

**ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
CUDDALORE-1**



**PG & RESEARCH DEPARTMENT OF BIOCHEMISTRY
PG SYLLABUS 2019-2021**

PG&RESEARCH DEPARTMENT OF BIOCHEMISTRY

Minutes of the Board of Studies (14.03.19)

The members of the Board of studies recommended the following modifications to be carried out in the syllabus for UG, PG, value added course and Diploma course to be implemented from 2019 onwards

UG

INCLUSIONS

- In Cell biology paper, the topics to be included in Unit I -diffusion and facilitated diffusion and in Unit III, types of lysosomes, ribosomes and ER to be included along with their enzymes.
- In Biomolecules-II paper, phosphatidyl serine in Unit I and oxytocin in Unit V should be included.
- In Nutritional Biochemistry paper, the topic “Role of vitamins as antioxidants and cofactor” in Unit II, in Unit IV - Mineral toxicity with reference to iron & copper and in Unit V - Nutritional requirements in disease condition such as Hypertension and Diabetes mellitus to be included.
- In Allied paper-Biophysics, carbohydrate-classification and properties was included in Unit I and FTIR in Unit V.
- In Advanced Biochemistry paper, the topics to be included: tyrosinases in Unit IV, Obesity in Unit III and Lipid profile in Unit V.
- In the skill paper- First Aid, the topics Bandages- general rules of applying bandages and its types to be included in the Unit I and Smoking -hazards & prevention, alcoholic hallucinations & management in Unit II.
- New allied paper for Zoology “Allied Biochemistry” to be implemented from the year 2019.
- New skill elective paper “Office Automation & Designing” to be included for II year Biochemistry students from the batch 2018 onwards.

MODIFICATIONS

- In Biomolecules-I paper, the topic inversion of sucrose will be shifted from Unit II to Unit III.

- In Cell Biology paper, the topics in Unit I were rearranged—Active transport:sodium potassium, Ca^{2+} and ATPase pumps, passive transport: endocytosis and exocytosis.
- In Biophysics paper Unit I & II were rearranged after inclusion of new topics.
- For Iyr Microbiology, the allied Biochemistry practical will be split into two and the exams will be conducted semester wise from 2019 onwards.

DELETIONS

- In Biomolecules-I paper, in Unit I - scope & importance of Biochemistry, Kiliani synthesis in Unit II, in Unit III- introduction&inUnit V heme synthesis should be removed.
- In Cell Biology paper, in Unit I-introduction& classification of cell and liposomes, Unit II- Zellweger syndrome and Unit IV- structure & organization of chromatin should be removed.
- In Biomolecules II paper, Unit I -steroids & carotenoids, Unit II - definition and amino acids, unit IV-hydrazinolysis and in unit V- insulin and lipoprotein should be removed.
- In Nutritional Biochemistry paper, the role of iron in prevention of anemia removed from unit IV. Role of Vitamin A & E in antioxidant and visual cycle and Vitamin C as co-factor in amino acid metabolism removed from Unit III.
- In Biophysics paper, Unit II - biological functions of fibrous proteins, globular proteins and lipoproteins, pH dependent ionization of amino acids to be removed from Unit II.
- In Practical I, Estimation of chloride by Mohr's method should be removed.
- In allied paper-Advanced Biochemistry, the topic glycogen metabolism to be removed in Unit I and dehydration in Unit III and triglycerides in Unit V to be removed.
- In allied paper-Basic Biochemistry, stereoisomerism and optical isomerism in unit I and examples in saturated and unsaturated fatty acids in Unit V to be removed.

PG

INCLUSIONS

- The expert suggested that the following papers should be renamed as:
 - Enzymes -----Enzymology
 - Molecular physiology ----- Human physiology
 - Bioinformatics----- Bioinformatics & computational Biology
 - Advanced Clinical Biochemistry ----- Clinical Biochemistry & clinical research
 - Advanced Endocrinology ----- Endocrinology
 - Principles of cell biology ----- Cell Biology

- In Bio-organic chemistry paper, in Unit IV - the topic micro RNA to be added.
- In Cell Biology paper, new Unit IV with cell signalling topics & mTOR pathways to be created.
- In Intermediary metabolism paper, in Unit II - glycogen storage diseases in unit IV lipid storage diseases and in unit III - inborn errors of metabolism—PKU, Alkaptonuria and tyrosinosis to be included.
- In Clinical Nutrition paper, in Unit IV- the topic glycemic index, disorders of protein malnutrition in unit I, BOD-POD in unit II and nutritional dietary management on certain diseases in unit IV and in Unit V - Phytochemicals should be included.
- In MLT paper, in Unit II - the following topics MCH, MCHC & MCV to be included and Lipid profile, A/G ratio and HbA1C to be included in unit-IV.
- In enzymology, Purification and characterization of enzymes to be included in unit V.
- In Analytical Biochemistry, the topics LCMS, GCMS, ICPMS in unit IV and HPTLC, Column chromatography and its types to be included in Unit I.
- In Endocrinology paper, New unit IV was created for pancreatic hormones and Unit V for sex hormones.
- In plant Biochemistry, polyphenols, flavonoids and saponins to be included in unit IV.
- Question paper pattern changed from the batch 2019 onwards.

DELETIONS

- In cell biology paper, the topics Liposomes, orientation, lectins to be deleted from Unit I.
- In Intermediary metabolism paper, Unit II - the topic mTOR pathway to be removed.
- In Cell biology paper, Unit II - mitosis & meiosis, Unit V - genetic basis and onset of cancer, tumour suppressor gene products should be removed.
- In Clinical Nutrition, the topics metabolic and clinical complications and recent advances in the medical nutritional management to be removed.
- In Advanced Endocrinology paper, in Unit I - cell signalling pathway topics should be removed.
- In Analytical Biochemistry, the topics Principle, instrumentation and applications of colorimeter and FPLC to be deleted.

MODIFICATIONS

- In Bio-organic chemistry paper, the heading in Unit V - Nucleic acid in cell to be renamed as DNA- protein interaction.
- In Cell Biology paper, Unit I & Unit II are merged and in Unit V - the title topic has been changed to cell cycle and cell death.

- In Intermediary metabolism paper, the topic anaplerotic reaction in Unit II is shifted to Unit I
- In MLT paper, the topics in Unit IV to be rearranged.
- In Endocrinology paper, units I & V were rearranged
- **DMLT**

INCLUSIONS

- In practical III, Diagnostic enzymes- SGOT, SGPT & ALP to be included and Blood grouping shifted to hematology practical.

VALUE ADDED COURSE

WATER QUALITY ANALYSIS

INCLUSIONS

- Estimation of elements (any three like Fe, Cu, Mg) should be included.

As per the suggestions from the university nominee, subject expert, industry expert, alumnus and other members of the board, the following corrections were made in the new syllabus which to be implemented from the year 2019 onwards.

There is no change in the existing M.Phil syllabus as per experts' suggestions.

The above recommendations of the board of studies are placed before the Academic Council for its perusal and to be approved for its implementation.

The following members were present

- | | |
|--|-------------------------------|
| 1. Dr.P.MarieArockianathan | Chairman |
| Head of the Department | |
| 2. Dr.Hannah Rachel Vasanthi | University Nominee |
| Professor, Department of Biotechnology | |
| Pondicherry University, | |
| Pondicherry | |
| 3. Dr.C.Sankaranarayanan | Member(subject expert) |
| Asst.Professor, | |
| Department of Biochemistry & Biotechnology | |
| Annamalai University | |
| Chidambaram | |
| 4. R.Priyanka | Member (Alumni) |
| Asst.Professor, Prist University | |
| Pondicherry | |

5. **Mr.P.Hari Narayanan** **Member (Industry)**
Senior Manager, QA
Solara Active Pharma Sciences
Cuddalore
- Dr.S.Celine Hilda Mary** **Member**
Assistant professor
6. **Mrs.D.Leema Rose Mary** **Member**
Assistant professor
7. **Mr.A.Lawrence** **Member**
Assistant professor
8. **Mr. John Robert** **Member**
Assistant professor
9. **Miss.R.Anitha** **Member**
Assistant professor
10. **Mrs.S.Seethalakshmi** **Member**
Assistant professor
11. **Dr.K.Shagirtha** **Member**
Assistant professor
12. **Dr.S.Silvan** **Member**
Assistant professor
13. **Dr. R.Ramakrishnan** **Member**
Assistant professor
14. **Dr.N.Priya** **Member**
Assistant professor

M.Sc BIOCHEMISTRY
M.Sc DEGREE COURSE IN BIOCHEMISTRY
(With effect from 2019)

PROGRAMME OUTCOMES (PO)

1. The Students are groomed to acquire professional skills in their respective domains.
2. The Students are encouraged to climb the academic ladder by pursuing Research Programme.
3. The Inherent Skills of the Students are transformed into Employability and Entrepreneurial Opportunities.
4. Graduates are trained to keep in pace with the rapidly changing technological frontiers.
5. The Students evolve into intellectually, ethically and socially ideal citizens of the Nation.

PROGRAMME SPECIFIC OUTCOME (PSO)

1. Students are able to exhibit their knowledge and in depth understanding of fundamentals principles in biochemistry such as structure and functions of biomolecules, metabolism and regulation of biochemical process.
2. Students are trained to acquire skill in the biochemical techniques and able to demonstrate their scientific skill in both experimentation and in real life situations.
3. Students are instilled with ability to approach in each every biological process or research with moral, ethical and scientific reasoning.
4. Students are prepared to communicate their ideas and thoughts effectively and also apply their critical scientific approach in their knowledge development.
5. Students are encouraged to acquire knowledge and skill throughout their life in order to meet the ever changing scenario in the society/challenges in the society.
6. Students are prepared to articulately interpret and predict various cause and effect relationship in biological process or research.

7. Students are entrusted to work independently to enrich their skill & knowledge through various activities like Seminar, Assignment, Quiz etc..
8. Students are empowered to gain effective skill for their future growth with existing knowledge to identify their career in diverse fields.

MSc BIOCHEMISTRY
M.Sc DEGREE COURSE IN BIOCHEMISTRY
(With effect from 2019)

Semester	Sub. Code	Subject Title	Hrs	Cr	Exam hrs	
First	19BC11	Main Paper – I(Bio organic chemistry)	5	4	3	
	19BC12	Main Paper – II(Cell biology)	5	4	3	
	19BC13	Main Paper–III(Intermediary Metabolism)	5	4	3	
	19EPB14A	Elective Paper–I	Clinical Nutrition	5	4	3
	19EPB14B		Medical lab Technology			
	PBCP101	Main Practical – I		8	6	6
		Seminar/paper presentation/library		2		
		Total		30	22	
Second	19PBC21	Main Paper – IV Molecular biology	5	4	3	
	19PBC22	Main Paper – V Enzymology	5	4	3	
	19PBC23	Main Paper – VI Analytical Biochemistry	5	4	3	
	19PBC24A	Elective Paper – II	Plant biochemistry	5	4	3
	19PBC24B		Endocrinology			
	PBCP202	Main Practical – II		8	6	6
		Seminar/paper presentation/library		2		
		Total		30	22	
Third	19PBC31	Main Paper –VII Clinical Biochemistry and Clinical Research.	5	4	3	
	19PBC32	Main Paper –VIII Immunology	5	4	3	
	19PBC33	Main Paper–IX Biotechnology	5	4	3	
	19PBC34A	Elective	Developmental & Inheritance	5	4	

		Paper III	Biology			3
	19PBC34B		Bioinformatics & computational biology.			
	PBCP303	Main Practical – III		8	6	6
	ECHR901S	Human Rights		2	1	3
	19SPBC31	SSC* optional –extra credit			2	
		Total		30	23	
Fourth	19PBC41	Main Paper – X Human physiology		5	4	3
	19PBC42	Main Paper – XI Research methodology and Biostatistics		5	4	3
	19EPB43A	Elective	Pharmacology	5	4	3
	19EPB43B	Paper– IV	RecombinantDNA Technology)			
	JPBC1016	Project work		15	11	
		Total		30	23	
	Total credits			90		

YEAR-I	BIO-ORGANIC CHEMISTRY (75 hrs) For the students admitted from the year 2019	19PBC11
SEMESTER-I		HRS/WK-5
CORE-I		CREDIT-4

Learning objectives:

- To provide information about biochemically important aspects of the Biomolecules .
- To understand the structure of biomolecules and its properties
- To know about the DNA-protein interactions and the techniques used to characterize it.

Course Outcomes:

CO1- To understand and acquire knowledge about the classification, structure, properties and biological importance of carbohydrates.

CO2- To gain knowledge about the different structural aspects of proteins and the allosteric nature of hemoglobin.

CO3- To acquire knowledge about the classification, structure and properties of lipids and its importance in physiological process.

CO4- To acquire the knowledge about the structure, types, properties and functions of DNA and RNA

CO5- Be familiar with important motifs involved in DNA-protein interaction and also gain technical skills in predicting the interactions.

SEMESTER II	SUB CODE: PBC701S					BIO-ORGANIC CHEMISTRY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	5	4	4	3	4	3	4	4	3	4	3	5	4	3.8
CO2	4	4	3	4	3	3	4	4	4	5	5	4	4	3.9
CO3	4	3	4	3	4	3	4	5	4	3	3	3	4	3.6
CO4	3	4	4	3	3	4	3	4	4	4	3	4	3	3.5
CO5	4	3	3	4	3	4	3	4	4	3	4	4	3	3.6
Mean overall score													3.7	

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	$0 \leq \text{rating} \leq 1$	$1.1 \leq \text{rating} \leq 2$	$2.1 \leq \text{rating} \leq 3$	$3.1 \leq \text{rating} \leq 4$	$4.1 \leq \text{rating} \leq 5$
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT-I CARBOHYDRATES [20 hrs]

Carbohydrates: classification-properties of monosaccharides and disaccharides. Polysaccharides: occurrence, structure and biological functions of cellulose, chitin, starch and glycogen. A brief account on fructans, arabinans and galactans, bacterial cell wall polysaccharides and blood group antigens. Glycosaminoglycans: structure and biological role of hyaluronic acid, chondroitin sulfate and heparin. Sialic acid – structure and significance, Proteoglycans and their biological importance. Receptor proteins.

UNIT-II PROTEINS [15 hrs]

Amino acids: classification, properties. Classification of protein. Orders of protein structure. Primary structure – determination of amino acid sequence of proteins. The peptide bond – Secondary structures – α -helix, β -sheet and β -turns. Pauling and Corey model for fibrous proteins. Reverse turns and super secondary structures. Tertiary structure. The Ramachandran plot. Collagen triple helix. Conformational properties of silk fibroin. Quaternary structure of proteins. The structure of hemoglobin. Models for hemoglobin allostery. Prions.

UNIT-III LIPIDS [10 hrs]

Lipids : Introduction, classification– structure and functions. Fatty acids – saturated, unsaturated and hydroxy fatty acids. PUFA, significance of omega 3 and 6 fatty acids. Phospholipids and glycolipids – structure and functions. Structure and functions of cholesterol. DHA in memory function, lipids as signal, cofactor and pigments. Lipoproteins – classification and composition.

UNIT-IV NUCLEIC ACIDS [15 hrs]

DNA double helical structure – Watson and Crick model. A, B and Z forms of DNA. DNA supercoiling and linking number. Properties of DNA – buoyant density, viscosity, denaturation and renaturation – The cot curve. Major classes of RNA – mRNA, rRNA, tRNA, snRNA, micro RNA, Sno RNA – structure and biological functions.

UNIT-V DNA -PROTEIN INTERACTIONS [15 hrs]

Salient features of nucleic acid recognition by proteins. DNA binding motifs in proteins – the basic helix loop helix (bHLH) motif, zinc finger, the leucine zipper and helix-loop helix. RNA binding motifs in proteins. Techniques characterizing nucleic acid-protein complex – gel retardation assay, DNase I foot printing, CHIP.

TEXT BOOKS:

2. Jain, J.L. & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition, S. Chand & Company, New Delhi.
3. Nelson, D.L. and Cox, M.M (2008). Lehninger Principles of Biochemistry. 5th Edition, W.H. Freeman and Company, New York.
4. Zubay, G. (1999). Biochemistry, 4th Edition, WCB. McGraw-Hill, New York.

REFERENCES:

1. Victor W. Rodwell, Harpers Illustrated Biochemistry 30th Edition Paper back– Import, 1 Jan 2015.
2. Donald Voet, Judith, G. Voet, and Charlotte, W Pratt, (2008). Fundamentals of Biochemistry, 3rd Edition. John Wiley & Sons, New Jersey.
3. Berg, J. M., Tymoczko, J. L. and Stryer, L. Biochemistry. Freeman, 7th edn, 2011.
4. Text book of biochemistry (1997) 4th edition Thomas M devlin, A John Wiley, Inc publication, New York.
5. Bery J.M., Tymoezko J.L. and Stryer L. (2008) Biochemistry, 5th Edition, W.H. Freeman and Company, New York
6. Murray, K.R. Granner, K.D. Mayes, P.A. and Rodwell W.V. (2009). Harper's Biochemistry. 23rd Edition, Prentice Hall International Inc., New Jersey.

YEAR-I	CELL BIOLOGY (75 hrs) For the students admitted from the year 2019	19PBC12
SEMESTER-I		HRS/WK-5
CORE-II		CREDIT-4

Learning objectives:

- To understand the structure and purpose of the basic components of the Cell and its organelles
- To understand the vast networks of communication that occurs between and within each cell in our body.
- To acquire knowledge about microfilaments and microtubules and the components involved in cell- cell interaction
- To know the mechanism of cell cycle, cell death and genes to inhibit cancer.

Course Outcomes:

CO1: To gain in-depth knowledge about the structure and functions of various cell organelles, membrane and the techniques involved in visualization.

CO2: Able to understand the cell - cell interactions and the functional aspects of their components.

CO3: Able to understand the structure, functions and organization of microfilaments and microtubules.

CO4: To gain in-depth knowledge about the various mechanisms involved in cell signaling process.

CO5: To acquire knowledge and understand the different phases of cell cycle apart from types and tumorigenic properties of cancer.

SEMESTER II	SUB CODE: NEW CODE					CELL BIOLOGY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	5	3	3	4	4	4	4	5	4	4	3	4	4	3.9
CO2	5	4	3	4	4	3	3	4	4	4	3	4	4	3.8
CO3	4	4	3	4	4	4	4	4	4	5	4	3	4	3.9
CO4	3	4	4	3	4	3	4	3	3	4	3	4	3	3.5
CO5	4	3	4	4	3	3	4	3	4	3	3	5	4	3.6
Mean overall score													3.7	

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT I Biomembrane and Organelles [25 hrs]

Structure and functions of organelles: nucleus, mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes, Ribosomes & peroxisomes. Membrane - Models, Membrane lipids: fluidity, asymmetry and phase transition. Membrane proteins - Types, proteins on RBC membrane, Purification of subcellular organelles, Bright field microscopy, phase contrast microscopy, SEM, TEM, AFM, FACS-Principle and applications. Marker enzyme for different organelles.

UNIT II Cell – adhesion and cell cell interaction [15 hrs]

Cell-Cell interaction: - ECM; Collagen, hyaluronan & proteoglycans, laminin, integrins and fibronectins. Cell-Cell adhesion: Specialised junctions -- Desmosomes, Gap junctions, tight junctions Adhesion molecules - Cadherins - Connexins.

UNIT III Cell Organization and Movement [10hrs]

Microfilaments, Actin – Structures, Assembly and disassembly. Microtubules – structure and composition. Microtubular associated proteins, MTOCs, Cilia and Flagella - Structure and functions, Intermediary filaments.

UNIT I V Cell signalling [15hrs]

Cell surface receptor and signalling pathways – cell surface receptors, signal transduction and second messengers –adenylate cyclase system, cAMP, G-protein coupled receptors. G-protein as cellular transducer, inositol triphosphate and calcium, DAG and NO, ion channels, Signal transmission via Ras proteins and MAP kinase pathways. Crosstalk in signaling pathways. mTOR pathways.

UNIT V Cell cycle & cell death [10hrs]

Overview of cell cycle and its control. Checkpoints in cell cycle regulation. Apoptosis (Programmed cell death) - Pathways, regulators & effectors in apoptosis and necrosis. Cancer: types & properties of cancer cells. Tumor suppressor genes-functions .

TEXTBOOKS:

1. Harvey Lodish. W. H. Freeman; Sol edition (2007), Molecular cell Biology
2. Alberts 2002. Molecular Biology of the Cell 4th ed. Garland Sci.
3. Karp, G. Cell 2010, Molecular Biology: Concepts and Experiments, 6th edn, Wiley.

REFERENCES:

1. Robert Murray, Bender, (2012) Harper's Illustrated Biochemistry. McGraw Hill
2. De Robertis and De Robertis. Cell and Molecular Biology. Lea and Febiger 8th ed.
3. Nelson, D.L. and Cox, M.M (2008). Lehninger Principles of Biochemistry. 5th Edition, W.H. Freeman and Company, New York
4. Kelein Smith, and M Kish, (1995). Principles of cell biology, 2nd Edition, Harper and Row Publisher.

YEAR-I	INTERMEDIARY METABOLISM (75 hrs) For the students admitted from the year 2019	19PBC13
SEMESTER-I		HRS/WK-5
CORE-III		CREDIT-4

Learning objectives:

- ❖ To provide students with an appreciation and an understanding of key metabolic pathways of various biomolecules.
- ❖ To give insights to various pathways -how it generates energy and performs cellular work.
- ❖ To gain skills to interpret how the pathways are regulated by various metabolic and hormonal changes.

Course Outcomes:

CO1: To gain insights about the biological oxidation process, high energy compounds and key carbohydrate metabolic pathways such as glycolysis, TCA and ETC.

CO2: To understand the key metabolic steps involved in various pathways of carbohydrate metabolism.

CO3: To gain knowledge about the metabolic pathways of amino acid metabolism and its related inborn errors.

CO4: To gain knowledge about the metabolic pathways of lipid metabolism and its storage diseases.

CO5: Able to understand and interpret the metabolic pathways of nucleic acid metabolism and nucleotide coenzymes.

SEMESTER II	SUB CODE: NEW CODE					INTERMEDIARY METABOLISM								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	3	4	3	4	5	4	4	3	4	4	3	4	3.8
CO2	3	3	3	4	4	4	4	4	3	4	3	4	3	3.5
CO3	4	4	4	5	3	4	4	3	3	4	4	4	3	3.8
CO4	3	4	5	4	4	3	3	4	4	3	3	4	4	3.7
CO5	3	4	3	4	3	3	4	5	4	3	4	4	4	3.7
Mean overall score													3.7	

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	$0 \leq \text{rating} \leq 1$	$1.1 \leq \text{rating} \leq 2$	$2.1 \leq \text{rating} \leq 3$	$3.1 \leq \text{rating} \leq 4$	$4.1 \leq \text{rating} \leq 5$
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT I **BIOENERGETICS** [15 hrs]

Biological oxidation-reduction reactions, redox potentials, High energy phosphate compounds – phosphate group transfer, Glycolysis-regulation and energetic- PDH complex-citric acid cycle, regulation and energetic.ETC–oxidative phosphorylation-regulation and inhibition- uncouplers.

UNIT II **CARBOHYDRATE METABOLISM** [15 hrs]

Pentose phosphate pathway. Gluconeogenesis, glycogenesis & glycogenolysis metabolism - regulation, glyoxylate cycle and Gamma aminobutyrate shunt pathways, Cori cycle, anapleurotic reactions, glucuronate pathway. Hormonal regulation of carbohydrate metabolism. Glycogen storage diseases

UNIT III **AMINO ACID METABOLISM** [15 hrs]

Amino Acids – General reactions of amino acid metabolism - Transamination, decarboxylation, oxidative & non-oxidative deamination of amino acids.Catabolism of carbon skeletons of amino acids tyrosine and aliphatic amino acids. Urea cycle and its regulation. In born errors of metabolism-PKU,Alkaptonuria, Tyrosinosis.

UNIT IV **LIPID METABOLISM** [15 hrs]

Introduction, hydrolysis of tri-acylglycerols, α -, β -, ω - oxidation of fatty acids. Oxidation of odd numbered fatty acids ,PUFA– fate of propionate, role of carnitine, degradation of complex lipids. Fatty acid biosynthesis, Energetics of fatty acid cycle.Acetyl CoA carboxylase, fatty acid synthase, biosynthetic pathway for tri-acylglycerols, phosphoglycerides and sphingomyelin .Metabolism of cholesterol and its regulation.lipid storage diseases

UNIT V **NUCLEIC ACID METABOLISM** [15 hrs]

Nucleotides – Biosynthesis of Purines (de nova and salvage) and biosynthesis of Pyrimidines - catabolism and regulation of purine and pyrimidine biosynthesis. Biosynthesis of NAD^+ / NADP^+ and FAD^+ .

TEXT BOOKS:

1. Nelson, D. L. & Cox, M. M. Lehninger Principles of Biochemistry. Freeman, 5th edn, 2008

2. U.Sathayanarayana,(2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.
3. Jain, J.L & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.

REFERENCES:

1. Berg, J. M., Tymoczko, J. L. and Stryer, L, 2011. Biochemistry. Freeman, 7th edn,
2. Zubay, Biochemistry” 1998, 4th ed. William C. Brown Publication,
3. Voet, D. & Voet, 2010. J. G. Biochemistry. 4th edn,
4. Victor W. Rodwell, 2015. Harpers Illustrated Biochemistry 30th Edition Paper back— Import, 1 Jan
5. West, E.S. and Todd, W.R., 1985, Textbook of Biochemistry, MacMillan, Germany.

YEAR-I	CLINICAL NUTRITION (75 hrs) For the students admitted from the year 2019	19EPB14A
SEMESTER-I		HRS/WK-5
ELECTIVE-I		CREDIT-4

Learning objectives

- ❖ To study the nutritional aspects of various foodstuffs and its measurement.
- ❖ To study the functional aspects of vitamins and minerals.
- ❖ To understand the nutritional management of diet in different age groups and diseases.
- ❖ To learn and gain knowledge about the functional foods.

Course Outcomes:

CO1: Students gain knowledge about diet and different nutritional disorders.

CO2: To understand and gain knowledge about different types of nutritional measurements.

CO3: Students are able to comprehend the daily requirements of vitamins & minerals.

CO4: Students are able to demonstrate and exhibit different dietary plan for different age groups & disease condition.

CO5: Students are able to gain knowledge about importance of nutraceuticals and antioxidants in human health.

SEMESTER II	SUB CODE: NEW CODE					CLINICAL NUTRITION								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	3	5	2	2	3	3	5	5	3	5	4	3.7
CO2	5	4	4	3	2	2	3	4	5	3	4	3	3	3.5
CO3	4	3	3	2	2	5	3	3	3	3	5	5	3	3.4
CO4	3	3	4	5	2	2	5	4	4	2	5	5	4	3.7
CO5	4	3	4	5	2	5	3	4	3	5	5	3	3	3.8
Mean overall score													3.6	

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT-1 NUTRITIONAL DISORDER [15 hrs]

Introduction: Diet-composition, fibre in diet. Disorders associated with protein metabolism-marasmus and kwashiorkor, Biological value of proteins, Chemical score. Fats: sources-essential and non-essential fatty acids-disorders concerned with fatty acid metabolism-Refsum's disease, atherosclerosis, and fatty liver.

UNIT II BASAL METABOLIC RATE [15 hrs]

Basal metabolic rate-factors affecting BMR-determination of BMR, direct and indirect methods-Benedict's Roth apparatus-respiratory quotient, BOD. SDA, Anthropometry: height, weight, skin fold thickness and arm circumference and their importance in nutrition. BOD, POD.

UNIT III VITAMINS & MINERALS [15 hrs]

Vitamins-Classification, fat soluble and water soluble vitamins-source, daily requirements, functions and deficiency manifestations. Micro, Macro and trace elements- daily requirements, functions and deficiency manifestations.

UNIT IV NUTRITIONAL MANAGEMENT [15 hrs]

Objectives of diet therapy-regular diet and rationale for modifications in energy and other nutrients, texture-fluid, soft diets etc. Glycemic index. Nutritional management of: obesity, cardiovascular diseases, Diabetes mellitus, Renal disorders and neurological disorders (Parkinson's disease, Alzheimer's disease). Nutrition at different stages of life-during infancy, adolescence, pregnancy, lactation and old age.

UNIT V Recent advances in clinical nutrition [15 hrs]

Neutraceuticals: Adverse effects of neutraceuticals. Functional foods-Health benefits of functional foods in Immune function & mental health. Probiotics and prebiotics-Types & Health benefits. Antioxidants-Role of antioxidants in human health, Phytochemicals (polyphenols, flavonoids & terpenes).

TEXTBOOKS:

1. M. Swaminathan,1987, "Food and Nutrition Vol I&II", Second edition, Bangalore, Bappco Publishers.
2. Mahan ,L. KandEscott-Stump ,S (2000):Krause's Food Nutrition and Diet therapy,10thed, W-13 Saunders Ltd
3. U.Sathayanarayana,(2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.

REFERENCES:

1. Williams, SR(1993):Nutrition and Diet Therapy,7thed, Times Mirror/Mosby College Publishing
2. Shills,ME,Olson,JA,Shike,M and Ross,A.C(1999):Modern Nutrition in Health and Disease,9thed,A.Vaiiams and willons
3. Davidson and Passmore(2000):Human Nutrition and Dietetics
4. Anthony A.Albanase(1972),Newer Methods of Nutritional Biochemistry, Academic Press
5. Patricia Trueman, 2007, "Nutritional Biochemistry" (I edition), Chennai, MJ publishers
6. M.N Chatterjea and RanaShinde," Text book of Medical biochemistry",4th edition, Jaypee Publishers, New Delhi

YEAR-I	MEDICAL LAB TECHNOLOGY (75hrs) For the students admitted from the year 2019	19EPB14B
SEMESTER-I		HRS/WK-5
ELECTIVE-I		CREDIT-4

Learning objectives:

- ❖ To impart basic knowledge of biochemistry, apparatus, units, equipment, and analysis in the Clinical Biochemistry.
- ❖ To discuss the laboratory test and diagnosis of various blood components
- ❖ To learn about various histotechniques, handling and processing of tissue specimens as well as staining procedures.
- ❖ To learn the different culturing techniques and its identification methods.

COURSE OUTCOMES:

CO1: To learn about the handling of the laboratory equipments and also know about how to collect and preserve the biological samples.

CO2: To gain the knowledge about to accessing various blood components and predict its clinical significance.

CO3: To acquire the knowledge and skill about various steps involved in the histopathological techniques.

CO4: To understand the importance of various biochemical parameters and its clinical significance.

CO5: To learn the basic skills of microbial culture and its safety measures.

SEMESTER II	SUB CODE: NEW CODE					MEDICAL LAB TECHNOLOGY								HOURS:4 CREDITS:3
	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	5	4	3	5	4	3	5	4	4	5	5	4	3	4.2
CO2	4	4	5	4	3	5	3	5	4	3	4	3	4	3.9
CO3	4	3	4	3	4	4	5	4	3	5	3	4	3	3.8
CO4	4	5	3	4	3	4	4	3	3	5	4	5	4	3.9
CO5	3	5	4	4	3	4	4	5	4	5	4	3	5	4.2

Mean overall score	4.0
---------------------------	------------

This course is having **HIGH** association with programme outcome and programme specific outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT-I LABORATORY CARE AND INSTRUMENTATION [15 hrs]

Automation in clinical lab: Instrumental concept, selection of instrument, quality assurance, control of pre analytical and analytical variables. Internal and external quality control measurements. Collection and preservation of samples.

UNIT-II HEMATOLOGY [15 hrs]

Blood grouping and Rh factor, cross matching, clotting time, bleeding time, hemoglobin estimation, total count-RBC count and WBC count, Differential WBC count, MCHC, MCH, MCV. Erythrocyte Sedimentation Rate (ESR), Hematocrit value (Packed Cell Volume). Screening test-HIV, HBs Ag, TPHA. Platelet and its significance, Coombs test.

UNIT-III CLINICAL PATHOLOGY [15 hrs]

Brief outline of histopathology: Tissue cutting, fixation, embedding, tissue slicing by microtome, slide mounting and staining techniques.

UNIT-IV CLINICAL BIOCHEMISTRY [15 hrs]

Biochemical parameters::Blood glucose, HbA1c, urea, uric acid, lipid profile, total protein, albumin test, A/G ratio, normal values and their significance. Enzymes: SGOT, SGPT, serum alkaline and acidic phosphates, amylase, lactic dehydrogenase test, normal values and their significance. Electrolytes: sodium, potassium, calcium, phosphorous - its role and abnormalities.

UNIT-V MICROBIOLOGY [15 hrs]

Culturing of organisms from various specimens, culture media and antibiotic sensitivity test (pus, urine, blood, sputum, throat swab). Gram stain, Ziehl-Neilson staining (TB, Lepra bacilli). Safety procedure in microbiological techniques.

TEXTBOOKS :

1. Kanai L. Mukherjee, Medical Laboratory Technology Vol. I. Tata McGraw Hill 1996, New Delhi.
2. Gradwohls, 2000. Clinical laboratory methods and diagnosis ed. Alex. C.
3. Sonnenwirth & Leonard Jarret. M.D.B.I. Publications, New Delhi,

REFERENCES

1. Henry, John Bernard, Todd Sanford and Davidson, 2002. Clinical diagnosis and management by laboratory methods. W.B. Saunders & Co.
2. Fischbach Francis A, 2003. Manual of laboratory and diagnostic tests.
3. Philadelphia, J.B. Lippincott & Co, N.Y.
4. Sood, R, 2005, Medical Laboratory methods and interpretation, Jaypee Brothers Medical Publications, New Delhi.

YEAR-I	MOLECULAR BIOLOGY (75 hrs) For the students admitted from the year 2019	19PBC21
SEMESTER-II		HRS/WK-5
CORE-IV		CREDIT-4

Learning objectives:

- ❖ To teach the life processes at the sub cellular and molecular level.
- ❖ To discuss central dogma of molecular biology in depth.
- ❖ To make them learn various repair processes involved in DNA damage.
- ❖ To explain various transposable elements, stress proteins and membrane fusion proteins and their function.

Course Outcomes:

CO1: To understand the basic concepts of molecular biology and its central dogma apart from gene transfer mechanism in microorganism

CO2: To acquire in-depth knowledge of the factors involved in prokaryotic and eukaryotic replication process.

CO3: To gain appropriate knowledge about transcription process and its modifications and also get cleared insight of operation/regulation of different operons.

CO4: To acquire sufficient knowledge and skill about the features and decoding of genetic code and also understand the translation process in prokaryotes and eukaryotes.

CO5: To understand the mechanism of DNA repair and its types and gain significant knowledge about protein targeting, HSPs and transposons.

SEMESTER II	SUB CODE: PBC805S					MOLECULAR BIOLOGY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	3	5	4	3	5	4	4	3	3	4	3	3.7
CO2	3	4	3	4	3	5	3	4	4	3	4	3	4	3.6
CO3	4	3	4	3	4	4	5	4	3	5	3	4	3	3.8
CO4	4	5	3	3	3	4	4	3	3	4	2	5	4	3.6
CO5	3	3	2	4	3	4	4	3	3	3	4	3	3	3.2
Mean overall score													3.6	

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	$0 \leq \text{rating} \leq 1$	$1.1 \leq \text{rating} \leq 2$	$2.1 \leq \text{rating} \leq 3$	$3.1 \leq \text{rating} \leq 4$	$4.1 \leq \text{rating} \leq 5$
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT-I CHROMOSOME [20 hrs]

DNA-genetic material-Griffith, Avery et al and Hershey and Chase experiment value ,C value paradox, Cot value, organization of chromosomes and nucleosomes, Euchromatin, heterochromatin, centromeres and telomeres, central dogma of molecular biology , mitochondria and chloroplast DNA-Gene transfer in microorganisms-conjugation-Hfrtransfer,chromosomal transfer and the mediation by F plasmids, transformation-competence, transduction .Repetitive DNA-Highly repetitive moderately repetitive and unique DNA sequences, Satellite DNA, Telomerase. Overlapping genes.

UNIT -II REPLICATION [15 hrs]

Replication-conservative and semiconservative- experimental proof for semiconservative replication-factors involved in prokaryotic and eukaryotic replication-DNA polymerases in prokaryotes and eukaryotes-inhibitors of replication-replication of circular DNA and linear DNA. Sigma & Theta replication.Mitochondrial replication.

UNIT-III TRANSCRIPTION AND GENE REGULATION [10 hrs]

Transcription-promoters, RNA polymerase in prokaryotes and eukaryotes-initiation, elongation and termination of transcription process -inhibitors of transcription, Group I& II introns, post transcriptional modification of mRNA, tRNA and rRNA, Antisense RNA .RNA editing.Operon concept- Lac, arabinose and trp operon.

UNIT-IV GENETIC CODE AND TRANSLATION [15 hrs]

Genetic code: features and deciphering of genetic code. Wobble hypothesis. Translation: activation of amino acids, initiation, elongation and termination process in prokaryotes and eukaryotes. Inhibitors of protein synthesis in prokaryotes and eukaryotes, post translational modification.

UNIT-V DNA REPAIR& TRANSPOSONS [15 hrs]

DNA repair- photoreactivation, Excision repair, Post replication and mismatch repair, base and nucleotide excision recombination and SOS repair. Protein targeting- Heat shock proteins, glycosylation; SNAPs and SNAREs, transposons, retroposons.

TEXT BOOKS:

1. Lewin B(2004):Genes VIII ,Oxford University Press,New York
2. Watson. J. D, Baker. T. A, Bell. S. P, Gann. A, Levine. M,Lodish. R. Molecular Biology of Gene. 5th The Benjamin /Cummings Pub. Co. Inc, 2003
3. Ajoypaul. 2007. Text book of cell and molecular biology. Books and allied. Kolkata,
4. Krebs.J.E.et. al., 2011, lewin'sgenes X (Ed:10), Jones and Baret publishers, US.
5. David Freifelder, 2008. Molecular Biology. (Ed: 2). Narosa Publications, New Delhi.
6. Twyman. 2003. Advanced Molecular Biology. Bios Scientific Publishers LTD. Oxford, UK.

REFERENCES:

1. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and James Darnell, J, 2012.Molecular Cell Biology ,7th edn, Freeman.
2. Weaver. R. F. 2005. Molecular Biology. 3rd ed. McGraw Hill publilcation.
3. WeaverR.F and Philip.P.W(1989):Genetics,WMCBrwnPublishing,USA
4. Nelson, D. L. & Cox, M. M. Lehninger, 2008.Principles of Biochemistry. 5th edn, Freeman.
5. Primrose (2001) - Principles of gene manipulation. 6th Edition Blackwell Scientific Publishers. UK
6. Karp, 2010. Cell and Molecular Biology: Concepts and Experiments. 6th edn, Wiley.
7. Alberts B. 2002. Molecular Biology of the Cell, (Ed: 3) Garland Science, NY.

YEAR-I	ENZYMOLOGY (75 hrs) For the students admitted from the year 2019	19PBC22
SEMESTER-II		HRS/WK-5
CORE-V		CREDIT-4

Learning objectives:

- ❖ To provide a deeper insight into the fundamentals of enzyme structure and function and kinetics of enzymes.
- ❖ To learn the regulation and inhibition of enzymes.
- ❖ It deals with current applications of enzymes and the methods of immobilization.

COURSE OUTCOMES (CO)

CO1-Students can able to gain knowledge about thermodynamic concepts involved in enzymatic reactions and classification of enzymes.

CO2- Able to understand the kinetics of the enzyme catalysed reaction using different plots.

CO3-To exhibit knowledge and understanding about the enzyme catalytic reactions in the active site with appropriate example

CO4- To understands the mechanisms of enzyme regulation and its allosteric effects with suitable examples.

CO5- Able to gain knowledge about the types of inhibition in enzyme catalysis, immobilization of enzymes and its applications.

SEMESTER II	SUB CODE: PBC806S					ENZYMOLOGY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	3	5	4	3	4	2	4	3	3	4	3	3.5
CO2	5	4	3	4	3	5	3	4	4	3	4	3	4	3.8
CO3	4	3	2	3	4	4	5	4	3	5	3	4	3	3.6
CO4	5	3	4	3	3	5	4	3	3	4	2	3	4	3.5
CO5	4	3	2	4	3	4	4	3	4	3	4	3	3	3.2
Mean overall score													3.5	

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	$0 \leq \text{rating} \leq 1$	$1.1 \leq \text{rating} \leq 2$	$2.1 \leq \text{rating} \leq 3$	$3.1 \leq \text{rating} \leq 4$	$4.1 \leq \text{rating} \leq 5$
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT I ENZYMES [20 hrs]

Introduction, Classification and Nomenclature of enzymes - General characteristics of enzyme activity, Factors affecting enzyme activity. First Law & Second Law of thermodynamics. ΔG , characteristics of free energy, entropy and enthalpy. Law of mass action - Zero and first order reaction.

UNIT II KINETICS OF ENZYME ACTION [15hrs]

Concept of ES complex, collision, transition state theories and energy of activation, derivation of Michaelis-Menten equation for uni-substrate reactions. Different plots for the determination of K_m , V_{max} and their significance. Turn over number. The rate of expression for Bisubstrate reactions for Ping Pong, random & ordered Bi-Bi mechanisms. Multienzyme complex and its function with reference to PDH.

UNIT III MECHANISM OF ENZYME ACTION [10hrs]

Acid-base catalysis, covalent catalysis, metal ion catalysis, proximity, orientation effect. Active site – definition, common features of active site – Investigation of active site structure – trapping ES complex, Use of substrate analogue. Modification of amino acid side chain by single chemical procedure. Strain & distortion theory. Lock and Key. Chemical modification of active site groups. Site directed mutagenesis of enzymes. Mechanism of action of chymotrypsin and lysozyme.

UNIT IV ENZYME REGULATION [15hrs]

General mechanisms of enzyme regulation, product inhibition. Reversible and irreversible. Covalent modifications of enzymes. Allosteric enzymes - positive and negative co-operatively with special reference to aspartate transcarbamoylase & Phosphofructokinase.

UNIT V INHIBITION AND APPLICATION [15hrs]

Irreversible, reversible- competitive, noncompetitive, uncompetitive inhibition. Kinetic differentiation and Graphical analysis- Suicide inhibition. Immobilized enzymes-methods of immobilization-applications of immobilized enzymes K_i , IC_{50} . Industrial enzymes and its application. Purification of enzymes and characterization of enzymes.

TEXT BOOKS:

1. Trevor Palmer, (2004). Enzymes. 5th edition, Affiliated East –West press (P)Ltd. New Delhi.
2. Dixon, E.C.Webb , (1979). Enzymes. 3rd Edition, CJRthorne and K.F.Tipton, Longmans Green & Co , London and Academic Press, New York.
3. Nicholas, C. Price , (1998).Fundamentals of Enzymology. 2nd Edition, Oxford UniversityPress. UK

REFERENCES

1. Zubay,1998“ Principles of Biochemistry”, 4th ed.. William C.Brown Publ.
2. Berg, J. M., Tymoczko, J. L. and Stryer, L. Biochemistry. Freeman, 7th edn, 2011.
3. Uhlig H.1998. Industrial enzymes and their applications. John Wiley,
4. Balasubramanian. 1998. Concepts in Biotechnology Universities Press (India) Ltd.,
5. Chapline, Bucke,,1990. “Protein Biotechnology,”1st edition, Cambridge University Press,
6. Marangoni ,2002. Enzyme kinetics. A modern approach, John Wiley.
7. Bohinski, R.C, 1987, Modern concepts in Biochemistry, Alllyn and Bascon Inc., Boston

YEAR-I	ANALYTICAL BIOCHEMISTRY (75 hrs) For the students admitted from the year 2019	19PBC23
SEMESTER-II		HRS/WK-5
CORE-VI		CREDIT-4

Learning objectives:

- ❖ To understand the bio analytical techniques along with their theory, working principal, common instrumentation and possible applications
- ❖ To develop the skills to understand the theory and practice of bio analytical techniques.
- ❖ To provide scientific understanding of analytical techniques.

Course Outcomes:

CO1: To gain knowledge about the Principle instrumentation and application of various types of chromatography and its interpretation.

CO2: To acquire knowledge about the principle preparation, instrumentation and application of different kinds of electrophoretic techniques.

CO3: To get in-depth understanding about the basic principle: types of rotors instrumentation and application of different types of centrifugation process.

CO4: Able to exhibit their knowledge about the principle, instrumentation and application of spectroscopic techniques.

CO5: Able to demonstrate their skills in basic concepts of radioactivity, its measurement and application.

SEMESTER II	SUB CODE: : NEW CODE					ANALYTICAL BIOCHEMISTRY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	3	5	3	4	5	4	5	4	5	4	4	5	4.2
CO2	4	4	4	5	4	3	5	3	4	5	3	5	4	4.1
CO3	3	4	5	3	3	3	4	5	4	5	4	3	5	3.9
CO4	4	5	4	5	4	4	4	3	5	3	3	5	4	4.1
CO5	5	3	4	5	4	3	5	4	3	5	4	4	5	4.2
Mean overall score													4.1	

This Course is having **VERYHIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT I CHROMATOGRAPHY [15 hrs]

Principle, instrumentation and applications of thin layer and gas chromatography. HPTLC, Column chromatography-packing, loading, elution and detection. Column chromatography and its types. Ion-exchange chromatography-preparation of resins, procedure and applications. Molecular exclusion chromatography-principle, gel preparation, operation and applications. Affinity chromatography- principle, materials, procedure and applications. HPLC- principle, materials, instrumentation and applications, UPLC, UHPLC and software's used to interpret chromatogram.

UNIT II ELECTROPHORETIC AND ELECTROCHEMICAL TECHNIQUES [15 hrs]

Electrophoresis: General principles. Support media. Cellulose acetate electrophoresis. Electrophoresis of proteins-native gels, SDS-PAGE, gradient gels, isoelectric focusing, 2-D PAGE. Detection, estimation and recovery of proteins in gels. Electrophoresis of nucleic acids- agarose gel electrophoresis, DNA sequencing gels.

UNIT III CENTRIFUGATION TECHNIQUES [10 hrs]

Centrifugation-principle, types of centrifuges, rotors-types, preparative centrifugation- types, instrumentation and applications. Analysis of subcellular fractions. Analytical ultracentrifuge-instrumentation and applications -sedimentation velocity and sedimentation equilibrium.

UNIT IV SPECTROSCOPIC TECHNIQUES [20 hrs]

Laws of absorption and absorption spectrum., UV-visible spectrophotometry and spectrofluorimetry. Flame spectroscopy- principle and applications of atomic absorption and flame emission. NMR, FTIR, mass spectroscopy-principle, instrumentation and application. LCMS, GCMS, ICPMS.

UNIT V RADIOISOTOPE TECHNIQUES [15 hrs]

Units of radioactivity. Detection and measurement of radioactivity- GM counter, solid and liquid scintillation counting, quenching and quench correction, scintillation cocktails and sample preparation. Cerenkov counting. Autoradiography. Applications of radioisotopes in biology. Radiation hazards and safety aspects.

TEXTBOOKS:

1. AvinashUpadhyaye, and NirmalendheNath, (2002). Biophysical Chemistry Principles and Techniques. 3rd edition, Himalaya Publishers,New Delhi.
2. Keith Wilson, and John Walker, (2010). Principles and Techniques of Practical Biochemistry. 7th edition, Cambridge University Press. UK.

REFERENCES:

1. Boyer, R. 2000.Modern Experimental Biochemistry. 3rd ed. Addison Wesley Longman,
2. Simpson CFA &Whittacker, M. Electrophoretic techniques.
3. Sambrook, 2001.Molecular Cloning. Cold Spring Harbor Laboratory.
4. Friefelder and Friefelder, 1994. Physical Biochemistry – Applications to Biochemistry andMolecular Biology. WH Freeman & Co.
5. Pavia, 2000. Introduction to Spectroscopy. 3rd ed. Brooks/Cole Pub Co.

YEAR-I	ENDOCRINOLOGY (75 hrs) For the students admitted from the year 2019	19EPB24B
SEMESTER-II		HRS/WK-5
ELECTIVE-II		CREDIT-4

Learning objectives:

- ❖ To provide students with a broad understanding of the major human endocrine glands and their hormones, together with understanding hormones action and their effect on target cells.
- ❖ To provide students with an understanding of the medical conditions resulted from abnormal hormone secretion and the laboratory tests that are used to diagnose these conditions

COURSE OUTCOMES:

CO1:To gain the knowledge about the functions of pituitary, hypothalamus and pineal gland hormones and its regulations.

CO2:To learn and understand the structure and functions of thyroid, parathyroid hormones and its regulations.

CO3:To understand the structure and functions of gastrointestinal and pancreatic hormones.

CO4:To acquire the knowledge about the structure and functions of adrenal hormones and its regulation.

CO5:To gain the knowledge about the structure and functions of male and female sex hormones and its regulation.

SEMESTER II	SUB CODE: : NEW CODE					ENDOCRINOLOGY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	3	4	4	4	4	3	5	4	5	3	4	3.9
CO2	3	3	4	4	3	3	4	3	4	4	5	2	4	3.5
CO3	4	4	5	3	3	4	3	4	3	4	3	4	3	3.6
CO4	4	5	4	3	3	3	4	3	4	4	4	3	4	3.7
CO5	3	4	4	3	3	5	4	4	4	3	4	3	3	3.6
Mean overall score													3.7	

This course is having **HIGH** association with programme outcome and programme specific outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT I HYPOTHALAMIC, PITUITARY & PINEAL GLAND HORMONES [20hrs]

Definition & Classification - Mechanism of hormone action .Definition of signals, ligands and receptors, endocrine, paracrine and autocrine signalling. Pituitary Hormones: Anatomy of pituitary gland, hormones of the pituitary, Hypothalamic releasing factors, Anterior pituitary hormones: biological actions, regulation and disorders of growth hormones, ACTH, gonadotrophins prolactin and Leptin. Posterior pituitary hormones: vasopressin and Oxytocin- biological actions, regulation and disorders, MSH. Pineal gland - melatonin hypothesis, melatonin secretion and circulation, proposed role of pineal gland and mechanism of action.

UNIT II THYROID & PARATHYROID HORMONES [15 hrs]

Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions. Antithyroid agents. Parathyroid hormone - Synthesis, Secretion and biological actions. Calcitonin and calcitriol - Hormonal regulation of calcium and phosphate metabolism. Hypercalcemia and hypocalcemia, Rickets and osteomalacia

UNIT III ADRENAL & GASTRO INTESTINAL HORMONES [15 hrs]

Adrenal gland structure. Adrenal cortical hormones - Synthesis, regulation, transport, metabolism and biological effects. Cushing's syndrome, aldosteronism, congenital adrenal hyperplasia, adrenal cortical insufficiency. Adrenal medullary hormones – synthesis, secretion, metabolism, regulation and biological effects of catecholamines. Pheochromocytoma .

G.I. Tract hormones – chemical nature & functions of Gastrin, Enterogastin, Secretin & Cholecystokinin

UNIT-IV PANCREATIC HORMONES [10 hrs]

Pancreatic hormones – cell types of islets of langerhans -synthesis, regulation, biological effects and mechanism of action of glucagon and insulin. Somatostatin, leptin, Adiponectin, Pancreatic polypeptide and Ghrelin.

UNIT V SEX HORMONES [15 hrs]

Male sex hormones: Biosynthesis, regulation, transport, metabolism and biological actions of androgens. Hypogonadism and gynecomastia.

Female sex hormones: Biosynthesis, regulation, transport, metabolism and biological effects of oestrogen and progesterone. The menstrual cycle. Amenorrhoea.

TEXT BOOKS:

1. Robert Murray, Bender, (2012) Harper's Illustrated Biochemistry.
2. Williams Textbook of Endocrinology – Wilson and Foster 8th ed.
3. Devlin, 1997, Textbook of Biochemistry (with clinical correlation), John Wiley, USA.

REFERENCES:

1. Principles of Biochemistry – Mammalian Biochemistry – Smith. McGraw Hill 7th ed
2. Nelson, D. L. & Cox, M. M, 2008. Lehninger Principles of Biochemistry. 5th edn, Freeman.
3. Wilson and Foster, 1992, Textbook of Endocrinology, (8th edn), W.B. Saunders, USA.
4. Mac. E. Hadley and Jon. E. Levin, 2009, Endocrinology 6th ed., Darling Kindersly Pvt. Ltd., India
4. Guyton, A.C. and Hall, J.E (2006), Textbook of Medical Physiology, 11th Edition, Saunders Co. Pennsylvania.

YEAR-I	PLANT BIOCHEMISTRY (75 hrs) For the students admitted from the year 2019	19EPB24A
SEMESTER-II		HRS/WK-5
ELECTIVE-II		CREDIT-4

Learning objectives:

- ❖ To acquire knowledge of the chemistry of important biological processes in plants.
- ❖ To acquire knowledge about photosynthesis, metabolism of nitrogen compounds and about molecular mechanisms of signalisation and regulation.
- ❖ To acquire knowledge about the importance of secondary metabolites and stress metabolism.

Course Outcomes (CO)

CO1- Able to gain knowledge about the different components of plant cells apart from mechanism of absorption by plants.

CO2- To get in-depth knowledge about the functions and mechanisms of different plant hormones.

CO3- To acquire knowledge about the steps and mechanisms involved in photosynthesis of plants.

CO4- To know and interpret the different secondary metabolites present in the plants and its stress adaptation.

CO5- To gain thorough understanding about the nitrogen fixing mechanisms adopted by the soil microbes.

SEMESTER II	SUB CODE: EPBC808A					PLANT BIOCHEMISTRY								HOURS:4 CREDITS:3
	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	3	5	4	3	4	3	4	5	4	3	4	3.8
CO2	5	3	4	4	3	4	5	4	3	4	5	4	3	3.9
CO3	4	4	3	3	4	5	3	4	3	4	5	3	4	3.8
CO4	5	3	3	4	3	3	5	3	4	3	4	4	3	3.6
CO5	4	4	3	4	4	5	4	4	4	3	4	3	4	3.8
Mean overall score													3.8	

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
--------------------	---------------	----------------	----------------	----------------	-----------------

Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT I PLANT CELL & ABSORPTION [10 hrs]

Discovery and definition of plant cell – cell wall, plasmodesmata, meristematic cells, and secretory systems. Mechanism of absorption .Ion exchange passive absorption. Active absorption .The carrier concept.Donnan’s equilibrium.

UNIT II PLANT HORMONES [10 hrs]

Structure, biosynthesis, mode of action & physiological effects of auxins, gibberellins, cytokinins and IAA.Biochemistry of seed dormancy, seed germination,fruit ripening and senescence.Synthetic seeds.

UNIT III PLANT PIGMENTS & PHOTOSYNTHESIS [20 hrs]

Structure & synthesis of chlorophyll, phycobilins and carotenoids. Photosynthesis photosystem –I & II-Light absorption, Hill reaction, Red drop & Emerson’s enhancement effect. Cyclic and non-cyclic photophosphorylation, calvin cycle. Photosynthesis – factors and regulation. Chloroplast ATP synthase, complexes associated with thylakoid membranes, and light harvesting complexes. C3, C4 pathway and CAM.

UNIT IV SECONDARY METABOLITES & STRESS METABOLISM [15 hrs]

Secondary metabolites in plants – classification & function of alkaloids, terpenoids, tannins, polyphenols, flavanoids, saponins, lignin and pectin. Stress metabolism in plants - Environmental stresses, salinity, water stress, heat, chilling and their impact on plant growth. Heavy metals, radiations and their impact on plant growth, criteria of stress tolerance.

UNIT V NITROGEN FIXING ORGANISMS [20hrs]

Nitrogen fixing organisms: Structure and mechanism of action of nitrogenase: Rhizobium symbiosis .Leghaemoglobin; strategies for protection of nitrogenase against the inhibitory effect of oxygen; nif genes of klebsiella pneumoniae including their regulation. Nitrate Assimilation: Nitrate reductase; regulation of nitrate assimilation. Ammonia assimilation by glutamine synthetase- glutamine oxoglutarate amino transferase (GS-GOGAT). Nitrite and nitrate reductase.

TEXTBOOKS :

1. Jain.V.K., 2005. Fundamentals of Plant Physiology, revised 1st edition S.Chand and Co.
2. Pandey.S.N., and Sinha.B.K., Plant Physiology, 1999, Vikas Publishing House.

3. Heldt, HW. (2005), Plant Biochemistry. 3rd Edition, Elsevier Academic Press Publication, USA.

REFERENCES:

1. Solisbury and Ross, Plant Physiology, 3rd edition, CBS Publishers and Distributors.
2. Hans-Walter Held, Plant Biochemistry, 3rd edition, Elsevier India Pvt. Ltd.
3. Bonner and Varner, Plant Biochemistry, 3rd edition, Academic Press.
4. Bowsher, C, Steer, M. and Tobin, A (2008). Plant Biochemistry. Garland Science, Taylor and Francis Group, LLC. New York.
5. Verma, 2001. Plant physiology, 7th Revised edition, Emkay Publications.
6. S. N. Pandey and B.K. Sinha, 1999. Vikas Publishing House Pvt. Ltd, 3rd edition, Plant Physiology.

**PG QUESTION PAPER PATTERN FROM THE YEAR 2019 ONWARDS
ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE, (AUTONOMOUS)
CUDDALORE-1.**

SEMESTER EXAMINATION

CLASS : I M.ScBIOCHEMISTRY (SHIFT I)

SUBJECT :XXXX

Sub Code : XXXX

TIME : 3hrs

MARKS: 75

PART A

1. Choose the best answer (5 x 1 = 5)

1 Question from each unit.(5 questions)

II. Say true or false (5 X 1 = 5)

1 Question from each unit.(5 questions)

III Answer in one sentence (5 x1 =5)

1 Question from each unit.(5 questions)

PART B

Answer all the questions

Either or type questions (5x6=30)

1 Question from each unit.(5 questions)

PART C

(3x10=30)

Answer any three questions out of five

1 Question from each unit.(5 questions)

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

General instructions

COMMENCEMENT OF THE COURSE:

The course shall commence from 1st week July/Last week of June of the academic year.

MEDIUM OF INSTRUCTION:

English shall be the Medium of Instruction for all the Subjects of study and for examinations of the **Diploma In Medical Laboratory Technology**.

CURRICULUM:

The Curriculum and the syllabus for the course shall be as prescribed in these regulations and are subject to modifications by the Standing Academic Board from time to time.

DURATION OF THE COURSE:

The duration of certified study for the **Diploma In Medical Laboratory Technology** shall be over a period of ONE academic year

WORKING DAYS IN THE ACADEMIC YEAR:

Each semester in academic year shall consist of not less than 110 working days.

ATTENDANCE REQUIRED FOR ADMISSION TO EXAMINATION:

No candidate shall be permitted to appear in any one of the parts **Diploma In Medical Laboratory Technology** Examinations unless he/she has attended the course in the subject for the prescribed period

A candidate is required to put in a minimum of 80% of attendance in both theory and practical separately in each subject before admission to the examinations.

INTERNAL ASSESSMENT MARKS:

The Internal Assessment should consist of the following points for evaluation:-

- i) Theory
- ii) Practical / Clinical
- iii) Viva

(a) A minimum of two written examinations shall be conducted in each subject during a year and the best marks of the one performance shall be taken into consideration for the award of Internal Assessment marks.

(b) A minimum of one practical examination shall be conducted in each subject (wherever practical has been included in the curriculum) and grades of ongoing clinical evaluation to be considered for the award of Internal Assessment marks.

DURATION:

- Course Duration - 1 year
- Weeks per year - 25 weeks

- Hours per week - 18 hours
- Hours per semester - 300 hours
- No. of minimum working days per year - 180 days
- Timings-2 to 5 pm/9.30 to 12.30 p.m

COMMENCEMENT OF THE EXAMINATIONS:

- I st Semester Examination will be conducted in the month of February
- II nd Semester Examination will be conducted in the month of August
- If the date of commencement of examination falls on Saturdays / Sundays or declared Public Holidays, the examination shall begin on the next working day.

MARKS QUALIFYING FOR PASS:

- 40% of marks in the semester Theory Examinations
- 40% of marks in the semester Practical Examinations
- 25% internal and 75% external marks for theory.
- 40% internal and 60% external marks for practical.

CARRY OVER OF FAILED SUBJECTS:

1. A candidate has to pass in theory and practical examinations separately in each of the paper
2. The candidate has to successfully the course in double the duration of the course (i.e. 2 years from the date of joining)

NUMBER OF EXAMINERS One internal and one external examiner should jointly conduct practical/ oral examination for each student

SYLLABUS FOR DIPLOMA IN MEDICAL LABORATORY
CURRICULUM TEMPLATE

Semester	Paper name	Total Instructional hours	credits	Total marks
I	Fundamentals of MLT & Instrumentation	50	4	100
I	Physiology & Immunology	50	4	100
I	Microbiology	50	4	100
I	Practical -1	75	6	100
	Practical -2	75	6	100
II	Clinical Biochemistry	50	4	100
II	Hematology, Serology & pathology	50	4	100
II	Laboratory Management, preventive medicine & Ethics	50	4	100
II	Practical-3	75	6	100
II	Practical -4	75	6	100
	Internship training	2 weeks	12	

Total credits-60 Marks- 900

QUESTION PAPER PATTERN	No. of Questions	Marks per question	Total Marks
Essays	3	10	30
Short Notes	5	5	25
Short Answers	5	2	10
Objectives	10	1	10
Total		75	

I SEMESTER
PAPER I - FUNDAMENTALS OF MEDICAL LABORATORY TECHNOLOGY &
INSTRUMENTATION

UNIT 1: Introduction to Clinical laboratory

Basic laboratory principles, Organization of clinical laboratory and role of medical laboratory technician - Safety measures - Medical laboratory professional and professionalism in laboratory workers and personnel hygiene

UNIT 2 Common Laboratory Equipment's Incubator, Hot Air Oven, Water Bath - Anaerobic Jar, Centrifuge, colorimeter, desiccators, Autoclave -Microscope - Fundamentals of Microscopy, Resolution & Magnification, Light Microscopy, Electron Microscopy- Glassware – Description of Glassware, handling and care and its use,

UNIT 3: Basic Steps for Drawing a Blood Specimen

Requirement of Blood Collection - Blood collection - Phlebotomy - Sampling errors - Collection and preservation of biological fluids - Anticoagulants - Preservation of samples - Chemical preservatives - Process of analysing the specimens.

UNIT 4: Preparation of Reagents & Quality control

Buffer and pH- Preparation of reagents: Normal, per cent and Molar solution - normal saline, types of reagent solutions. Clinical Laboratory records- Modern Laboratory set up - Quality control: Accuracy, Precision, and Reference values. Chemicals-danger signs and disposal methods.

UNIT 5:

Types of analyzers - Semi-auto analyzer - Batch analyzer - Random Access autoanalyzers. Steps in the automated systems - Responsibilities of a technician in the maintenance of the analyzers.PCR and ELISA

REFERENCES

- 1.Fischbach, 2005. Manual of lab and diagnostic tests, Lippincott Williams Wilkins, New York.
- 2.Gradwohls, 2000. Clinical laboratory methods and diagnosis. (ed) Ales C. Sonnenwirth and leonardjarret, M.D.B.I., New Delhi.
- 3.JOchei and Kolhatkar, 2002. Medical laboratory science theory and practice, Tata McGraw-Hill, New Delhi.
- 4.Kanai L. Mukherjee, 2007, Medical laboratory technology Vol.1.Tata McGraw Hill

Paper II - PHYSIOLOGY & IMMUNOLOGY

Unit 1: Cardio Vascular System

Name of the blood vessels & lymph gland locations .Structure and functions of various parts of the heart, arterial and venous system, brief account on common cardiovascular disorders [myocardial infarction, stroke, Arrhythmia]

Unit 2:Respiratory & Digestive System

Various parts of respiratory system and their functions, Physiology of Respiration .names and various parts of digestive system-Liver, Spleen, Gall Bladder, Pancreas, Buccal Cavity, Pharynx, Oesophagus, Stomach, intestine. Physiology of digestion and absorption.

Unit 3: Urinary & Reproductive System

Various parts of urinary system and its function-structure and function of kidneys-physiology of urine formation - pathophysiology of renal disease and edema physiology and anatomy of Male & Female reproductive system-Prostate & Uterus & Ovaries.

Unit 4: Musculoskeletal and Nervous system

Classification of bones & joints, structure of skeleton –structure of skeletal muscle – physiology of muscle contraction.Various parts of nervous system- Brain and its parts –functions of nervous system - Spinal Cord & Nerves.

Unit 5: Immunology:

Introduction -Non specific resistance to infection -Specific immunity.Antigens. Antibodies-Structure and function.- Complement and antigen-antibody reaction. Hybridoma and Monoclonal antibodies.Hypersensitivity. -Autoimmunity. -Transplantation and Tumour immunity.

REFERENCES

1. Solomon. E.A., (2008) Introduction to Human Anatomy and Physiology 3rd Ed, Saunders: St Louis.
2. Chaurasia, B.D., & Garg, K., (2012) *Human Anatomy Regional and Applied*. CBS Publications: New Delhi
3. T.S. Ranganathan – *A text book of Human Anatomy*
4. Fattana, Human anatomy (Description and applied) *Saunders's & C P Prism Publishers*, Bangalore – 1991

Paper –III MICROBIOLOGY

UNIT-I

8 Hrs

Historical introduction - with special reference to the contribution of Louis Pasteur, Joseph Lister, Robert Koch, Edward Jenner and Alexander Fleming; Observation of micro- organism - Wet preparations, Staining preparations- Simple, Differential, Special staining methods; Anatomy of Bacterial cell; Morphological Classification of bacteria with example.

UNIT –II

8 Hrs

Sterilization and Disinfection – Principles - Methods of Sterilization – Physical methods & Chemical methods. Culture media preparation - Solid and Liquid - Types of Media – Crude, Semi-Synthetic, Synthetic, Enriched, Enrichment, Selective, Differential and Special Purpose Media. Anaerobic culture technique – Wright’s tube, Roll tube, McIntosh fields jar method. Pure culture technique – Tube dilution, Pour, Spread, Streak plate.

UNIT- III

10 Hrs

Antibiotic, Classification of antibiotics, Antibiotic susceptibility testing, Infections of the respiratory tract, urinary tract, digestive tract and central nervous system.

UNIT IV

12 Hrs

General Introduction of Virus - General characteristic of Viruses – Cultivation of virus - Retro viruses - HIV, Hepatitis virus, Rabies virus, Pox virus, Picorna virus - Polio - Orthomyxo virus - Influenza - Arbo virus - Chikungunya, Dengue and Adeno virus with reference to their mode of infection, pathogenesis and Lab diagnosis.

UNIT- V

12 Hrs

Structure – Classification - Cutaneous (Dermatophytes) & Sub cutaneous and Systemic Mycosis (Histoblastomyces) - Opportunistic fungal infections (Candida, Cryptococcus) -Diagnosis of fungal infections. Parasitology – Classification and identification of common human parasites Entamoeba histolytica, Giardia Lamblia, Balantidium coli, Leishmaniadonovani. Plasmodium, Wuchrereria

REFERENCES

- Ananthanarayan, R. and K. JayaramPanicker., Textbook of Microbiology, 2013 (9th Edition), Universities Press (India) Pvt., Ltd., Hyderabad.
- Pelczer J, R E. C .S John Noel R Krieg, Microbiology: 1986, MC Graw Hill Book Company,.

- Prescott L. M; J.H Harley and D. A Klein, Microbiology, 1993, C. Brown Publishers.
- Ronald M. Atlas, Microbiology, Fundamentals and Applications, 1993 Macmillan Publishing Company, New York.
- Subash. C. Parija, Text book of Medical Parasitology, 1996, All India Publishers & Distributers., Madras.

PRACTICAL—I

Part-I

- Study of Human Skeleton parts with skeletal models..
- Study with charts and models of all organ systems mentioned above.
- Microscopic slides examination of elementary human tissues, cells.

(The teaching of Anatomy & Physiology should be coordinated so that structure and function of different parts of human body are correlated)

Part-II

- 1.Laboratory safety, Glass ware cleaning.
2. Pipettes, record maintenance.
- 3.Preparation of various reagents
3. Tests for Carbohydrate.
4. Tests for Proteins&Amino Acids.
5. Tests for Iron, Calcium, Iodine, Flourine, etc
7. Disinfection practices in laboratory and wards.
8. .Common lab instrumentation-hot air oven, incubator,colorimeter,balance,centrifuge etc.

PRACTICAL- II

MICROBIOLOGY

1. Use and care of microscopes.
2. Simple staining methods and gram stains
3. Special staining methods – capsule, spore, acid fast

4. Preparation of media.
5. Assay for disinfection.
6. Techniques of cultivation of bacteria.
7. Biochemical testing – Catalase, oxidase, citrate, urease, TSI, Carbohydrate fermentation, MR VP, Indole
8. Antibiotic sensitivity test
9. Isolation, Characterization and identification of pathogens from various clinical specimens.
- 10.

REFERENCE BOOKS:

1. Fischbach, 2005. Manual of lab and diagnostic tests, Lippincott Williams Wilkins, New York.
2. Gradwohls, 2000. Clinical laboratory methods and diagnosis. (ed) Ales C. Sonnenwirth and leonardjarret, M.D.B.I., New Delhi.
3. J Ochei and Kolhatkar, 2002. Medical laboratory science theory and practice, Tata McGraw-Hill, New Delhi.
4. Kanai L. Mukherjee, 2007, Medical laboratory technology Vol.1. Tata McGraw Hill.

II SEMESTER

PAPER – IV CLINICAL BIOCHEMISTRY

UNIT I

Carbohydrate – absorption, metabolism, Maintenance of blood glucose levels – hormonal influence, Diabetes mellitus Tests involved in carbohydrate metabolism.

UNIT II

Protein – digestion, absorption and metabolism – urea synthesis, Tests involved in protein metabolism. Lipid digestion, absorption and metabolism Tests involved in lipid metabolism

UNIT III

Function of liver in health and disease: Jaundice, Hepatitis; liver function test. Assessment and clinical manifestation of renal, hepatic, pancreatic, gastric & intestinal function, enzyme of pancreatic origin and biliary tract, test of myocardial infarction.

UNIT IV:

Physiological functions of Water, electrolyte and buffer systems – sodium, potassium, chloride, bicarbonate. Clinical importance of Minerals – calcium, phosphorous, iron, magnesium, copper – metabolism and Vitamins (Vit.C& E), enzymes (SGOT & SGPT)and Isoenzymes (LDH & CPK)

UNIT V:

Biologically important hormones: insulin, glucagons, epinephrine, thyroid, growth hormone, parathyroid, pituitary, steroid hormones, Body fluids- Cerebrospinal Fluid. - Synovial fluid - Pleural fluid - Pericardial fluids - Peritoneal fluids-Semen analysis- physical, chemical & microscopic examination, sperm count, motility

REFERENCES

- 1.Clinical Diagnosis by laboratory methods – Todd and Sanford
- 2.Text book of medical laboratory technology – PrafulGodhar
- 3.Clinical biochemistry – Teitz
- 4.Practical clinical biochemistry – Harold Varley
- 5.Harpers illustrated biochemistry – Murray, Granner, Mayes, Rodwell

Paper V - Hematology, Serology & Histopathology

UNIT I :

Composition of Blood - functions of blood elements - Blood Group and coagulation of blood. Normal blood cell morphology, Manual red and white blood cell counts, platelets count, preparing and staining a blood smear, white blood cell differential count, Microhematocrit Routine biochemistry analysers, Immuno-based analysers, Hematology analysers, Cell counters. Disorders of hemostasis, PTT. Clotting time and clot lysis, tourniquet test.

UNIT II

Principles of serological test - Widal test, VDRL, Rapid Plasma Reagent test. C-reactive protein, Rheumatoid Arthritis. Staphylococcal agglutination, antistreptolysin -O- test Immunological test for pregnancy, Haemagglutination, Complement fixation, Precipitation

UNIT III :

Introduction to histopathological techniques- Sample reception and record keeping Specimen fixation and fixatives .Processing of tissue Embedding, Microtomy Frozen section -Mounting and staining -Theory of H & E stain, Stains – AFB, Fite, PAS, PASM, Masson's trichrome.

UNIT IV:

Principal & Practice of blood Transfusion, Standard operating procedures for usage, donation & storage of blood, screening of donor, compatibility testing, safety, procurement of supplies. Blood bank—general laboratory preparations and reagents in blood bank. Documentation in blood bank- Types of documents. Storage of Blood and its components .Packing and Transportation.

UNIT V:

Principles of blood groups and antigen antibody reactions ABO – Rh blood group systems, other red cell antigens and antibodies. Coombs test – investigation of transfusion reaction and haemolytic disease of the newborn, antibody detection and titration.

REFERENCES

1. Ramani Sood, Laboratory Technology (Methods and interpretation) 4th Ed. J.P. Bros, New Delhi
2. Satish Gupta Short text book of Medical Laboratory for technician J.P. Bros, New Delhi
3. Shirley Mitchell Lewis, Barbara J. Bain, Imelda Bates (2006) Dacie And Lewis Practical Haematology, 10th Ed, Churchill Livingstone/Elsevier

4. Barbara A. Brown(2008) Hematology: principles and procedures 6th Ed Lea &Febiger.
5. Bernadette F. Rodak, George A. Fritsma, Kathryn Doig(2007) Hematology: Clinical Principles and Applications 3rd Ed, Elsevier Health Sciences

Paper VI: Laboratory Management, Preventive Medicine & Ethics

Unit-I

Ethical Principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals, introduction to basics of GLP and accreditation. Advantages of accreditation. Brief knowledge about National & International agencies for clinical laboratory accreditation. NABL & CAP.

Unit-II

Quality Management system: Introduction, General safety precautions, Quality assurance, Quality control system, Internal and External quality control, quality control chart. Ethics in laboratory practice.

Unit-III

Occupational health – occupational environment, occupational hazards and occupational diseases.

Unit-IV

Hospital management- definition, sources of healthcare waste, health hazards of healthcare waste and treatment, disposal of wastes & disposal technologies for healthcare waste.

UNIT V

Community medicine-basic concepts, indicators of health—characteristics and types. Concept of disease and its prevention. Identification and Public Health Importance of arthropods (Entomology): Mosquitoes, Lice, Fleas, Flies, Rats & Rodents. Food-borne diseases of Public Health importance, Assessment of Nutritional status.

TEXT BOOKS

1. Teitz,(2007), Fundamentals of Clinical Chemistry, 6th edition, Elsevier Publications
2. Bishop(2013), Clinical Chemistry, 7th edition, Wiley Publications
3. Henry's Clinical Diagnosis and Management by Laboratory Methods, (2011), 22nd edition, Elsevier

REFERENCE BOOKS

1. Bishop(2013), Clinical Chemistry, 7th edition, Wiley Publications
2. Henry's Clinical Diagnosis and Management by Laboratory Methods, (2011), 22nd edition, Elsevier

Practical III
CLINICAL BIOCHEMISTRY (Practicum)

Determination in Blood/Serum of

1. Glucose Tolerance Tests
2. Glucose
3. Urea
4. Creatinine
5. Uric Acid
6. Lipid Profile (Cholesterol, HDL, LDL, Triglycerides)
7. Total serum protein and albumin
8. Bilirubin-direct & Indirect
9. Preparation of anticoagulant fluids
10. Ict
11. Screening of HbS, Ag. HIV and HCV and rapid kit methods
12. Antiglobulin Test
- 13 T3, T4, TSH
14. Organ function test
15. Bio safety Precautions and Guidelines
- 19. URINE ANALYSIS**

Practical IV
HISTOPATHOLOGY (Practicum)

1. Fixatives
2. Processing of the Tissues Including Bone
3. Embedding
4. Section Cutting
5. Staining & mounting
6. Special stains
7. Handling and embedding of tiny tissue biopsies
8. Frozen section technique
9. Techniques Equipments & Procedures
10. Specimen Collection and Preparation

11. Staining Procedure and Mounting
12. Preparation of Fluids for Cytological Examination
13. Paraffin section cutting.
14. H & E staining
15. Special staining
16. PAS staining, principle&uses.
17. Reticulin
18. PTAM
19. Van gerson
20. Amyloid stain, pearl stain
21. Melanin bleach&masson's Fontana
22. AFB staining (TB and Leprosy)
23. Pap staining
24. MGG staining for enac
25. Museum techniques
26. Preparation of mounting medium & mounting of specimen-

PATHOLOGY (practical)

1. Examination of Body fluids
2. Semen Analysis
3. Stool Examination
4. Screening of donors.

HEMATOLOGY (Practicum)

1. Collection of Blood Samples
2. Obtaining peripheral Blood Smear
3. Staining Of Blood Smear
4. Obtaining Cell Counts – RBC, WBC & Platelets.
5. Absolute Eosinophils Count
6. Estimation of Haemoglobin
7. Packed Cell Volume, Erythrocyte Sedimentation Rate
8. Reticulocyte Count
9. Differential Count
10. Bleeding Time
11. Clotting Time
12. Grouping of blood.
13. Cross matching of blood samples.
14. Coomb's test,

15.PT

16.Apt (demo)

REFERENCES

1. Teitz, *Clinical Chemistry*. W.B. Saunders Company Harcourt (India) Private Limited New Delhi.
2. KAPLAN, *Clinical Chemistry*, Mosby Company, St. Louis Washington, D.C. Toronto.
3. Biochemistry, U. Satyanarayan, Books and Allied (P) Ltd. Kolkata-India
4. RamanicSood, *Laboratory Technology (Methods and interpretation)* 4th Ed. J.P. Bros, New Delhi
5. Mukharji, *Medical Laboratory Techniques*, Vol - I, II & III, 5th Edn. Tata McGrawHill, Delhi.