

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE

(An Autonomous College)

Affiliated to Periyar University, Salem | Accredited by NAAC with 'A' Grade

Recognized by UGC under Section 2(f) & 12 (B)



ESTD-1994

**MUTHAYAMMAL
COLLEGE OF ARTS
AND SCIENCE**

(Autonomous)

A UNIT OF VANETRA GROUP

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DEGREE OF MASTER OF SCIENCE

Learning Outcomes - Based Curriculum Framework

- Choice Based Credit System

Syllabus for M.Sc., Medical Biochemistry (Semester Pattern)

(For Candidates admitted from the academic year
2021 -2022 and onwards)

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

RASIPURAM - 637408

VISION

- ❖ To redefine the scope of higher education by infusing into each of our pursuits, initiatives that will encourage intellectual, emotional, social and spiritual growth, thereby nurturing a generation of committed, Knowledgeable and socially responsible citizens.

MISSION

- ❖ To Ensure State of the world learning experience
- ❖ To espouse value based Education
- ❖ To empower rural education
- ❖ To instill the sprite of entrepreneurship and enterprise
- ❖ To create a resource pool of socially responsible world citizens

QUALITY POLICY

To seek – To strive – To achieve greater heights in Arts & Science, Engineering, Technological and Management Education without compromising on the quality of education.

DEPARTMENT OF BIOCHEMISTRY

VISION

- ❖ To ensure state of the world learning experience in science

MISSION

- ❖ To expose the scientific education to empower science in rural peoples Vision

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Post Graduates will be able to promote learning environment to meet the industry expectation.

PEO2: Post Graduates will be incorporated the critical thinking with good Communication and Leadership skills to become a self-employed

PEO3: Post Graduates will be upholding the human values and environmental sustenance for the betterment of the society.

GRADUATE ATTRIBUTES

The Graduate Attributes of M.Sc., Medical Biochemistry are

GA1: Research skills

GA2: Multicultural competence

GA3: Critical thinking

GA4: Problem solving

GA5: Disciplinary knowledge

GA6: Moral and Ethical awareness

GA7: Self directed learning

PROGRAMME OUTCOMES (POs)

PO1: Post graduates will attain profound proficiency and expertise

PO2: Post graduates will be ensured with corporative self – directed learning

PO3: Post graduates will acquires acumen to handle diverse contexts and function in domains of multiplicity;

PO4: Post graduates will exercise intelligence in research Investigations and Introducing innovations.

P05: Post graduates will learn ethical values and commit to Professional ethics

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: To acquire necessary knowledge and skills in core themes, principles and components of basic Biochemistry

PSO2: To demonstrate the knowledge of biochemical processes from the cellular and molecular aspects

PSO3: To Integrate and apply the techniques studied and to compare and contrast the depth of scientific knowledge in the broad range of fields

PSO4: To be able to understand, analyze and apply the studied basic and concepts in wide variety of applications including diagnostics, biochemical pathway regulation and drug development and use this knowledge and apply the same for multitude of laboratory applications.

PSO5: To provide students with the knowledge and skill base that would enable them to go for self-employment and entrepreneurship.



MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE(Autonomous) - Rasipuram - 637 408
Scheme of Examinations - LOCF-CBCS Pattern
(for the Students Admitted from the Academic Year:2021-2022 Onwards)
Programme : M.Sc. MEDICAL BIOCHEMISTRY

S.No.	STUDY COMPONENTS	COURSE_CODE	TITLE OF THE COURSE	Hrs./W		CREDIT POINTS	MAX.MARKS		
				Lect.	Lab.		CIA	ESE	TOTAL
SEMESTER - I									
1	DSC THEORY - I	21M1PMBC01	CHEMISTRY OF BIOMOLECULES	5		5	25	75	100
2	DSC THEORY - II	21M1PMBC02	BIOCHEMICAL TECHNIQUES	4	-	4	25	75	100
3	DSC THEORY - III	21M1PMBC03	CELLULAR BIOCHEMISTRY	5		5	25	75	100
4	DSC PRACTICAL - I	21M1PMBP01	PRACTICAL : BIOCHEMICAL ANALYSIS	-	6	3	40	60	100
5	DSC PRACTICAL - II	21M1PMBP02	PRACTICAL : TECHNIQUES IN BIOCHEMICAL SEPARATION		6	3	40	60	100
6	DSE – I	21M1PMBE01	HUMAN ANATOMY AND PHYSIOLOGY	4		4	25	75	100
			TOTAL	18	12	24	180	420	600
SEMESTER - II									
1	DSC THEORY - IV	21M2PMBC04	BIOENERGETICS AND INTERMEDIARY METABOLISM	4	-	4	25	75	100
2	DSC THEORY - V	21M2PMBC05	CLINICAL ENZYMOLOGY	4	-	4	25	75	100
3	DSC THEORY - VI	21M2PMBC06	ADVANCED ENDOCRINOLOGY	4		4	25	75	100
4	DSE – II	21M2PBCE02	MEDICAL MICROBIOLOGY	4		4	25	75	100
5	HUMAN RIGHTS	21M2PHUR01	HUMAN RIGHTS	2	-	2	100		
6	DSC PRACTICAL - III	21M1PMBP03	PRACTICAL : ENZYMOLOGY AND ENDOCRINOLOGY		6	3	40	60	100
7	DSC PRACTICAL - IV	21M1PMBP04	PRACTICAL : MICROBIOLOGY		6	3	40	60	100
			TOTAL	18	12	24	280	420	600
SEMESTER - III									
1	DSC THEORY - VII	21M3PMBC07	IMMUNOLOGY	4	-	4	25	75	100
2	DSC THEORY - VIII	21M3PMBC08	CLINICAL AND NUTRITIONAL BIOCHEMISTRY	4	-	4	25	75	100
3	DSC THEORY - IX	21M3PMBC09	PHARMACEUTICAL BIOCHEMISTRY AND TOXICOLOGY	4		4	25	75	100

4	DSE - III	21M2PMBE02	BIostatISTICS AND MEDICAL BIOINFORMATICS	4		4	25	75	100
5	GEC - EDC - I	21M3PMBTED1	EDC - I	4		4	25	75	100
6	DSC PRACTICAL - V	21M3PMBP05	PRACTICAL :CLINICAL BIOCHEMISTRY		5	2	40	60	100
7	DSC PRACTICAL - VI	21M3PMBP06	PRACTICAL : IMMUNOTECHNOLOGY	-	5	2	40	60	100
8	INTERNSHIP	21M3PMBIS1	INTERNSHIP	-		2	100		
			TOTAL	20	10	26	305	495	700
SEMESTER - IV									
1	DSC THEORY - X	21M4PMBC10	BIOMEDICAL INSTRUMENTATION	5	-	5	25	75	100
2	DSE- IV	21M4PMBE04	MOLECULAR BIOLOGY AND BIOTECHNOLOGY	5		5	25	75	100
3	PROJECT WORK	21M4PMBPR1	PROJECT WORK	-		4	50	150	200
4	ONLINE - COMPETITIVE EXAMINATION	21M4PMBOE1	Biochemistry for Competitive Examination	-	-	2	100		
			TOTAL	10	0	16	200	300	400
			OVERALL TOTAL	66	34	90	965	1635	2300
	EXTRA CREDIT COURSE	21M4PMBEC1	MOOC Courses offered in SWAYAM / NPTEL	-	-	2	-	-	-

**List of Extra Disciplinary Course(GEC) Details
SYLLABUS - LOCF-CBCS Pattern
EFFECTIVE FROM THE ACADEMIC YEAR 2021-2022 Onwards**

S.No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	II	21M2PMBED1	Biochemistry in Health
2	II	21M2PMBED2	Clinical Lab technology
3	II	21M2PMBED3	Principles of Nutrition
4	II	21M2PMBED4	Human Physiology and Coding

**List of Elective Subjects Details for M.Sc.Medical Biochemistry
SYLLABUS - CBCS PATTERN
EFFECTIVE FROM THE ACADEMIC YEAR 2021-2022 Onwards**

S.No.	SEM	SUBJECT_CODE	TITLE OF THE SUBJECT
1	I	21M1PBCE01	Human anatomy and Physiology
2	II	21M2PBCE02	Medical Microbiology
3	II	21M2PBCE03	Biostatistics and Medical Bioinformatics
4	II	21M2PBCE04	Molecular Biology and Biotechnology

PG – REGULATIONS

1. Internal Examination Marks - Theory

Components	Marks
CIA I & II	10
Attendance	5
Assignment	5
Seminar	5
Total	25

Attendance Percentage	Marks
96 %to 100%	5
91%to 95%	4
86%to 90%	3
81%to 85%	2
75%to 80%	1
Below 75%	0

2. Question Paper Pattern for CIAI,II AND ESE (for 75Marks) (3hours)

Section-A (10Marks) (Objective Type)

10 x 1 = 10 Marks

Answer ALL Questions

ALL questions carry EQUAL Marks

Section-B(15Marks)(Analytical Type)

Answer any THREE Questions out of FIVE questions

3 x 5 = 15 Marks

ALL questions carry EQUAL Marks

SECTION-C (50 Marks)

Answer ALL the Questions

5 x 10 = 50 Marks

Either or Type.

ALL Questions Carry EQUAL Marks

Total

75 Marks

(Syllabus for CIA-I 2.5 Unit , Syllabus for CIA-II All 5 Unit)

2.a)Components for Practical CIA.

Components	Marks
CIA -I	15
CIA - II	15
Observation Note	5
Attendance	5
Total	40

2.b) Components for Practical ESE.

Components	Marks
Completion of Experiments	50
Record	5
Viva	5
Total	60

3. Internship/Industrial Training, Mini and Major Project Work

Internship/ Field Work Industrial Training		Project Work	
Components	Marks	Components	Marks
CIA*1		CIA	
Work Diary	25	a) Attendance Marks	20
Report	50	b) Review Marks	30
Viva-voce Examination	25		50
Total	100		
		ESE*1	
		a) Final Report Marks	120
		b) Viva-voce Marks	30
		Total	150
			200

*1Evaluation of report and conduct of viva- voce will be done jointly by Internal and External Examiners

4. Components for Human Rights Course(CIA Only)

- The Course Human Rights is to be treated as 100% CIA course which is offered in II Semester for I year PG students.
- Total Marks for the Course = 100

Components	Marks
Two Tests	75
Assignments	25
Total	100

- In case the candidate fails to secure 50 marks, which is the passing minimum, he/she may have to reappear for the same in the subsequent semesters.

5. Guidelines for Competitive Exams- Online Mode- Online Exam 3 hours

Components	Marks
100 Objective Type Questions 100*1=100 Marks	100

Objective type Questions from Question Bank

- The passing minimum for this paper is 50%
In case, the candidate fails to secure 50% passing minimum, he/she may have to reappear for the same in the subsequent semesters.

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M1PMBC01	CHEMISTRY OF BIOMOLECULES	DSC THEORY - I	I	5	5			5
Objective	To study the structure and functions of macromolecule							
Unit	Course Content						Knowledge Levels	Sessions
I	Carbohydrates: Definition, Biological importance of Carbohydrates. Stereoisomerism and Optical isomerism of sugars (Fischer and Haworth Projection formulae). Cyclic structure, Epimers, Anomers and Mutarotation. Monosaccharides – Classification, Structure and Biological importance of Hexose sugars; Reactions of sugars. Disaccharides - Structure, Occurrence and Biological importance of Sucrose, Lactose and Maltose. Polysaccharides: Homopolysaccharides; Structure, Occurrence and Biological functions : Starch, Glycogen, Cellulose. Chitin, Dextrin and Inulin. Heteropolysaccharides; Structure, Occurrence and Biological functions of - Hyaluronic acid, Chondroitin sulfate and Heparin. Artificial sweeteners – Saccharin and Monellin						KI-K2	13
II	Amino acids: Definition, Amino acids as ampholytes. Structure and classification of amino acids, Chemical reaction of amino acids. Essential and Non essential amino acids. Peptide bond: Structure and significance of peptide bond, amino acid sequencing (Sanger's and Edman methods). Protein structure: Levels of structure in Protein Architecture, Primary structure of proteins (Eg. Insulin), Secondary structure of proteins – helix and pleated sheets (eg. Collagen), Tertiary structure of proteins (Eg. Myoglobin), Quaternary structure of proteins (Eg. Hemoglobin) other Forces and weak bonds stabilizing the Protein structure.						KI-K3	13
III	Lipids : Definition, Classification and Biological role of lipids Simple lipids - Properties and Characterization of fats – Hydrolysis, Saponification, Halogenation, Acetyl number, Rancidity of fats, Reichert-Meissel number. Compound lipids - Structure and function of phospholipids (Lecithin, Sphingomyelin Cephalin, Phosphatidyl Inositol and Phosphatidylserine) and Glycolipids (Gangliosides and Cerebrosides). Derived lipids - Classification, structure and properties of saturated and unsaturated fatty acids; Essential and Non essential fatty acids. Sterols – Structure, Function and Properties of Cholesterol, Bile acids [no structure] , and						KI-K3	14

	lipoproteins biological production and significance.. Eicosanoids, Prostaglandins, Thromboxanes, Leukotrienes,		
IV	Nucleic acids Structure of Purines and Pyrimidines; Unusual bases (5-Bromouracil, Pseudouridine, Inosine, Dihydroxyuridine, Methylcytosine); Nucleosides and nucleotides – structure and functions. Chemical and enzymatic sequencing methods. DNA – Watson & Crick Model, A, B and Z forms of DNA. Properties of DNA - buoyant density, viscosity, chromic effect, T _m , denaturation, renaturation, hybridization and Cot analysis. Chemical properties Major classes of RNA – mRNA, rRNA, tRNA, snRNA, hnRNA – structure and biological functions.	KI-K4	12
V	Vitamins and Minerals : Classification of Vitamins - Fat soluble and water soluble. Dietary source, structures, RDA, functions and deficiency states. Macro and micro elements – Dietary source, structures, RDA, functions and deficiency of Iron, calcium, phosphorus, magnesium, iodine, Zinc and copper	KI-K5	8
Course Outcome	C01: Explain about the structure, properties and functions of polysaccharides	K1	
	C02: Illustrate on structure, properties and functions of lipids, interactions of lipids in biological membrane.	K3	
	C03: Determine the classification, properties and significance of proteins	K3	
	C04: Explain about the DNA properties and functions, biological importance of histone proteins	K4	
	C05: Determine the significance of vitamins and its antioxidant activity, minerals of biological significance	K5	
Learning Resources			
Text Books	<ol style="list-style-type: none"> 1. Lehninger's Principles of Biochemistry ,Nelson, David I. and Cox, M.M., 2000 Macmillan N Y 2. Fundamentals Of Biochemistry, Donald Voet, Judith G. Voet and Charlotte W Pratt, 1999, John Wiley & Sons, NY 3. Biochemistry. Lubert Stryer, 3rd Edn., 1994. W H Freeman and Co, San Francisco. 4. Biochemistry 4th edition, by Zubay G L , 1988 W M C Brown Publishers. 		
Reference Books	<ol style="list-style-type: none"> 1. Principles of Biochemistry, Garrette & Grisham, 1994, Saunders college publishing 2. Outlines of Biochemistry, Eric E. Conn, P.K. Stumpf, G. Brueins and Ray H. Doi., 1987, John Wiley & Sons, NY 3. Text book of biochemistry, Thomas M Devlin, A 1987, 4th edition John Wiley, Inc publication, New York 		

**Website
Link**

1. <https://thebiologynotes.com/>
2. <https://microbenotes.com/>
3. <https://nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-10.pdf>

L-Lecture

T-Tutorial

P-Practical

C-Credit

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M1PMBC01	CHEMISTRY OF BIOMOLECULES	DSC THEORY - I	I	5	5			5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	M	M	M	M	S	M	M
CO2	S	M	S	S	M	S	S	M	M	S
CO3	S	S	M	M	S	M	M	M	M	M
CO4	S	M	S	M	M	S	M	S	S	M
CO5	S	M	M	M	M	M	M	M	S	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M1PMBC02	BIOCHEMICAL TECHNIQUES	DSC THEORY - II	I	4	4			4
Objective	This course focus on the biochemical techniques includes spectrophotometer, centrifugation, electrophoresis, radioactivity etc.,. Learning these techniques will be very useful for operating instruments and become the basic knowledge in their future							
Unit	Course Content						Knowledge Levels	Sessions
I	pH scale: buffer solution, pH electrode, Clarke's Oxygen electrode and their applications. Microscopy: Principles and applications of light, phase contrast, fluorescence, scanning and transmission electron microscopy.: Principles, preparation of specimens for TEM and SEM. Organ and tissue slice technique, cell disruption and homogenization technique, Microtomy – Staining and fixation. Cell sorting and cell counting of various tissue culture collections. Cryopreservation and manometric techniques.						K1-K2	9
II	Chromatography: Principles, Instrumentation and applications of paper chromatography, exclusion chromatography, column chromatography, Chromato focussing affinity chromatography and adsorption chromatography: Gel preparation, principle and application ion-exchange chromatography – Types of resins, apparatus preparation and application Liquid chromatography: Principle, Instrumentation and applications of GLC, LC, LPLC and HPLC						K1-K3	8
III	Electrophoresis: Principles, Instrumentation and applications of paper electrophoresis, agar gel, starch gel, PAGE, Capillary electrophoresis PFGE, high and low voltage electrophoresis, Isoelectric focussing, Tachophoresis. Centrifugation: Principles, laws of sedimentation. Preparative and Analytical Centrifugation – Differential centrifugation and Density gradient centrifugation. Analytical Ultracentrifuges. – Instrumentation and application; Sedimentation equilibrium methods. Analysis of sub cellular fractions. Criteria of purity of macromolecules.						K1-K3	8
IV	Spectroscopy: Basic laws of light absorption, optical rotatory dispersion. Basic principles, instrumentation and applications Circular dichroism and X-ray diffraction. Basic principles, instrumentation and applications of UV and visible light spectrophotometry, spectro fluorimetry, Atomic Flame Photometry, Plasma Emission Spectroscopy, Infra-red spectrophotometry, Mass spectrometry, Tandem mass						K1-K4	10

	spectroscopy, ESR, NMR.		
V	Tracer techniques: Radioactive isotopes and half life of isotopes, Principles and applications of tracer techniques in biology and medical sciences, measurement of alpha, beta and gamma radiations. Radiation dosimeter, Autoradiography; Principle, Biological applications. Geiger Muller Counter and Liquid Scintillation counter.	K1-K5	10
Course Outcome	CO1: The students will be able to understand the principle and working of different chromatography and different centrifugation techniques. Capable to choose and apply suitable separation techniques to identify different biomolecules	K1	
	CO2: The students will get the theoretical knowledge of various instruments and their practical applications	K2	
	CO3: Learn fundamental principles behind electrophoresis and apply them practically.	K3	
	CO4: Understand the intersection of life and information sciences, using SDS-PAGE, southern and northern blots and applying them at genome level.	K4	
	CO5: Understand the law of absorption spectrum, principle and mechanism of UV visible spectrophotometry, ESR, NMR, IR, spectrofluorimetry, turbidimetry, nephelometry and luminometry, thereby learn its applications in research level.	K5	
Learning Resources			
Text Books	1. Principles and techniques of practical Biochemistry, Keith Wilson and John Walker, 1995. Cambridge University Press 2. Biophysical chemistry Principles and Techniques- Avinash Upadhyaye and Nirmalendhe Nath, 2001. Himalaya Publishers 3. Tools of Biochemistry David Cooper.		
Reference Books	1. Analytical Biochemistry (1998) – DJ Holine & HAZEL Peck, Longman Group. 2. An Introduction to Spectroscopy for Biochemist, Brown. SB Academic Press. 3. Introduction to Centrifugation, Ford T.C and Graham J.N., Bioscientific Publishers Ltd, Oxford		
Website Link	1. https://www.ncbi.nlm.nih.gov/pmc/articles 2. https://www.vedantu.com/		

L-Lecture T-Tutorial P-Practical C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M1PMBC 02	BIOCHEMICAL TECHNIQUES	DSC THEORY - II	I	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
C01	S	M	M	M	M	M	S	M	M	M
C02	S	S	S	M	S	S	M	S	S	S
C03	S	M	M	S	M	M	M	M	M	M
C04	S	S	S	M	M	S	S	M	S	S
C05	S	M	M	M	S	M	M	M	M	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M1PMBC03	CELLULAR BIOCHEMISTRY	DSC THEORY - III	I	5	5			5
Objective	To Know about tissue types, organization and classes of cell junctions and describe the role of cell adhesion molecules and ECM components. Understand what happens during the cell cycle and cell death and explain about membrane transports and checkpoints in the cell cycle.							
Unit	Course Content						Knowledge Levels	Sessions
I	Origin of single cell – theories and concepts. Cell cycle: Prokaryotic and eukaryotic cell cycle, cell growth and extracellular signal molecular basis of cell cycle regulation, cell cycle check points, cyclin and cyclin dependent kinases, Apoptosis: Survival and death facts cell death receptors, cell – cell interactions in cell rescue and death, erythropoietin in RBC development. Molecular apoptotic events in C. elegans and mammals, bcl family of proteins, caspases, significance of apoptosis						K1-K2	12
II	Cell environment: Extracellular matrix, glycocalyx, basal lamina, components of ECM –fibronectin, laminin, collagen, heparin sulphate, proteoglycans, role of ECM in cell growth and survival. Cytoskeletons: Microtubules and Microfilaments, G and F actin, dynamics of actin assembly and polymerization, myosin and molecular motors. microvilli and pseudopodial extension. Intermediate filaments: types and functions. Kinetochore architecture and spindle assembly focal adhesion points,. Major types of cell adhesion molecules (CAMs) – Cadherin, Integrins, Selectins and super family Immunoglobulin						K1-K2	13
III	Cell– cell communication: Autocrine, paracrine, endocrine, juxtacrine communication. Nitric oxide and paracrine factors involved in communication EGF's Hedgehog family, Wnt family, TGF, beta super family, BMP family, signal transduction pathways: G protein, cAMP pathway, IP3 pathway, RTK pathway, MAP kinase pathway. Major classes of cell junctions anchoring, Gap, tight junctions						K1-K4	10
IV	Composition of Cell membrane: Lipid Bilayer, Peripheral and Integral proteins. Fluid mosaic model. Membrane transport types: Uniport, Synport, Antiport. Active transport: P-types [Na+K+ATPases, F-Type ATPases (ATP synthetases), Ionophores, Ion channels and ligand/ voltage gated channels Protein sorting: Golgi and endoplasmic reticulum and lysosome complex in protein targeting, signal recognition particles – chaperons and protein folding. GPI anchoring, targeting of proteins to mitochondria, protein glycosylation and post translational modification, vesicular transport and						K1-K5	13

	secretory pathways.		
V	Cancer Biology: Etiological factors, primary, secondary tumors benign and malignant tumors. Oncogene: proto oncogenes and viral oncogenes, oncogene activation, tumor suppressor genes, DNA tumorviruses, tumor specific antigens and tumor evasion. Metastasis: Molecular events in migration, extravasation, chemokines, role of ECM in metastasis. Angiogenesis: angiogenetic and antiangiogenetic factors, vasculogenesis. Types of cancer cells and morphological alterations.	K1-K5	12
Course Outcome	C01:Know about tissue types, organization and classes of cell junctions and describe the role of cell adhesion molecules and ECM components	K1	
	C02:Understand what happens during the cell cycle and cell death and explain about membrane transports and checkpoints in the cell cycle.	K2	
	C03:Understand the basic structures, properties and organisation of eukaryotic and prokaryotic chromosomes.	K3	
	C04:Pertain on Overview of cell cycle, cell growth, tumors, cancers and isolation techniques.	K4	
	C05:Describe carcinogenesis.	K5	
Learning Resources			
Text Books	<ol style="list-style-type: none"> 1. Cell & Molecular Biology, Gerald Karp,1999 2. Genes – Benjamn Lewin, Latest Edition 3. Cellular & Molecular Biology Baltimore, Dainell & Lodish. 4. General Microbiology –Powar, Vol II 2nd Edition, 1999 		
Reference Books	<ol style="list-style-type: none"> 1. Biochemistry of lipids and membrane : VANCE AND VANCE. 2. Molecular biology of the cell – ALBERTS, BRAY, LAWIMS, RAFF. 3. Molecular cell biology – J. AVERS 4. Molecular biology of the gene – WATSON et al (4th edition) 		
Website Link	<ol style="list-style-type: none"> 1. https://www.ncbi.nlm.nih.gov/books/NBK26857/ 2. https://chem.libretexts.org/Bookshelves/Biological_Chemistry/ 3. https://www.verywellhealth.com/oncogenes-types-and-role-in-cancer-4178292 		

L-Lecture

T-Tutorial

P-Practical

C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M1PMBC03	CELLULAR BIOCHEMISTRY	DSC THEORY - III	I	5	5			5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	M	S	M	M	S	M	S
CO2	S	M	S	S	M	M	M	M	M	M
CO3	S	S	M	M	M	M	S	M	S	S
CO4	S	M	S	M	S	M	M	M	M	M
CO5	S	S	M	M	M	M	M	M	M	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M1PMBE01	HUMAN ANATOMY AND PHYSIOLOGY	DSE - I	I	4	4			4
Objective	To study the mechanism of human body systems and mode of action of Hormones							
Unit	Course Content						Knowledge Levels	Sessions
I	<p>HUMAN ANATOMY: Overview of Anatomy – Medical and Anatomical terminology – Sections of the body – Anatomical Variations – Organization of the body cells, Tissues. Introduction to Systemic Anatomy – Types of bone – Joints – Classification of joints – innervations of joints – Muscle tissue and muscular system – Types of Muscles Anatomical structure of Liver, Kidney and stomach</p>						K1-K2	8
II	<p>Cardiovascular system: Blood and Body fluids: Composition and function, Red blood cells, Hemoglobin, white blood cells and platelets. Blood coagulation, blood groups and blood transfusion. Formation and functions of lymph. Body buffers. Cardiac output - Definitions, factors affecting, physiological variations, regulation of heart rate. Coronary circulation. Pulse - Jugular pulse, radial pulse and triple response. Heart sounds - Cause, characteristics and significances. Cardiac rhythm and tachycardia</p>						K1-K3	8
III	<p>Respiratory system: Diffusion of gases in lungs, transport of oxygen from lungs to tissues via blood, factors influencing the transport of oxygen. Transport of CO₂ from tissues to lungs through blood, factors influencing the transport of CO₂. Excretory System: Mechanism of formation of urine, composition of urine, Micturition. Renal regulation of acid balance, Mechanism of tubular reabsorption and excretion of urine. Influence of hormone in kidney function.</p>						K1-K3	9
IV	<p>Digestive system: Secretion of digestive juices, digestion and assimilation of Carbohydrates, Proteins Fats and vitamins. Gastro intestinal hormones. Nervous system: Structure of neuron, resting potential and action potential, Propagation of nerve – impulses, Structure of synapse, synaptic transmission (electrical and chemical theory). Structure of Neuro muscular junction and mechanism of neuro muscular transmission, Second messengers, Neuro transmitters</p>						K1-K5	10

V	<p>Reproductive systems Function of reproductive system. Male reproductive system - functions of testis, spermatogenesis site and stage factors influencing semen, Endocrine functions of testis, Androgens - Testosterone - structure and functions. Female Reproductive system - Ovulation, Menstrual cycle, physiological changes during pregnancy - Actions of oestrogen, progesterone, functions of placenta. Lactation - Composition of milk and factors controlling lactation</p>	K1-K5	10
Course Outcome	CO1: Understand the fundamental mechanisms of body fluids and blood cells.	K1	
	CO2: Illustrate the circulatory system includes heart structure, cardiac cycles and cardiac factors and respiratory system includes anatomy, physiology, gas exchange and explain the role of lungs in acid base balance.	K2	
	CO3: Learn about the anatomy of digestive system and secretions, composition and functions of gastric and biliary system thereby learn how to digest the biomolecules in intestine.	K3	
	CO4: Describe the structure and functions of kidney and muscle. Explain mechanism and theories of muscle contraction	K5	
	CO5: Recognize the role of central nervous system in human body. Study the functional units, chemical composition and metabolism of brain	K5	
Learning Resources			
Text Books	<ol style="list-style-type: none"> 1. Human Physiology – Volume I & II, Chatterjee, C.C - 11th edition, 1992. 2. Text book Medicinal Chemistry, Chatterjee. C. 3. Text book of human physiology, Saradha Subramaniam 4. Text book of Medical physiology, Guyton, 2001, 10th Edn., W.B. Saunders 		
Reference Books	<ol style="list-style-type: none"> 1. Agarwal physiological T.B. of Biochemistry, Agarwal G.R & Agarwal B.P. Chemistry. 2. Harper's Biochemistry, Murray. R.G. et al., 2009, 24th edition. 3. Lecture notes on human physiology, Vol II, M. M. Muthiah 1991 4. Concise human physiology, Sukkar, M.Y. Munshid and Ardawi 5. Review of Medical Physiology Ganong. W.F 		
Website Link	<ol style="list-style-type: none"> 1. https://www.onlinebiologynotes.com/ 2. https://bio.libretexts.org/ 3. https://www.osmosis.org/ 		

L-Lecture T-Tutorial P-Practical C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M1PMBE01	HUMAN ANATOMY AND PHYSIOLOGY	DSE - I	I	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	M	M	M	M	M	M	M
CO2	S	M	S	M	M	S	M	M	S	M
CO3	M	M	S	S	M	M	S	M	S	M
CO4	S	S	M	S	S	M	M	S	M	M
CO5	S	M	M	M	M	M	M	M	M	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PMBC04	BIOENERGETICS AND INTERMEDIARY METABOLISM	DSC THEORY - IV	II	4	4			4
Objective	To understand the principles of cellular energy metabolism, schematize the oxidative pathways of carbohydrates, Lipids, Proteins & Nucleic acids and to gain knowledge on mitochondrial Electron transport chain and Oxidative Phosphorylation							
Unit	Course Content						Knowledge Levels	Sessions
I	Bioenergetics : Energy transformation , Laws of thermodynamics, Gibbs energy, Free energy changes and redox potential, ATP as Energy Currency of cells , High and low energy compounds – Electron transport chain ,Oxidative phosphorylation , Inhibitors and Uncouplers of ETC, shuttle systems.						K1-K2	8
II	Carbohydrate Metabolism Introduction to metabolism of cells, glycolysis and its regulation, citric acid cycle, its function in energy generation and regulation of TCA cycle, Gluconeogenesis and its regulation, Metabolism of glycogen and its regulation. Hexose Monophosphate Pathway, Uronic acid pathway, Cori cycle, Metabolism of other hexoses – Fructose, Galactose. Hormonal influence and regulation of Carbohydrate metabolism.						K1-K3	9
III	Lipid Metabolism : Biosynthesis of Fatty acid - Palmitic acid, Stearic acid ,Oleic acid, linoleic acid and Arachidonic acid, Oxidation of saturated and unsaturated fatty acids. Oxidation of fatty acids alpha ,beta and omega oxidation in even and odd numbered fatty acids. Metabolism of Triacyl glycerol, phospholipids and sphingolipids. Cholesterol biosynthesis and regulation. Catabolism transport and excretion of cholesterol, lipoprotein metabolism. Ketone bodies formation and utilization.						K1-K4	10
IV	UNIT IV Aminoacid Metabolism Biosynthesis and Degradation of Tryptophan, Phenylalanine, Lysine, Methionine and Glutamine. Transamination, oxidative and non-oxidative deamination, decarboxylation- urea cycle and its regulation. Integration of metabolic Pathways. Interrelationship of carbohydrates proteins and fat metabolism. Interconversion of major food stuffs. Metabolic profile of the principal organs and their relationships.						K1-K4	10

V	Nucleotide Metabolism Purine nucleotides Metabolism: de novo synthesis, salvage pathway and catabolism with energetics. Pyrimidine nucleotides Metabolism: de novo synthesis, salvage pathway and degradation of pyrimidine nucleotides. Regulation of Purine and Pyrimidine nucleotide metabolism. Synthesis tRNA, rRNA and mRNA with regulation.	K1-K5	8
Course Outcome	CO1:Understand the energy transformation and chemical logic of metabolic pathways in living organism	K1	
	CO2:Know in detail about enzymes, redox carriers, ETC and oxidative phosphorylation machinery	K2	
	CO3:Recognise carbohydrate metabolism and its various biochemical processes responsible for the formation, breakdown and interconversion of carbohydrates in living organisms	K3	
	CO4:Comprehend the concepts of lipid metabolism and amino acid metabolism	K4	
	CO5:Understand concepts of nucleotide metabolism nucleic acid metabolism	K5	
Learning Resources			
Text Books	1. Fundamentals of Biochemistry, J.L. Jain, S. Chand publications, 2004. 2. Biochemistry, Lubert Stryer, 4th edition, W.H. Freeman & Co, 1995. 3. Fundamentals of Biochemistry (1999) - Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY.		
Reference Books	1. Lehninger's Principles of Biochemistry (2000) - Nelson, David l. and Cox, M.M. Macmillan / Worth,NY. 2. Harper's Biochemistry Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 24th edition, Prentice Hall International. Inc. 3. Principles of Biochemistry, Geoffrey L. Zubay, 3rd edition William W. Parson, Dennis E. Vance, W.C. Brown Publishers,1995. 26 4. Principles of Biochemistry, David L. Nelson, Michael M.Cox, Lehninger, 4th edition, W.H. Freeman and company.		
Website Link	1. www.biosciencenotes.com 2. https://microbenotes.com/		

L-Lecture

T-Tutorial

P-Practical

C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PMBC04	BIOENERGETICS AND INTERMEDIARY METABOLISM	DSC THEORY - IV	II	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	M	M	M	S	M
CO2	M	M	M	S	M	S	M	M	S	M
CO3	S	M	M	M	S	M	S	M	M	M
CO4	M	M	M	M	S	M	S	M	M	S
CO5	S	M	S	M	M	M	M	M	M	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M1PMBC05	CLINICAL ENZYMOLOGY	DSC THEORY - V	II	4	4			4
Objective	This paper aims to provide a basic understanding of biological catalysis, Mechanism of action of enzymes, structure and function relationship and Understands the enzyme kinetics and role of coenzymes/co-factors and an overview of Industrial application of enzyme							
Unit	Course Content						Knowledge Levels	Sessions
I	IUB system of classification and nomenclature, Enzyme units , Active site, Enzyme Kinetics Activation energy, Derivation of Michaelis Menten equation, Factors affecting enzyme activity, Enzyme assay, Coenzymes, Isoenzymes and mutlienzyme complex, Mechanism and regulation of enzyme action- Allosteric and feedback regulation						K2	8
II	Principles of Diagnostic enzymology – Laboratory investigation of serum and urinary enzymes, Intracellular localization of enzymes, Diagnostic and Prognostic importance of plasma and non plasma specific enzymes. Cytosolic enzymes – SGPT,ALP and Myocardial isoenzymes LDH, CPK – their source, properties, function, normal value, diagnostic importance. Significance of enzymes in bone disorder and muscle wasting						K2	10
III	Clinical significance of Enzymes -Transaminases, Creatine Kinase, Lactate Dehydrogenase, Alkaline phosphatase, Acid phosphatase, Aldolases, Amylases, Elastase, Gamma glutamyl Transferase, 5' - Nucleotidase, Choline Esterases, Hexokinase, Lipoprotein Lipase.						K2	9
IV	Enzymes in Inborn error of metabolism – Phenylketonuria, Alkaptonuria, Tyrosinosis, Albinism, Hartnup's disease ,Galactoaemia, Taysacch's disease, Niemann Pick's disease, Hunter Syndrome, Lesh Nyhan Syndrome						K2	8
V	Enzymes in Medicine and diagnosis. Normal and Abnormal value of diagnostic marker enzymes, Enzymes in detoxication of drug metabolism, Enzymes in diagnosis: Cerebrospinal fluid, Amniotic fluid and Biopsy samples. Antioxidant enzymes – SOD, Catalase, GPX and GR. Therapeutic enzymes: Thrombolytic enzyme, wound healer, erythropoiesis stimulator						K2	10
Course Outcome	CO1:Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and Compare methods for production, purification, characterization of enzymes						K1	
	CO2:Understand the diagnostic importance of enzymes and their significances						K2	

	C03:Know about the clinical significance of the enzymes	K3	
	C04:Describe the enzymes involved in the inborn error of metabolism	K4	
	C05:Understand the importance of Enzymes in Medicine and diagnosis	K5	
Learning Resources			
Text Books	<ol style="list-style-type: none"> 1. Enzymes By Dixon , E.C Webb, CJR Thorne and K.F. Tipton, Longmans , London. 2. Fundamentals of Enzymology, Nicholas C.Price, and Lewis Stevans, 1998. 2nd ed., . 3. Understanding Enzymes, Trevor Palmer, 1991. 3rd Edn., Ellis Horwood Limited. 		
Reference Books	<ol style="list-style-type: none"> 1. Protein Biotechnology, Gary Walsh and Denis Headon, 1994. John Wiley and Sons, 2. Protein Biochemistry and Biotechnology, Gary Walsh, 2002, John Wiley and Sons Ltd. 3. Enzyme kinetics and Mechanism –Paul F.Cook 		
Website Link	<ol style="list-style-type: none"> 1. https://www.onlinebiologynotes.com/ 2. https://www.studocu.com/row/document/all-saints-university/biochemistry-1/clinical-enzymology/2968517 3. http://mt-lectures.blogspot.com/2016/06/lecture-10-enzymology_11.html 		

L-Lecture

T-Tutorial

P-Practical

C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PMBC05	CLINICAL ENZYMOLOGY	DSC THEORY - V	II	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	S	M	M	M	M	M
CO2	S	S	M	M	M	M	S	M	S	S
CO3	M	M	S	S	S	S	M	M	M	M
CO4	M	S	M	M	M	M	S	M	M	S
CO5	S	M	M	M	M	M	M	M	S	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessmen Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PMBC06	ADVANCED ENDOCRINOLOGY	DSC THEORY - VI	II	4	4			4
Objective	To study about the functions, mechanism of action, diagnosis and investigations of hormones							
Unit	Course Content						Knowledge Levels	Sessions
I	Hormones - Introduction, classification, hormonal effects and regulation – basic concepts Chemical properties of hormones: Peptide hormones, Steroid hormone, Neurohormone. Concept of Receptors – Cell surface and intracellular (cytoplasmic and nuclear) receptors, G protein coupled receptors, Pharmacological receptors – Neurotransmitter receptors. Second messenger system – Ca ²⁺ cAMP, cGMP, DAG, and IP3						K1-K2	10
II	Chemical nature and mechanism of action of steroid hormones and glycoprotein hormones on target tissues. Hypothalamus, Pituitary- Posterior and Anterior, Thyroid, parathyroid, Adrenal and Pineal glands: Secretions, Structure, physiology and Mechanism of action.						K1-K2	9
III	Secretions, Structure, physiological function and Mechanism of action of Pancreatic hormones – Insulin, glucagon, Gastrointestinal hormones – Gastrin, secretin and somatostatin, Sex hormones - testosterone, progesterone and oestrogen						K1-K3	8
IV	Secretions, Structure, physiological function, Mechanism of action, Dysfunction and pathophysiology of hypothalamus – Posterior and anterior hypophyseal complex. Dysfunction and pathophysiology of thyroid, parathyroid, pancreas, adrenals, gonads and gastrointestinal hormones						K1-K4	9
V	Endocrine system: Laboratory diagnosis and investigations related to the disorders of Hypothalamus- Hypophyseal complex. ELISA, [All types] PCR Techniques with reference to hormones estimation in biological sample: Insulin, T3 and T4. TSH. FSH, LH GH, EGN, PGN						K1-K5	9
Course Outcome	CO1:Determine the classification and mechanism of action of hormones						K1	
	CO2:Explain about the chemistry, synthesis and significance of hypothalamic, pituitary and thyroid hormones						K2	
	CO3:Analyze about the pancreatic hormones, gastrointestinal and sex hormones						K3	
	CO4:Predict the dysfunction of hypothalamus, parathyroid, pancreas, adrenals, gonads and gastrointestinal hormones.						K4	

	C05:Report on laboratory diagnosis and investigations of hormones	K5	
Learning Resources			
Text Books	1. Endocrinology, Mac E. Hadley, 2006, 4TH . Edition. Prentice Hall International Inc 2. Textbook of Medical Physiology, Guyton and Hall, 2000. 10th Edition, Saunders Publishing Co. 3. Harpers Biochemistry, Murray et al., 2003. 2nd Edition, Mc Graw Hill Publications, USA.		
Reference Books	1. Principles of Biochemistry, Emil Smith, Handler Abraham, 1983.7 th Edn., White, Mcgraw Hill International book company. 2. Williams textbook of Endocrinology, P.Reed Larson, HenryM. Korenberg, Shlom Melmed and Kenneth S. Polonsky, 2003, 10th Edition, Saunder Philadelphia, USA		
Website Link	1. https://www.onlinebiologynotes.com/ 2. https://www.vedantu.com/ 3. https://www.osmosis.org/		

L-Lecture

T-Tutorial

P-Practical

C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PMBC06	ADVANCED ENDOCRINOLOGY	DSC THEORY - VI	1	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	S	M	S	S	M	M	S	M
CO2	S	M	M	M	M	S	S	S	M	S
CO3	M	S	S	M	S	S	M	M	S	M
CO4	M	M	M	M	M	S	M	S	M	M
CO5	S	M	M	S	M	S	M	M	M	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PMBE02	MEDICAL MICROBIOLOGY	DSE – II	II	4	4			4
Objective	The aim of the study is to get knowledge about microorganisms and their characters. Gain knowledge about the medical applications of microorganisms.							
Unit	Course Content						Knowledge Levels	Sessions
I	Classification of medically important bacteria, fungi, parasites and viruses. Infection – types – Source – Methods of transmission of infections. Host parasite relationship. Bacterial virulence factors. Staining and biochemical identification of bacteria. Ground rules for collection, transport and processing of clinical specimens for microbiological diagnosis						K1- K2	8
II	Medical Bacteriology Morphology, cultural characters, antigenic characters, pathogenicity, laboratory diagnosis, treatment and control of diseases caused by Staphylococcus aureus, Streptococcus pyogenes, Streptococcus pneumoniae, Neisseria meningitidis, Neisseria gonorrhoeae, Clostridia, Salmonella typhi, Shigella dysenteriae, Vibrio cholerae, Mycobacterium tuberculosis, Antibacterial antibiotics – mode of action						K1- K2	8
III	Medical Mycology Morphology, culture properties, pathogenicity, laboratory diagnosis, treatment and control of superficial mycosis – Tinea Nigra and Piedra. Cutaneous mycosis – Dermatophytes. Subcutaneous mycosis – Mycetoma. Systemic mycosis – Histoplasma. Opportunistic mycosis – Candida. Antifungal agents and mechanism of action in inhibition of fungal growth.						K1- K3	9
IV	Medical Parasitology Morphology, life cycle, pathogenicity, lab diagnosis treatment and control measures of Intestinal amoebae – Entamoeba histolytica. Intestinal and genital flagellates – Giardia intestinalis and Trichomonas vaginalis. Blood flagellates – Trypanosoma. Haemosporina – Plasmodium. Coccidian – Toxoplasma gondii. Helminthic parasites – Cestodes – Taenia solium. Trematode – Fasciola hepatica. Nematodes – Ascaris lumbricoides and Wuchereria bancrofti						K1- K4	10

V	Medical Virology Morphology, cultivation, replication, pathogenicity, laboratory diagnosis treatment and control measures of diseases caused by Pox virus, Herpes virus, Hepatitis (A,B and C) Orthomyxo virus – Influenza virus. Picarνο virus – Polio. Paramyxo virus – Parainfluenza virus, Mumps, Measles, .Rhubella virus, HIV, Arbo viruses. Oncogenic viruses. Emerging viruses. Antiviral agents and mechanism of action.	K1- K5	10
Course Outcome	CO1: Understand the classification and controlling of microbes and study isolation of microbes and maintenance.	K1	
	CO2:Describe important characteristic of microorganisms, thereby identify different type of microorganisms.	K2	
	CO3:Study about various types of microorganisms involved in infection of food products.	K3	
	CO4: Recognise the sources and transmission of infections and how the factors involving in infection	K4	
	CO5: Know about the different types of microscopes and its function.	K5	
Learning Resources			
Text Books	<ol style="list-style-type: none"> 1. Principles of Bacteriology, Virology and Immunity. Topley and Wilson, 1995. 9th edition, Vol I, Edward Arnold, London 2. Text book of Microbiology. Anantna Narayanan and Paniker's 2013. 9th Edition. Universities Press, (India) Private Limited, Hyderabad. 3. Medical Microbiology, Greenwood, D., Slack, R.B. and Peutherer, J F. , 2002. 16th Edition.Churchill Livingston, London 		
Reference Books	<ol style="list-style-type: none"> 1. Medical Virology Morag C and Timbury, M.C 1994. 10th Edition. Churchill Livingston, London 2. A text book of Medical Mycology , Jegadish Chander ,1996. Interprint. New Delhi 3. Text book of Medical Parasitology Protozoology and Helminthology Text and colour Atlas.Subash Chandra Parija 2013. 4th Edition. All India Publishers and Distributers, New Delhi. 4. Medical Microbiology and Immunology. Warren Livingstone and Ernest Jawetz 2000. 6th Edition. McGraw Hill companies. Inc. 		
Website Link	<ol style="list-style-type: none"> 1. https://microbenotes.com/category/bacteriology/ 2. https://www.microscopemaster.com/ 3. https://nios.ac.in/media/documents/dmlt/Microbiology/Lesson-37.pdf 		

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M2PMBE02	MEDICAL MICROBIOLOGY	DSE - II	II	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	M	M	M	M	M	M	S
CO2	M	M	S	S	M	M	S	M	M	S
CO3	M	S	M	M	S	M	M	S	S	S
CO4	M	M	S	M	M	M	M	M	M	M
CO5	S	M	M	M	S	M	M	M	M	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc., Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PMBC07	IMMUNOLOGY	DSC THEORY - VII	III	4	4			4
Objective	To study the immune responses of human body against antigen, immunological techniques and vaccine synthesis.							
Unit	Course Content						Knowledge Levels	Sessions
I	Overview of the immune system: Non – specific and specific components of immunity. Cells, primary and secondary organs of immune system. Hematopoiesis. Antigens – Immunogenicity, haptens, adjuvants, epitopes - T cell and B cell epitopes. Immunoglobulins- Structure, classes, biological activities, antigenic determinants, Ig superfamily, organization and expression of Ig genes, abzymes						K1-K2	8
II	T cell and B cell receptors, Interaction of T cells and B cells. T cell and B cell maturation, activation, differentiation and proliferation. Effector mechanism- Macrophage activation, cytokine mediated immunity. Clonal selection theory, Immunoglobulin rearrangements, Class switching. Complement system and regulation. Cytokines and Cell – mediated effector responses						K1-K3	8
III	Organization and functions of MHC, structure of MHC molecules, Antigen processing and presentation. Classes of MHC molecules. Hypersensitive reactions [all types]. Immune response to infectious diseases. Transplantation types, MHC antigens in transplantation, Mechanism of graft rejection and Immunosuppressive therapy. Autoimmunity and Immuno-deficiency diseases; types, mechanism of HIV organization and pathogenesis						K1-K4	9
IV	Oncogenes, tumour antigens and cancer induction, metastasis, immune response to tumour, cancer immunotherapy. Immunization – Active and passive Immunization, types of vaccine and vaccine technology; Peptide vaccine, toxoids, Recombinant vector vaccine, DNA vaccine, Synthetic peptide vaccine. Hybridoma techniques- HAT media, Production of monoclonal and polyclonal antibodies. Gene transfer into mammalian cells – cultured cells and mou						K1-K5	10
V	Experimental animal models – Inbred strains, Adaptive - transfer systems, Haemolytic plaque assay, SCID mice. Cell – culture systems - primary, cloned and hybrid lymphoid cell lines. Protein labelling techniques. Antigen - Antibody reactions – Agglutination and precipitation, Immuno-electrophoresis, Immuno - blotting technique, RIA, ELISA - principle, types and applications. Immuno-fluorescence, Avidin-biotin mediated assay, Flow cytometry						K1-K5	10
Course Outcome	CO1:Understand the humoral and cell mediated immunity.						K1	

	C02:Know the primary and secondary lymphoid organ.	K2	
	C03:Describe the theories of antibody formation and factors influencing antibody production.	K3	
	C04:Learn the types of transplantation and understand how its malfunction is linked with autoimmune disease and hypersensitivity.	K4	
	C05:C05 Understand the active and passive immunization and learn how to make recombinant vector vaccines.	K5	
Learning Resources			
Text Books	1. Immunology (2007) Kuby 6th edition 2. ROITT's Essential Immunology(2002) Wiley publication 12th edition. 3. Immunology - A introduction - Tizard 4. Immunology – Kannan. MJP Publishers Edition: 2013		
Reference Books	1. Biomedical Methods Hand Book-John M. Walkset Ralph Raplay. Humana Press, 2005. 2. George P. Patrinos, Wilhelm Ansorge, (2009). Molecular Diagnostics 3. Stress, immunity of ageing – L Cooper. Marcel Dekkar 4. Nucleic Acid Testing for Human Diseases. Ed. Attila Lorincz. Taylor and Francis Publishers(CRC, NY), 2006		
Website Link	1. https://ameripharmaspecialty.com/ 2. https://www.britannica.com 3. https://pathology.jhu.edu/		

L-Lecture

T-Tutorial

P-Practical

C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PMBC07	IMMUNOLOGY	DSC THEORY - VII	III	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M	M	M	M	M	S
CO2	S	M	M	M	M	S	S	M	S	M
CO3	M	M	M	S	S	M	M	S	M	S
CO4	M	M	M	M	M	M	M	M	S	M
CO5	S	M	M	M	M	M	S	M	M	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PMBC09	PHARMACEUTICAL BIOCHEMISTRY AND TOXICOLOGY	DSC THEORY - VIII	III	4	4			4
Objective	This course deals with the study of fundamental concepts of pharmacology about the physicochemical properties of the drug, their origin, classification and nomenclature of drugs, how do they act, etc., It also enables the students to gain the complete knowledge about drug designing and also know about the principles of toxicology.							
Unit	Course Content						Knowledge Levels	Sessions
I	Biopharmaceutical properties of drugs: Mechanism of drug absorption – physicochemical factors versus drug absorption. Drug dissociation versus drug absorption. Isomerism and pharmacological activity. Structural features and pharmacological activity; geometric isomerism, configuration influence on pharmacologic activity. Effect of conformational isomerism on biological activity of drugs.						K1-K2	9
II	Theoretical aspects of drug designing. Molecular modelling: Principles of computational chemistry, molecular mechanics, chemical methods. Hardware considerations, Software considerations. Receptors and drug action, Affinity – Role of chemical bonding. Dose – Response relationships, Receptor location, Receptor and the biological response. Receptor subtypes. Dynamic nature of receptors. Nonsteroidal anti – inflammatory drugs. Drugs affecting sugar metabolism. Drugs of clinical significance.						K1-K2	8
III	Drug metabolism: First phase metabolism – Elimination pathway – Entero - hepatic cycling of drugs. Drug biotransformation pathway – phase I – Hepatic cytochrome P450 enzyme system; Cytochrome P450 cycle – induction and inhibition. – Oxidation catalysed by cytochrome P450 isoforms – All types of hydroxylation, Deamination – Dealkylation – Dehalogenation. Oxidations: Microsomal & Non – microsomal oxidations. Miscellaneous reductions.						K1-K3	10
IV	Drug conjugation pathways- Phase – II: Hyaluronic acid conjugation – sulfate conjugation – conjugation with amino acids; Acetylation, Glutathione conjugation, cyanide conjugation. Extra hepatic metabolism – Toxicity from oxidative metabolism. Drug interactions – Ames test. Metabolic pathways of common drugs. Lovastatin, Acetaminophen, Ciprofloxacin, Caffeine, Theophylline, Nicotine, Ibuprofen, Tamoxifen. General toxicology: Basic principles of diagnosis. Mechanism of toxic effect, Toxicokinetics. Response of respiratory system, reproductive system, liver and kidney to toxic agents. Toxic effects of metals, solvents and environmental pollutants.						K1-K4	10

V	Toxicology: Principles of toxicology and treatment of poisoning. Heavy metals and antagonists. Non-metallic environmental toxicants. Methods involved in the development of new drugs. Preclinical toxicological studies. Determination of LD 50 and ED50. Acute, sub-acute and chronic toxicity studies. Antidotes in the management of poisoning. Applied analytical toxicology and toxico vigilance.	K1-K5	8
Course Outcome	C01: Understand clearly the basic concepts of pharmacology	K1	
	C02: Have a thorough knowledge of the mechanism of drug action, Drug interaction, and Receptors.	K2	
	C03: Know the aspects of New discoveries of drugs and drug designing	K3	
	C04: Know about the drug interactions and its mechanism	K4	
	C05: Recognize the principles of toxicology, Antidotes, and the management of poisoning.	K5	
Learning Resources			
Text Books	1. Text Book of Biochemistry, B.Harrow and A.Mazur, 1996, 9th Edition, W.B.Saunders Co., Philadelphia. 2. An Introduction to Practical Biochemistry, D.T.Plumer, 1988. 3rd Edition, Tata McGraw Hill, New Delhi.		
Reference Books	1. Pharmacology and Pharmacotherapeutics, Satoskar, R.S et al., 2015.24th Edition, Popular Prakasham, Bombay. 2. Applied Biopharmaceutics and Pharmacokinetics, Shargel, L. et al., 2015. 7th Edition, McGraw-Hill Medical.		
Website Link	1. https://pharmacy.utah.edu/pharmtox/research/drug-metabolism-biochemical 2. http://www.csun.edu/~hcchm001/biosites.htm 3. http://www.pharmatips.in/Articles/Pharmacology/List-Of-Pharmacology-Books.aspx 4. https://guides.ou.edu/c.php?g=113836&p=1138201		

L-Lecture

T-Tutorial

P-Practical

C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PMBC09	PHARMACEUTICAL BIOCHEMISTRY AND TOXICOLOGY	DSC THEORY - VIII	III	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	M	M	M	M	M	M	M
CO2	S	M	M	M	S	M	S	M	M	M
CO3	M	M	M	S	M	M	M	M	M	M
CO4	S	M	S	M	S	M	S	M	S	S
CO5	M	S	M	M	M	M	M	S	M	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PMBC08	CLINICAL AND NUTRITIONAL BIOCHEMISTRY	DSC THEORY - IX	III	4	4			4
Objective	The aim of the study of this paper is clinical approach of blood and urine samples and their complications and to gain knowledge about nutraceutical							
Unit	Course Content						Knowledge Levels	Sessions
I	<p>Uses of Biochemical data in clinical medicine- specific uses of biochemical tests in management and prognosis-screening. Acquisition & Interpretation of biochemical data-Factors affecting test results-Pre-analytical factors-Biological factors – Endogenous & Exogenous– Accuracy–Precision and Analytical goal.</p> <p>Quality of laboratory medicine- Quality management systems, Personnel information systems- clinical effectiveness. Clinical quality indicators- effectiveness, demand management.</p> <p>Selection of methods for common analysis in serum/plasma – total proteins, glucose, urea, creatinine</p> <p>Specimen: Whole blood, plasma, serum, CSF and gastric fluid collection methods and preservation</p>						K1-K2	9
II	<p>Disorders of glucose metabolism: Role of hormones in regulation of plasma glucose level, renal threshold value, Hyperglycemia and Diabetes mellitus: Diagnosis, prognosis and management, hypoglycemia. Glycogen storage diseases, Fructosuria, Lactose intolerance.</p> <p>Disorders of lipid metabolism: Familial hypercholesterolemia, hypo and hyper cholesterolemia, Fatty liver, Hyper and hypo lipoproteinemia, hypertriglyceridemia, Atherosclerosis and Myocardial Infarction – Biochemical changes, Diagnosis, prognosis and management.</p> <p>Disorders of Nitrogen metabolism: Excretion of nitrogenous waste products, porphyrias, Hemoglobinopathies, Uric aciduria- Pathogenesis, diagnosis and management.</p>						K1-K3	10
III	<p>Liver function tests: Based on abnormalities of bile pigment metabolism, changes in plasma proteins, excretion, detoxification. Role of serum enzymes in diagnosis of liver diseases. Management of jaundice, hepatitis, cirrhosis, liver failure, hepatic coma and gall stones. Kidney function tests: Abnormal constituents of urine, biochemical findings, Glomerular and tubular function tests. Pathogenesis, Biochemical changes, diagnosis, and prognosis: Nephrotic syndrome, Glomerular nephritis, kidney failure, Urolithiasis and nephrolithiasis.</p> <p>Gastric functional tests: Fluid composition, pathology, diagnosis and management of Ulcer [all types] and gastritis. Tumor markers and molecular significances;</p>						K1-K3	10

	Oncofetal protein, Oral carcinoma, mammary carcinoma, liver carcinoma, Kidney cancer, leukemia-Acute and Chronic Lymphoid Leukemia and Myeloid Leukemia		
IV	Composition of human body. Energy content of foods. Measurement of energy expenditure: direct & indirect calorimetry. Basal metabolic rate (BMR) and specific dynamic action (SDA) and factors affecting BMR. Thermogenic effects of foods. Energy requirements of man and woman and factors affecting energy requirements. Nutritional disorders and management – Malnutrition, Kwashiorkor, Marasmus and nitrogen imbalance. Obesity and secondary causes of obesity, appetite and eating disorders. Physicochemical properties and physiological functions of dietary fibers.	K1-K4	8
V	Functional Foods and Nutraceuticals - Introduction - Defining the concept – Cereals and pulses and functional food. Teleology of Nutraceuticals – Primary and secondary metabolites in plants. General Teleology – a) Carotenoids b) Conjugated linolenic acid c) Flavonoids d) Sulphur containing Amino Acid Derivatives e) Omega 3 fatty acids f) PUFA g) Terpenoids. Dietary Supplements – role of nutraceuticals in the management of Inborn errors of metabolism, obesity, neurological disorder, diabetes mellitus, hypertension, Cardiac vascular disease, vitamin A Deficiency.	K1-K5	8
Course Outcome	CO1: Understand the collection and analysis of blood and urine samples.	K1	
	CO2:Understand the role of carbohydrates and lipid metabolism in various diagnostic and therapeutic approaches	K2	
	CO3:Know about the gastric function test for diagnosis and therapeutic complications. To learn the different blood tests that are used to evaluate renal function tests and liver functions.	K3	
	CO4:To know about the energy content of food, Dietary requirements and Measurement of energy expenditure, Protein-energy malnutrition disorders	K4	
	CO5:To learn about nutraceuticals, role of nutraceuticals in the management of various disorders	K5	
Learning Resources			
Text Books	1. Practical Clinical Biochemistry, Harold Varley, 2006. 4th and 6th editions, CBS publishers. 2. Clinical Chemistry in diagnosis and treatment, Mayne, 1999, ELBS. 3. Food Science, Srilakshmi B, 2002, 5th edition, New Age International Pvt Ltd.		

Reference Books	1. Clinical Biochemistry- Metabolic and clinical aspects, William J. Marshall, Marta Lapsley, Andrew P. Day, Ruth M. Ayling, 2014. Churchill Livingstone, Elsevier 2. Modern Nutrition in health and disease, Robert S Goodhart, 2012, 11th edition, Lippincott Williams and Wilkins. 3. Food facts and principles, N Shakuntala, O Manay, 2001, New Age International Pvt Ltd. 7. Clinical Chemistry in diagnosis and treatment, Mayne, 1999, ELBS
Website Link	1. https://www.healthline.com/health/ 2. https://www.mayoclinic.org/diseases

L-Lecture

T-Tutorial

P-Practical

C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PMBC08	CLINICAL AND NUTRITIONAL BIOCHEMISTRY	DSC THEORY - IX	III	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M	M	M	M	S	S
CO2	S	M	M	S	M	S	M	S	M	S
CO3	M	M	M	M	M	M	M	S	M	M
CO4	M	S	S	M	M	S	S	M	M	M
CO5	S	M	M	S	M	M	S	M	M	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PMBE03	BIostatistics AND MEDICAL BIOINFORMATICS	DSE - III	III	4	4			4
Objective	To study different levels of Bioinformatics tools and applications of statistics in science and to study this paper we can understand methods which is used to implement in Research.							
Unit	Course Content						Knowledge Levels	Sessions
I	Organizing a statistical survey, Planning and executing the survey. Source of data - Primary and secondary data collection. Classification and tabulation of data. Diagrammatic and graphic presentation of data.						K1-K2	8
II	Measure of central tendency - arithmetic mean, median, mode, quartiles, deciles and percentiles. Measure of variation - range, quartile deviation, mean deviation, standard deviation, Coefficient of variation. Correlation analysis - Scatter diagram, Karl's Pearson's coefficient of correlation and Spearman's rank method. Regression analysis.						K1-K3	8
III	Sampling distribution and test of significance – Concepts of sampling, Testing of hypothesis, errors in hypothesis testing, standard error and sampling distribution, sampling of variables (large samples and small samples.). Student's "t" distribution and its applications. Chi-square test and goodness of fit. Analysis of variance - one way and two way classification. Duncan's Multiple Range test.						K1-K3	9
IV	Aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities - internet basics – HTML - introduction to NCBI data model - Various file formats for biological sequences. Primary sequence databases - Composite sequence databases - Secondary databases - Nucleic acid sequence databases - Protein sequence data bases - Structural databases -- Protein structure visualization tools (Ras Mol, Swiss PDB Viewer). Sequence analysis of Biological data - Significance of Sequence alignment - Pairwise sequence alignment methods - Multiple sequence alignment methods – Tools and application of multiple sequence alignment.						K1-K4	10

V	Definition of genome and genomics. Types of gene map-genetic, cytogenetic and physical. Molecular markers for mapping - RFLPs, microsatellites and SNPs. Assembling a physical map of the genome - chromosome walking and jumping. Genome projects: E.coli, D.melanogaster, A. thaliana and mouse. The human genome project: goals, mapping strategies, markers, sequencing technologies, results of final sequence, potential benefits and risks, ethical, legal and social issues (ELSI).	K1-K5	10
Course Outcome	CO1: This course covers the basic tools for the collection, analysis and presentation of data in all areas of research.	K1	
	CO2: To measure the central tendency, variation and correlation analysis	K2	
	CO3: To analyze sampling distribution, sampling of variables and test of significance	K3	
	CO4: To know about bioinformatic tools for multiple sequence alignment.	K4	
	CO5: To know about genomics and its benefits and risks	K5	
Learning Resources			
Text Books	<ol style="list-style-type: none"> 1. Biostatistics analysis, Zar, J.H, 1984.Prentice Hall, New Jersey 2. Statistical methods for biologists, Palanichamy. S and Manoharan. M., 1990. 3. Bioinformatics - Concepts, Skills, and Applications , S.C. Rastogi Namita Mendiratta and Parag Rastogi, 2003 CBS Publishing. 4. Bioinformatics, C S V Murthy, 20031st Edition. Himalaya Publishing House 5. Basic Bioinformatics, S. Ignacimuthu and S.J. Narosa, 1995.Publishing House 		
Reference Books	<ol style="list-style-type: none"> 1. Biostatistics – A foundation for analysis in health science, Wayne W,Daniel and Chad L.Cross,10th Edn. John Wley & Sons Inc. 2. Biochemical calculation and biostatistics, Dr. E.Padmini, 2010.2nd Edn. Wiley India Pvt.Limited 3. Bioinformatics - A practical guide to analysis of Genes & Proteins Andreas D Baxevanis and B F Francis, 2000. John Wiley. 4. An Introduction to Computational Biochemistry, C.S. Tsai, 2002. Wiley& Liss, New York. 5. Biostatistics – A foundation for analysis in health science, Wayne W,Daniel and Chad L.Cross,10th Edn. John Wley & Sons Inc. 		
Website Link	<ol style="list-style-type: none"> 1. https://onlinecourses.nptel.ac.in/noc19_bt19/preview 2. https://nptel.ac.in/courses/102106065 3. https://onlinecourses.nptel.ac.in/noc22_bt13/preview 		

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PMBE03	BIostatistics AND MEDICAL BIOinformatics	DSE - III	III	4	4			4

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	S	S	M	M	M	M
CO2	M	S	M	M	M	M	M	M	S	S
CO3	M	M	S	M	M	M	S	S	M	M
CO4	M	M	M	S	M	M	M	M	M	S
CO5	S	M	S	M	M	M	S	M	M	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc- Medical Biochemistry LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PMBIS1	INTERNSHIP TRAINING	INTERNSHIP	III					2
Objective	To earn academic credit and develop new skills at the same time. Internship must take place outside a university research lab							
Guidelines for internship training programme						Knowledge Levels	Sessions	
<ol style="list-style-type: none"> The students are expected to have a practical training in any business unit or undertaking to enable them to acquaint himself / herself with the procedure, practice and working of companies. Each student should undergo industrial training for a minimum period of two weeks during the third semester vacation. He / She shall undergo the above training in the institutions like banks, insurance companies, mutual funds, transport undertakings, private limited and public limited companies, hotels and hospitals, travel and tourism industries and financial institutions. Students may make their own arrangements in fixing the companies for candidates should submit a report in not less than 25 type written pages. Candidates should submit the attendance certificate from the institution for having attended the training for 2weeks. Industrial training reports shall be prepared by the students under the supervision of the faculty of the department. Industrial training report must contain the following: Cover page Copy of training certificate Profile of the business unit Report about the work undertaken by them during the tenure of training Observation about the concern Findings Industrial training certificate shall be forwarded to the university, one month before the commencement of the third semester university examinations. Internship viva - voce examination will be conducted with internal & external examiners at the end of the fifth semester and the credits will be awarded 						K1-K4		
Course Outcome	CO1: Enhancing learning in a professional environment					K1		
	CO2: Gaining experience with current technology					K2		
	CO3: Contributing to significant projects					K3		

	CO4: Building personal skills, Developing a resume that highlights desirable skills	K4	
	CO5: Networking with people working in the science community	K4	
Learning Resources			
L-Lecture T-Tutorial P-Practical C-Credit			

M.Sc- Medical Biochemistry LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PM BIS1	INTERNSHIP TRAINING	INTERNSHIP	III					2

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	M	S	M	S	S	S	S
CO2	S	S	S	S	M	S	S	M	S	M
CO3	M	S	M	S	M	S	M	M	S	S
CO4	S	S	S	M	S	S	M	S	M	M
CO5	S	S	M	S	M	M	S	S	M	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Career plan discussion 3.Experimental discussion
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom

Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance
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Designed By	Verified By	Approved By

M.Sc- Medical Biochemistry LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M3PMBIS1	INTERNSHIP TRAINING	INTERNSHIP	III					2
Objective	To understand the basis and general methodology of the molecular separation techniques specified in the course. and to expertise on the application of these techniques to the separation of mixtures with known compositions.							
Unit	Course Content						Knowledge Levels	Sessions
I	<p>pH and Buffers: Definitions for Acids and bases, pH: - Definition and determination of pH. Buffer system of human body.</p> <p>Cell Fractionation Techniques: Organ and tissue slice techniques, tissue homogenization, cell lysis - Methods of cell disruption, extraction, salting in and salting out.</p> <p>Dialysis and Ultrafiltration – Artificial membranes, semipermeable membranes, Donnan membrane equilibrium and biological significance of osmosis.</p> <p>Basic principles of cell sorting and counting.</p> <p>Maintenance and preservation of cells.</p> <p>Microscopy: Simple, Light, Dark, Phase Contrast</p>						K1-K2	8
II	<p>Chromatographic Techniques: Principles, procedure and applications of paper chromatography, thin layer chromatography, column chromatography - ion exchange chromatography, gel filtration chromatography, affinity chromatography.</p> <p>Gas Liquid Chromatography, High performance Liquid Chromatography.</p>						K1-K2	8
III	<p>Centrifugation: Basic principles of sedimentation, Svedberg's constant, sedimentation velocity and sedimentation equilibrium. Types of centrifuges – desk top, high speed and ultracentrifuges. Types of Rotors - swinging bucket, fixed angle, vertical tube and zonal rotor.</p> <p>Types of centrifugation: Preparative centrifugation - differential and density gradient centrifugation with applications, Analytical centrifugation – molecular weight determination.</p>						K1-K3	8

IV	<p>Electrophoretic Techniques: Principles, techniques and applications of paper electrophoresis, gel electrophoresis - agarose, SDS-PAGE, Capillary electrophoresis, isoelectric focusing, Factors affecting electrophoresis.</p> <p>Spectroscopic Techniques: Laws of absorption -Beer - Lambert's law and its limitations. Principles, instrumentations and applications of colorimeter, spectrophotometer, spectrofluorimeter and flame photometer.</p>	K1-K4	10
V	<p>Radioisotope Techniques: Radioactivity, stable and radioactive isotopes, Radioactive decay - rate of radioactive decay and units of radioactivity. Methods of detection of radioisotopes: - GM counter, Scintillation counter. Autoradiography and its applications. Advantages, disadvantages and safety aspects of radio isotopic techniques.</p> <p>Radioisotopes in Biology: Radioisotopes commonly used in biochemical studies – ¹⁴C, ³²P, ³⁵S, ³H, ¹³¹I.</p>	KI-K5	11
Course Outcome	CO1: Illustrate the cell fractionation techniques and clarify about the microscope handling.	K1	
	CO2: Disclose the chromatographic techniques for the separation components	K2	
	CO3: Explain the principles of centrifugation techniques for the separation of components	K3	
	CO4: Understand basic principles behind electrophoretic and spectroscopic techniques	K4	
	CO5: Describe about the measurement and the applications of radioisotopes	K5	
Learning Resources			
Text Books	<p>1. Biophysical chemistry Principles and Techniques - Avinash Upadhyaye and Nirmalendhe Nath, Himalaya Publishers.</p> <p>2. A Biologist Guide to Principles and Techniques of Biochemistry, Keith Wilson and Kenneth Goulding, Edward Arnold publishers.</p>		
Reference Books	<p>1. Cell biology, T. Devasena, 2012, Oxford University press.</p> <p>2. Principles and techniques of practical Biochemistry, Keith Wilson and John Walker, 1995. Cambridge University Press.</p> <p>3. An Introduction to Spectroscopy for Biochemist, Brown. SB Academic Press.</p>		
Website Link	<p>1. https://link.springer.com/content/pdf/bfm%3A978-1-4419-9785-2%2F1.pdf</p> <p>2. https://onlinecourses.nptel.ac.in/noc22_cy43</p> <p>3. https://nptel.ac.in/courses/104102009</p>		

L-Lecture T-Tutorial P-Practical C-Credit

M.Sc- Medical Biochemistry LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M3PMBIS1	INTERNSHIP TRAINING	INTERNSHIP	III					2

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
C01	S	S	S	S	S	S	S	S	S	S
C02	S	S	S	S	M	S	S	M	S	S
C03	M	S	S	S	S	S	S	S	S	S
C04	S	S	S	M	S	S	M	S	S	S
C05	S	S	M	S	S	S	S	S	M	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG	S					

Tutorial Schedule	1.Group discussion 2.Career plan discussion 3.Experimental discussion
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M4PMBC10	BIOMEDICAL INSTRUMENTATION	DSC THEORY - X	IV	5	5			5
Objective	The objective of this course is to introduce student to basic biomedical engineering technology and introduce different biological signals, their acquisition, measurements and related constraints.							
Unit	Course Content						Knowledge Levels	Sessions
I	Classification of biomedical equipments - Diagnostic, therapeutic and clinical laboratory equipments, bioelectric signals and their recording. Electrodes for ECG, EMG and EEG and their characteristics, bioelectrode - types, electrode - tissue interface, contact impedance. Transducers for biomedical application. Types, properties, characteristics and selection of transducers for biological instrumentation.						K1- K3	12
II	Biosensors – Principle and mechanism of calorimetric, potentiometric, immuno and optical biosensors. Autoanalyser - types and application. Automatic tissue processing and application of microtome. Principle and clinical application of pulse oximeter and sphygmomanometer.						K1- K3	12
III	Principle and applications - X-ray machine, radiography, fluoroscopy, conventional X-ray imaging, angiography, Computer tomography and linear tomography. Ultrasonic imaging system. Physics of ultrasonic waves, medical ultrasound, different mode of operation of ultrasound – A scan and B scan, application of ultra sound scan, CT scan, MRI scan and echocardiography.						K1- K3	12
IV	Introduction, characteristics, diagnostics and therapeutic application and advantage of pulsed ruby laser, ND- YAG laser, CO2 laser, argon laser and helium neon laser. Introduction, types, merits, demerits, limitations, diagnostic and therapeutic application of endoscope, laparoscope and cardio scope.						K1- K3	12
V	Therapeutic instruments - Introduction, types, life time, classification, power source and electrodes of cardiac pacemaker and defibrillators. Application of surgical diathermy equipment and heme dialysis in medicine. Computer application in medicine - computerized catheterization laboratory, computerized patient monitoring system.						K1- K3	12
Course Outcome	CO1: Learn about the mode of operation of various instrument and its medical applications.						K1	
	CO2: Elucidate cardiovascular system, respiratory and nervous systems and related measurements						K2	

	C03: Learn about the Principle and application of various sensors	K3	
	C04: Discuss the application of Electronics in diagnostics and therapeutic area	K4	
	C05: Understand the Computer applications in medicine	K5	
Learning Resources			
Text Books	1. Handbook of medical instruments, R.S Khandpur, 2003. 2nd Edn. Tata McGraw-Hill Publishing Company. 2. Biomedical instrumentation, Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, 1980. 2nd Edn. Prentice-Hall, 3. Medical Instrumentation, John G. Webster, 2003, John Wiley & Son		
Reference Books	1. Principles of applied Biomedical instrumentation by L.A. Goddes and L.E. Baker, 1989. 3rd Edn. John Wiley India Pvt.Ltd. 2. Introduction to Biomedical Equipment Technology, Carr J. and J, Brown J. M, 2009. 4th Edn.. Pearson. 3. Medical electronics and Instrumentation by Sanjay Gupta.		
Website Link	1. https://www.bharathuniv.ac.in/page_images/pdf/Electrodes-in-biomedical-instrumentation-Manoj.pdf 2. https://www.laserax.com/blog/ 3. https://www.physics-and-radio-electronics.com/physics/ 4. https://prezi.com/bagzxon0btna/diagnostic-instruments-therapeutic-instruments/		

L-Lecture

T-Tutorial

P-Practical

C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M4PMBC 10	BIOMEDICAL INSTRUMENTATION	DSC THEORY - X	IV	5	5			5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	S	M	M	M	M	S	M	M
CO2	M	S	M	S	M	M	S	M	S	S
CO3	S	M	S	M	M	S	M	S	M	M
CO4	M	S	M	S	M	M	M	S	M	S
CO5	S	M	M	S	M	S	M	M	S	M
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessments Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M4PMBE04	MOLECULAR BIOLOGY AND BIOTECHNOLOGY	DSE- IV	IV	5	5			5
Objective	To describe the general principles of gene organization and expression in both Prokaryotes and eukaryotic organism. To explain various level of gene regulation and its functions.							
Unit	Course Content						Knowledge Levels	Sessions
I	Molecular structure of Genes and chromosomes. Organization of genes in Prokaryotes and Eukaryotes. Prokaryotic and Eukaryotic Transcription units - Structure of DNA-semi conservative model of replication- experimental evidences. Replication of DNA; Enzymes, replication in eukaryotes; circular and helical DNA regulation – regulation of replication. DNA damage and repair.						K1-K2	12
II	Transcription – structure and functions of RNA polymerase – initiation, elongation, and termination of transcription. Post transcriptional modifications. Transcription in Eukaryotes. Various classes of RNA – mRNA, tRNA, snRNA, and hnRNA.						K1-K2	12
III	Genetic code – salient features, decipheration , Wobble hypothesis, natural variation in genetic code. Translation: Prokaryotic and Eukaryotic Translation; Initiation, elongation and termination – Inhibitors of translation – Post translational modifications and protein sorting.						K1-K2	12
IV	Animal cell culture: Culture media – role of carbon dioxide, serum, growth factors, glutamine in cell culture. Types of cell culture – primary and established culture, organ culture, tissue culture. Disaggregation of tissue and primary cell culture, cell separation, cryopreservation.						K1-K2	12
V	Transgenic animals and plants – monoclonal and polyclonal antibodies – vaccines and diagnosis – edible vaccines – humulin- interferons, Stem cells – History – types- culturing of stem cells – Embryonic stem cells, cord blood, adult stem cells- cloning- stem cell banking – Stem cell therapy- Ethics.						K1-K2	12
Course Outcome	CO1:Understand the basic structures, properties and organization of eukaryotic and prokaryotic chromosomes and Emphasize the molecular mechanism of DNA replication involved in eukaryotes and prokaryotes.						K1-K2	
	CO2:Deeply understand the transcription process in prokaryotes and eukaryotes.						K1-K2	

	CO3:Know about the translation and post translational modification in prokaryotes and eukaryotes.	K1-K2	
	CO4:Know the transgenic plants and its applications & risks. Also understand the genetic modification in food industry and its applications, and controversies over risks.	K1-K2	
	CO5:Know the plant molecular biology techniques and their applications	K1-K2	
Learning Resources			
Text Books	1. Cell and Molecular Biology, 2000. 3rd edn. Gerald Karp, John Wiley and Sons Inc 2. Molecular Biology Weaver R F, 1999. McGraw Hill Inc. NY 3. Cloning 1 and 2, Glover D.M. and Hames B.D. 1995 IRL Press .		
Reference Books	1. Essential Molecular Biology A Practical approach, T.A. Brown, 2007. 2nd edition, IRL Press, Oxford. 2. Gene Cloning, An introduction, T.A. Brown 1995, 3rd Edn. Chapman and Hall. 3. Harvey Lodish, Arnold Berk & Chris A. Kaiser, Molecular Cell Biology. W. H. Freeman; 6th edition (2007).		
Website Link	1. https://microbenotes.com/ 2. https://www.mayoclinic.org/		

L-Lecture

T-Tutorial

P-Practical

C-Credit

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M4PMBE 04	MOLECULAR BIOLOGY AND BIOTECHNOLOGY	DSE- IV	IV	5	5			5

CO-PO Mapping

CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	S	M	M	S	M	M	M	M
CO2	M	M	M	M	M	M	S	S	M	S
CO3	S	M	S	S	M	M	M	M	M	M
CO4	M	S	M	M	M	S	M	S	M	M
CO5	S	M	M	M	S	M	M	M	M	S
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG						

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessments Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc., Medical Biochemistry LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M4PBCPR1	PROJECT WORK	PROJECT WORK	IV	12	-	-	17	5
Objective	To inculcate/impart skills on experiment designing, experiment execution and research report to provide skills on writing thesis dissertation							
Details	Course Content				Knowledge Levels	Sessions		
PROJECT PREPARATION FORMAT								
Cover Page & Title Page	Cover Page & Title Page: The fonts and locations of various items on this page should be exactly as shown in a specimen copy.							
Inside cover page	Inside cover page Same as cover page.							
Bonafide Certificate	Bonafide Certificate: The Bonafide Certificate shall be in double line spacing using Font Style Times New Roman and Font Size 14.							
Acknowledgement	Acknowledgement: This should not exceed one page.							
Abstract	Abstract: Abstract should be one page synopsis of the project report typed double line spacing, Font Style Times New Roman and Font Size 14.							
Contents	Table of Contents: The table of contents should list all headings, sub headings after the table of contents page, as well as any titles preceding it. The title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents. One and a half spacing should be adopted for typing the matter under this head.							
Tables	List of Tables: The list should use exactly the same captions as they appear above the tables in the text. 1.5 spacing should be adopted for typing the matter under this head.							
Figures	List of Figures: The list should use exactly the same captions as they appear below the figures in the body of the text. One and a half spacing should be adopted for typing the matter under this head. All charts, graphs, maps, photographs and diagrams should be designated as figures. X and Y axes titles are mandatory for all the graphs.							
Symbols	List of Symbols, Abbreviations and Nomenclature: 1.5 spacing should be adopted or typing the matter under this head. Standard symbols, abbreviations etc. should be used.							
Chapters	Chapter I - Introduction: Statement of the Problem, Significance, Need for the study, Objectives							
	Chapter II- Review of literature							
	Chapter III- Methodology: Tools used, Procedures, Hypothesis.							
	Chapter IV- Results and Discussion: Tables and Figures, Statistical Presentations, Hypothesis Testing.							
	Chapter V- Summary and conclusion							
	Chapter VI- Scope of the Project							
	References							

Guidelines For Project Preparation			
Numbering	<ul style="list-style-type: none"> • Every page in the project report, except the project report title page, must be accounted for and numbered. • The page numbering, starting from acknowledgements and till the beginning of the introductory chapter, should be printed in small Roman numbers, i.e, i, ii, iii, iv.. • The page number of the first page of each chapter should not be printed (but must be accounted for). All page numbers from the second page of each chapter should be printed using Arabic numerals, i.e. 2,3,4,5.. • All printed page numbers should be located at the right corner at the bottom of the page. 	K4- K6	
Chapters	<ul style="list-style-type: none"> • Use only Arabic numerals. Chapter numbering should be centered on the top of the page using large bold print. <Size 14><Times New Roman> 	K4- K6	
TEXT			
Regular Text	Regular Text: Times Roman 12 pts and normal print.	K4- K6	
Chapter Heading	Chapter Heading - Times Roman 14 pts. Bold and capital.	K4- K6	
Section Headings	Section Headings - Times roman 12 pts. Bold and capital.	K4- K6	
Subsection Headings	Subsection Headings - times roman 12 pts. bold print and Leading capitals i.e, only first letter in each word should be in capital.	K4- K6	
Special Text	Special Text- Italics/Superscript /Subscript/Special symbols, etc., as per necessity. Special text may include footnotes, endnotes, physical or chemical symbols, mathematical notations, etc.	K4- K6	
Sections	Sections: Use only Arabic numerals with decimals. Section numbering should be left justified using bold print. Example: 1.1, 1.2, 1.3, etc.	K4- K6	
Sub Sections	Sub Sections: Use only Arabic numerals with two decimals. Subsection numbering should be left Justified using bold print. Example: 1.1.1, 1.1.2, 1.1.3, etc.	K4- K6	
References	<p>Use only Arabic numerals. Serial numbering should be carried out based on Alphabetical order of surname or last name of first author.</p> <p>The format is written like, author name followed by year followed by title of the work followed by details of the journal. Same font as regular text, serial number and all authors names to be in bold print.</p> <p>Title and Journal names should be in italic.</p> <p>One Author: Williams, G. State and Society in. Onco State, Nigeria, Afrographika, 1980.</p> <p>Two Authors: Phizacklea, A & Miles, R. Labour and Racism. London, Routledge & Kegan Paul, 1980.</p> <p>3+ Authors: O'Donovan, P., et al. The United States. Amsterdam, Time-Life International, 1966.</p>	K4- K6	
Typing Instructions	Typing Instructions: The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style 'Times New Roman' and Font size 12. Use A4 (210 mm X 297 mm) bond un-ruled paper (80 gsm) for all copies submitted. Use one side of the paper for all printed/typed matter.	K4- K6	

Justification	Justification: The text should be fully justified	K4- K6	
Margins	Margins: The margins for the regular text are as follows LEFT - 1.5" RIGHT - 1" TOP - 1" BOTTOM - 1"	K4- K6	
Paragraph Spacing	Use 6 pts before & 6 pts after paragraphs. All paragraphs in the seminar/project report should be left justified completely, from the first line to the last line. Use 1.5 spacing between the regular text and quotations. Provide double spaces between: (a) From top of page to chapter title, (b) Chapter title and first sentence of a chapter, Use single spacing (a) In footnotes and endnotes for text. (b) In explanatory notes for tables and figures. (c) In text corresponding to bullets, listings, and quotations in the main body of seminar/project report. (d) Use single space in references and double space between references.	K4- K6	
Tables	All tables should have sharp lines, drawn in black ink, to separate rows/columns as and when necessary. Tables should follow immediately after they are referred to for the first time in the text. Splitting of paragraphs, for including tables on a page, should be avoided. Provide double spaces on the top and the bottom of all tables to separate them from the regular text, wherever applicable. The title of the table etc. should be placed on the top of the table. The title should be centered with respect to the table. The titles must be in the same font as the regular text and should be single spaced.	K4- K6	
Figures	All figures, drawings, and graphs should be drawn in black ink with sharp lines and adequate contrast between different plots if more than one plot is present in the same graph. The title of the figure etc. should be placed on the bottom of the figure. Figures should follow immediately after they are referred to for the first time in the text. Splitting of paragraphs, for including figures on a page, should be avoided. Provide double spaces on the top and the bottom of all figures to separate them from the regular text, wherever applicable. Figures should be centered with respect to the figure. The titles must be in the same font as the regular text and should be single spaced. The title format is given below: Fig. <blank><chapter number>.<serial number><left indent><figure	K4- K6	
Page Dimension & Binding Specifications	The project report should be prepared in A4 size. The dissertation shall be properly bound; The bound front cover should indicate in Silver and embossed letter.		
Course Outcome	Co:1 Identification of research idea	K4	
	Co:2 Analyze of problem solving skills	K4	
	Co:3 Analyze sources for conduct of Research	K4	
	Co:4 Evaluate the research report	K5	
	Co:5 Create the research report	K6	
Learning Resources			
Text Books	1. Research Methodology: Methods and Techniques, by C.R. Kothari, New Age Publications, 2009.		

Reference Books	<ol style="list-style-type: none">1. Research Methodology: Methods and Techniques by C.R. Kothari, New Age Publications, 1985.2. Essentials of Research Design and Methodology by: Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005.
Website Link	<ol style="list-style-type: none">1. http://gen.lib.rus.ec/

M.Sc., Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards										
Course Code	Course Title			Course Type	SEM	Hours	L	T	P	C
21M4PBCP R1	PROJECT WORK			PROJECT WORK	IV	12	-	-	17	5
CO-PO Mapping										
CO Number	P01	P02	P03	P04	P05	PS01	PS02	PS03	PS04	PS05
CO1	L	M	M	L	S	L	M	S	S	S
CO2	M	S	S	S	S	M	S	S	S	S
CO3	S	M	S	M	S	M	M	S	M	M
CO4	S	S	S	M	S	S	S	S	M	M
CO5	M	M	M	S	M	M	M	S	L	S
Level of Correlation between CO and PO		L-LOW			M-MEDIUM			S-STRONG		
Tutorial Schedule					-					
Teaching and Learning Methods					-					
Assessment Methods					EA - 100% 1. Project Report - 150 Marks 2. Viva-Voce - 50 Marks 3. Total - 200 Marks					
Designed By			Verified By				Approved By			
DR. M.SHABANA BEGUM			DR. M.SHABANA BEGUM							

M.Sc., Medical Biochemistry –Biochemistry for Competitive Examination Syllabus-LOCF-CBCS-Pattern with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	SEM	Hours	L	T	P	C
21M4PBCOE1	Biochemistry for Competitive Examination	Self study Online -Competitive Examination	IV	-	-	4	0	2
Objective	Creating the awareness on competitive examination among students. Imparting knowledge about the appearing for Competitive Examination and it impacts and developing an attitude of appearing for such exams.							
	Course Content						Knowledge Levels	Sessions
	<p>Assemblage of different topics related to Biochemistry in particular, Physiology, Molecular Biology. Metabolism. Lipids. Enzymes. Proteins. Amino Acids and Metabolite etc. . Major emphasis has been put forth to include recent developments in the subjects. This course aims to give a holistic view of all the topics which comprised of some factual text points, multiple choice questions (MCQ), it is extremely suitable for students pursuing their higher degree in University/institute for their entrance exams, students preparing for various national and state level competitive entrance exams such as ICAR-JRF/SRF/NET/ARS, IARI/NDRIPh.D., SAUs; CSIR/UGC-NET/JRF/SRF; ICMR, DBT, GATE, BARC, IISc, JNU, BHU, etc. to get admission in Ph.D. in Biochemistry. In addition, it is also useful for UPSC and states PSC.</p> <p>Rules for creating MCQ pattern.</p> <ol style="list-style-type: none"> Objective type online examination will be conducted at the end of 4th semester. Questions must be taken from all previous question papers of CSIR-NET, SET, NEET, UPSC, IBPS and Common Entrance Test for Ph.D. Test critical thinking. Multiple choice questions to test the superficial knowledge. Learners to interpret facts, evaluate situations, explain cause and effect, make inferences, and predict results. Emphasize Higher-Level Thinking Use memory-plus application oriented questions. These questions require students to recall principles, rules or facts in a real life context. <p>Eg.1 <u>Ability to Justify Methods and Procedures</u> Why is adequate lighting necessary in a balanced aquarium? a. Fish need light to see their food. b. Fish take in oxygen in the dark. c. Plants expel carbon dioxide in the dark. d. Plants grow too rapidly in the dark.</p> <p>Eg.2 <u>Ability to Interpret Cause-and-Effect Relationships</u> Why does investing money in common stock protect against loss of assets during inflation? a. It pays higher rates of interest during inflation. b. It provides a steady but dependable income despite economic conditions. c. It is protected by the Federal Reserve System. d. It increases in value as the value of a business increases.</p> <ol style="list-style-type: none"> Mix up the order of the correct answers Keep correct answers in random positions and don't let them fall into a pattern that can be detected <p>6. Use a Question Format Multiple-choice items to be prepared as questions (rather than incomplete statements) Incomplete Statement Format: The capital of California is in Direct Question Format----- Less</p>						K1-K6	

	<p>effective.</p> <p>In which of the following cities is the capital of California? -This is Best format.</p> <p>7. Keep Option Lengths Similar Avoid making your correct answer the long or short answer</p> <p>8. Avoid the “All the Above” and “None of the Above” Options Students merely need to recognize two correct options to get the answer correct</p> <p>9. HOD's instruct to the faculty to prepare minimum 500 questions booklet (cumulatively for each programme) with solutions and circulate among the students.</p> <p>10. Each Department to prepare the Questions (MCQ pattern with four answers) and submit to ICT.</p>		
Course Outcome	<p>CO1: Students will be able to determine rules, techniques, and development of digital commercialized</p> <p>CO2: Use the current biochemical and molecular technique concept to plan and carry out experiments</p> <p>CO3: To be able to test the various models and theories of communication in real life situation.</p> <p>CO4: To develop the knowledge of basic concepts and elements of communication and mass communication</p> <p>CO5: To assess forms and levels of critical thinking.</p>		
Learning Resources	1. David L. Nelson, Michael M. Cox. Lehninger Principles of Biochemistry.		
	2. Prasad R Manjeshwar. Textbook of Biochemistry for Medical Students. Fifth Edition 2019		
	3. Rebecca James Perumcheril. Self Assessment and Review of Biochemistry.		
	4. Aditya Arya. Concise Biochemistry for CSIR NET and other competitive exams.		
	5. G.Rajagopal and B.D.Toora. MCQS IN BIOCHEMISTRY. AHUJA PUBLISHING HOUSE. Third Edition 2016.		
Reference Books OM PRAKASH GUPTA- Competitive biochemistry 2014, Jaya Publishing House, Delhi (India)			
Website Link	https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf https://swayam.gov.in/nc_details/NPTEL		
	L-Lecture T-Tutorial P-Practical		

CO-PO Mapping

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5		
C01	S	S	S	S	M	S	S	M	S	S		
C02	S	M	S	S	S	S	S	S	S	M		
C03	M	S	M	S	S	M	S	S	S	S		
C04	S	S	S	S	S	S	S	S	M	S		
C05	S	S	S	S	M	S	S	S	S	S		
Level of Correlation between CO and PO					L-LOW		M-MEDIUM		S-STRONG			
Tutorial Schedule					NET/SET/GATE/CET/TRB /NEET Old question papers –solutions –online mock test							
Teaching and Learning Methods					Self study , Group discussion ,Chalk and Talk, Audio-Video Learning, learning through mock test							
Assessment Methods					100 multiple choice questions through computer based online examinations passing minimum is 50%							
Designed By							Verified By			Approved By		

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M2PBCED1	BIOCHEMISTRY IN HEALTH	GEC - EDC - I	II	3	3			4
Objective	To understand the different types of biomolecules, common disorders of nutritional deficiency and to gain knowledge on the biological importance of micro nutrients.							
Unit	Course Content						Knowledge Levels	Sessions
I	Carbohydrate - Source of carbohydrates, significance of carbohydrates in cellular activities and organism life system. Mucopolysaccharidosis, Lactose and Fructose intolerance. Normal level of sugar, alterations; Diabetes mellitus, types and its complications. Control and Management of diabetes mellitus.						K2	6
II	Protein -Sources of proteins and amino acids. Importance of proteins in living organisms. Normal level of protein in human. Protein deficiency disease-Kwashiorkor and Marasmus Protein quality 'Inborn error of amino acid metabolism.						K2	6
III	Fatty acids - source of fats and importance of fats and lipids in living organism and. Role of LDL, VLDL, HDL and chylomicrons in human body. Normal levels of cholesterol, hypercholesterolemia and role of cholesterol in Blood pressure. Atherosclerosis and Heart attack. Prevention and control of heart related diseases						K2	6
IV	Water – biological importance. Vitamins- water soluble and fat soluble vitamins; Sources, chemical composition, Biological function and property, Deficiency diseases in human.						K2	6
V	Minerals Source and deficiency disorders of Macro-minerals; Sodium, Potassium, Calcium, Magnesium, Micro-minerals: Copper, phosphorus, Iron, Iodine, Zinc and Selenium in human Prevention and control of Anemia.						K2	6
Course Outcome	C01: Summarize the sources, importance of carbohydrates and gain awareness about Diabetes mellitus.						K2	
	C02: Understand the importance of proteins in living organism with their deficiency disorders.						K2	
	C03: Describe the sources and importance of lipids along with the disorders of lipid metabolism.						K2	
	C04: Explain the sources, RDA, importance and deficiency disorders of vitamins.						K2	
	C05: Describe about sources and biological importance of minerals.						K2	
Learning Resources								

Text Books	1. Text book of Medical Biochemistry 2002.M.N. Chatterjea and Rana Shinde, 5th Edn. JayPee Publications, New Delhi 2. Fundamentals of Biochemistry, Dr.A.C.Deb 2006, New Central Book Agency(P)Ltd. Kolkota. 3. Essentials of Biochemistry Sathyanarayanan.U. 2002, Books and allied (P) Ltd. 4. Essentials of Medical Physiology , K.Sembilingam and Prema Sembulingam, 2010. 5th Edn.Jaypee Bros, medical Publishers (P) Ltd. Chennai.								
Reference Books	1. Text book of Medical Physiology - A.C . Guyton, 8th Edn.1991, W.B.Saunders, Harcourt Brace Company, Bangalore. 2. Fundamentals of Biochemistry for Medical Students by Ambika shanmugam 2006.Published by author; West CIT Nagar, Chennai-35 3. Text Book of Biochemistry, S.Nagini, 2002. Scitech Publications (P) Ltd., Chennai								
Website Link	1. https://onlinecourses.swayam2.ac.in/cec20_bt19/preview 2. https://onlinecourses.nptel.ac.in/noc22_cy06/preview 3. https://drvasantraopawarmedicalcollege.com/facilities/ict-enabled-t-l/								
	L-Lecture	T-Tutorial	P-Practical		C-Credit				

M.Sc-Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M2PBCED1	BIOCHEMISTRY IN HEALTH	GEC - EDC - I	II	3	3			4

CO-PO Mapping														
CO Number	P01	P02	P03	P04	P05	PS01	PS02	PS03	PS04	PS05				
C01	S	M	S	M	M	M	S	M	M	M				
C02	S	M	S	M	M	M	S	M	M	M				
C03	S	S	S	M	M	S	M	M	S	M				
C04	S	M	M	S	M	M	M	M	M	S				
C05	S	M	M	S	M	M	M	S	M	S				
Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG											

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assessment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2022-2023 Onwards								
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M2PBCED2	CLINICAL LAB TECHNOLOGY	GEC - EDC - II	II	3	3			4
Objective	This syllabus has been formulated to impart basic knowledge of biochemistry, analytical techniques and to perform clinical laboratory tests accurately and efficiently.							
Unit	Course Content						Knowledge Levels	Sessions
I	Laboratory principles Basic laboratory principles - Good laboratory practices (GLP) Code of conduct of medical laboratory personnel - Organization of clinical laboratory - Role of medical laboratory technician - Safety measures - Medical laboratory professional and professionalism in laboratory workers - communication between physician and lab technician - hospital and clinic borne infection and personnel hygiene						K2	6
II	Laboratory Professionalism Common glass wares in clinical laboratory - care and maintenance - Calibration of pipettes and volumetric apparatus - Cleaning and sterilization methods - antiseptics and disinfectants - staining techniques – vital stains						K2	6
III	Laboratory techniques and set up Automation in Clinical Biochemistry- Instrumental concept, Selection of Instrument, Quality assurance, Control of pre-analytical and analytical variables, External and internal quality control measurements. Good Clinical Practices. Clinical laboratory records- Modern laboratory set up - Quality control: Accuracy, Precision, and Reference values.						K2	6
IV	Specimen collection Clinical samples and specimens - Specimen collection, transport, storage and disposal – common laboratory infections - Anticoagulants: EDTA, Di-potassium salts of EDTA, double oxalate, single oxalate, sodium citrate and sodium fluoride.						K2	6
V	Buffer and solution preparation Acid - Base balance – Electrolytes - Buffer and pH Preparation of solution: Normal, per cent and Molar solution - normal saline -Methods of measuring liquids.						K2	6
Course Outcome	CO1:To gain knowledge in the general safety measurements and personnel hygiene						K2	
	CO2: To understand the principles and applications of the glasswares.						K2	
	CO3: To understand the principles and applications of instruments and maintaining accuracy						K2	
	CO4: To understand the principles and applications of collection and preservation of specimens						K2	
	CO5:To understand the preparation of buffer and percentage solutions						K2	
Learning Resources								

Text Books	1. Wilson, K. and Walker, J. (2012) Practical Biochemistry – Principles and techniques of Biochemistry and Molecular Biology, 7th Edition, Cambridge University Press, India 2. Milton A. Anderson (2002) GLP Essentials: A Concise Guide to Good Laboratory Practice, Second Edition CRC press 3. Voet, D., Voet, J.G., and Pratt, C.W. (2013). Fundamentals of Biochemistry – Life at the Molecular Level, Fourth Edition, John Wiley & Sons. Inc, New York.								
Reference Books	1. Murray, R.K., Bender, D.A., Bootham, K.M., Kennlley, P.J., Rodwell, V.W. and Weil, P.A. (2012). Harpers Illustrated Biochemistry, Twenty ninth Edition, Tata McGraw Hill Companies Publication, New Delhi. 2. Burtis, C.A. and Bruns, D.E. (2007). Fundamentals of Clinical Chemistry, Sixth Edition, W.B Saunders Co, Philadelphia, London, Toronto.								
Website Link	1. https://epgp.inflibnet.ac.in/ 2. https://guides.fscj.edu/medicallaboratorytechnology/websites 3. https://jefferson.kctcs.libguides.com/clt/websites								
	L-Lecture	T-Tutorial	P-Practical		C-Credit				

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M2PBCED2	CLINICAL LAB TECHNOLOGY	GEC - EDC - II	II	3	3			4

CO-PO Mapping											
CO Number	P01	P02	P03	P04	P05	PS01	PS02	PS03	PS04	PS05	
C01	S	M	M	M	S	M	M	S	M	S	
C02	S	M	M	M	S	M	S	S	S	M	
C03	S	S	M	S	S	S	M	M	M	S	
C04	S	M	M	S	M	M	S	M	S	S	
C05	S	M	M	S	M	M	M	M	M	S	
Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG								

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

Designed By	Verified By	Approved By

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards								
Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M2PBCED3	PRINCIPLES OF NUTRITION	GEC - EDC - III	II	3	3			4
Objective	This course reviews the basic principles of nutrition, the metabolism of proteins, fats, vitamins and minerals and the role food choices play in health promotion and disease prevention.							
Unit	Course Content						Knowledge Levels	Sessions
I	Water Balance – Functions of water, water distribution, maintenance of water and regulation of acid-base balance in the body. Electrolyte balance						K2	6
II	Introduction to Nutrition - History of Nutrition , Energy - Definition of Kilocalories, Joule, energy value of foods, determination, and physiological fuel values, SDA of foods, Basal Metabolic Rate definition, factors influencing BMR. Recommended Dietary Allowances for energy. Carbohydrates - Classification, functions, sources, digestion, absorption and utilization. Dietary fiber and health.						K2	6
III	Protein - Classification, functions, sources and requirements, digestion, absorption and utilization, definition and calculation of Protein quality – PER, BV, NPU, digestibility coefficient, reference protein, essential amino acids and mutual supplementation of dietary protein. Fats and Lipids - Classification, functions, sources and requirement. Importance of essential fatty acids, their requirements and deficiency						K2	6
IV	Vitamins – Fat soluble vitamins –A, D, E and K- functions, source, requirements, deficiency Water soluble vitamins –The B-complex vitamins (Thiamine, Riboflavin, Niacin, Folic acid, Biotin, pantothenic acid) and Vitamin C - functions, source, requirements and deficiency.						K2	6
V	Minerals - General functions in the body, classification- macro and micro minerals. Micro minerals – Iron, Fluorine, Zinc, copper, Iodine -functions, absorption, utilization, requirements, deficiency and toxicity . Macro minerals – Calcium and phosphorus - functions, absorption, utilization, requirements, deficiency and toxicity						K2	6
Course Outcome	CO1: Understands the role of water and electrolytes in human body.						K2	
	CO2: Understands the role of food and nutrients in health and disease processes.						K2	
	CO3: Explain the role of nutrition and its significance						K2	
	CO4: Describe about sources and biological importance of vitamins.						K2	

	C05:Describe about sources and biological importance of minerals.	K2						
Learning Resources								
Text Books	1. Srilakshmi B, 2014, Nutrition Science, Fourth Edition, New Age International Publishers, New Delhi. 2. Swaminathan M, (1996), Hand Book of Food and Nutrition, Bangalore Printing Publishing Company, Bangalore 3. Shubhangini A. Joshi, (2014)“Nutrition and Dietetics”, Tata Mc Grow Hill publishing Company Ltd, New Delhi.							
Reference Books	1. Sumathi R. Mudambi, Rajagopal, M.V., Fundamentals of Foods and Nutrition, New Age International (P) Ltd, Publishers, Third edition, 1997. 2. Mangala Kango, Normal Nutrition, Curing diseases through diet, CBS Publications, First edition, 2005. 3. Paul.S.,Text Book of Bio-Nutrition, Fundamental and Management, RBSA Publishers, 2003.							
Website Link	1. https://onlinecourses.swayam2.ac.in/cec20_bt19/preview 2. https://onlinecourses.nptel.ac.in/noc22_cy06/preview 3. https://drvasantraopawarmedicalcollege.com/facilities/ict-enabled-t-l/							
	L-Lecture	T-Tutorial	P-Practical		C-Credit			

M.Sc- Medical Biochemistry Syllabus LOCF-CBCS with effect from 2021-2022 Onwards

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21M2PBCED3	PRINCIPLES OF NUTRITION	GEC - EDC - III	II	3	3			4

CO-PO Mapping												
CO Number	P01	P02	P03	P04	P05	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	S	M	M	M	M	M	M	M	M	S		
CO2	S	M	S	S	M	M	M	M	M	M		
CO3	S	S	S	S	M	S	M	S	S	S		
CO4	S	M	M	M	M	M	M	S	M	S		
CO5	S	M	M	M	M	M	M	M	M	M		
Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG									

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
Assesment Methods	Assignment, Class test, Unit test, Internal exams, Seminars, Attendance

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Course Code	Course Title	Course Type	Sem	Hours	L	T	P	C
21M2PBCED4	HUMAN PHYSIOLOGY AND CODING	GEC - EDC - IV	II	3	3			4
Objective	To understand the basic physiological concepts of the human body, diseases related in the biological systems and to study the concept of medical billing related to coding							
Unit	Course Content						Knowledge Levels	Sessions
I	Digestive system: outline of digestive system. Buccal, gastric and Intestinal digestion. Role of liver in digestion. Intestinal- Absorption and assimilation- hormonal influence in digestion. Excretory system; Structure of kidney and ultra-structure of nephron. Formation and composition of urine. Outline of excretory system - ' Micturition'						K2	6
II	Respiratory and Circulatory system: Types of respiration. - Outline of respiratory system, respiratory pigments, Transport of O ₂ and CO ₂ . Factors affecting oxygen dissociation curve and carbon dioxide dissociation curve. Chloride shift.						K2	6
III	Circulatory organs, composition of blood, systemic, pulmonary circulation, Heartbeat, cardiac cycle, origin and conduction of heart beat, Regulation of heart beat, human heart' coronary circulation, ischemic heart disease, ECG, Blood pressure and cardiac output						K2	6
IV	Nervous and Muscular system: outline of nervous system, structure of neuron, types of neuron, neurotransmitters. Condition of nerve impulse transmission, synaptic transmission. Muscle – Types of muscle- Role of Actin and Myosin.-Action Potential. Neuro muscular junction. Reflex action						K2	6
V	Introduction to Coding and Billing Medical Billing- part of coding in billing. CPT, diagnosis and modifiers, basic description of the codes. Specialty codes						K2	6
Course Outcome	CO1: Gain the basic knowledge on Human physiology						K2	
	CO2: The paper covers the working of internal organ and system						K2	
	CO3: The students can understand the physiological functions of the biological systems						K2	
	CO4: Understand the functions of important physiological systems including digestive, excretory, circulatory, nervous, cardiac systems.						K2	
	CO5: Study the interrelationship between medical coding and Billing						K2	
Learning Resources								

Text Books	1. Sembulingam, K. and Sembulingam, P. (2010).Essentials of Medical Physiology,Fifth Edition, J.P. Medical Publishers (P) Ltd, New Delhi 2. Chandramouli, R.(2010).Textbook of Physiology, Third Edition, Jaypee Brothers Medical Publishers (P) Ltd. New Delhi 3. Davies, A., Blackely, A.G.H. and Kidd, C. (2001).Human Physiology, Churchill Livingstone, Toranto, Harcourt Publishers Ltd, New York.								
Reference Books	1. Guyton, A.C. and Hall, J.E. (2010).Textbook of Medical Physiology,Twelfth Edition, Saunders Company Publishers, New York. 2. Tortora, G.J. and Graabowski, S.R. (2009).Principles of Anatomy and Physiology, Twelfth Edition, John Wiley & Sons, New York. 3. Fox, S. (2010).Human Physiology, Twelfth Edition, WCB McGraw- Hill Publications, New York.								
Website Link	1. https://nptel.ac.in/courses/102104042 2. https://onlinecourses.nptel.ac.in/noc20_bt42/preview 3. https://www.slideshare.net/MushtaqAhmadWani3/medical-coding-71919467								
	L-Lecture	T-Tutorial	P-Practical		C-Credit				

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21M2PBCED4	HUMAN PHYSIOLOGY AND CODING	GEC - EDC - IV	II	3	3			4

CO-PO Mapping												
CO Number	P01	P02	P03	P04	P05	PS01	PS02	PS03	PS04	PS05		
CO1	S	M	M	S	S	M	S	M	M	M		
CO2	M	M	M	M	M	M	M	M	M	M		
CO3	S	S	M	M	M	S	M	M	M	M		
CO4	M	M	M	M	M	M	S	M	S	M		
CO5	S	M	M	S	S	M	S	M	S	M		
Level of Correlation between CO and PO	L-LOW	M-MEDIUM		S-STRONG								

Tutorial Schedule	1.Group discussion 2.Role play 3.Listening skills 4.Flash cards
Teaching and Learning Methods	Chalk and talk method, PPT Classes, Smart classroom
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