PERIYAR UNIVERSITY

SALEM – 636011

DEGREE OF MASTER OF SCIENCE

CHOICE BASED CREDIT SYSTEM

M.Sc. MEDICAL BIOCHEMISTRY

OBE REGULATIONS AND SYLLABUS

(SEMESTER PATTERN)

(For Candidates admitted in the Colleges affiliated to

Periyar University from 2021-2022 onwards)

REGULATIONS

GOALS AND OBJECTIVES OF MEDICAL BIOCHEMISTRY

Medical Biochemistry is particularly emphasizing the multidisciplinary character of the profession in order to enable application of scientific knowledge in the medical context. Curriculum is harmonized with the recommendations that are accepted in the majority of European countries, and consists two years programme leading to the Post –Graduate Degree of Master in Medical Biochemistry.

GOAL OF MEDICAL BIOCHEMISTRY

Illuminate students the principles governing the structure, functional and interaction of biomolecules. At the same time new revision reflects tremendous development in Biochemistry. Significantly emphasize is placed on the interrelationship of ideas so the students could evaluate diagnostic data and provide an expert opinion to the medical team.

The multidisciplinary approach is achieved by introducing various disciplines into curriculum:

1. Biomedical disciplines (anatomy, physiology, Metabolism, Clinical & Nutritional Biochemistry, immunology and microbiology etc.);
2. Professional medical biochemistry discipline interprets with clinical biochemistry, haematology, clinical immunology, Bioanalytical techniques, Pharmaceutical toxicology, molecular diagnostics and Molecular Biology etc. The competences and skills in communication, laboratory management, automation, and information of laboratory system is also learned in theory and practicals.
3. Training programmes would be intensively correlated training in the hospital laboratory will start readily from the first year. The CBCS credits will be assigned to the each subject, and student mobility would be encouraged. There will be great co- operation with the teaching hospitals related to Faculty, in particular for the courses Integral laboratory diagnostics and Professional laboratory practice.
4. At completion of the new Medical Biochemistry curriculum the graduate would have a thorough knowledge of all aspects of medical biochemistry science relevant to the discipline, and competences to organize laboratory practice and apply current techniques, to evaluate the diagnostic data and to provide an expert opinion in the medical team, or to pursue a career in the fundamental and applied scientific research. The new concept comprises relevant knowledge in clinical cytology, microbiology, clinical immunology, blood banking, analytical toxicology, molecular diagnostics thus concurring with the current trends in Medical Biochemistry and

Laboratory Medicine.

Our specific goals for the programme are to

- Provide a sound background in Basic Biochemistry for Students in Health sciences where these students can perform research work in the Medical, Eye and Dental hospitals
- Make students aware of the relevance of Biochemistry to Health-related professions
- Provide a working knowledge of Medical Biochemistry that will be applicable for the practice of Clinical Diagnostic Laboratory and could even run diagnostic lab on theirown.

OBJECTIVES OF MEDICAL BIOCHEMISTRY

Student small-group learning experiences encourage professional behaviour and teamwork in a context that promotes use of resources such as the library, and information technology. Course topic scheduling is coordinated to prepare students for and reinforce topics in Clinical Physiology where possible. The following list is illustrative of the educational objectives of this course. Through interactive lecture sessions, small group sessions, and course examinations, students will be able to:

1) Recognize and explain the functions of the key molecular components and steps of the synthesis, assembly, and degradation of biological macromolecules;
2) Recall and relate the molecular structures and chemical properties of biological macromolecules to their functions including ligand/substrate recognition, enzyme reactions, formation of multi-molecular complexes; and regulation;
3) Relate digestive processes and body production of usable and storable chemical energy to the chemical composition of foodstuffs, including vitamin and nutrient requirements;
4) Describe the inputs and outputs of human intermediary metabolism, and relate mechanisms of metabolic regulation by hormones, feedback loops and other mechanisms to body organ systems and their demands for energy and metabolites
5) Recognize and explain the molecular basis of major body mechanisms for self- recognition and self-defense including blood factors, antibodies, anti-oxidants, hemostasis, and glucose homeostasis;
6) Describe key features and operating principles of the organization of the human genome, control of gene expression and cell cycle regulation;

SKILLS

1) Relate knowledge of normal bio-molecular structure-function relationships, metabolic and regulatory processes, and defense mechanisms to the molecular basis, diagnosis and treatment of diseases;

2) Recognize and explain the sources, detection and consequences of genetic defect(s) underlying diseases;

Attitudes/Behaviors:

1) Demonstrate a professional attitude and good communication skills by effective participation in cooperative problem solving, especially in small group exercises directed towards understanding the biochemical and genetic bases of disease origins,diagnoses and treatments.

1. PREAMBLE AND OBJECTIVES OF THE COURSE:

The syllabus aims to provide the strength to acquire an advanced knowledge and understanding of the core principles of Biochemistry.

The major objectives of M.Sc. Medical Biochemistry/Biochemistry/Mcribiology course are,

- To study the structures and functions of biomolecules.
- To learn Anatomy and Physiology of human body
- To understand the principles, instrumentation and applications of analytical techniques.
- To study the principles of enzyme catalysis, bioenergetics and major metabolic pathways.
- To study the expression of molecular genes and molecular techniques.
- To understand human physiology and nutritional requirements.
- To study molecular concepts of body defenses and its mechanisms.
- To impart knowledge in principles and applications of clinical Biochemistry.
- To obtain knowledge in Pharmaceutical, Microbial and Industrial Biochemistry.
- To acquire skills for laboratory experiments.
- To prepare candidates for a career in Pharmaceutical industries, food industriesetc.

2. CONDITION FOR ADMISSION

A candidate who has passed B.Sc degree in Medical Biochemistry/ Biochemistry/ Microbiology or an Equivalent B, Sc. Examination in Bachelor of Medical Laboratory Course or some other B.Sc board equivalence submitted by the respective University may be accepted by the syndicate as equivalent there to with Biochemistry shall be eligible for admission into M.Sc., course in Medical Biochemistry.

3. DURATION OF THE COURSE:

The course for the degree of Master of Science shall consist of two academic years divided into four semesters.

4. COURSE OF STUDY:

The course of study for the M.Sc. Degree in the Branch Medical Biochemistry shall comprise the following subjects according to the syllabus,

i) Major: Medical Biochemistry

ii) Integrated and Skilled Based Elective Course and Non Major Elective Course subjects

iii) Human Rights (Languages and English)

Non major elective course subjects may be chosen by the respective colleges andthe same must be communicated to the University.

SEMESTER I SEMESTER II

SEMESTER IIISEMESTER

IV

5. EXAMINATIONS

There shall be four examinations- two in the first year, two in the second year. Candidates failing in any subject / subjects will be permitted to appear for such failed subject / subjects at subsequent examinations. The Syllabus has been divided into four semesters. Examinations for I and III semesters will be held in November/ December and for II and IV semesters will be held in April / May.

The practical examination I&II will be held in semester-I. Practical III & IV will be held at the semester-II. Practical- V & VI will be held in semester –III and in semester-IV individual Research Project should be performed and dissertation should be and their report shall be evaluated in viva voce examination conducted before the examiners at the end of IV - semester.

6. PASSING MINIMUM

A candidate shall be declared to have passed the examination if he /she secure not less than 50% of the marks in each paper / practical. Candidates who do not secure the required minimum marks for a pass in a paper / practical shall be required to appear for and pass the same at a subsequent appearance. For practical, the minimum for a pass includes the record notebook marks also. There is no passing minimum for the record notebook. However submission of a record notebook is a must.

7. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class. All other successful candidates shall be declared to have passed in the Second Class. Candidates who obtain 75% and above in the aggregate shall be declared to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

8. RANKING

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of three academic years from the year of admission to the course only are eligible for University Ranking.

GRADING SYSTEM

Evaluation of performance of students is based on ten-point scale grading system as given below

Ten Point Scale			
Grade of Marks	Grade Points	Letter Grade	Description
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	Absent

9. MAXIMUM DURATION FOR THE COMPLETION OF THE PG PROGRAMME

The maximum duration for completion of the PG Programme shall not exceed EIGHT semesters.

10. COMMENCEMENT OF THIS REGULATION

These regulations shall take effect from the academic year 2017-2018, i.e. for students who are to be admitted to the first year of the course during the academic year 2017-2018 and thereafter.

11. TRANSITORY PROVISION

Candidates who were admitted to the PG course of study before 2017-2018 shall be permitted to appear for the examinations under those regulations for a period of three

years i.e. up to and inclusive of the Examination of April/May 2021. Thereafter, theywill be permitted to appear for the examination only under the regulations then in force.

12. PAPERS GIVEN BY THE BOARD AS NON – MAJOR ELECTIVE COURSE

SEMESTER III

Fundamentals of Human physiology (Or) Biochemistry in Nutrition

SEMESTER IV

Biochemistry in Human Health (Or) Biochemistry in Diagnosis

13. PATTERN OF QUESTION PAPER (FOR MAJOR, ELECTIVE AND EDC)

Maximum – 75 marks Duration – 3 hours

Section –A (15 x1 = 15 marks)

Answer all the questions

(Multiple Choice Questions- Two questions from each unit)

Section –B (2x5 = 10 marks)

Answer any two questions

(One question from each unit)

Section –C (3x10 = 50 marks)

Answer all the questions

(Either or Choice-Two questions from each unit)

PATTERN OF QUESTION PAPER (FOR PRACTICAL)

Internal – 40 marks (includes Attendance, Observation and Performance in the laboratory)

External – 60 marks

Question paper should contain two experiments with either or choice. First experiment is Major which has 25 marks and the second experiment is Minor question which has 20 marks. The mark distribution as follows

S No	Content	Experiment I	Experiment II
1	Principle	5	5
2	Procedure	5	5
3	Table / Graph	5	0
4	Observation / Calulation	5	5
5	Result	5	5
6	Spotters	5	5
7	Record	5	5
8	Viva	5	5

FOR RESEARCH

S.No.	Particulars	Marks	Examiners
1	Dissertation	30%	Internal Examiner
		30%	External Examiner
2	Viva-voce	20%	Internal Examiner
		20%	External examiner

Program objectives and outcomes

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The career perspectives of the Master's program in Biochemistry are

PEO 1: To prepare students for the future careers in the concerned/various relevant fields in which a core understanding of the chemistry of life is important.

PEO 2: To enable the graduates to exhibit leadership, make life long learners with professional and social ethics and make them communicate effectively.

PEO 3: To add highly skilled scientific workforce in the area of biomedical research sectors, academic, industry as well as for research laboratories across the country and the globe by following best practices for improving the professionalization and employability of students.

PEO 4: The practical and technical skills with laboratory-based work and the final year research project prepare the students for a research or technical position by defining specific and transferable skills.

PEO 5: To sensitize and train the students towards research with typical employers include pharmaceutical, biotechnology, food, water and agricultural companies and specialist services, such as toxicological studies.

PEO 6: To train the students in generic and competency skills so as to be able to work in potential places including scientific and medical publishers and the Intellectual Property Office

PROGRAMME SPECIFIC OBJECTIVES (PSOs)

The Overall objective of the Program is to promote education and research in biochemistry and provide academic and professional excellence for immediate productivity in industrial, or clinical settings for an ultimate benefit of society and environment.

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 forself-employment and entrepreneurship

PROGRAMME OBJECTIVES (POs)

PO1: To demonstrate comprehensive knowledge on various areas of Biochemistry. PO2: To acquire skills in areas related to the current and emerging developments.

PO3: To communicate the concepts, constructs and techniques of the subject learnt in a clear, concise and lucid manner.

PO4: To plan and execute the experiments to the relevant theories of Biochemistry.

PO5: To apply critical thinking, scientific reasoning and mathematical skills in studied areas of Biochemistry.

PO6: To train the students to acquire various relevant generic and competency skills in various aspects of biochemistry so as to be able to work independently in a group or individually

PO7: To make a student life long learner with moral and ethical values

PROGRAMME OUTCOME (PO'S):-

M.Sc programme in Biochemistry will provide students with the necessary knowledge and skills to undertake a career in research, either in industry or in an academic setting. The training provided will give students the breadth and depth of scientific knowledge in Biochemistry. On completion of the programme, students will be qualified to apply for a PhD or to gain employment in the pharmaceutical or biotechnology industries, which are among the strongest growth sectors. The programme will be based on a combination of taught modules, independent learning and an extended research project to be carried out either in the University departments or industry or in association with industry at the University. The programme incorporates a substantial element of hands-on research experience, with enhanced experimental skills being gained alongside experienced research workers.

It is intended that, on successful completion of the M.Sc degree programme, students will :

1. **be capable of demonstrating comprehensive knowledge** and have a fundamental/systematic or coherent understanding of major concepts, theoretical principles and experimental findings in biochemistry.
2. **acquire skills in areas related to the current and emerging developments** in the field of Biochemistry.
3. **be identifying and applying appropriate biochemical principles** and methodologies to solve a wide range of problems associated with Biochemistry.
4. **communicate the results of studies undertaken** in Biochemistry accurately in a range of different contexts using the main concepts, constructs and techniques of the subject learnt in a clear and concise manner in writing and oral skills.
5. **Plan and execute the experiments**, investigate, analyze and interpret data collected using appropriate experimental methods, and report the findings of the experiment and relate the interpretations and conclusions to relevant theories of Biochemistry.
6. They will have the **ability to employ critical thinking, scientific reasoning and efficient problem** solving skills in the basic areas of biochemistry.
7. Be able to **demonstrate relevant generic skills and competencies** such as (i) problem solving skills, (ii) investigative skills, (iii) communication skills (iv) analytical skills, (v) ICT skills, (vi) skills such as the ability to work both independently and in a group.
8. **demonstrate professional behaviour** such as (i) unbiased and truthful in all aspects of work (ii) follow moral and ethical practices (iii) Life long learners aimed at personal development and for improving knowledge/skill development (iv) focusing on issues related to social cause.
9.

Credit calculation

S. No	**Method of teaching**	**Hours**	**Credits**
1	Lecture	1	1
2	Tutorial/demonstration	1	1
3	Practical/Internship/ Self-Learning	2	1

M.Sc MEDICAL BIOCHEMISTRY
COURSE OF STUDY AND SCHEME OF EXAMINATION

S.No.	Subject	Subject Title	Instruction Hrs / Week	Exam Hours	University Examination			Credits
					Internal (25%)	External (75%)	Total	
I SEMESTER								
1.	Core I	CHEMISTRY OF BIOMOLECULES	5	3	25	75	100	4
2.	Core II	BIOCHEMICAL TECHNIQUES	5	3	25	75	100	4
3.	Core III	CELLULAR BIOCHEMISTRY	5	3	25	75	100	4
4.	Elective I	HUMAN ANATOMY AND PHYSIOLOGY	5	3	25	75	100	4
5.	Core Practical I	LAB COURSE - I	5	6	40	60	100	4
6.	Core Practical II	LAB COURSE - II	5	6	40	60	100	4
II SEMESTER								
1.	Core IV	BIOENERGITICS AND INTERMEDIARY METABOLISM	5	3	25	75	100	4
2.	Core V	CLINICAL ENZYMOLOGY	4	3	25	75	100	4
3.	Core VI	ADVANCED ENDOCRINOLOGY	5	3	25	75	100	4
4.	Elective II	MEDICAL MICROBIOLOGY	4	3	25	75	100	4
5.	Common Paper	HUMAN RIGHTS	2	3	25	75	100	
6.	Core Practical III	LAB COURSE - III	5	6	40	60	100	3
7.	Core Practical IV	LAB COURSE - IV	5	6	40	60	100	3

Note: Online Course certificate (SWAYAM/NPTEL) should be submitted to the Institution at the end of third semester (Compulsory)

S.No.	Subject	Subject Title	Instruction	Exam Hours	University Examination			Credits
					Internal	External	Total	
III SEMESTER								
1.	Core VII	IMMUNOLOGY	4	3	25	75	100	5
2.	Core VIII	PHARMACEUTICAL BIO --CHEMISTRY AND TOXICOLOGY	4	3	25	75	100	5
3.	Core IX	CLINICAL AND NUTRITIONAL BIOCHEMISTRY	4	3	25	75	100	5
4.	Elective III	BIOSTATISTICS & MEDICAL BIOINFORMATICS	4	3	25	75	100	4
5.	EDC	CHOICE OF PAPER SELECTED BY THE COLLEGE OR DEPARTMENT	4	3	25	75	100	4
6.	Core Practical V	LAB COURSE - V	5	6	40	60	100	3
7.	Core Practical VI	LAB COURSE - VI	5	6	40	60	100	3
IV SEMESTER								
1.	Core X	BIOMEDICAL INSTRUMNTATION	5	3	25	75	100	5
2.	Elective IV	MOLECULAR BIOLOGYAND BIOTECHNOLOGY	4	3	25	75	100	4
3.	Project				40	60	100	6
4.		**TOTAL**	**99**				**2300**	**90**

Subject	Total Marks	Total Credits
No. Of Core paper/ Practical/ project [16]	1700	69
Elective - Major: [04]	400	15
Non-Major Supportive course - EDC and Human rights [2]	200	06
Grand Total	2300	90

Subject Code:

S. No	Type of paper	Title of the subject	Subject code
1.	Core I	CHEMISTRY OF BIOMOLECULES	21PMB01
2.	Core II	BIOCHEMICAL TECHNIQUES	21PMB02
3.	Core III	CELLULAR BIOCHEMISTRY	21PMB03
4.	Elective I	HUMAN ANATOMY AND PHYSIOLOGY	21PMBE01
5.	Core Practical I	LAB COURSE - I	21PMBP01
6.	Core Practical II	LAB COURSE - II	21PMBP02
7.	Core IV	BIOENERGITICS AND INTERMEDIARY METABOLISM	21PMB04
8.	Core V	CLINICAL ENZYMOLOGY	21PMB05
9.	Core VI	ADVANCED ENDOCRINOLOGY	21PMB06
10.	Elective II	MEDICAL MICROBIOLOGY	21PMBE02
11.	Common Paper	HUMAN RIGHTS	21PHR01
12.	Core Practical III	LAB COURSE - III	21PMBP04
13.	Core Practical IV	LAB COURSE - IV	21PMBP04
14.	Core VII	IMMUNOLOGY	21PMB07
15.	Core VIII	PHARMACEUTICAL BIO - -CHEMISTRY AND TOXICOLOGY	21PMB08
16.	Core IX	CLINICAL AND NUTRITIONAL BIOCHEMISTRY	21PMB09

17.	Elective III	BIOSTATISTICS & MEDICAL BIOINFORMATICS	21PMBE03
18.	EDC	CHOICE OF PAPER SELECTED BY THE COLLEGE OR DEPARTMENT	
19.	Core Practical V	LAB COURSE - V	21PMBP05
20.	Core Practical VI	LAB COURSE - VI	21PMBP06
21.	Core X	BIOMEDICAL INSTRUMNTATION	21PMB10
22.	Elective IV	MOLECULAR BIOLOGYAND BIOTECHNOLOGY	21PMBE04
23.	Project		21PMBPR1

M.Sc. MEDICAL BIOCHEMISTRY

SEMESTER I

Course Name: Chemistry of Biomolecules	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMB01		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Core I**				

OBJECTIVE

- **To study the structure and functions of macromolecules**

UNIT –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.

UNIT – 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.

UNIT – 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. ompound 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 lipoproteins biological production and significance.. Eicosanoids, Prostaglandins, Thromboxanes, Leukotrienes,

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 - byoyant density, viscosity, chromic effect, Tm, denaturation, renaturation, hybridization and Cot analysis.Chemical properties

Major classes of RNA – mRNA, rRNA, tRNA, snRNA, hnRNA – structure and biological functions.

UNIT – 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.

REFERENCE BOOKS

1. Lehninger's Principles of Biochemistry ,Nelson, David l. 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, Sanfrancisco.
4. Biochemistry 4th edition, by Zubay G L ,1988 W M C Brown Publishers.
5. Principles of Biochemistry, Garrette & Grisham, 1994, Saunders college publishing
6. Outlines of Biochemistry, Eric E.Conn, P.K. Stumpf, G.Brueins and Ray H.Doi,,1987, John Wiley & Sons, NY
7. Text book of biochemistry, Thomas M Devlin, A 1987, 4th edition John Wiley, Inc publication, New York.

Course Outcome:

1. To explain about the structure, properties and functions of polysaccharides
2. Illustrate on structure, properties and functions of lipids, interaction s of lipids in biological membrane.
3. Determine the classification, properties and significance of proteins
4. Explain about the DNA properties and functions, biological importance of histone

proteins

5. To determine the significance of vitamins and its antioxidant activity, minerals of biological significance

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SEMESTER I

Course Name: Biochemical Techniques	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMB02		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Core II**				

COURSE OBJECTIVES :

This course focus on the biochemical techniques includes spectrophotometry, centrifugation, electrophoresis, radioactivity etc.,. Learning these techniques will be very useful for operating instruments and become the basic knowledge in their future

UNIT 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.

UNIT – 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.

UNIT – III

Electrophoresis: Principles, Instrumentation and applications of paper electrophoresis, agar gel, starch gel, PAGE, Capillary electrphoresis 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.

UNIT – 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 spectroscopy, ESR, NMR,

UNIT - 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.

REFERENCES:

1. Principles and techniques of practical Biochemistry, Keith Wilson and John Walker, 1995.Cambridge University Press.
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.
4. Biophysical chemistry Principles and Techniques- Avinash Upadhyaye and Nirmalendhe Nath , 2001. Himalaya Publishers.
5. A Biologist Guide to Principles and Techniques of Biochemistry, Keith Wilson and Kenneth Goulding, Edward Arnold publishers.
6. Tools of Biochemistry David Cooper.
7. Computational Biochemistry C. Stan Tsai.

Course Outcomes:

1. Understand the working principles, construction and applications of electrochemical techniques related to various aspects of biological sciences.
2. Describe the techniques and applications of chromatography for biological sample separation.
3. Recognize how the centrifugation plays a role in separation of sample with different molecular weight.
4. Have a clear picture of radioisotopes, radioactivity, decay patterns, tracer techniques and use of isotopes in biological studies.

5. Study the principles, mechanism and applications of various Electrophoretic techniques in research and industrial level.

6. 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.

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SEMESTER I

Course Name: Cellular Biochemistry	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMB03		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Coe III**				

COURSE OBJECTIVES :

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 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

UNIT-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

UNIT-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, IP_3 pathway, RTK pathway, MAP kinase pathway. Major classes of cell junctions-anchoring, Gap, tight junctions

UNIT 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 secretory pathways.

UNIT 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.

REFERENCE BOOKS

1. Molecular Cell Biology, 4th edn. (2000) by Lodish H, Baltimore and others W.H.Freeman and company, NY

2. Molecular Biology of cells, B. Alberts, Alexander Johnson, ,Julian Lewis, Martin Raff, Keith Roberts, Peter Walter,5thEdn. 2008. G.S. Garland Sciences, Taylor & Francis Group,New york

3. Cell Biology by David E Sadava,2004, Panima Book Publishing Corporation, New Delhi

4. Cell and Molecular Biology by EDP De Robertis and EMF De Robertis

5. Principles of Cell Biology by Klein Smith and M Kish

6. Cell and Molecular Biology 3rd Edn. Gerald Karp, John Wiley & Sons Inc.

Course Outcome:

1. Know about tissue types, organization and classes of cell junctions and describe the role of cell adhesion molecules and ECM components.

2. Understand what happens during the cell cycle and cell death and explain about membrane transports and checkpoints in the cell cycle.

3. To understand the basic structures, properties and organisation of eukaryotic and prokaryotic chromosomes.

4. Pertain on Overview of cell cycle, cell growth, tumors, cancers and isolation techniques

5. Describe on carcinoigenesis

M.Sc. MEDICAL BIOCHEMISTRY

SEMESTER I

Course Name: Human Anatomy and Physiology	Hours	L	T	P	Credit
Course code: 21PMBE01		3	1	0	4
Total Marks : Internal – 25 External – 75	Paper Type: Elective I				

COURSE OBJECTIVES:

To study the mechanism of human body systems and mode of action of Hormones

UNIT I

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

UNIT II

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

UNIT III

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.

UNIT IV

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.

UNIT V

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

REFERENCE BOOKS

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
5. Agarwal physiological T.B. of Biochemistry ,Agarwal G.R & Agarwal B.P. Chemistry.
6. Harper's Biochemistry, Murray. R.G. et al., 2009, 24th edition.
7. Lecture notes on human physiology, Vol II, M. M. Muthiah 1991
8. Concise human physiology, Sukkar, M.Y.Munshid and Ardawi
9. Review of Medical Physiology Gaanong.W.F

Course Outcomes:

1. To understand the fundamental mechanisms of body fluids and blood cells.
2. 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.

3. 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.

4. Describe the structure and functions of kidney and muscle. Explain mechanism and theories of muscle contraction.

5. Recognize the role of central nervous system in human body. Study the functional units, chemical composition and metabolism of brain.

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SEMESTER I

Course Name: Lab Course I	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBP01		**0**	**0**	**5**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Practical I**				

1. Microscopy
2. Staining Techniques [Morphological observation only]
3. Microtomy
4. Histochemical Techniques
5. Mitosis and Meiosis
6. Cell Fractionation
7. General Reactions of Carbohydrates, Lipids, Amino acids and Proteins
8. Iodine Value, Acid Value and Saponification Value
9. Estimation of Vitamin A and Vitamin C
10. Preparation of Cholesterol from Brain

REFERENCE BOOKS

1. Laboratory techniques in Biochemistry and Molecular Biology, Work and Work.
2. A Biologist's Guide to principles and of practical Biochemistry K. Wilson and Goulding W.H, 1986. ELBS Edn.,
3. Modern Experimental Biochemistry, Boyer R. 3rd Edn. Benjamin Cummings Publications
4. Laboratory Manual in Biochemistry. Jayaraman J. 1996. 5th Print New Age International Ltd. Publishers, New Delhi.
5. Biochemical methods. Sadasivam. S. and Manickam A.,1991, 2nd edn. New Age International Ltd. Publishers, New Delhi

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SEMESTER I

Course Name: Lab Course II	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBP02		**0**	**0**	**5**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Practical II**				

1. Analyse the following contents in the selected food sample Calories, Crude fibre and Dietary fibre, Moisture, Nitrogen, Ash calcium, phosphorus, iron, carotene, thiamine, riboflavin, fat, protein
2. Estimation of amino acids
3. Separation of amino acids and sugars by paper chromatography (Ascending, Descending, and Circular)
4. Separation of Protein Hb, Cytochrome C by Molecular sieve chromatography
5. Separation of amino acids by Paper Electrophoresis
6. Separation of Serum Protein by SDS PAGE
7. Separation of DNA by AGE

REFERENCE BOOKS

1. Laboratory techniques in Biochemistry and Molecular Biology, Work and Work.
2. A Biologist's Guide to principles and of practical Biochemistry K. Wilson and Goulding W.H, 1986. ELBS Edn.,
3. Modern Experimental Biochemistry, Boyer R. 3rd Edn. Benjamin Cummings Publications
4. Laboratory Manual in Biochemistry. Jayaraman J. 1996. 5th Print New Age International Ltd. Publishers, New Delhi.
5. Biochemical methods. Sadasivam. S. and Manickam A.,1991, 2nd edn. New Age International Ltd. Publishers, New Delhi

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SEMESTER II

Course Name: Bioenergetics and Intermediary metabolism	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMB04		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Core IV**				

COURSE OBJECTIVES:

The Course aims to understand the major metabolic pathways involved in synthesis and degradation of biomolecules and energy generation

UNIT 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.

UNIT 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.

UNIT 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.

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.

UNIT 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.

REFERENCE BOOKS

1. Lehninger's Principles of Biochemistry, Nelson, David l. and Cox, 2000 M.M. Macmillan/ worth,.NY
2. Fundamentals Of Biochemistry, Donald Voet, Judith G.Voet and Charlotte W Pratt, 1999, John Wiley & Sons, NY
3. Outlines of Biochemistry, Eric E.Conn, P.K. Stumpf, G.Brueins and Ray H.Doi, 1987. John Wiley & Sons, NY
4. Biochemistry, Lubert stryer, 1994. 3rd Edn., W H freeman and co, Sanfrancisco.
5. Text book of biochemistry,Thomas M Devlin, 1997 4th edition ,A John Wiley, In
6. Biochemistry, Zubay G L , 1988.4th edition W M C Brown Publishers.
7. Principles of Biochemistry , Garrette & Grisham, 1994. Saunders college Publishing
8. Harper's Biochemistry, R.K. Murray and others, 25th ed 2009. Appleton and Lange, Stanford
9. Regulation in Metabolism , E.A.Newshome ,C. Start, John Wiley & Sons.

Course Outcomes:

1. Understand the energy transformation and chemical logic of metabolic pathways in living organism.
2. Know in detail about enzymes, redox carriers, ETC and oxidative phosphorylation machinery.
3. Recognise carbohydrate metabolism and its various biochemical processes responsible for the formation, breakdown and interconversion of carbohydrates in living organisms.

4. Describe what happens in the lipid metabolism, fatty acid oxidation, cholesterol synthesis and degradation as well as in ketogenesis and plasma lipoproteins.

5. Describe what happens during protein, nucleic acid and porphyrin metabolism

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SEMESTER I

Course Name: Clinical Enzymology	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMB05		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Core V**				

COURSE OBJECTIVES

This paper aims to provide a basic understanding of biological catalysis, Mechanism of action of enzymes, structure and function relationship, Understanding the enzyme kinetics and role of coenzymes/co-factors and an overview of Industrial application of enzymes

UNIT 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.

UNIT II

Princi**ples 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

UNIT 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.

UNIT IV

Enzymes in Inborn error of metabolism – Phenylketonuria, Alkaptonuria, Tyrosinosis, Albinism, Hartnup's disease ,Galactoemia, Taysacch's disease, Niemann Pick's disease, Hunter Syndrome, Lesh Nyhan Syndrome.

UNIT 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

REFERENCE BOOKS

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. 3rdEdn., Ellis Horwood Limited.
4. Protein Biotechnology, Gary Walsh and Denis Headon, 1994.John Wiley and Sons,
5. Protein Biochemistry and Biotechnology, Gary Walsh,2002, John Wiley and Sons Ltd.
6. Enzyme kinetics and Mechanism –Paul F.Cook

Course outcomes

After the completion of this course, the student will be able to

1. Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and Compare methods for production, purification, characterization of enzymes
2. To understand the diagnostic importance of enzymes and their significances.
3. Know about the clinical significance of the enzymes
4. Describe the enzymes involved in the inborn error of metabolism
5. To understand the importance of Enzymes in Medicine and diagnosis

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SEMESTER II

Course Name: Advanced Endocrinology	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMB06		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Core VI**				

OBJECTIVE

- To study about the functions, mechanism of action, diagnosis and investigations of hormones

UNIT – 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 IP_3.

UNIT – 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.

UNIT- 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.

UNIT- 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.

UNIT-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.

REFERENCE 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. Principles of Biochemistry, Emil Smith, Handler Abraham, 1983.7 th Edn., White, Mcgraw Hill International book company.

4. Williams textbook of Endocrinology, P.Reed Larson, HenryM. Korenberg, Shlom Melmed and Kenneth S. Polonsky, 2003, 10th Edition, Saunder Philadelphia, USA.

5. Harpers Biochemistry, Murray *et al.*, 2003. 2nd Edition, Mc Graw Hill Publications, USA.

Course outcome

1. Determine the classification and mechanism of action of hormones.
2. Explain about the chemistry, synthesis and significance of hypothalamic, pituitary and thyroid hormones.
3. Analyze about the pancreatic hormones, gastrointestinal and sex hormones
4. Predict the dysfunction of hypothalamus, parathyroid, pancreas, adrenals, gonads and gastrointestinal hormones.
5. Report on laboratory diagnosis and investigations of hormones

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SEMESTER II

Course Name: Medical Microbiology	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBE02		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Elective II**				

COURSE OBJECTIVES:

The aim of the study is to get knowledge about microorganisms and their characters. Gain knowledge about the medical applications of microorganisms.

UNIT 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

UNIT - 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

UNIT -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.

UNIT – 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.

UNIT – 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 – Inluenza virus. Picarno virus – Polio. Paramyxo virus – Parainfluenza virus, Mumps, Measles, .Rhubella virus, HIV, Arbo viruses. Oncogenic viruses. Emerging viruses. Antiviral agents and mechanism of action.

REFERENCE BOOKS

1. Principles of Bacteriology, Virology and Immunity. Topley and Wilson, 1995. 9th edition, Vol I, Edward Arnold, London

2. Medical Virology Morag C and Timbury, M.C 1994. 10th Edition. Churchill Livingston, London

3. Medical Microbiology, Greenwood, D., Slack, R.B. and Peutherer, J F. , 2002. 16th Edition.Churchill Livingston, London

4. Text book of Microbiology. Anatntha Narayanan and Paniker's 2013. 9th Edition. Universities Press, (India) Private Limited, Hyderabad.

5. A text book of Medical Mycology , Jegadish Chander ,1996. Interprint. New Delhi

6. 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.

7. Medical Microbiology and Immunology. Warren Livingstone and Ernest Jawetz 2000. 6th Edition. McGraw Hill companies. Inc.

Course Outcomes:

1. Understand the classification and controlling of microbes and study isolation of microbes and maintenance.

2. Describe important characteristic of microorganisms, thereby identify different type of microorganisms.

3. Study about various types of microorganisms involved in infection of food products.

4. Recognise the sources and transmission of infections and how the factors involving in infection.

5. Know about the different types of microscopes and its function.

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SEMESTER III

Course Name: Lab course III	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBP03		**0**	**0**	**5**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Practical III**				

I. Assay of Enzymes

1. Isolation, purification, and kinetics of ALP and ACP in animal sample
2. Determination of activity of enzymes: LDH, AST, ALT, CK, Phosphatase (Spectrophotometric method) and Antioxidant enzymes [CAT, SOD, GPx, GR].
3. Separation of LDH isozymes in PAGE from serum/Liver
4. Kinetic studies of Amylases and Acid phosphatase

II. Endocrine function tests

1. Assay of Insulin by ELISA
2. Estimation of urinary excretion of VMA, 5-HIAA, 17 - ketosteroids, Catecholamines and Cortisol
3. Estimation of bilirubins and hepato-biliary function tests
4. Thyroid function tests – T3 and T4 Assay
5. Analysis of gastric juice
6. Estimation of TSH, Progesterone and Oestrogen .

REFERENCE BOOKS

1. Laboratory Manual in Biochemistry. J. Jayaraman,1996. 5th Print .New Age International Ltd. Publishers, New Delhi
2. Biochemical methods, S. Sadasivam and A.Manickam, 1991. 2nd Edn.,New AgeInternational Ltd. Publishers, New Delhi.
3. Text book of Practical Biochemistry, David T.Plummer, 2010. 3rd Edn., Book Vistas, NewDelhi

4. Enzyme structure and mechanism, Aln Fersht,1997, Reading, USA

5. Modern Experimental Biochemistry, Rodney F. Boyer, 2000. 3rd Edn. Benjamin Cummings Publications.

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SEMESTER III

Course Name: Lab course IV	Hours	L	T	P	Credit
Course code: 21PMBP04		0	0	5	4
Total Marks : Internal – 25 External – 75	Paper Type: Practical IV				

1. Bacterial Staining techniques – Simple, Gram, Acid fast, Endospore, Capsule, granule and Metachromatic staining.
2. Motility Test – Hanging drop method
3. Biochemical identification of bacteria – Catalase test, Oxidase test, IMViC test, TSI, Urease and carbohydrate fermentation tests
4. Lactophenol cotton blue staining – Penicillium spp., Aspergillus spp., Trichophyton spp., Microsporum spp., and Candida albicans
5. Gram Staining and Germ tube test of Candida albicans
6. Lugol's iodine mount – Cysts - Entamoeba histolytica, Entamoeba coli, Giardia lamblia
7. Eggs – Ascaris lumbricoides
8. Blood smear examination – Plasmodium/Microfilariae (Demo)
9. Antibiotic sensitivity test – Kirby Bauer method
10. ELISA – HIV and HBs
11. Viral Haem-agglutination Assay
12. ASO test
13. WIDAL Test
14. RPR Test

REFERENCE BOOKS

1. Microbiology laboratory Manual., Sundararaj T.Mrs. AswathySunararaj, No 5, 1st Cross Street, Thirumalainagar, Perungudi, Chennai - 96
2. Microbiology: A laboratory manual, James G Cappuccino and Natalie Sherman 2004. 6th edition, Published by Pearson Education.

3. Myer's and Koshy's Manual of diagnostic procedures in medical microbiology and Immunology/serology. Published by Department of Clinical Microbiology. CMC and Hospital, Vellore, Tamil Nadu

4. Experiments in Microbiology, Plant pathology and Biotechnology, Aneja K R 2005. 4th edition. New age International publishers, Chennai.

5. Experiments in Microbiology. Rajan S and Selvi Christy 2015. Anjana Book House, Publishers and distributors, Chennai, Tamil Nadu

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SEMESTER III

Course Name: Immunology	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMB07		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Core VII**				

OBJECTIVES:

To study the immune responses of human body against antigen, immunological techniques and vaccine synthesis.

UNIT 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.

UNIT 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.

UNIT 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

UNIT-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 mouse embryos

UNIT-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.

REFERENCE BOOKS

1. Kuby Immunology,Thomas J. Kindt, Richard A Goldsby, 2013. 7th Edn., Publisher W H Freeman & Co
2. Roitt's Essential Immunology- Ivan Roitt, Peter Delves, et al., 2011, 12th Edition, Wiley – Blackwell Science.
3. Immunology, An Introduction:Ian R. Tizard,1995.Saunders Publishers.
4. The Immune System,Peter Parham ,2014. Publisher Garland publishing
5. Cellular and Molecular Immunology. Abbas et al., 2011. Elsevier

Outcomes:

1. Understand the humoral and cell mediated immunity.
2. Know the primary and secondary lymphoid organ.
3. Describe the theories of antibody formation and factors influencing antibody production.
4. To learn the types of transplantation and understand how its malfunction linked with autoimmune disease and hyper sensitivity.
5. Understand the active and passive immunization and learn how to make recombinant vector vaccines.
6. Clear knowledge about the agglutination and precipitation techniques involved in research level.

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SEMESTER III

Course Name: Pharmaceutical Biochemistry and Toxicology	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMB08		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Core VIII**				

COURSE OBJECTIVES:

This course deals with the study of fundamental concepts of pharmacology about the physisochemical propertiesof 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 I

Biopharmaceutical properties of drugs: Mechanism of drug absorption – physiochemical 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.

UNIT 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.

UNIT III

Drug metabolism: First phase metabolism – Elimination pathway – Entero - hepatic cycling of drugs. Drug biotransformation pathway – phase I – Hepatic cytochrome P_{450} enzyme system; Cytochrome P_{450} cycle – induction and inhibition. – Oxidation catalysed by cytochrome P_{450} isoforms – All types of hydroxylation, Deamination – Dealkylation – Dehalogenation. Oxidations: Microsomal & Non – microsomal oxidations. Miscellaneous reductions.

UNIT 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, Toxico kinetics. Response of respiratory system, reproductive system, liver and kidney to toxic agents. Toxic effects of metals, solvents and environmental pollutants.

UNIT 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 ED_{50}. Acute, sub-acute and chronic toxicity studies. Antidotes in the management of poisoning. Applied analytical toxicology and toxico vigilance.

REFERENCE 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.

3. Pharmacology and Pharmacotherapeutics, Satoskar,R.S et al., 2015.24th Edition, Popular Prakasham, Bombay.

4. Applied Biopharmaceutics and Pharmacokinetics, Shargel,L. et al., 2015. 7th Edition, McGraw-Hill Medical.

Course Outcome:

- Students who complete this course will be able to:
- Understand clearly about the basic concepts of pharmacology
- Have a thorough knowledge about the mechanism of drug action, Drug interaction, Receptors.
- Know the aspects of New discovery of drugs and drug designing.
- Recognize the principles of toxicology, Antidotes and the management of poisoning.

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SEMESTER III

Course Name: Clinical and Nutritional Biochemistry	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMB09		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Core IX**				

OBJECTIVES:

- The aim of the study of this paper is clinical approach of blood and urine samples and their complications.
- To gain the knowledge about neutraceuticals

UNIT I

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.

Quality of laboratory medicine- Quality management systems, Personnel information systems- clinical effectiveness. Clinical quality indicators- effectiveness, demand management. Selection of methods for common analysis in serum/plasma – total proteins, glucose, urea, creatinine

Specimen: Whole blood, plasma, serum, CSF and gastric fluid collection methods and preservation

UNIT II

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.

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.

Disorders of Nitrogen metabolism: Excretion of nitrogenous waste products, porphyrias, Hemoglobinopathies, Uricaciduria- Pathogenesis, diagnosis and management.

UNIT III

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.

Gastric functional tests: Fluid composition, pathology, diagnosis and management of Ulcer [all types] and gastritis.Tumor markers and molecular significances; Oncofetal protein, Oral carcinoma, mammary carcinoma, liver carcinoma, Kidney cancer, leukemia-Acute and Chronic Lymphoid Leukemia and Myeloid Leukemia

UNIT 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 fibres.

UNIT 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.

REFERNCE 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. Clinical Biochemistry- Metabolic and clinical aspects, William J. Marshall, Marta Lapsley, Andrew P. Day, Ruth M. Ayling,2014. Churchill Livingstone, Elsevier.

4. Food Science, Srilakshmi B, 2002, 5thedition, New Age International Pvt Ltd.

5. Modern Nutrition in health and disease, Robert S Goodhart, 2012, 11th edition, Lippincott Williams and Wilkins.

6. Food facts and principles, N Shakuntala, O Manay, 2001, New Age International Pvt Ltd.

7. Clinical Chemistry in diagnosis and treatment, Mayne,1999, ELBS

8. Clinical Biochemistry- Metabolic and clinical aspects, William J.Marshall, Marta Lapsley,Andrew P. Day, Ruth M. Ayling,2014. Churchill Livingstone, Elsevier.

9. Food Science , B. Srilakshmi,2003.3rdEdn. New Age International

10. Modern Nutrition in health and disease, Robert S Goodhartand Maurice E. Shils,1974.5th Edn. Lea & Febiger US

11. Food facts and principles, Sakuntala N.Manay and M. Shadaksharaswamy; 2009.3rd Edition New Age International

Course Outcomes:

1. Understand the collection and analysis of blood and urine samples.

2. Understand the role of carbohydrates and lipid metabolism in various diagnostic and therapeutic approaches.

3. Have a clear knowledge about inborn error and hereditary defects in amino acids metabolism.

4. Know about the gastric function test for diagnosis and therapeutic complications.

5. To learn the differentiate blood tests that are used to evaluate renal function test and liver functions.

6. Know in detail about the disorders of mineral metabolism and Erythrocyte metabolisms

7. To know about the energy content of food and Nutritional profile of principal foods

8. Lean about Dietary requirements and Measurement of energy expenditure

9. To learn about the Dietary protein and Protein energy malnutrition disorders

10. To learn about Disorders related to the deficiency of minerals

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SEMESTER III

Course Name: Biostatistics and Medical Bioinformatics	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBE03		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Elective III**				

OBJECTIVES:

- To study different levels of Bioinformatics tools and applications. To gain knowledge about nanoparticles and their applications in science.
- To study this paper we can understood methods which is used to implement in Research.

UNIT 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.

UNIT 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.

UNIT 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.

UNIT 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.

UNIT 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).

REFERENCE BOOKS

1. Biostatistics analysis, Zar, J.H, 1984.Prentice Hall, New Jersey
2. Statistical methods for biologists, Palanichamy. S and Manoharan. M., 1990.
3. Statistical methods, S.P Gupta. 2011. 41st Edn. Chand & Co.
4. Biostatistics – A foundation for analysis in health science, Wayne W,Daniel and Chad L.Cross,10th Edn. John Wley & Sons Inc.
5. Biochemical calculation and biostatistics, Dr. E.Padmini, 2010.2nd Edn. Wiley India Pvt.Limited
6. Bioinformatics - Concepts, Skills, and Applications , S.C. Rastogi Namita Mendiratta and Parag Rastogi, 2003 CBS Publishing.
7. Bioinformatics - A practical guide to analysis of Genes & Proteins Andreas D Baxevanis and B F Francis, 2000. John Wiley.
8. Introduction to Bioinformatics,T K Attwood, D J Parry and Smith, 2005., 1st Edition, 11th Reprint Pearson Education.ss
9. Bioinformatics, C S V Murthy, 20031st Edition. Himalaya Publishing House,
10. Basic Bioinformatics, S. Ignacimuthu and S.J. Narosa, 1995.Publishing House.
11. An Introduction to Computational Biochemistry, C.S. Tsai, 2002. Wiley& Liss, New York.

Course Outcomes:

1. On completion of this course, students are able to understand about biostatistics, bioethics, IPR and legal protection, patent filling and infringement and biosafety.
2. Understand the sample, population and statistical inference.
3. Gain knowledge about concept, philosophical consideration and epistemology of science, ethical terms, principles and theories of bioethics

4. Understand the basic concepts of bio-informatics databases and tools on internet. Learn how to apply computational facility in different fields of life sciences, physical and chemical sciences.

5. Have a clear detail about different protein structure and its predicting method.

6. To learn how can utilise the BLAST and FASTA analysis for biological sequence.

7. Recognise how can visual the structures and classification of proteins by visualization tools and learn to utilise this tools for alignment and analysis.

8. Understand the drug designing through computer based modification programs using synthetic or natural source

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SEMESTER III

Course Name: Lab course V	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBP05		**0**	**0**	**5**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Practical V**				

COURSE OBJECTIVES:

To study the basic concepts of techniques in isolation, identification and estimation of clinical samples.

I Haematology

1. Enumeration of RBC and WBC
2. Differential count
3. Estimation of Haemoglobin
    a) Colorimetric method
    b) Sahli's method
4. Determination of Bleeding Time and Clotting time
5. ESR, Haematocrit and PCV

II Blood/ Serum Analysis

1. Estimation of total blood sugar, GTT, GlyHb
2. Estimation of Total protein by Lowry's method
3. Determination of A:G ratio by Biuret method
4. Estimation of Urea DAM method
5. Estimation of Creatine and Creatinine- Alkaline picrate method
6. Estimation of Cholesterol, TG, HDL,LDL and VLDL
7. Estimation of Bilirubin [TB, DB & IB]
8. Estimation of Vitamin A and C
9. Determination of LDH and CPK activity

10. Determination of AST & ALT activity

11. Estimation of Cu and Fe

III Urine Analysis

1. Estimation of Urea, Uric acid, Creatine and Creatinine
2. Estimation of Titrable acidity
3. Estimation of Phosphate
4. Estimation of Na & K, Ca
5. Estimation of Chloride- Vanslyke's method

REFERENCE BOOKS

1. Laboratory Manual in Biochemistry, J. Jayaraman, 1996. 5th Print New Age International Ltd. Publishers, New Delhi.
2. Biochemical methods. Sadasivam. S. and Manickam A. 1991, 2nd edn. New Age International Ltd. Publishers, New Delhi.
3. Text book of Practical Biochemistry, David T.Plummer, 2010. 3rd Edn., Book Vistas, NewDelhi
4. Modern Experimental Biochemistry, III Edn. Boyer R. Benjamin Cummings Publications
5. Practical Clinical Biochemistry- Vol I Harold Varely, Alan H. Gowenlock, Maurice Bell,1980,5thEdn Heinmann Medical London
6. Harold Varley - Practical Clinical Biochemistry, Vol II Harold Varely, Alan H. Gowenlock, Maurice Bell,1980,5thWillinson Heinmann Medical
7. Laboratory Manual in Biochemistry Pattabiraman, T.N., 2015.4th Edn. All India Publishers.
8. Hand Book of Emergency Lab Tests, Worthly L.I.G.1996. Churchill Livingstone

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SEMESTER III

Course Name: Lab course VI	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBP06		**0**	**0**	**5**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Practical VI**				

COURSE OBJECTIVES:

To study the basic concepts of techniques in alutination, precipitation and immune responses

I. Agglutination

1. Blood Grouping and Rh Typing
2. RA test
3. CRP test
4. Pregnancy Test

II. Precipitation

1. Immunodiffusion – Mancini and Ouchterlony method
2. Immuno Electrophoresis
3. Rocket Immuno Electrophoresis
4. Counter Current Immuno Electrophoresis
5. Immunoprecipitation test

III. Enzyme immune assay

1. ELISA

IV. Hybridization Technique

1. Western Blotting

REFERENCE BOOKS

1. Practical immunology Frank L Hay and Olywn M R 4th Edn. Westwood
2. Practical Manual of Biochemistry S.P. Singh, 2013. CBS publishers
3. Laboratory techniques in Biochemistry and Molecular Biology, Work and Work.
4. Bioinformatics – A Practical Guide to the analysis of gene and proteins.

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SEMESTER VI

Course Name: Biomedical Instrumentation	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMB10		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Core X**				

COURSE OBJECTIVES:

This course focus on the biochemical techniques includes spectrophotometry, centrifugation, electrophoresis, radioactivity etc., Learning these techniques will be very useful for operating instruments and become the basic knowledge in their future.

UNIT - I

Classification of biomedical equipments - Diagnostic, therapeutic and clinical laboratory equipments, bielectric 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.

UNIT - 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.

UNIT - 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.

UNIT - IV

Introduction, characteristics, diagnostics and therapeutic application and advantage of pulsed ruby laser, ND- YAG laser, CO_2 laser, argon laser and helium neon laser.

Introduction, types, merits, demerits, limitations, diagnostic and therapeutic application of endoscope, laparoscope and cardio scope.

UNIT - 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.

REFERENCE 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 & Sons.
4. Principles of applied Biomedical instrumentation by L.A. Goddes and L.E. Baker, 1989. 3rd Edn. John Wiley India Pvt.Ltd.
5. Introduction to Biomedical Equipment Technology, Carr J. and J, Brown J. M, 2009. 4th Edn..Pearson.
6. Medical electronics and Instrumentation by Sanjay Gupta.

Course Outcomes:

1. construction and applications of electrochemical techniques related to various aspects of biological sciences.
2. Describe the techniques and applications of chromatography for biological sample separation.
3. Recognize how the centrifugation plays a role in separation of sample with different molecular weight.
4. Have a clear picture of radioisotopes, radioactivity, decay patterns, tracer techniques and use of isotopes in biological studies.
5. Study the principles, mechanism and applications of various Electrophoretic techniques in research and industrial level
6. 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.

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SEMESTER VI

Course Name: Molecular Biology and Biotechnology	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBE04		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: Elective IV**				

Course Objectives:

- 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 I

Molecular structure of Genes and chromosomes. Organisation of genes in Prokaryotes and Eukaryotes. Prokaryotic and Eukaryotic Transcription units - Structure of DNA- semiconservative model of replication- experimental evidences.

Replication of DNA; Enzymes, replication in eukaryotes; circular and helical DNA regulation – regulation of replication. DNA damage and repair.

UNIT - 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

UNIT - 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.

UNIT - 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..

UNIT - V

Transgenic animals and plants – monoclonal and polyclonal antibodies – vaccines and diagnosis – edible vaccines – humulins- interferons

Stem cells – History – types- culturing of stem cells – Embyonic stem cells, cord blood, adult stem cells- cloning- stem cell banking – Stem cell therapy- Ethics.

REFERENCE BOOKS

1. Molecular Cloning: A Laboratory Manual, J.Sambroot E.F. Fritsch and T.Maniatis, 2000.Cold Spring Harbe Laboratory Press New York,
2. Gene VII Benjamin Lewin, 2000.Oxford University Press, London
3. Cell and Molecular Biology, 2000. 3rd edn. Gerald Karp, John Wiley and Sons Inc
4. Molecular Cell Biology – Lodish, Baltimore et al., 1995, Scientific American Book,.
5. Molecular Biology David Freifelder Naro 1995.Publishing House, New Delhi
6. Molecular Biology Weaver R F, 1999..McGraw Hill Inc. NY
7. Molecular Biotechnology. Glick B.R. and Pasternak J.J. 2010,4th Edn. ASM Press, USA.
8. DNA Molecular Biotechnology, 2003. Glick B.R. and Pasternak J.J.
9. Cloning 1 and 2, Glover D.M. and Hames B.D. 1995 IRL Press .
10. Recombinant DNA ,J.Watson, 1992 2nd edition, W.H, Freeman and Co., NY.
11. Essential Molecular Biology A Practical approach, T.A. Brown, 2007. 2nd edition, IRL Press, Oxford.
12. Gene Cloning, An introduction, T.A. Brown 1995, 3rd Edn. Chapman and Hall.

Course outcome:

1. To understand the basic structures, properties and organisation of eukaryotic and prokaryotic chromosomes.
2. To emphasize the molecular mechanism of DNA replication and recombination involved in eukaryotes and prokaryotes.
3. Deeply understand the transcription process in prokaryotes and eukaryotes.
4. To knows about the translation and post translational modification in prokaryotes and eukaryotes.
5. Learn the changes and consequences in chromosome structure and its related disorders, thereby know how the DNA repair mechanism by anticancer therapeutics involved against DNA mutation and uncontrolled cell growth

6. Know the transgenic plants and its applications & risks. Also understand the genetic modification in food industry and its applications, controversies over risks.

7. Know the plant molecular biology techniques and its applications.

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EXTRA DISCIPLINARY COURSE I

Course Name: Biochemistry in Health	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBED1		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: EDC I**				

UNIT 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.

UNIT - 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.

UNIT - 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

UNIT – IV

Water structure, physical and chemical properties. Vitamins- water soluble and fat soluble vitamins; Sources, chemical composition, Biological function and property, Deficiency diseases in human.

UNIT - 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.

REFERENCE BOOKS

1. Text book of Medical Physiology - A.C . Guyton,8th Edn.1991, W.B.Saunders, Harcourt Brace Company, Bangalore.

2. Text book of Medical Biochemistry 2002.M.N. Chatterjea and Rana Shinde, 5th Edn. JayPee Publications, New Delhi

3. Text book of Medical Biochemistry 2008.M.N. Chatterjea and Rana Shinde, 7th Edn. JayPee Publications, New Delhi

4. Fundamentals of Biochemistry, Dr.A.C.Deb 2006, New Central Book Agency(P)Ltd. Kolkota.

5. Essentials of Biochemistry Sathyanarayanan.U. 2002, Books and allied (P) Ltd.

6. Fundamentals of Biochemistry for Medical Students by Ambika shanmugam 2006.Published by author;West CIT Nagar ,Chennai-35

7. Essentials of Medical Physiology , K.Sembilingam and Prema Sembulingam, 2010. 5th Edn.Jaypee Bros, medical Publishers (P) Ltd. Chennai.

8. Text Book of Biochemistry, S.Nagini, 2002. Scitech Publications (P) Ltd., Chennai

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EXTRA DISCIPLINARY COURSE II

Course Name: Human Physiology and Nutrition	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBED1		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: EDC II**				

UNIT 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'.

UNIT - II

Respiratory and Circulatory system: Types of respiration. - Outline of respiratory system' respiratory pigments, Transport of 0_2 and CO_2. Factors affecting oxygen dissociation curve and carbon dioxide dissociation curve. Chloride shift.

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.

UNIT - III

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.

UNIT – IV

Introduction on Nutrition: Food factors for human being. Nutritional classification, foods, Energy – Energy value of food and its determination, energy expenditure – components – basal metabolism, physical activity and thermogenesis- foods' Basal metabolism: Definition, determination of basal metabolic rate (BMR). Standards of BMR factors affecting BMR, energy utilization in cells and energy balance. Dietary fiber- Definition, types of fiber in plant foods, sources, composition, role of dietary fiber and resistant starch in nutrition, effect of over consumption of fiber.

UNIT - V

Nutritional consequences and Dietary Allowances Nutritive value of protein' Protein calorie

malnutrition in children. protein and energy/ requirements Nitrogen balance and imbalance. Deficiency Disease of Vitamins and Minerals (Iron, sodium, potassium, fluoride, magnesium and calcium.) Infant nutrition, nutrition for preschool children, school children, adolescents, pregnant and lactating mothers. Industrial workers. Geriatric nutrition and Lathyrism. Obesity: Aetiology and occurrence, physiological regulation of foods intake assessment, complication, treatment and prevention of obesity. Therapeutic diets.

REFERENCE BOOKS

1. Food Science ,Norman N.Potter, 1986. 3rd edn. .Springer Science LLC, NY.

2. Text book of Medical Physiology, Arthur C Guyton, 1976. 5th Edn. W. B. Saunders publications, Tokyo.

3. Text Book of Medical Biochemistry ,M.N, Chatterjea and Rana Shindhe 2002. 5th Edition Chatterjee . JayPee publications, NewDelhi.

4 Food facts and principles, 1987. Shakuntala Manay , John Wley and Sons.

5 Modern nutrition in Health and disease , Robert S. Goodhart, Maurice, E. Shils, 1980. Michael G. Wohl, Robert S. Goodhart and Maurice E. Shils (Editor).

6 Review of Medical Physiology by Ganong .W.F .2016, 25thEdition, A& L Lange series.

7 Concise Human Physiology ,Sukkar.M.Y, EI-Munshid.H. A and Ardawi.M.S.M. 2000, John Wiley and Sons.

8 Human nutrition and dietetics,s.Davidson and J.R.Passmore . ELBS, Zurich.

9 Nutrition in health and disease ,Whol& Gccd har-t .

10 Human nutrition and dietetics I.S. Garral ,W.P.T.James lLPs Co3

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EXTRA DISCIPLINARY COURSE III

Course Name: Hospital Management and Medical Coding	**Hours**	**L**	**T**	**P**	**Credit**
Course code: 21PMBED3		**3**	**1**	**0**	**4**
Total Marks : Internal – 25 External – 75	**Paper Type: EDC III**				

UNIT - I

Introduction on Hospital management: Eligibility and personal skills required for Hospital management .Job opportunities in Hospital management. Important hospital management Institutes in India and World Hospital management. Concept of Modern Hospital & privatization in Health Sector, Public Sector Hospitals and Level of care f offered, facilities, Effects of Globalization in Health care, Concept of Corporate Hospital in developing countries,.

UNIT - II

Infrastructure and lay out of an ideal corporate hospital, -l Functioning of modern hospitals & changing need of patients Hospitality in Hospital Care, - Invasive and non- invasive diagnostic facilities in modern hospital Care offered in Specialty and Super specialty Hospitals. Hospital management system: Benefits of Hospital management systems, Modules of Hospital management system .Interfacing of analyzer Pathology lab management. Radiology, Blood Bank, Pharmacology management software's.

UNIT - III

History of Medical Transcription: Drawbacks of MRP system, Advent of Medical Transcription .Web friendly operating system. Market information on companies. What Medical Transcription does? Benefits in a nut shell. Planning on Medical Transcription set up Induction and orientation.

UNIT - IV

Impact of Medical Transcription: Medical Transcription impact on its stock holders

Impact during the implementation process. Impact on Departments, Organization as whole, Employment, Nature of job, Information access and Individual employees. Advantages in corporate entity, Disadvantages.

UNIT - V

Medical Transcription implementation: Medical Re engineering, Choosing appropriate transcription, Customise to suit the changes Medical Transcription: Best practices Costs,

Failure , Gap analysis. Implementation, Life cycle Medical Transcription- Trouble and their solutions.

REFERENCE BOOKS

1. Hospital Management module II- 2001, NIHFW, New Delhi
2. Hospital Administration. G. D. Kunders. 2004.
3. Hospital and Health Services and Administration, Syed Amin Tabish,2001.Oxford University Press.