICAL TECHNIQUES

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To provide insights in the techniques used in biochemical analysis
- To understand the basic principles behind the working of the common instruments used in the biochemical analysis
- To know the instrumentation of the common instruments used in the biochemical analysis

UNIT - I Chromatography:

Principles, Instrumentation and Applications - Paper, Thin Layer Chromatography, Column Chromatography, Ion exchange Chromatography, Molecular sieve Chromatography, Affinity Chromatography, High Performance Liquid Chromatography, Gas Liquid Chromatography.

UNIT – II Electrophoresis:

Principle, Instrumentation and Applications-Factors affecting electrophoretic mobility- Paper Electrophoresis, Agarose Gel Electrophoresis, PAGE, SDS PAGE, Iso electric focusing.

UNIT – III Centrifugation:

Principle, Instrumentation and Applications- RCF, Svedberg unit, Types of centrifuge and Rotors - Preparative, differential, density gradient, differential, Analytical ultracentrifugation – instrumentation and applications - Determination of molecular weight.

UNIT – IV Spectroscopy:

Principle, Instrumentation and Applications -Colorimeter, UV spectrophotometer, Flame Photometer, Atomic Absorption Spectrophotometer, Fluor meter.

UNIT – V Radioactivity:

Radioactive decay, Units of radioactivity, types of radiation, measurement of radioactivity - GM counter, Scintillation counter, Autoradiography, Applications of radioisotopes in biology.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Application of techniques Eg. Usage of PCR in today's scenario

REFERENCES:

1. Upadhayay, Upadhyay and Nath, Biophysical Chemistry – Principles and Techniques, Himalaya Publishing House, Pvt. Ltd, 4th edition.
2. Chatwal, Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House.
3. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, Cambridge, 5th edition.
4. Terrance G Cooper, Tools in Biochemistry, Wiley India Pvt Ltd.
5. David Sheehan, Physical Biochemistry- Principles and Applications, Willey Blackwell, UK.
6. Friefelder and Friefelder. Physical Biochemistry – Applications to Biochemistry and Molecular Biology. WH Freeman &Co. 1994.
7. Sharma B K, Spectroscopy, Krishna Prakashan Media P. Ltd.-Meerut , 2015.
8. Rajan Katoch, Analytical techniques in Biochemistry and Molecular Biology, Springer, 2011.
9. Sharma R K, Basic Techniques in Biochemistry and Molecular Biology, Dreamtech Press, 2020.
10. Basha, M. Electrophoresis. In: Analytical Techniques in Biochemistry. Springer Protocols Handbooks. Humana, New York, NY. 2020.
11. https://www.pdfdrive.com/biophysical-chemistry-principles-and-techniques-e192900555.html
12. https://www.pdfdrive.com/elementary-organic-spectroscopy-principles-and-chemical-applications-e183848666.html
13. https://link.springer.com/book/10.1007/978-1-0716-0134-1#book-header
14. http://www.freebookcentre.net/Chemistry/Acid-Base-Chemistry-Books.html

COURSE OUTCOMES:

- Understand the underlying principles of biochemical techniques
- Comprehend the chromatographic techniques
- Describe the principles of electrophoresis and realize its applications
- Understand the process and applications of centrifugation
- Perceive the utilization of radioactive material for analysis.

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Second Year	**CORE PRACTICAL III BIOCHEMICAL TECHNIQUES**	**Semester III**
Code:	**(Practical)**	**Credit: 4**

COURSE OBJECTIVES:

- To provide hands on training in the techniques used in industries and research
- To apply the principles studied
- To make the students proficient in handling instruments
- To familiarize the students to chromatography, centrifugation, electrophoresis and spectroscopy.

1 Separation of sugars and amino acids by paper chromatography
2 Separation of amino acids and lipids by TLC
3 Separation of leaf pigments by column chromatography
4 Separation of serum protein by paper electrophoresis
5 Separation of nucleic acid by agarose gel electrophoresis
6 Estimation of carbohydrate by an throne method
7 Estimation of ascorbic acid by colorimetric method
8 Demonstration of Flame Photometer
9 Demonstration of Sub cellular organelle separation by differential centrifugation

REFERENCES:

1 Dr. J. Jayaraman, Laboratory Manual in Biochemistry New Age International Publishers.
2 David Plummer, An Introduction to Practical Biochemistry –Tata McGraw Hill Education, 3rd edition.
3 Sadasivam S and Manickam A, Biochemical Methods, New Age International Publishers.
4 P. Palanivelu, Analytical Biochemistry and Separation Techniques - A laboratory Mannual for B.Sc. and M.Sc. students, Twenty First Century Publications.

COURSE OUTCOMES:

- The students will be able to handle Colorimeters, Spectrophotometers, Centrifuge, Chromatographic and electrophoretic units.
- The students will be able to apply the principles studied.

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Second Year **SECOND ALLIED COURSE I** **Semester III**

BASIC MICROBIOLOGY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- Microbes are omnipresent, including as symbionts and commensals. This course provides a brief but thorough overview of the types of microbes, their distribution, diseases and control, as well as their beneficial applications
- It provides hands-on training in the basic skills necessary for sterile practices and the handling and manipulation of cultures in the microbiology laboratory

UNIT – I Introduction and classification:

Definition, scope and history of microbiology. Germ theory of disease. Differences between prokaryotic and eukaryotic microorganisms. Classification of Bacteria: based on Gram's staining, temperature and oxygen requirement. Types of bacteria: chlamydia, rickettsia, mycoplasma, actinomycetes, cyanobacteria and eubacteria. Brief overview of Archea.

UNIT – II Viruses, fungi, algae and protozoans:

Classification and types of viruses: Baltimore classification. General characteristics of major groups of fungi: Oomycota, Zygomycota, Ascomycota and Basidiomycota. Classification of protozoa: Mastigophora, Sarcodina, Sporozoa and Ciliophora. General characteristics of major groups of algae: Chlorophyta, Phaeophyta, Rhodophyta, Pyrrophyta, Chrysophyta and Euglenophyta.

UNIT – III Microbial growth:

Microbial growth, growth rate, doubling time and exponential growth phases. Factors affecting microbial growth: nutrient factors (C, H, N, O, P, S and trace elements) and non-nutrients (temperature, hydrostatic pressure, pH, osmotic strength). Types of nutrient media and special nutrient media. Differential media, and examples to distinguish between different groups of bacteria using differential media. Streak plate, pour plate, Antibiotic sensitivity test.

UNIT – IV Food and industrial microbiology:

Quality control of drinking water: total coliform count. Microorganisms in milk and milk products, and the preservation of milk. Role of microbes in industrial production of fermented foods: alcoholic beverages, dairy products, coffee and chocolate. Preservation of wine. Single-cell proteins, microbial biofuel and biofertilizers.

UNIT – V Microbial diseases and antimicrobial agents:

Diseases caused by bacteria, viruses, protozoa and fungi: airborne diseases, water-borne diseases and milk-borne diseases. Prion diseases. Principles and

methods of sterilization and disinfection. History, and brief overview of antibiotics, their mechanisms of action, and antibiotic resistance.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Chalk and talk**:** Occurrence of microbes in nature, Methods for isolation of microbes from spoiled vegetables and fruits.

REFERENCES:

1. Willey JM, Sherwood LM and Woolverton CJ, Prescott, Harley, and Klein's Microbiology (7th ed.), Boston: McGraw Hill, 2007.Leboffe MJ and Pierce BE, A photographic atlas for the microbiology laboratory (4th ed.), Englewood: Morton Publishing, 2011.
2. Ananathanarayanan and Panikar, Text book of microbiology (10th ed.), New Delhi: The Orient Blackswan, 2017.

COURSE OUTCOMES:

Upon successful completion of the course, students possess:

- Foundational horizontal knowledge in microbiology
- Awareness of communicable diseases, their mode of transmission, preventive and control measures, for public health awareness
- The skill of handling microbial cultures, sterile practices and basic microbial techniques, which will be useful in handling diseased samples in the biochemistry laboratory.

*****

Second Year **SECOND ALLIED PRACTICAL I** **Semester III**

BASIC MICROBIOLOGY

Code: **(Practical)** **Credit: 2**

COURSE OBJECTIVES:

- To gain knowledge regarding different microbiological techniques.
- To understand the principle and techniques for isolation procedure
- To understand the principle and procedure for staining techniques

1. Introduction to sterilization techniques- sterilization of glass wares, autoclaving.
2. Preparation of liquid and solid media
3. Isolation of Bacteria and fungi from soil samples – serial dilution technique
4. Measurement of bacterial population
5. Pure culture techniques: spread plate, streak plate technique and pour plate
6. Methylene blue reductase test (MBRT).
7. Determination of Bacterial growth curve
8. Identification of bacteria by morphological and Biochemical characteristics
9. Smear preparation and staining of bacteria: simple staining, Grams staining and spore staining
10. In vitro antibiotic sensitivity tests for selected bacterial cultures
11. Methods for preserving microbial cultures: slant, glycerol stock and lyophilisation.

REFERENCES:

1. Sherman, N. and Cappuccino, J.G. (2004) Microbiology A Laboratory Manual, Benjamin Cummings Publishing Company, San Francisco.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Understand the microbial culture techniques
- Acquire knowledge isolation and characterization techniques
- Understand the mechanism sterilization and staining

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Second Year **NON MAJOR ELECTIVE I** **Semester III**

NUTRITIONAL BIOCHEMISTRY

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To make the students aware of the basic nutrition
- To learn the basic food groups
- To understand the nutrient requirements for various age groups
- To learn the dietary requirements for diseases

UNIT – I Nutrition:

Definition, Food -definition, Functions of Food, Basic five food group, Food pyramid, Food facts and fallacies

UNIT – II Types of Food:

Nutrition-definition, physiological role and significance of carbohydrates, lipids, protein. Protein energy ratio. Malnutrition Kwashiorkar & marasmus. Obesity.

UNIT – III Energy calculations:

RDA, definition of energy, Cal, RQ, SDA, BMI, BMR, Methods to determine energy requirements and expenditure

UNIT – IV Recommended Dietary Allowances:

Nutritional requirements of Infants, Preschool, School going and Adolescents

UNIT – V Dietary Recommendations:

Nutritional requirement for Adult man and woman, Pregnant women, Lactating women, Old age. Therapeutic diets for anaemia, diabetes and heart disease

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Preparation of diet charts for pregnant, lactating women and old age.

REFERENCES:

1. M Swaminathan, Essentials of Food and Nutrition, Vol I &II, The Bangalore Printing and Publishing Ltd
2. Sri Lakshmi, Nutrition Science New Age International Pvt Ltd.
3. W.Heimann, Fundamentals of Food Chemistry,
4. R Passmore and M A Eastwood, Davidson and Passmore, Human Nutrition and Dietetics, ELBS, Churchill Livingstone

5. C Gopalan, B V Rama Sastri and S C Balasubramanian, Nutritive value of Indian Foods, National Institute of Nutrition, ICMR
6. Monica Sharma, Text book of Nutrition, CBS Publishers 2020
7. Mudambi S R, Rajagopal M V Fundamentals of Food, Nutrition and Diet Therapy, New Age International P publishers, 2007
8. https://www.pdfdrive.com/complete-food-and-nutrition-guide-e13023246.html
9. https://www.pdfdrive.com/encyclopedia-of-foods-a-guide-to-healthy-nutrition-e158400089.html
10. https://www.pdfdrive.com/introduction-to-human-nutrition-2nd-edition-e1688125.html
11. https://www.pdfdrive.com/food-science-health-and-nutrition-e59336862.html

COURSE OUTCOMES:

- Define the basic concepts of nutrition.
- List the sources of various nutrients.
- Explain the nutritional requirements for various age groups.
- Discuss the health effects of nutrients.
- Prepare menu charts for various diseases.

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Second Year **CORE COURSE IV** **Semester IV**

BIOPHYSICAL CHEMISTRY

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To provide an insight on the physical laws governing biological systems
- To inculcate the basics of colloidal phenomena
- To make the students understand the methodology of pH measurement and its importance
- To provide details of thermodynamics and bioenergetics

UNIT – I Ionization and pH measurement:

Water -Physical Properties of water, structure of water, hydrogen bonding, dipole moment. Acids and bases - Ionization: Basis of acidity and basicity - Bronsted Lowry theory, Strength of acids and bases, acid-base equilibrium in water; electrolyte dissociation and electrolytes. Henderson Hassel Bach equation, Measurement of pH, reference electrodes, glass electrodes, pH meter, Buffers and buffers with biological importance.

UNIT – II Colloids:

Colloids-Classification and properties of colloids, salting in and salting out of proteins, Hofmeister series, Donnan Equilibrium. Diffusion-definition, Fick's law of diffusion, diffusion coefficient- determination and significance. Osmosis – definition, osmotic pressure- measurement, significance of osmosis in biology, osmoregulation.

UNIT – III Viscosity:

Viscosity-Factors affecting viscosity, measurement, applications and significance of viscosity in living systems. Surface Tension- Antonoff'srule-Factors affecting surface tension, measurement and role of pulmonary surfactants. Adsorption-Types of adsorption interactions, characteristics, Gibb's adsorption equation and significance of adsorption

UNIT – IV Thermodynamics:

Thermodynamics- First, second, third and zeroth law of thermodynamics, Law of mass action, Oxidation reduction reactions, potentiometric titration of oxidation reduction reactions. Bioenergetics- Free energy and entropy changes in biological systems, coupling of endergonic and exergonic reactions, biological oxidation.

UNIT – V Spectroscopy:

Spectroscopy- Basic principles- Laws of absorption, deviations from Beer's law, Extinction coefficient, Absorption Spectrum, calibration curve, chromosphere concept, complimentary colors.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Presentation on absorption spectrum and performing simple experiments to demonstrate surface tension and viscosity.

REFERENCES:

1. Upadhayay, Upadhyay and Nath, Biophysical Chemistry – Principles and Techniques, Himalaya Publishing House, Pvt. Ltd, 4th edition.
2. P.G.Nag, Basics and Applied thermodynamics, McGraw Hill Education, 2nd edition.
3. Chatwal, Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House.
4. Lehninger's Principle of Biochemistry.: Nelson Cox. 3rd ed. Mac Millian Worth Publ. 2000. Endocrinology: Mac E. Hadely. 5th ed. Pearson Education, 2000.
5. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, Cambridge, 5th edition.
6. Allan Cooper, Biophysical Chemistry, Royal Society of Chemistry, 2004.
7. L. Stryer.. Biochemistry, 5thedition. W.H.Freeman&Company, New York, 2002.
8. James P Allen, Biophysical Chemistry, Wiley Blackwell, 2008.
9. Banwell, Fundamentals of molecular spectroscopy, Mc Graw Hill Education, 2017.
10. Donald L Pavia, Introduction to spectroscopy, Cengage Learning India Pvt Limited, 2015.
11. https://enggbiochem.files.wordpress.com/2014/08/biophysical-chemistry.pdf
12. https://www.pdfdrive.com/biophysical-chemistry-e184869448.html
13. http://www.freebookcentre.net/chemistry-books-download/Biophysical-Chemistry-Lecture-Notes.html

COURSE OUTCOMES:

- Develop a general understanding of how the physical laws govern biological systems/processes.
- Acquire a basic knowledge on application of physical methods to understand biological processes.
- Develop an understanding on colloidal phenomena.
- To know the factors governing the structure and functions of macromolecules.
- To comprehend the basic principles of thermodynamics.

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Second Year	**CORE PRACTICAL IV BIOPHYSICAL CHEMISTRY**	**Semester IV**
Code:	**(Practical)**	**Credit: 4**

COURSE OBJECTIVES:

- To enable students to prepare buffers and measure pH
- To understand the separation of proteins
- To clearly learn osmosis, surface tension and viscosity
- To measure the absorption spectra of substances

1 Preparation of Buffers and measurement of pH
2 Titrable acidity of aminoacids
3 Donnan Membrane equilibrium
4 Salting Out Process- Separation of Proteins
5 Exosmosis and Endosmosis
6 Osmosis with potato osmometer
7 Determination of surface tension using tween 60
8 Determination of surface tension using stalgmometer by drop number method
9 Determination of viscosity of a solution using Ostwald viscometer Absorption spectra of glucose, protein, urea

REFERENCES:

1 Dr. J. Jayaraman, Laboratory Manual in Biochemistry New Age International Publishers.
2 David Plummer, An Introduction to Practical Biochemistry –Tata McGraw Hill Education, 3rd edition.
3 Sadasivam S and Manickam A, Biochemical Methods, New Age International Publishers.
4 P.Palanivelu, Analytical Biochemistry and Separation Techniques- A laboratory Manual for B.Sc and M.Sc students, Twenty First Century Publications.

COURSE OUTCOMES:

- Students will be able to measure pH of solutions and prepare buffers.
- Students will be able to calculate the titrable acidity of amino acids.
- Determine the surface tension and viscosity.
- Observe and record the absorption spectra of substances.

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Second Year	SECOND ALLIED COURSE II MEDICAL MICROBIOLOGY	Semester IV
Code:	(Theory)	Credit: 4

COURSE OBJECTIVES:

- To know the clinical aspects of various microbial diseases.
- To understand disease and causative agents.
- To understand the significance of diagnostic microbiology.
- To provide an advanced understanding of the microbial mechanisms and pathological processes responsible for common pathogens.

UNIT – I Microflora of the human body and host pathogen interaction:

Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections.

UNIT – II Bacterial disease and Fungal diseases:

Bacteria:. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control Respiratory Diseases: S. pyogenes, M.tuberculosis Gastrointestinal Diseases: E. coli, S.typhi, Vibrio cholerae, H. pylori, S. aureus, , Clostridium tetani, botulinum. Fungi: following types of mycoses and one representative disease to be studied with respect to transmission, symptoms and prevention Cutaneous mycoses: Tineapedis (Athlete's foot) Systemic mycoses: Histoplasmosis Opportunistic mycoses: Candidiasis.

UNIT – III Viral diseases and Protozoan diseases:

The following diseases in detail with Symptoms, mode of transmission, control Polio, Herpes, Hepatitis, Rabies, Dengue, AIDS, Influenza with brief description of swine flu, Ebola, Chikungunya. Protozoan diseases. Symptoms, mode of transmission, prophylaxis and control Malaria, Kala-azar.

UNIT – IV Antimicrobial agents:

General characteristics and mode of action, Antibacterial agents: Five modes of action with one example each: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin. Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Remdesvir, gancyclovir. Antibiotic resistance.

UNIT – V Sample collection, transport and diagnosis:

Collection, transport and culturing of clinical samples, principles of different diagnostic tests, Diagnostic kits. (ELISA, Immunofluorescence, Agglutination based tests,Complement fixation, PCR, DNA probes).

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Chalk and talk about SARS, coronavirus, monkeypox, and black fungus. Preventive measures and treatment strategies.

REFERENCES:

1 Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication 2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013).
2 Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication 3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition.
3 Elsevier 4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition.
4 McGraw Hill Higher Education 5. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition.Pearson International Edition.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Understand Mechanisms of various bacteria, viral infections.
- Acquire the knowledge on the mechanisms of causation of diseases.
- Explain the nature of the diseases.
- Illustrate the significance of clinical microbiology able to develop skills to facilitate employability in diagnostic and research institutes.

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Second Year **NON MAJOR ELECTIVE II** **Semester IV**

CLINICAL BIOCHEMISTRY

(Theory)

Code: **Credit: 2**

COURSE OBJECTIVES:

- To know the clinical aspects of various metabolic disorders
- To understand the significance of diagnostic Biochemistry
- To provide an advanced understanding of the biochemical mechanisms and pathophysiological processes responsible for common biochemical disorders.

UNIT – I Body fluids:

Types of specimen - Blood, serum, plasma, urine, feaces, CSF, amniotic fluid, solid tissues, specific cells. Specimen collection and processing (Blood and Urine). Homeostasis, Disorders of fluids, electrolyte balance and gastrointestinal system, disorder involving changes in hydrogen ion concentration. Blood disorders-Anaemias, Sickle Cell Anemia, Thalassemia, Porphyrias and porphyrinurias. Disturbances in blood clotting - haemophilia A and haemophilia B.

UNIT – II Liver and Kidney disorders:

Liver disorders-Jaundice-Haemolytic, Hepatic and Obstructive Jaundice. Hepatitis, Cirrhosis. Liver function tests. Renal disorders- Glomerulonephritis, Renal failure and Nephrolithiasis.Renal function tests, normal and abnormal constituents of urine.

UNIT – III Disorders of Carbohydrate Metabolism:

Normal glucose level in blood, Blood glucose homeostasis: Role of tissues and hormones in the maintenance of blood glucose. Renal Threshold Value. Hyperglycemia and Hypoglycemia, Glycosuria, Diabetes Mellitus – classification, metabolic abnormalities, symptoms, complications, diagnosis-glucose tolerance test (GTT) and management. Glycogen Storage Diseases, Fructosuria, Galactosemia.

UNIT – IV Disorders of Protein, Amino acid and Nucleic acid metabolism:

Plasma proteins- variation in diseases. Nitrogen Balance, Proteinuria, Multiple Myeloma, Phenylketonuria, Alkaptonuria, Tyrosinosis, Albinism, Hartnups disease. Fanconic Syndrome, Cystinuria, LeschNyhan Syndrome, Gout, Hyperuricemia and Hypouricemia.

UNIT – V Disorders of Lipid metabolism:

Plasma lipoproteins, cholesterol triglycerides and phospholipids in health and disease, Fatty Liver, Atherosclerosis, Obesity, Lipid Storage Diseases, Hypolipoproteinemia and Hyperlipoproteinemia.

UNIT – VI Biochemical and molecular epidemiology of human cancer (For continuous internal assessment only)

REFERENCES:

1. Chatterjee MN and Ranashinde. 2012. Text Book of Medical Biochemistry, 8th Edition, Jaypee Brothers Medical Publisher (P) Ltd, New Delhi.
2. Carl Burtis, R. Edward Ashwood and David Bruns (eds), Tietz E. 2012. Textbook of Clinical Chemistry and Molecular Diagnosis, 5th Edition, Springer Publishers, India.
3. Graham Basten. 2011. Introduction to Clinical Biochemistry, Interpreting Blood Results. Book Boon. 2 nd Edition, Bookboon.
4. Devlin TM. 2011. Textbook of Biochemistry with Clinical Correlations. 7th Edition, John Wiley & Sons Publishers.
5. Allan Gaw, J. Michael, Murphy, Rajeev Srivastava, A. Robert. 2013. Clinical Biochemistry, 5th Edition. Elsevier Publication, USA.
6. Harold Varley. 2006. Practical Clinical Biochemistry. 6th Edition. CBS Publishers.
7. Lippincott William &Wilikns. 2018. Clinical Chemistry, Principles, Techniques, Correlations with Access. 8th Edition. Michael Bishop, Edward Fody, & Larry Schoeff Publishers.
8. Tata McGraw Hill Companies. 2001. The Metabolic & Molecular Basis of inherited Diseases, Vol 1, 8th Edition, Vallersty Publishers.
9. Dennis Kasper and Eugene Braunwald. 2005. Principles of Internal Medicine. Harrison's Vol 1 & 2, 16th Edition, McGraw-Hill Publishers.
10. Thomas M Devlin. 2006. Textbook of Biochemistry with Clinical Correlation. 2nd Edition, Wiley & Sons Publishers.
11. Graham Basten. 2011. Introduction to Clinical Biochemistry, Interpreting Blood Results. Book Boon. 2nd Edition. Ventus Publishers, USA.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able :

- Understand the difference between plasma, serum, normal and abnormal constituents in various body fluids, Blood clotting mechanism and anticoagulants.
- Acquire the knowledge on the mechanisms of causation of diseases of liver and kidney.
- Explain the nature and functions of various enzymes in diseases.
- Understand the clinical aspects of various metabolic disorders
- Illustrate the significance of clinical biochemistry able to develop skills to facilitates employability in diagnostic and research institutes.

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Third Year **CORE COURSE V** **Semester V**

ENZYMES

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To study the Classification and Nomenclature of enzymes and, specificity of enzyme
- To make them learn the enzyme kinetics, mechanism of enzyme action and factors affecting enzyme activity
- To make them understand the technique of immobilization.

UNIT – I Introduction to Enzymes:

Classification, nomenclature, properties and functions of Enzymes and Coenzymes Metallo enzymes and metal activated enzymes. Units of enzyme activity. Turnover number. Non-Protein enzymes-Ribozymes. Abzymes.

UNIT – II Enzyme kinetics and Inhibition:

Michaelis-Menten equation, Line weaver- Burke plots. Importance of Kcal/Km and Vmax. Factors influencing enzymes activity. Enzyme inhibitors- reversible and irreversible inhibitors, Competitive, Non competitive and Uncompetitive inhibition. Feedback inhibition. Kinetics of Allosteric Enzymes.

UNIT – III Mechanism of Enzyme action:

Active site: Definition and characteristics- Lock & Key model and Induced fit model. Enzymes catalysis: acid base catalysis, covalent catalysis, metal ion catalysis. Specificity of enzyme action Formation of Enzyme – Substrate complex. Bisubstrate reactions-brief introduction to sequential and Ping-Pong mechanisms with example.Mechanism of action of Chymotrypsin and Lysozyme.

UNIT – IV Isolation and Purification of Enzymes:

Isolation- localization and extraction of free and membrane bound enzymes. Purification of enzymes- Methods. Separation procedure based on molecular size, solubility difference and electric charge and selective adsorption. Fractionation of enzymes. Criteria of purity of enzymes.

UNIT – V Applications of Enzymes:

Immobilization of enzymes. Principles and various methods of immobilization - Ionic bonding, adsorption, covalent bonding, microencapsulation and gel entrapment. Applications of immobilized enzymes. Applicationsof enzymes in Industry. Clinical importance of enzyme.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Industrial importance of enzymes for cleaner and greener technology**.**

REFERENCES:

1 Price and Stevens 1989, Fundamentals of Enzymology, Oxford Bioscience publications 2ndEd,.Newyork
2 Palmer T. and Bonner P. 2007. Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, 2nd edition, Horwood Publishers, United Kingdom.
3 Weisman, Hand book of Enzyme technology, 3rd edition, Printice Hall Publishers, United Kingdom.
4 U. Satyanarayana, 2019. Fundamentals of Biochemistry, Allied & Books Pvt Ltd, Calcutta.
5 JL. Jain. 2005. Fundamentals of biochemistry, 6th Edition, S.Chand Publishers, New Delhi.
6 D.L.Nelson, Michael M. Cox, 2004, Lehninger Principles of Biochemistry: International Edition, CBS Publishers, 4th Ed, London.
7 Biochemistry: Stryer. W.H. Freeman & Co., Scientific Research an Academic Publisher, New York.4th Ed.1995
8 D.Voet, and JG.Voet. 1990. Biochemistry, 4th edition, John Wiley& Sons Inc., Publishers, NewYork
9 A.White, 1959. Principles of Biochemistry, 3rd edition, McGraw Hill Book Co., Publishers, NewYork.
10 Priceand Stevens, 1999. Fundamentals of Enzymology, 3rd edition, Oxford University Press, NewYork.
11 https://www.pdfdrive.com/biochemistry-books.html
12 https://www.chem.purdue.edu/courses/chm333/Spring%202013/Lectures/Spring%202013%20Lecture%2013-14.pdf
13 https://www.chem.purdue.edu/courses/chm333/Spring%202013/Lectures/Spring%202013%20Lecture%2015.pdf
14 https://www.chem.purdue.edu/courses/chm333/Spring%202013/Lectures/Spring%202013%20Lecture%2016-%2017.pdf
15 https://www.rgpv.ac.in/campus/PY/enzymes_ppt.pdf

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Understand the classification and nomenclature of enzymes, specificity of enzyme Catalysis and regulatory enzymes.
- Explain the mechanism of enzymes and the role of vitamins as coenzyme precursors.
- Express the Michaelis - Menten equation and graphical representation of various inhibitors.
- Discuss the factors affecting enzyme activity and enzyme isolation & purification.
- Describe the principles and methods of enzyme immobilization.

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Third Year	CORE COURSE VI MOLECULAR BIOLOGY	Semester V
Code:	(Theory)	Credit: 5

COURSE OBJECTIVES:

- To learn about the basic principles of inheritance and the significance of the organization of genome mechanisms in the expression of genetic material and its regulation.
- To understand Molecular biology with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development.
- To emphasize the molecular mechanisms of DNA replication, repair and protein synthesis.

UNIT – I Overview of genetic material:

Structural organisation of chromatin, DNA as a genetic material-Griffith, Avery, McLeod and McCarthy and Hershey and Chase Experiments, concepts of gene, Chromosomal Structure (prokaryotic and eukaryotic)

UNIT – II Replication of DNA:

Models of DNA Replication (Prokaryotes and Eukaryotes) - Origin and direction of replication, discontinuous replication, Enzymes in DNA replication- DNA polymerases Primase, Ligase, Helicase, Topoisomerases. Singlestrand DNA binding protein, Replication strategies for replicatingcircular DNA: φ mode replication,σ mode or rolling circle replication and D-loop replication.Inhibitors of replication.

UNIT – III Transcription:

Transcription (Prokaryotes and Eukaryotes)-RNA synthesis –initiation, elongation and termination - transcription activators and repressors, RNA Processing: splicing, polyadenylation, capping. Structure and functions of different types of RNA.

UNIT – IV Translation:

Genetic code –Codon and Anticodon interactions, Translation (Prokaryotes and Eukaryotes) initiation, elongation, termination, translational inhibitors, post-translational modification of proteins.

UNIT – V DNA Repair and Gene Regulation:

Types of Gene mutations – Base substitution, Frame shift mutation-insertion, deletion, missense, nonsense mutation. DNA repair mechanism-Mismatch repair photo reactivation, excision and SOS repair. Regulation of Gene expression: Inducible operons – Lac Operon, Repressible operon – Tryptophan.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Latest research in the areas of gene expression and genome organization, cellular morphology and function, molecular metabolism, cellular trafficking, and signal transduction.

REFERENCES:

1 Bruce Alberts, Alexander D. Johnson and Julian Lewis. 2014. Molecular Biology of the Cell, 6th edition, WW. Norton & Company Publishers, New York, USA. Cooper GM. and RE. Hausman. 2009.
2 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington Publishers, Augusta, Georgia. Geoffrey Cooper and Robert E Harsman. 2004.
3 The Cell-A Molecular Approach, 3rd edition. ASM Press Publishers, Washington, United States. James D. Watson, A. Baker Tania, P. Bell Stephen, Gann Alexander, Levine Michael and Losick Richard. 2017.
4 Molecular Biology of the Gene, 7th edition, Pearson EducationPublishers, New York, USA.Rastogi SC. 2011. Cell and Molecular Biology, 3rd edition, New age International publisher, New Delhi, India.
5 David Freifelder. 2008. Molecular Biology, 2nd edition, Narosa publishing house Publishers, India.
6 Alberts B., Johnson A., Lewis J., Mofgan D., Raff M., Roberts K and Walter P. (2014).
7 Molecular Biology of the Cell. 6th edition. Garland Science, New York, USA.
8 Allison A. Lizabeth. 2012. Fundamental Molecular Biology, 2nd edition. J Willey and Sons, Hoboken, New Jersey.
9 Berg JM, Tymoczko JL, Gatto GJ and Stryer L. 2015. Biochemistry, 8th edition, WH Freeman & Co., New York, USA.
10 David Nelson L. and Michael Cox. 2021. Lehninger Principles of Biochemistry. 8th edition, WH. Freeman & Co Ltd Publishers, New York, USA.
11 Freifelder D and Malacinski GM. 2010. Essentials of Molecular Biology, 4th edition, John and Bartlett Publishing, UK.
12 George M Malanciski. 2008. Freifelder's Essentials of Molecular Biology, 4th edition. Narosa Publishing House, India.
13 Gerald Karp. 2008. Cell and Molecular Biology, 5th edition, John Wiley and Sons Publishers, Hoboken, New Jersey.
14 Krebs JE., Kilpatrick ST. and Goldstein ES. 2013. Lewin' GENES XI, Jones & Bartlett Learning. Burlington, Massachusetts.
15 Lodish H., A. Berk, CA. Kaiser, M. Krieger, MP. Scott, A.Bretscher, H. Ploegh and P.Matsudaira. 2007. Molecular Cell Biology. 6th edition, WH. Freeman Publishers, New York, USA.
16 Watson JD, TA. Baker and SP. Bell. 2008. Molecular Biology of the Gene. 5th edition,Dorling Kindersley (India) Pvt. Ltd., Publishers, New Delhi.
17 https://agrilife.org/gold/files/2012/09/Lecture-26.pdf
18 https://static1.squarespace.com/static/6019d0bc7dff866728d961d3/t/601a68429c231608a9b8f2a0/1612343363359/biochemistry_satyanarayana_ebook_free.pdf
19 https://drive.google.com/file/d/1tghNWPyuqPiqK1Rl11ZzUrFwcoMiuoMa/

20 http://www.freebookcentre.net/biology-books-download/Basics-of-molecular-cell-biology-(PDF-36P).html

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Understand and apply the principles and techniques of molecular biology.
- Learn the most significant discoveries and theories through the historical progress of biological scientific discoveries, and their impacts on the development of molecular biology.
- Acquire knowledge on the principles and laws of inheritance at the cell, individual and population levels.
- Understand the concepts such as gene structure and function, gene regulation, microbial genetics, mutation and DNA repair, PCR and sequencing, cancer genetics and evolution.
- Learn as to how gene expression is regulated at different levels, and as to how tissue-specific expression is achieved and can be manipulated and studied experimentally.

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Third Year **CORE COURSE VII** **Semester V**

INTERMEDIARY METABOLISM

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To make the students learn Bioenergetics with reference to as to how the living cells harness energy and channel it to biological work and to Metabolism, and as to how the cells extract and utilize energy through numerous enzyme-catalyzed reactions.
- To understand the major catabolic and anabolic pathways in metabolism of carbohydrates, lipids, amino acids and nucleotides.
- To make them the key regulatory aspects in metabolic pathways

UNIT – I Bioenergetics:

High energy phosphate compounds - structure and importance of ATP. Biological oxidation- Enzymes involved in oxidation and reduction. Electron transport chain, Inhibitors of ETC. Mechanism of oxidative phosphorylation, Inhibitors and Uncouplers.

UNIT – II Carbohydrate metabolism:

Glycolysis and its energetics, oxidation of pyruvate to acetyl CoA, Citric acid cycle and their regulation, anaplerotic reactions, Hexose Mono Phosphate pathway, gluconeogenesis, glycogenesis and glycogenolysis,

UNIT – III Lipid metabolism:

Biosynthesis and oxidation of fatty acids, biosynthesis and catabolism of triglycerides, phospholipids, glycolipids. Synthesis and catabolism of cholesterol. Synthesis andcatabolism of ketone bodies.Metabolism of plasma lipoproteins-chylomicrons, LDL, VLDL, IDL and HDL.

UNIT – IV Amino acid metabolism:

Biosynthesis of essential and non-essential amino acids. Catabolism of essential and non-essential amino acids and their regulation. Glucogenic and ketogenic amino acids Transamination, oxidative deamination, Decarboxylation, Urea cycle and its regulation.

UNIT – V Nucleic acid and porphyrin metabolism:

De novo synthesis of purines and pyrimidines, nucleotide and salvage pathway of purines and pyrimidine nucleotide synthesis. Catabolism of purines and pyrimidines nucleotides. Biosynthesis and catabolism of porphyrin and Heme.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

specific *events* in the *metabolism* and Inherited *Metabolic* Disorders. Metabolic Imaging in Humans (ICIMD).

REFERENCES:

1 Denise R Ferrier. 2013. Biochemistry (Lippincott's Illustrated Reviews), 6th edition, Lippincott Williams and Wilkins Publishers, Philadelphia.
2 Keith N Frayn andRhys D. Evans. 2019. Human Metabolism A Regulatory Perspective, 4th edition, John Wiley Publishers, New Jersy.
3 Reginald H. Garrett, Charles M. Grisham. 2010. Biochemistry, 4th edition, Mary Finch Publishers, Massachusetts, United States.
4 Robert K. Murray, Darryl K. Granner, Peter A. Mayes, and Victor W. Rodwell. 2012. Harper's Illustrated Biochemistry, 29th edition, McGraw-Hill Medical Publishers, Canada.
5 Voet.D and Voet. J.G. 2010. Biochemistry, 4thedition, John Wiley & Sons Inc Publishers, New Jersy.
6 Berg JM, JL. Tymoczko, and L. Stryer W.H. 2012. Biochemistry, 7th edition, Freeman Publishers, New York.
7 David A Bender, Shauna M C Cunningham. 2021. Introduction to Nutrition and Metabolism, 6th edition, CRC Press Publishers, Florida.
8 David Nelson L and Michael Cox. 2021. Lehninger Principles of Biochemistry, 8th edition, W.H.Freeman & Co Ltd Publishers,New York.
9 Sareen S Gropper, Jack L Smith, & Timothy P Carr. 2018. Advanced Nutrition and Human Metabolism, 7th edition, Cenage Learning Publishers.
10 Victor Rodwell and David Bender. 2018. Harper's Illustrated Biochemistry, 31st edition Paperback – Illustrated, McGraw-Hill Education, New York.
11 https://www.pdfdrive.com/biochemistry-books.html
12 https://www.pnas.org/content/107/Supplement_2/8947
13 https://pubmed.ncbi.nlm.nih.gov/23680095/
14 https://www.ncbi.nlm.nih.gov/books/NBK556047/

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Understand the basic principles of bioenergetics and mitochondrial mechanisms in energy production.
- Appreciate the reaction pathways by which carbohydrates and lipids are synthesized and degraded.
- Comprehend the metabolic fates of amino acids and the features of protein catabolism.
- Know the biochemistry of porphyrins, purines and pyrimidines.
- Discuss the overall concept of cellular metabolism – anabolic and catabolic pathways, energy storage and release, production of building blocks for macromolecule synthesis.

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Third Year | **CORE PRACTICAL V** | **Semester V**

ENZYME KINETICS AND MOLECULAR BIOLOGY

Code: | **(Practical)** | **Credit: 4**

COURSE OBJECTIVES:

- To gain the knowledge regarding different analytical techniques for biomolecules
- To understand the principle and techniques for isolation procedure
- To estimate and analyze DNA and RNA using standard methods in body fluids.

1. Isolation of enzymes from natural sources.
2. Determination of specific activity, pH and temperature of salivary amylase.
3. Determination of effect of temperature on alkaline phosphatase activity.
4. Determination of the effect of pH on Urease activity.
5. Determination of KM and Vmax using Line weaver-Burk plot for any one enzyme.
6. Determination of activators for any one enzyme.
7. Determination of inhibitors for any one enzyme.
8. Isolation of DNA/RNA.
9. Estimation of DNA by Diphenylamine method.
10. Estimation of RNA by Orcinol method.

REFERENCES:

1 Price and Stevens 1989, Fundamentals of Enzymology, Oxford Bioscience publications 2nd Ed, New york.

2 U. Satyanarayana, 2019. Fundamentals of Biochemistry, Allied & Books Pvt. Ltd, Calcutta.

3 JL. Jain. 2005. Fundamentals of biochemistry, 6th Edition, S. Chand Publishers, New Delhi.

4 D. Voet, and JG. Voet. 1990. Biochemistry, 4th edition, John Wiley & SonsInc, Publishers, New York

5 A. White, 1959. Principles of Biochemistry, 3rd edition, McGraw Hill Book Co., Publishers, New York.

6 Lehninger Principles of Biochemistry: D.L. Nelson, Michael M. Cox, International Edition, CBS Publishers, 4th Ed, 2004.

7 Stryer. W.H., 1995, Biochemistry Freeman &Co., Scientific Research an academic Publisher4th Ed., New York.

8 Marangoni, 2002, Enzyme kinetics. A modern approach, 1st edition, John Wiley Publishers, United Kingdom.

9 M. Dixon, and JF, Webb. 1979. Enzymes, 2nd edition, Longman Publishers, London.

10 Stryer, I. 1988.Biochemistry, 2nd edition, W.H. Freeman & Co., Publishers, New York.

11 https://www.pdfdrive.com/biochemistry-books.html

12 http://amrita.olabs.edu.in/?sub=73&brch=8&sim=133&cnt=2

13 https://courses.lumenlearning.com/biolabs1/chapter/enzymes/
14 https://practicalbiology.org/bio-molecules/factors-affecting-enzyme-activity/investigating-the-effect-of-ph-on-amylase-activity
15 https://www.easybiologyclass.com/properties-of-enzymes-biochemistry-lecture-notes/

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

Analyze the equations of enzyme kinetics.

- Understand the principles of enzyme inhibition.
- Evaluate the mechanism of enzyme catalysis.
- Determine the catalytic mechanism employed by the most well characterized enzymes.
- Understand the principles and procedures for isolation and evaluation of nucleic acids.

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Third Year **MAJOR BASED ELECTIVE I** **Semester V**

1. HUMAN PHYSIOLOGY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To make the students understand fundamental mechanisms underlying normal function of cells and tissues.
- To make the students to understand fundamental mechanisms underlying normal function of organs, and organ systems of the human body
- To make the students to enrich on anatomy of few vital system

UNIT – I Body fluids:

Extracellular fluid-plasma and interstitial fluid. Intracellular fluid: Lymph and Blood-composition, functions, osmolarity of the body fluids, ionic composition. Blood cells, hemoglobin, haematopoiesis, blood coagulation and blood groups.

UNIT – II Circulatory and Respiratory System:

Structure of Heart and blood vessels, cardiac cycles, cardiac factors controlling blood pressure, electrocardiogram. Functions of heart. Anatomy of lungs and physiology of respiration, pulmonary surfactant, exchange of gases between lung and blood and between blood and tissues. Role of lung in acid-base balance.

UNIT – III Digestive system:

Anatomy of the digestive system, Salivary, Gastric and Biliary Secretions-composition and functions. Intestinal hormones, movements in Gastro intestinal tract, Secretion, digestion and absorption in the small intestine. Absorption in the large intestine; Digestion and absorption of carbohydrates, lipids and proteins

UNIT – IV Excretory system:

Outline of Excretory organs, Structure and functions of kidney. Structure of Nephron, Urine- composition and formation. Renal regulation of acid-base balance.

UNIT – V Neuro Muscular System:

General organization. Functional units. Resting and action potential- conduction of nerve impulse. Synaptic transmission. Neurotransmitters.
Muscle: Kinds of muscle, structure. Mechanism and theories of muscle contraction

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Live 3D printed tissues and tissue implantation. Disorders in dementia and Alzheimer's disease.

REFERENCES:

1. Human Physiology: Vol I & II C.C. Chatterjee, 2016.
2. Human Physiology-Systemic & applied-Sahalya, 2009.
3. Tortora, G.J. and Graabowski, S.R..Principles of Anatomy and Physiology, Twelfth Edition, John Wiley & Sons, New York. 2009.
4. Michael McKinley and Valerie Dean O' Houghlin Human Anatomy, 5th edition, McGraw Hill Publishing Company. 2014.
5. Eric. P. Widmaier., Hershel Raff and Kevin-T. Strang..Vander's Human Physiology, 11th edition, McGraw Hill Publishing Company. 2008.
6. Ross and Wilson anatomy and physiology in health and illness , 13th edition, Elsevier, 2018.
7. Sherman, J andLuciano, D.. Human Physiology,13th edition, McGraw Hill Publishing Company, 2020.
8. Essentials of Medical physiology, 8th edition. K.Sembulingam and Prema Sembulingam. Jaypee brothers medical publishers (P) ltd. 2019
9. Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology,Twelfth Edition, Saunders Company Publishers, New York, 2010.
10. Grabouski, T.. Principles of Human Anatomy and Physiology,14th edition, John Wiley and Sons. 2013.
11. https://www.pdfdrive.com/mcqs-and-emqs-in-human-physiology-medmaniacs-e17337498.html
12. https://www.pdfdrive.com/essentials-human-physiology-e1543905.html
13. https://www.pdfdrive.com/anatomy-physiology-d10512318.html

Course Outcomes:

Upon successful completion of this course the students would be able to:

1. Define physiology, main structures composing human body.
2. Explain the functional anatomy of different organs in each system.
3. Relates structure and functions of tissues and body fluids.
4. Explain the structure of cardiac, digestive, excretory, respiratory systems.
5. Understand the features and organization of the various components of the nervous system and mechanisms of neurotransmission.

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Third Year **MAJOR BASED ELECTIVE I** **Semester V**

2. BASIC BIOTECHNOLOGY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To make the students to understand the technological aspect applied to fermentation technology,
- To make the students understand gene cloning, transgenic plants and animals.
- To make the students understand Applications of biotechnology for environmental issues.

UNIT – I Fermentation Biotechnology:

Biotechnology – scope and importance, Basic principles of microbial growth, Bioreactor- batch and continuous bioreactor, fermentation culture medium, downstream processing. Fermentation production of penicillin and vitamin B12.

UNIT – II Food and Industrial Biotechnology:

Fermentation production of yoghurt and cheese. Production of single cell protein; spirulina - cultivation and uses. Biofertilizers – blue green algae- cultivation and uses. Production of amylase and protease.

UNIT – III Molecular Biotechnology:

Basic principles of cloning, Introduction of foreign DNA into host by particle bombardment gun, electroporation and microinjection. Basic Polymerase Chain Reaction (PCR), applications.

Unit – IV Animal and Plant Biotechnology:

Elementary details of Animal cell and tissue culture, medium, targeted gene transfer. Transgenic animals (Knockout Mice, transgenic sheep with human alpha1-antitrypsin gene, transgenic pigs for organs for humans, transgenic mosquitoes for disease control, transgenic chicken for high protein). Plant cell and tissue culture, medium, totipotent, pluripotent cells. Transgenic plants (enhancing photosynthetic efficiency, golden rice, BT cotton, herbicide tolerant plants, stress tolerant plants).

UNIT – V Environmental Biotechnology:

Biological fuel generation- ethanol and methane from biomass. Sewage treatment. Bioremediation: oil spill cleanup, bioleaching. Intellectual property management and handling of GMO's. Biosafety and hazards of environmental engineering.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Stem cell from bioreactors**,** Stem Cell Research, .Human Genome Project.

REFERENCES:

1. B.R.Glick & J.J. Pasterak , Molecular Biotechnology: Principles and Applications of Recombinant DNA, ASM Press, Washington, D.C., 2010
2. A.H.Patel , Industrial Microbology, Macmillan , India Ltd, 2012
3. Michael Butler, Animal Cell Culture and Technology, Garland Science/BIOS Scientific Publishers, Second Edition, London and New York. 2004.
4. Ramawat, K.G..Plant Biotechnology, S.Chand and Company Ltd, Ram Nagar, New Delhi, 2008.
5. Wang, L.K. Environmental Biotechnology, First Edition, A Product of Human Press, 2010.
6. R.C.Dubey , A text book of Biotechnology-, S.Chand Publications, 2014
7. P.K.Gupta , Elements of Biotechnology-, Rastogi Publications, 2nd edition 3rd reprint, 2015 2016.
8. Brown, T.A. Gene Cloning and DNA Analysis: An Introduction, 7th edition Wiley Blackwell 2012.
9. Renneberg, R. & Berkling,V. Biotechnology for beginners, Academic Press, 2017.John M Walker and Ralph Raply, Molecular Biology and Biotechnology 5th Edition, RCS publishing, 2009.
10. https://www.pdfdrive.com/molecular-biology-and-biotechnology-5th-edition-d4601580.html
11. https://www.pdfdrive.com/biology-and-biotechnology-e22686316.html
12. https://www.pdfdrive.com/biotechnology-applying-the-genetic-revolution-e18828053.html

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

1. Illustrate the various aspects of Biotechnological applications in Fermentation Industries.
2. Describe the principles underlying design of Fermenters, Fermentation Process and downstream processing and its applications.
3. Explain the concept of gene cloning
4. Explain the applications of transgenic plants and animals.
5. Explain the IPR and handling of GMO's

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Third Year | **SKILL BASED ELECTIVE I BIO-INSTRUMENTATION (Theory)** | **Semester V**

Code: | **Credit: 2**

COURSE OBJECTIVES:

- The student should have understood the analytical techniques in the field of Biosciences.
- To make the students to understand the basic principles of biological instruments.

UNIT -I Basic Instruments

pH meter, Buffer of biological importance, Principles and applications of Autoclave – Hot air oven – Incubator, Laminar air flow chamber / Biosafety cabinets , BOD Incubator, Lyophilizer.

UNIT – II Microscopy:

Microscopes types, use of techniques of preparing specimens, resolving power, optical Microscope-Basic idea of light microscopy, Types- bright field, dark field, ultra-violet, Fluorescence and phase-contrast microscopes, confocal microscopy Electron Microscope: TEM, SEM

UNIT – III Chromatographic and Electrophoresis Techniques:

Chromatographic Techniques: Paper, Thin Layer, Column, HPLC and GC. Electrophoresis Techniques: Starch Gel, AGE, PAGE.

UNIT – IV DNA sequencing techniques and Imaging techniques:

Polymerized Chain Reaction: PCR –steps, Types of PCR and its applications. Principle, Instrumentation and application of ECG, EEG, EMG, MRI, CT and PET scan.

UNIT – V Fluorescence and radiation based techniques:

Spectrofluorimeter, Flame photometer, Scintillation counter, Geiger Muller counter, Radioisotopes, Applications of radioisotopes. Autoradiography.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

To learn the separation of secondary metabolites from medicinal plants.

Reference Books:

1. Biophysical Chemistry (Principles and Techniques) 4thEdition, Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath, Himalaya Publishing House, India,2014.

2. Basic Instrumentation, K. K. Machve, Neha Publishers & Distributors, India 2010.
3. Principles and Techniques of Practical Biochemistry, Keith Wilson & John Walker, Cambridge University Press, India.2005.
4. Bioanalytical Techniques, Abhilasha Shourie and Shilpa S Chapadgaonkar, The Energy and Resources Institute, TERI, India, 2015.
5. Research Methodology, Methods and Techniques, 2nd ed, C.R. Kothari, New Age International Publishers. India, 2004.
6. Introduction to Instrumental Analysis, Braun, R.P. Tata McGraw Hill, India, 1987.
7. Fundamentals of Bioanalytical Techniques and Instrumentation, Ghosal Sabari and Srivastava A. K., PHI Learning Pvt. Ltd. India,2009.
8. https://www.pdfdrive.com/biochemistry-books.html
9. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod 10.pdf
10. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod 11.pdf

COURSE OUTCOMES:

- Demonstrate the basics of instrumentation by analysis
- Handle the instruments like colorimeter, spectrophotometer and to use them for biochemical determinations.
- Evaluate by Separating and Purifying the components
- Understand the need and applications of imaging techniques
- Categorize the working principle and applications of fluorescence and radiation based techniques

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Third Year **CORE COURSE VIII** **Semester VI**

IMMUNOLOGY

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To study about the organs involved in the immune system, their biological functions.
- To understand the immunity and its types, immune response and immunoglobulins.
- To study about hypersensitivity reactions and the production of polyclonal and monoclonal antibodies and their application.

UNIT – I Immune system:

Primary Lymphoid organs- Thymus, Bone Marrow. Secondary Lymphoid organs- Spleen, lymph node, MALT. Stem cell- origin and differentiation, Lymphocytes- classification- T, B and NK cells. Antigen presenting cells-macrophages, dendritic cells, langerhans cell. Mechanism of phagocytosis. Complement system – characteristic features and functions.

UNIT – II Immunity:

Types of immunity- Innate immunity- mechanism of nonspecific immunity. Acquired immunity- active and passive immunity, classification, vaccine-active immunization, passive immunization. Humoral and cell mediated immunity –induction mechanism. Cytokines –interleukins, interferons.

UNIT – III Immunoglobulins and immune reactions:

Structure and types, biological functions. Antigen- Types –factors determining antigenicity. Antigen- antibody interactions - agglutination, precipitation, opsonization, complement activation, bacteriolysis and Antitoxins. Blood Groups.

UNIT – IV Immune response:

Hypersensitivity reactions- types, mechanism and prevention. Transplantation-types-graft acceptance- mechanism and prevention of graft rejection, immune-suppressive drugs. HLA-immune response genes- HLA molecules, AIDS and Auto immune diseases-pathogenesis – treatment.

UNIT – V Immunochemical techniques:

Production of antisera, Monoclonal antibody- production and applications, Principle and applications of immunodiffusion, immunoelectrophoresis, immunofluorescence, and complement fixation test. Principle, technique and applications of RIA and ELISA.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Epidemiology and transmission dynamics of COVID-19.

REFERENCES:

1. Anil K. Sharma. 2019. Immunology: An Introductory Textbook, 1st edition, Jenny Stanford Publishers, California.

2. Gupta SK. 2017. Essentials of Immunology, 2nd edition, ARYA Publishers, New Delhi.
3. Kenneth Murphy. 2017, 9th edition, W.W. Norton &Company Publishers, New York.
4. Mohanty SK. 2019. Essentials of Microbiology & Immunology, 1st edition, Paras Medical Publishers, New Delhi.
5. Robert R. Rich. 2020. Clinical Immunology- Principles And Practice, 5Th edition, Elsevier Publishers, India.
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18. https://www.nature.com/ni/video
19. https://www.cell.com/immunity/home
20. https://www.wpunj.edu/sec/vsec/science_courses/bio/BIOimmuANIM.html
21. https://www.youtube.com/watch?v=K09xzIQ8zsg
22. https://nptel.ac.in/content/syllabus_pdf/102105083.pdf

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Demonstrate the basic knowledge of immunological processes at a cellular level, compare and contrast the key mechanisms and cellular players of innate, adaptive immunity and how they relate.
- Summarize central immunological principles, concepts and the mechanisms of protection against infectious diseases.
- Outline key events and cellular players in antigen presentation, and how the nature of the antigen will shape resulting effectors responses.
- Elucidate the genetic basis for immunological diversity and the generation of adaptive immune responses.
- Comprehend and explain the basis of immunological tolerance, autoimmunity, transplantation and explain the basis of allergy, allergic diseases.
- Understand all aspects of important techniques used for the study of immunological reaction.

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Third Year **CORE COURSE IX** **Semester VI**

CLINICAL BIOCHEMISTRY

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To know the clinical aspects of various metabolic disorders
- To understand the significance of diagnostic Biochemistry
- To provide an advanced understanding of the biochemical mechanisms and pathophysiological processes responsible for common biochemical disorders.

UNIT – I Body fluids:

Types of specimen - Blood, serum, plasma, urine, feaces, CSF, amniotic fluid, solid tissues, specific cells. Specimen collection and processing (Blood and Urine). Homeostasis, Disorders of fluids, electrolyte balance and gastrointestinal system, disorder involving changes in hydrogen ion concentration. Blood disorders-Anaemias, Sickle Cell Anemia, Thalassemia, Porphyrias and porphyrinurias. Disturbances in blood clotting - haemophilia A and haemophilia B.

UNIT – II Liver and Kidney disorders:

Liver disorders-Jaundice-Haemolytic, Hepatic and Obstructive Jaundice. Hepatitis, Cirrhosis. Liver function tests. Renal disorders- Glomerulonephritis, Renal failure and Nephrolithiasis.Renal function tests, normal and abnormal constituents of urine.

UNIT – III Disorders of Carbohydrate Metabolism:

Normal glucose level in blood, Blood glucose homeostasis: Role of tissues and hormones in the maintenance of blood glucose. Renal Threshold Value. Hyperglycemia and Hypoglycemia, Glycosuria, Diabetes Mellitus – classification, metabolic abnormalities, symptoms, complications, diagnosis-glucose tolerance test (GTT) and management. Glycogen Storage Diseases, Fructosuria, Galactosemia.

UNIT - IV: Disorders of Protein, Amino acid and Nucleic acid metabolism:

Plasma proteins- variation in diseases. Nitrogen Balance, Proteinuria, Multiple Myeloma, Phenylketonuria, Alkaptonuria, Tyrosinosis,Albinism, Hartnups disease. Fanconic Syndrome, Cystinuria, LeschNyhan Syndrome, Gout, Hyperuricemia and Hypouricemia.

UNIT – V Disorders of Lipid metabolism:

Plasma lipoproteins, cholesterol triglycerides and phospholipids in health and disease, Fatty Liver, Atherosclerosis, Obesity, Lipid Storage Diseases, Hypolipoproteinemia and Hyperlipoproteinemia.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Biochemical and molecular epidemiology of human cancer.

REFERENCES:

1. Chatterjee MN and Ranashinde. 2012. Text Book of Medical Biochemistry, 8th Edition, Jaypee Brothers Medical Publisher (P) Ltd, New Delhi.
2. Carl Burtis, R. Edward Ashwood and David Bruns (eds), Tietz E. 2012. Textbook of Clinical Chemistry and Molecular Diagnosis, 5th Edition, Springer Publishers, India.
3. Graham Basten. 2011. Introduction to Clinical Biochemistry, Interpreting Blood Results. Book Boon. 2nd Edition, Bookboon.
4. Devlin TM. 2011. Textbook of Biochemistry with Clinical Correlations. 7th Edition, John Wiley & Sons Publishers.
5. Allan Gaw, J. Michael, Murphy, Rajeev Srivastava, A. Robert. 2013. Clinical Biochemistry, 5th Edition. Elsevier Publication, USA.
6. Harold Varley. 2006. Practical Clinical Biochemistry. 6th Edition. CBSPublishers.
7. Lippincott William &Wilikns. 2018. Clinical Chemistry, Principles, Techniques, Correlations with Access. 8th Edition. Michael Bishop, Edward Fody, & Larry Schoeff Publishers.
8. Tata McGraw Hill Companies. 2001. The Metabolic & Molecular Basis of inherited Diseases, Vol 1, 8th Edition, VallerstyPublishers.
9. Dennis Kasper and Eugene Braunwald. 2005. Principles of Internal Medicine. Harrison's Vol 1 & 2, 16th Edition, *McGraw-Hill* Publishers.
10. Thomas M Devlin. 2006. Textbook of Biochemistry with Clinical Correlation. 2nd Edition, Wiley & Sons Publishers.
11. Graham Basten. 2011. Introduction to Clinical Biochemistry, Interpreting Blood Results. Book Boon. 2nd Edition. Ventus Publishers, USA.
12. https://www.pdfdrive.com/biochemistry-books.ht
13. https://www.enpab.it/images/2018/EbookBiologia%20Clinica%2001_Clinical%20Biochemistry%20and%20Metabolic%20Medicine%20-%20Martin%20Andrew%20Crook.pdf
14. http://www.student.oulu.fi/~taneliha/Harpers_Illustrated_Biochemistry(29th_Edition). pdf
15. https://static1.squarespace.com/static/6019d0bc7dff866728d961d3/t/601a68429c231608a9b8f2a0/1612343363359/biochemistry_satyanarayana_ebook_free.pdf

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Understand the difference between plasma, serum, normal and abnormal constituents in various body fluids, Blood clotting mechanism and anticoagulants.
- Acquire the knowledge on the mechanisms of causation of diseases of liver and kidney.
- Explain the nature and functions of various enzymes in diseases.
- Understand the clinical aspects of various metabolic disorders.
- Illustrate the significance of clinical biochemistry able to develop skills to facilitates employability in diagnostic and research institutes.

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Third Year | **CORE PRACTICAL VI CLINICAL BIOCHEMISTRY AND IMMUNOLOGY (Practical)** | **Semester VI**

Code: | **Credit: 4**

COURSE OBJECTIVES:

- To provide an advanced understanding of parameters involved in biochemical disorders.
- To understand the immune response based on antigen and antibody reaction.
- To provide hands on training on Collection of samples, and quantitative and qualitative determination of blood and urine samples.

1. Collection and preservation of blood and urine
2. Determination of Blood count-RBC, WBC-Total and Differential counts
3. Estimation of Haemoglobin content
4. Determinationof ESR.
3. Quantitative estimation in blood
    a. Glucose
    b. Protein& A/G ratio
    c. Cholesterol
    d. Urea
    e. Uric acid
    f. Bilirubin
    g. Creatine and Creatinine

4. Qualitative analysis of normal and abnormal constituents of urine.
5. Quantitative estimations in urine
    a. Glucose
    b. Urea
    c. Uric acid
    d. Creatine and Creatinine

6. Identification of various immune cells by morphology–Leishman staining, Giemsa Staining.

7. Agglutination Reactions- Latex Agglutination reactions- ASO, CRP.
8. Heamagglutination Reactions- Blood Grouping, Rh Typing

REFERENCES:

1. Jayaraman J. 2011. Laboratory Manual in Biochemistry, 3rd edition, New Age International Pvt Ltd Publishers, New Delhi.
2. Sadasivam S. Manickam A. 2009. Biochemical Methods, 3rd edition, New age publishers, New Delhi.
3. Sawhney, SK.,Randhir Singh. SK.., 2005. Introductory Practical Biochemistry, 2nd edition, Alpha Science International Ltd, Oxford, United Kingdom.

4. Alan H Gowenlock. 1998. Varley's Practical Clinical Biochemistry, 6th edition, CBS Publishers, India.
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6. Kanai L Mukerjee. 1996. Medical Lab Technology, Vol I& II, 1st edition, Tata Mcgraw Hill, Pennsylvania.
7. Ranjna Chawla. 2014. Practical Clinical Biochemistry Methods and Interpretations (Paperback). 4th edition, Jaypee Brothers Medical Publishers, New York.
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9. http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf
10. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistry-pdf.pdf?sequence=1&isAllowed=y
11. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistry-pdf.pdf?sequence=1&isAllowed=y

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- Perform the hematology based analysis.
- Explain the clinical significance of the laboratory tests.
- Diagnosis of clinical disorders by estimating biomarkers.
- Evaluate the abnormalities which commonly occur in the clinical field.
- Identify abnormal constituents of urine.
- Create awareness of different lifestyle diseases increasingly found in present day.

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Third Year **MAJOR BASED ELECTIVE II** **Semester VI**

1. ENDOCRINOLOGY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To obtain sound knowledge in hormonal biochemistry.
- To obtain knowledge on the mechanism of action of hormones.
- To understand the disorders related to hypo and hyper secretions of hormones.

UNIT – I Introduction to Hormones:

Definition, classification, biosynthesis and circulation in blood. Mechanism of hormone action. Plasma membrane receptors. Adenylate cyclase, Role of G-proteins. Protein kinases, tyrosine, kinase, Inositol phosphate. Calcium, calmodulin. Mechanism of steroid hormone receptors- Mechanism of action of steroid hormone

UNIT – II Thyroid and Parathyroid Hormones:

Hormones of the thyroid Biosynthesis and biological actions of thyroid hormones. Antithyroid agents.Thyroid disease- thyrotoxicosis, Goiter, Grave's disease Hashimoto's thyroiditis. Parathyroid hormone- Biological actions regulation of calcium and phosphorous metabolism. Calcitonin. Calcitriol- Biosynthesis and functions. Hyper and hypocalcemia. Hyperparathyroidism, hypoparathyroidism, Paget's disease. Ricket's and osteomalacia

UNIT – III Hypothalamus and Pituitary Hormones:

Vasopressin and oxytocin- synthesis and biological effects. Hypothalamic releasing factors. Anterior pituitary hormones actions. Growth promoting and lactogenic hormones. POMC family. Gigantism, Acromegaly, Dwarfism and Diabetes insipidus.

UNIT – IV Pancreatic Hormones:

Insulin- Biosynthesis, regulation of secretion and biological actions. Mechanism of action of insulin. Glucagon, somatostatin and pancreatic polypeptide, Insulin like growth factors. Hyper and Hypoglycaemia.

UNIT - V Adrenal Hormones:

Glucocorticoids, Mineralocorticoids- synthesis and biological effects. Catecholamines: biosynthesis and biological effects. Gonadal hormones- Androgens and estrogens. Ovarian cycle. Abnormal secretion of adrenal hormones- Addison's disease. Cushing's syndrome, congenital adrenal hyperplasia, phaeochromocytoma

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Recent techniques for assessing hormones in blood. Drugs for hypo and hyper secretion disorders.

REFERENCES:

1. Smith et al., Principles of Biochemistry – Mammalian Biochemistry –McGraw Hill 7th ed.1982
2. Murray et al., Harper's Biochemistry –. 26th ed. McGraw Hill, 2003.
3. Mace Hadley and Jone Levine Endocrinology, 6th edition, Published by Pearson education India, 2009.
4. Prakash Lohar S, Endocrinology –Hormones and human health, Mjp Publishers, 2021.
5. Shlomo Melmed,, Kenneth S. Polonsky, P. Reed Larsen, Henry M. Kronenberg, Williams Textbook of Endocrinology , 12th edition, Saunders, an imprint of Elsevier Inc.2011.
6. Williams et al., Textbook of Endocrinology-, 2015.
7. Wilson and Foster, Textbook of Endocrinology –8th edn., 1998.
8. K. Sembulingam and Prema Sembulingam Essentials of Medical Physiology 8th Edition Jaypee brothers publishers, 2019.
9. Estelle Jones, Mechanisms of Hormone Action, Foster Academics, 2015.
10. Mala Dharmalingam, TextBook of Endocrinology, 1st edition, Jaypee brothers, 2010.
11. https://www.pdfdrive.com/williams-textbook-of-endocrinology-expert-consult-d189818749.html
12. https://www.pdfdrive.com/harrison-endocrinology-e34584578.html
13. https://www.pdfdrive.com/endocrinology-basic-and-clinical-principles-e33437813.html

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- Discuss the definition of a hormone in terms of its general properties.
- Describe the different classes and chemical structures of hormones.
- Identify the glands, organs, tissues and cells that synthesize and secrete hormones,
- Explain how the secretion and regulation of hormones.
- Explain the consequences of under- and overproduction of hormones.

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Third Year **MAJOR BASED ELECTIVE II** **Semester VI**

2. FOOD AND NUTRITION

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To impart the knowledge on overview of nutrition, essential nutrients for metabolism
- To provide an overview of the important macro and micronutrients relevant to human health.
- To discuss the scientific rationale for defining nutritional requirements in healthy individuals with reference to specific conditions such as newborn, childhood, pregnancy, lactation, and older age.

UNIT – I Overview of Food:

Sources, food composition, properties and storage of common foods. Functions of food in relation to health- classification of foods based on nutrients. Food groups provide nutritive requirements for normal health- body building foods, energy foods and protective foods.

UNIT – II Energy metabolism:

Definition of unit of energy – cal, RQ, SDA and NPU. - Body Mass Index (BMI) - Basal Metabolic Rate (BMR) – determination and factors influencing The sources and functions of essential nutrients – proteins (high biological and low biological value), carbohydrates and fats. Sources and functions of dietary fibre, Pro and Prebiotics.

UNIT – III Micro and macro mineral nutrients:

Outline of sources, metabolic functions and deficiency manifestations – Calcium, Phosphorus, Sodium, Potassium, Iron, Copper, Selenium and Zinc. Fat and water soluble vitamins – Outline of sources, metabolic functions, Hyber and Hypovitaminosis. Role of Vitamin as Antioxidant

UNIT – IV Dietary Recommendations:

Concepts in dietary recommendations, RDA – ICMR and WHO- composition of balanced diet and RDA for Infants, children, adolescents, pregnant and lactating women and old persons.

UNIT – V Dietary Recommendations:

Concepts in dietary recommendations, RDA – ICMR and WHO- composition of balanced diet and RDA for Infants, children, adolescents, pregnant and lactating women and old persons.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Sustainable & Environmentally-friendly Nutrition, Vegan & Plant-based Nutrition. Personalised Nutrition & Biohacking., Nutrition Confusion, Alternative Proteins.Health at Every Size & Mindful Eating.

REFERENCES:

1. Geissler, C. and Powers, H. Human Nutrition, Twelfth Edition, Churchill Livingstone, USA. 2010.
2. Brody, T. Nutritional Biochemistry, Second Edition, Academic Press, USA. 2006.
3. Eastwood, M. Principles of Human Nutrition, Second Edition, Wiley - Blackwell Science Ltd Publishers, USA. 2003.
4. Swaminathan -Human Nutrition and Dietetics –, Bangalore printing and Pulv. Co. Ltd, 1996.
5. Peggy S. Stanfield and Y. H. Hui, Nutrition and Diet Therapy Self-Instructional Approaches. %th edition, Jones and Bartlett publishers, 2010.
6. Srilakshmi, B. Nutrition Science Revised Fourth Edition, New Age International Publishers, New Delhi. 2013.
7. Paul, S. A Textbook of Bio-nutrition – Curing Diseases through Diet, First Edition, CBS Publishers and Distributors, New Delhi. 2005.
8. Swaminathan, M. Advanced Textbook of Food and Nutrition, Volume II, Second Edition, The Bangalore Printing and Publishing Co. Limited, India. 2004.
9. S.R Mudambi, and M.V. Rajagopal, Fundamentals of food, nutrition and diet therapy. 5th edition New age international publishers 2007.
10. Indrani TK, Manual of Nutrition & Therapeutic Diet, 2nd edition, Jaypee Brothers Medical Pub, 2017.
11. https://alraziuni.edu.ye/uploads/pdf/fundamentals-of-foodnutrition-and-diet-therapy.pdf
12. https://www.pdfdrive.com/nutrition-and-diet-therapy-d33438176.html
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Course Outcomes:

Upon successful completion of this course the students would be able to:

- Describe the composition and biochemical and physiological functions of the nutrients.
- Explain the nutritional requirements at various stages of life.
- Summarize the role of food in promotion of a healthy lifestyle and disease prevention role of food.
- Assess the nutritional status of the community in order to determine the type magnitude and distribution of malnutrition.
- Understand the therapeutic role of key nutrients in maintaining health.

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Third Year **PROJECT** **Semester-VI**

Code: **Credit: 3**

The candidate shall be required to take up a Project Work by group or individual and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the students in the beginning of the final year. A copy of the Project Report will be submitted to the University through the Head of the Department on or before the date fixed by the University.

The Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her Project through a Viva-voce.

ASSESSMENT/EVALUATION/VIVA VOCE:

1. PROJECT REPORT EVALUATION (Both Internal & External)

   I. Plan of the Project - 20 marks

   II. Execution of the Plan/collection of Data / Organisation of Materials / Hypothesis, Testing etc. and presentation of the report. - 45 marks

   III. Individual initiative - 15 marks

2. Viva-Voce / Internal & External - 20 marks

TOTAL **- 100 marks**

PASSING MINIMUM:

	Vivo-Voce 20 Marks	**Dissertation 80 Marks**
Project	40% out of 20 Marks (i.e. 8 Marks)	40% out of 80 marks (i.e. 32 marks)

A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate.

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Third Year **SKILL BASED ELECTIVE II** **Semester VI**

MEDICAL LAB TECHNOLOGY

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To understand the basic concepts and to learn the techniques essential for clinical laboratory.
- To learn the methods of specimen collection
- To understand the concepts of histopathology
- To understand the basic requirements of a clinical lab technician and the quality control process

UNIT – I Basic Haematology and Biochemistry:

Specimen collection and handling, transportation of specimens, disposal of specimens after laboratory use. Composition of blood. Methods of estimation of Haemoglobin, total and differential count of WBC, Blood Group - methods of grouping and Rh factor. Levels of glucose, triglycerides, cholesterol in blood with clinical correlations. Urine normal and abnormal constituents.

UNIT – II Microbiology:

Microscopic examination, Gram staining, Culture media- preparation, pH adjustment, Making of culture plates, techniques of aseptic transfer, blood and urine culture. Antibiotic sensitivity tests. analysis of throat swab, sputum specimens, purulent exudates - Tuberculosis, Vibrio Cholera

UNIT – III Histopathology:

Tissue reception, labeling, fixation and section cutting, Preparation of paraffin blocks (Dehydration, clearing, embedding, blocking). Handling and care of microtome, types of microtome, sharpening of knives, and section cutting. Frozen section techniques - CO2 freezing, cryostat. Preparation of common stains. H & E, Congo red, methyl violet, Leishman stain, Giesma and staining techniques. Mounting of specimens, record keeping, indexing of slides.

UNIT – IV Immunology:

Agglutination tests, Haemagglutination tests, Precipitation tests and Flocculation tests, Tests for RA factor, CRP, ASO, VDRL, Widal, Hepatitis, HIV testing and EBV. Serum electrophoresis.

UNIT – V Laboratory Automation and Quality Control:

Functional components of clinical laboratories. Basic requirements of clinical laboratory technician. Maintenance of glassware and equipment. Quality assurance in a clinical laboratory. External QC and internal QC–Assessment-

Corrective and preventive actions. Clinical validation and accreditation. Equipment calibration. Automation - advantages over manual methods. Automated analyzers. Lab informatics and scientific data management system - record keeping, coding and indexing.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Demonstration all essential characteristics of a good lab technician and universal precautions of medical lab technology Learn other techniques like ELISA and autoanalyzer

REFERENCES:

1. Textbook of Biochemistry, West, E.S. and Todd, W.R., MacMillan, Germany, 1985.
2. Principles and Techniques of Practical Biochemistry, Keith Wilson & John Walker, Cambridge University Press, India.2005.
3. Praful. B. Godkar, Darshan. P. Godkar, Text book of Medical Laboratory Technology. Bhalani Publishing House. 2014
4. F.J.Baker, R.E.Silverton, Butterworth-Heinemann. Introduction to Medical Laboratory Technology. Butterworth- Heinemann. 2014.
5. Mayne. Clinical Chemistry in Diagnosis and Treatment. ELBS. 6th ed. 1994
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7. Todd & Stanford. Clinical Diagnosis and Management by Laboratory Methods. 16th ed. 2016.
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9. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod10.pdf
10. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod11.pdf

COURSE OUTCOMES:

- Perform the basic hematology techniques and undertake biochemical analysis of clinical samples
- Understand the tests performed in the clinical microbiology lab.
- Undertake histological analysis of samples
- Comprehend the basic techniques performed in clinical immunology laboratory.
- Know about quality control, lab accreditation and automation.

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