PROPOSED CURRICULUM

FOR

M.Sc. DEGREE
IN
MEDICAL BIOCHEMISTRY

UNIVERSITY OF CALICUT

PROPOSED CURRICULUM FOR M.Sc. DEGREE IN MEDICAL BIOCHEMISTRY UNIVERSITY OF CALICUT

1] INTRODUCTION

The Aim of the proposed course is to impart training to graduates for a period of two years, to render them proficient to:

A] Perform the Medical Biochemical techniques.

B] Interpret the results of various tests.

C] Supervise the Medical Biochemistry Laboratories.

2] NAME OF THE COURSE: M.Sc. Medical Biochemistry

3] ELIGIBILITY FOR ADMISSION:

Candidates seeking admission to the course shall have passed 4 year B.Sc Medical biochemistry Examination of the University of Calicut with at least 50% marks or a Qualification recognized as equivalent. In their absence, 3 year B.Sc. Biochemistry/B.Sc chemistry with at least 50% marks. Relaxation in minimum marks for eligibility allowed by the Government of Kerala to scheduled castes and scheduled tribes and other backward classes shall be made. Candidates with higher qualification are also eligible for admission, provided they possess the minimum qualification mentioned in the draft syllabus.

In the absence of four-year B.Sc Medical Biochemistry graduates, those with B.Sc. Biochemistry [Three year course] or B.Sc. Chemistry [Three year course] may be considered for admission, provided they undergo a Basic Medical Sciences course [consisting of Anatomy, Physiology and Biochemistry] in one year, followed by the proposed two year M.Sc Medical Biochemistry, making up a total of three years.

4] DURATION OF THE COURSE: As above.

5] UNIVERSITY EXAMINATIONS:

There shall be University examinations at the end of each semester as detailed in the scheme of examination, making up a total of three- first at the end of 1st semester, second at the end of 2nd semester and third at the end of 4th semester [i.e., for third and fourth semesters combined]. There shall be supplementary examinations at the end of the subsequent semester. Candidates who fail to secure a pass in any particular paper shall appear for that paper in the supplementary examination, in order to secure a pass. Candidates who fail in any one or more papers in an examination need appear for only those papers, for securing complete pass in the examination. All the students who complete the course prior to the examination and register for the examination shall be promoted to the subsequent semester.

FIRST SEMESTER

A]	PAPER- I	Biomedical Techniques and Biostatistics [Both Theory and Practicals]
B]	PAPER-II	Intermediary Metabolism, Haematology [Both Theory and Practicals] Basic Microbiology [Theory only]
C]	PAPER-III	Clinical Biochemistry, Laboratory - Management [Both Theory and Practicals] and Toxicology [Theory only]

SECOND SEMESTER

A]	PAPER-I	Immunology and immunological Techniques [Both Theory and Practicals]
B]	PAPER-II	Molecular Biology and Applied Genetics [Both Theory and Practicals]
C]	PAPER-III	Inborn Errors of Metabolism and Advanced Clinical Biochemistry [Both Theory and Practicals]

THIRD SEMESTER

A]	PAPER-I	Diagnostic Biochemistry and Organ Function Tests [Both Theory and Practicals]
B]	PAPER-II	Vitamins, Minerals and Hormones [Both Theory and Practicals]
C]	PAPER-III	Immunopathology [Both Theory and Practicals]

FOURTH SEMESTER Dissertation

NB: III and IV Semester are combined. Examination shall be conducted at the end of IV Semester.

Those admitted with B.Sc. Biochemistry [Three-year course] or B.Sc. Chemistry [Three-year course], should pass the Basic Medical Sciences course [consisting of Anatomy, Physiology and Biochemistry] in the first year itself, failing which, they should not be permitted to join the subsequent two years of the M.Sc. Medical Biochemistry course.

Candidates who complete the course of study and secure pass in all the papers of the two years examination shall be declared to have qualified for the degree. Such candidates shall be placed in the second class

Candidates who qualify for the degree passing all the examinations in the first attempts securing not less than 65% marks of the aggregate of all the University examinations and internal assessment taken in together shall be declared to have passed in the first class. Those who secure not less than 75% of the aggregate marks shall be declared to have passed in first class with distinction.

PROVISION FOR RANKING STUDENTS:

Ranking of student shall be made separately in each specialization. There shall be no provision for improvement of results in any examination.

7] COURSE OF STUDY:

The course shall comprise of both theoretical and practical studies in different subjects of study included in the curriculum.

8] ATTENDANCE OF REQUIREMENT:

The attendance requirement will be 80%, with the provision for condonement upto a maximum of 10% on medical grounds.

9] INTERNAL ASSESSMENT MARKS

Internal assessment marks shall be awarded to the candidates in each paper as detailed in the scheme of examination. The award shall be on the basis of the assessment made by the teachers from the candidates' performances in the examination conducted by the departments class test. Laboratory work, seminars, symposium, record work etc during the course of study. The marks secured by the candidates in each subject shall be forwarded to the University at the end of each semester for examinations. In the case of failed candidates, the internal assessment will not be retained. They must appear for fresh internal assessments before each attempt of University examination.

NUMBER OF HOURS

I	1st Semester	
	Theory Including Seminar Symposium and Journal Club	360 Hrs
	Practical	360 Hrs
	Total	720 Hrs
II	2nd Semester	
	Theory Including Seminar Symposium and Journal Club	360 Hrs
	Practical	360 Hrs
	Total	720 Hrs
III	Semester	
	Theory Including Seminar Symposium and Journal Club	360 Hrs
	Practical	360 Hrs
	Total	720 Hrs
IV	Semester	Dissertation
	Total	720 Hrs

STAFF PATTERN

[For 20 students admitted]

1. PROFESSOR	: One
Qualification and Experience	: MBBS and MD in Biochemistry with minimum 10 years teaching experience after Post graduation
2. READER [Medical]	: One
Qualification and Experience	: MBBS and MD in Biochemistry with minimum 5 years teaching experience after Post graduation.
3. READER [Non-Medical]	: Two
Qualification and Experience	: M. Sc. Biochemistry and Ph. D with minimum 5 year teaching experience after Ph.D.
4. LECTURER [Medical]	: One
Qualification and Experience	: MBBS Degree
5. LECTURER [Non- Medical]	: Two
Qualification and Experience	: MSc Biochemistry with minimum two years teaching experience after Post graduation.

ALLOTMENT OF MARKS

Note: In those topics, which do not have practicals, the marks for the practical section is distributed to the other topics included in the same paper
Semester 1- Paper 2 Basic Microbiology (No practicals)
Semester 1- Paper 3 Toxicology (No practicals)

FIRST SEMESTER

PAPER -1 Section A - Biomedical Techniques & Section B – Biostatistics

(Section A & Section B to be answered separately)

	Duration [hours]	Maximum	Minimum for Pass
Theory	3	100	40
Theory: Internal assessment	-	25	-
Practicals & Record	18	100	40
Practical: Internal assessment	-	25	-
Viva	-	50	-
Total		250	125
		300	150

FIRST SEMESTER

PAPER -2 Section A - Intermediary Metabolism ; Section B - Haematology and Basic Microbiology

(Section A & Section B to be answered separately)

	Duration [hours]	Maximum	Minimum for Pass
Theory	3	100	40
Theory: Internal assessment	-	25	-
Practicals & Record	18	100	40
Practical: Internal assessment	-	25	-
Viva	-	50	-
Total		250	125
		300	150

FIRST SEMESTER

Paper - 3 Section A Clinical Biochemistry, Laboratory Management ; Section B Toxicology

(Section A & Section B to be answered separately)

	Duration [hours]	Maximum	Minimum for Pass
Theory	3	100	40
Theory: Internal assessment	-	25	-
Practicals & Record	18	100	40
Practical: Internal assessment	-	25	-
Viva	-	50	-
Total		250	125
		300	150

SECOND SEMESTER

Paper -1 Immunology and Immunological Techniques

	Duration [hours]	Maximum	Minimum for Pass
Theory	3	100	40
Theory: Internal assessment	-	25	-
Practicals & Record	18	100	40
Practical: Internal assessment	-	25	-
Viva	-	50	-
Total		250	125
		300	150

SECOND SEMESTER

Paper -2 Molecular Biology and Applied Genetics

	Duration [hours]	Maximum	Minimum for Pass
Theory	3	100	40
Theory: Internal assessment	-	25	-
Practicals & Record	18	100	40
Practical: Internal assessment	-	25	-
Viva	-	50	-
Total		250	125
		300	150

SECOND SEMESTER

Paper -3 Inborn errors of Metabolism and Advanced Clinical Biochemistry

	Duration [hours]	Maximum	Minimum for Pass
Theory	3	100	40
Theory: Internal assessment	-	25	-
Practicals & Record	18	100	40
Practical: Internal assessment	-	25	-
Viva	-	50	-
Total		250 300	125 150

THIRD AND FOURTH SEMESTERS are combined and the Examination at the end of fourth semester

PAPER -1 Diagnostic Biochemistry and Organ Function Tests

	Duration [hours]	Maximum	Minimum for Pass
Theory	3	100	40
Theory: Internal assessment	-	25	-
Practicals & Record	18	100	40
Practical: Internal assessment	-	25	-
Viva	-	50	-
Total		250 300	125 150

Paper -2 Vitamins, Minerals and Hormones

	Duration [hours]	Maximum	Minimum for Pass
Theory	3	100	40
Theory: Internal assessment	-	25	-
Practicals & Record	18	100	40
Practical: Internal assessment	-	25	-
Viva	-	50	-
Total		250 300	125 150

Paper -3 (Immunopathology)

	Duration [hours]	Maximum	Minimum for Pass
Theory	3	100	40
Theory: Internal assessment	-	25	-
Practicals & Record	18	100	40
Practical: Internal assessment	-	25	-
Viva	-	50	-
Total		250 300	125 150

DISSERTATION

	Maximum marks	Minimum for pass
Evaluation of the work	100 150	50 75
Presentation	50	25
Viva	50	25
Internal Assessment	50	25
Total	250 300	125 150

Each Semester to have 3 Papers. For 3 Semesters, Total 9 Papers

300
Total Marks: 250 x 9 Papers :2250 2700
Dissertation :250 300

Grand Total :2500 marks
3000

SEMESTER - I

PAPER -I

BIOMEDICAL TECHNIQUES AND BIOSTATISTICS

BIOMEDICAL TECHNIQUES

1. Methods of qualitative analysis of Biomolecules: Principles, Experimental procedure and application of Chromatography: Paper, thin layer, ion exchange, affinity, gel filtration, gas liquid and HPLC. Principles, procedures and application of Electrophoresis: Paper, Agar gel, agarose gel, cellulose acetate, polyacrylamide gel Ultracentrifugation, Ultrafiltration.
2. Quantitative method: Principles and application of: Photometry, Spectrophotometry, Flurometry, Flame photometry, Atomic absorption spectrophotometry and ion selective procedures.
3. Isotopes: Detection and measurement of Radioactive Isotopes. Application of Isotopes in research and clinical Biochemistry.
4. Concept of pH and Buffers, Handerson-Hasselbach equation. Principle and procedure of determination of pH, Acid base balance and electrolyte balance ,Related disorders.
5. Cell fractionation, Biochemical activities of different fractions. Marker Enzymes.
6 Bioenergetics and Biological oxidation. Concept of free energy charge, High energy compounds, ATP generation, Redox potential, Electron Transport chain, oxidative phosphorylation, inhibitors, uncouplers and Ionophores.
7 Purification of enzymes from cells characterization and criteria of purity. Purification of proteins.

BIOSTATISTICS

1. Methods for collecting data, tabulation and representation of data, sampling and sample design, types of classification, tabulation, diagrammatic representation-line diagram, bar diagram, pie diagram- histogram, frequency polygon, frequency curves and cumulative frequency curves.
2. Measures of central tendency: Mean, Mode, Median, Range, Mean deviation, standard deviation and standard error.
3. Correlation analysis and regression analysis, probability- analysis of variables.
4. Tests of significance-"t" and "chi -square test" and goodness of fit.
5. Analysis of variance- one-way classification and two-way classification.

PRACTICALS

Biomedical techniques and Biostatistics

1. Chromatography-paper, thin layer, ion exchange, gel filtration, demonstration of HPLC and GLC.
2. Electrophoresis, agar gel, agarose gel and PAGE, Electrophoresis of serum protein- normal and abnormal.

3. Photometry, Spectrophotometry, Flame photometry, and demonstration of atomic absorption spectrophotometry, Flurometry, Ion selective electrodes and Chemiluminence.
4. Preparation of Buffers and determination of pH.
5. Cell fractionation methods.
6. Estimation of Electrolytes.(sodium, potassium, bicarbonate and chloride)
7. Assay for enzyme, Km value.
8. Effect of pH on enzyme action.
9. Effect of temperature on enzyme action
10. Collection, tabulation of data.
11. Graphical representation of data.
12. Correlation and regression analysis.
13. Students "t" test, "chi-square test".
14. Analysis of variance.

PAPER- II

INTERMEDIARY METABOLISM, HAEMATOLOGY AND BASIC MICROBIOLOGY

INTERMEDIARY METABOLISM

1. *Carbohydrate metabolism*: Details of metabolic pathways involving Carbohydrates in mammals. Embden-Meyerhof pathway, Hexose monophosphate shunt pathway, other minor pathways, and fructose and galactose metabolism. Digestion and absorption blood glucose homeostasis, hormones influencing Carbohydrate utilization- insulin, glucagon, glucocorticoids and adrenalin. Dietary fibers and its significance..
2. *Amino acid metabolism:* Protein digestion an absorption of amino acids, metabolism of individual amino acids, one carbon units, polyamines, nitric oxide, plasma proteins, transport proteins. Protein requirement, Nitrogen balance, Balanced diet, Nutritive value, Biological value, Chemical score ,Protein energy malnutrition, Kwashiorkor and Marasmus.
3. *Lipid metabolism:* Digestion and absorption, transport and storage, fatty acid synthesis, fatty acid oxidation pathways. Biosynthesis of phospholipids, glycolipids. Cholesterol metabolism, plasma lipoprotein metabolism. Role of adipose tissue and liver in lipid metabolism. Hormonal regulation of lipid metabolism. Prostaglandins, prostacyclines, leukotriens, throboxanes and very long chain fatty acids, Obesity, Starvation, PUFA.
4. *Regulation of metabolism*: TCA cycle, integration of metabolism, common terminal pathway, regulation, and amphibolic role. Hormonal regulation of metabolic pathway, Cori's cycle, Alanin cycle, adaptation during starvation.
5. Purin and pyrimidine metabolism: synthesis and degradation of bases and nucleotides, regulation and gout.
6. Protein degradation: cathepsins, proteosomes, caspases, and ubiquitin.
7. Muscle contraction.

PRACTICALS

1. Estimation of blood/ serum glucose by different methods.
2. Estimation of blood/ serum cholesterol by different methods
3. Estimation of blood/ serum albumin, total protein and A/G ratio by different methods
4. Estimation of blood/ serum urea by different methods
5. Estimation of blood/ serum creatinine by different methods
6. Estimation of blood/ serum triglycerides by different methods
7. Estimation of blood/ serum HDL cholesterol.
8. Glucose tolerance test.
9. Lipid profile.

HAEMATOLOGY

Principles of determination, Clinical significance and interpretation of the following parameters- TC, DC, ESR, Hb, PCV, BT, CT and Prothrombin time. Brief study of Blood Groups and Storage and Transfusion of Blood.

PRACTICALS

Determination of TC, DC, ESR, Hb, PCV, BT, CT and Prothrombin time.

BASIC MICROBIOLOGY

Sterilization methods and Disinfection of Laboratory equipments.

PAPER- III
CLINICAL BIOCHEMISTRY, LABORATORY MANAGEMENT AND TOXICOLOGY

CLINICAL BIOCHEMISTRY

Urine preservatives, Urine analysis, Urinary aminogram, Urolithiasis and Urine 24- hour assays for Protein, Calcium, Phosphorus, Urea, Creatine and Creatinine.
Blood: Collection, Anticoagulants, Preservatives and Deproteinization. Blood- Urea, Creatinine, Creatinine clearance test. Serum- Uric acid, Calcium, Phosphorus, Serum Proteins- Fractionation and Estimation.
Cerebrospinal fluid and other cavity fluids- Peritoneal, Pleural and Synovial.

LABORATORY MANAGEMENT

Apparatus selection and maintenance.
Chemicals selection, storage and disposal.
Calibration of volumetric and gravimetric equipment and apparatus.
Handling and disposal of infected, dangerous radioactive materials.
Accidents- safety measures and emergency treatment.
Quality control- Organization, Operation, Internal and External quality control.
Automation in clinical Biochemistry.

TOXICOLOGY

Outline the study of the biochemical and physiological actions and the screening procedure for detection of the following compounds- Organophosphorus insecticides, Ethanol, Methanol, Barbiturates, Cu, Pb, Hg, As, Cyanide, CO, Digitalis products, Strychnine, common mineral acids, Formic, Oxalic and Acetic acids. Agents that cause cellular hypoxia.

PRACTICALS

1. Physical and chemical analysis of urine - pH, specific gravity, osmolality, reducing substances, protein, ketone bodies, blood, Bile salts and bile pigments.
2. Urinary Aminogram.
3. Urinary stone, Gall stone and pancreatic stone analysis.
4. Creatinine clearance test.
5. Estimation of Blood-creatine,,uric acid, calcium and Phosphorus.(glucose,urea and creatinine in Paper II)
6. Estimation of urine- sugar, urea, Creatine, creatinine, uric acid, calcium and Phosphorus.
7. Analysis of cavity fluids- cerebrospinal, peritoneal, pleural and synovial.
8. Demonstration of different types of Autoanalysers.

II SEMESTER
PAPER- I
IMMUNOLOGY AND IMMUNOLOGICAL TECHNIQUES

1. History of Immunology- Innate and Acquired immunity, Mechanism of innate immunity, Inflammation- Inflammatory cells, Mediators, Inflammatory responses, Types.
   Antigens- Cells and Organs of immune system and evolution of immunity.
2. Immunoglobulins- Structure and Functions, Classes and Subclasses, Cryoglobulins, Pyroglobulins, immunoglobulin genes- Organization and Expression, antibody diversity and class switching.
   Monoclonal antibodies- Hybridoma Technique and M-antibody production, purification and characterization. Application in Biomedical Research, Clinical diagnosis and Treatment and Drug delivery systems.
3. Immune response- clonal selection theory and related theories, Primary and Secondary response, Humoral and Cell mediated immune response, Antigen processing and presentation, Role of MHL and accessory molecules, MHC molecules- Structure and role in antigen presentation, MHC genes, Formation, Activation and Differentiation of B and T cells, Structure and generation diversity cytokines- Properties and functions, Receptors, Relation to disease, Therapeutic uses, Cytokine antagonists, ADCC, NK cells, LAK cells, Regulation of immune response.
   Vaccines- Advances in the development of Vaccines. [Hemophilus B conjugate, Pertussis, Cholera, Malaria, Hepatitis B, Polio, HIV and Antitumour adjuants.
4. Complement system- Functions, Complement receptors, Activation pathways, Control mechanisms, Role in inflammation, Kinin cascade, Kinins in diseases.
5. Immunity against Bacteria, Virus, Fungi and Parasites.
6. Immunological methods in clinical laboratories:
   Methods, interpretation and applications of following methods,
   Double diffusion in Agar, Single radial immuno diffusion, Electrophoresis and immuno electrophoresis, Chromatography- ion exchange, gel, and affinity.
   RIA, ELISA, Western Blotting, Detection of immune complexes, Nephelometry and Immunofluorescence.
   Agglutination Tests- Direct and Indirect, Haemagglutination and Haemagglutination Inhibition, Complement assays- CFT, Hemolytic assays and Functional assays.
7. Detection of Cellular Immunity: Delayed hypersensitivity Skin tests, Assays for Lymphocytes- T and B Cell Assays, Flow cytometry, FACS clinical applications, Lymphocyte activation, Mixed lymphocyte culture, NK cells, Neutrophil function Tests and Histocompatibility Testing.

PRACTICALS

1. Double diffusion technique.
2. Radial immuno diffusion.
3. Haemagglutination.
4. Haemagglutination inhibition.
5. Latex agglutination tests.
6. Complement fixation tests.
7. Immuno electrophoresis.
8. Counter current Immuno electrophoresis.
9. Lymphocyte culture.
10. Detection of immune complex.
11. FITC conjugation of antibody.
12. Isolation of lymphoid organs of mice.
13. Neutrophil function tests.
14. ELISA.
15. Widal test.
16. VDRL.
17. Demonstration of RIA.
18. Demonstration of Western Blot Technique.

PAPER- II
MOLECULAR BIOLOGY AND APPLIED GENETICS

1. DNA: Structure, Types, Coiling and Supercoiling, Topoisomerases, Replication, Satellite DNA, Organization of Prokaryotic and Eukaryotic Genome.
   Chromosomes- Structure, Number, Sex chromosomes and Human karyotyping.
   Methods for Chromosome analysis- Chromosome Banding, FISH, CGH and Flow cytometry.
   Cell- cycle, Mitosis and Meiosis.
2. Transcription and Translation- Factors involved, RNA Processing, Types of RNA, Genetic code, Lac operon, Tryptophan Operon, Regulation in Eukaryotes, Gene amplification and Generation of antibody diversity.
3. Mutation- Spontaneous, Induced, Point mutation, Silent mutation, Frame shift mutation, Physical and Chemical Mutagens, Molecular basis, Site directed mutagenesis, Significance of mutagenesis, DNA repair, Isolating mutants and AME's Test.
4. Recombinant DNA technology- Necessary elements, Enzymes and their characters, DNA ligase, DNA modifying enzymes, Cloning, Vectors- plasmids, cosmids, Bacterophages, Shuttle Vectors, Expression Vectors, Construction of DNA and Cloning strategies- various methods, Genomic libraries [eg. using phage vectors], c DNA libraries, Introduction of r DNA into Host. Methods of Restriction maps and Sequencing.
5. Genetics in Medicine- Hemoglobin and Haemoglobinopathies, Phenylketonuria, Alkaptonuria, Homocystinuria, Lesch-Nyhan syndrome,

The genetics of Cancer, Down's syndrome, Di George syndrome, Klenefleter's syndrome, Turner's syndrome, Hermaphroditism, Cystic fibrosis, Hemophilia, Prenatal diagnosis of genetic diseases, Application of recombinant DNA technology in Medicine- PCR, RFLP, DNA Finger printing, Therapeutic proteins, Vaccines, Antibodies, Transgenic organisms, Gene therapy and Human genome project.

PRACTICALS

1. Isolation of DNA and RNA from Bacterial cells.
2. Estimation of DNA and RNA.
3. Isolation of plasmids from Bacterial cells.
4. DNA electrophoresis.
5. Study of mitotic stages.
6. Study of meiotic stages.
7. Lane brush Chromosomes and Polytene Chromosomes.
8. Isolation of mutants.
9. AMES Test.
10. Karyotype preparation.

PAPER III
INBORN ERRORS OF METABOLISM AND ADVANCED CLINICAL BIOCHEMISTRY

1. Inbom errors of carbohydrate metabolism
2. Inbom errors of lipid metabolism
3. Inbom errors of protein metabolism
4. Inbom errors of nucleic acid metabolism
5. Inbom errors of hormone metabolism
6. Inbom errors of vitamin and mineral metabolism
7. Inbom errors of neurotransmitter metabolism
8. Cancer biochemistry-cell cycle, check points, regulation, Oncogenes, Tumour suppressor genes, Apoptosis, Tumour markers and Bence Jones proteins.
9. Acute phase proteins-diagnosis and clinical significance of -c-reactive protein, Alpha feto protein, Alpha 1 antitrypsin, Alpha 2 macroglobulin, haptoglobin, Ceruloplasmin etc.
10. Biochemistry of AIDS-HIV genes, Biochemical change during HIV infection, Diagnosis and precautions.
11. Ageing-Biochemistry of ageing, Alzheimer's disease, Prions and Beta amyloid.

PRACTICALS

1. Detection/Estimation of C-Reactive protein.
2. Detection/Estimation of Alpha feto protein.
3. Detection/Estimation of Haptoglobins.
4. Detection/Estimation of Ceruloplasmin.
5. Diagnosis of HIV

6. Investigation for Alkaptonuria.
7. Investigation for Cystinuria.
8. Investigation for Pentosuria.
9. Investigation for Glycogen storage diseases.
10. Investigation for Galactosemia.
11. Glycosylated Hb, C-peptide and Fructosamine estimation.
12. Detection of Microalbuminuria.

III SEMESTER

PAPER-I

DIAGNOSTIC BIOCHEMISTRY AND TESTS OF ORGAN FUNCTION

1. CLINICAL ENZYMOLOGY
   Factors affecting enzyme levels in plasma or serum, Selection of Enzyme tests, Measurement of reaction rate and measurement of Enzyme Mass. Enzymes as analytical reagents. Analytical applications of immobilized enzymes. Measurement of isoenzymes and clinical significance. Antioxidants and Enzyme systems.
2. LIPOPROTEINS
   Clinical significance, Association with coronary disease, Diagnosis of Lipoprotein disorders reactive oxygen species and defense mechanisms.
3. DIABETES MELLITUS
   Classification, pathogenesis of Diabetes mellitus Type I and II. Diagnosis
4. HEMATOLOGICAL DISORDERS
   Biochemical changes in anaemia.
5. TESTS OF ORGAN FUNCTION
   a. Liver function tests.
   b. Kidney function tests.
   c. Cardiac function tests.
   d. Gastric function tests.
   e. Pancreatic function tests.

PRACTICALS

(Enzymatic assays related to each function test should be stressed)

1. Liver function tests.
2. Kidney function tests.
3. Cardiac function tests.
4. Gastric function tests.
5. Pancreatic function tests.
6. Biochemical tests in Anemia
7. Lipoprotein electrophoresis
8. Isoenzyme estimation [LDH, CPK]

PAPER-II

VITAMINS , MINERALS AND HORMONES.

1. VITAMINS: Chemistry, Absorption, Metabolism, Biochemical roles, Requirements and deficiency manifestations of Fat soluble Vitamins and water soluble Vitamins. Estimation of Vitamins.

2. Minerals: Absorption, Biochemical roles, requirements and deficiency manifestations of macrominerals, microminerals and ultra trace elements. Effect of toxic metals.
   Measurement of serum minerals like Zn, Cu, Na, K, Cl, Mg, Mn, Ca, P, I, Se, Fe, iron binding capacity, Transferrin, ferritin and Ceruloplasmin.
3. Endocrinology: Mechanism of action of hormones, hormone receptors, signal transduction, G-Proteins, Second messengers, c-AMP, c-GMP, Ca, Inositol Triphosphate, Diacylglycerol, Biosynthesis of adrenal and thyroid hormones, metabolic regulation by hormones, Hormonal regulation of gene expression and hormonal disorders.

PRACTICALS

1. Estimation of Ascorbic acid in food / Biological fluids.
2. Estimation of Minerals in serum [Zn, Cu, Mg, I, Fe]
3. Estimation of serum Transferrin
4. Estimation of serum T3, T4, TSH
5. Estimation of serum thyroglobulin
6. Estimation of Cortisol in blood.
7. Estimation of Catecholamines
8. Estimation of 24 hour urinary 17 Ketosteroids and Ketogenic steroids
9. Estimation of 24 hour urinary VMA

III SEMESTER

PAPER-III

IMMUNOPATHOLOGY

1. Mechanism of Antibody mediated inactivation: Direct and Indirect. Eg. Diabetes mellitus, Thyroid diseases, Pernicious anemia, Polyendocrinopathy, Infertility, Hemophilia, Myasthenia gravis. Anti-idiotypes and diseases.
2. Immune deficiency disorders.
3. Immunohematologic diseases. Transfusion reaction, Erythroblastosis foetalis, Warm and cold antibody diseases. Drug and Hemolytic diseases, Agranulocytosis, Thrombocytopaenic purpura. Immune suppression of blood cell production, Vascular purpura, Demonstration of cytotoxic antibodies in vitro.
4. Immune complex reaction: Arthus reaction, Serum sickness, Glomerulonephritis, Skin diseases mediated by immune complexes, Evaluation of circulating immune complexes.

5. Connective tissue diseases: Polyarteritis, SLE, Dermatomyositis, Rheumatic fever, Rheumatoid arthritis, and Progressive systemic sclerosis.
6. Atopic of anaphylactic reactions: Reaginic Ab, Anaphylaxis, Atopic allergy-Factors involved, Asthma, Hay fever, Food allergy, Insect allergy, Atopic eczema, Delayed Hypersensitivity reactions: Contact dermatitis, Viral infections, Graft-Host relationship in Pregnancy.
7. Autoallergic diseases: Encephalomyelitis, Multiple Sclerosis, Orchitis, Thyroiditis, and Sjogrens syndrome.
8. Granulomatous reactions- infectious diseases like Tuberculosis and Leprosy.
9. Drug allergy: Penicillin allergy, Allergic reaction to cancer chemotherapeutics.
10. Immunology of AIDS, Tumour and Transplantation.
11. Immunohaematology.

PRACTICALS

1. Screening and diagnostic tests used in different pathological conditions.
2. Delayed type hypersensitivity testing.
3. Detection of tumour markers.
4. Histocompatibility testing.
5. Blood grouping and Cross matching.

References

1.Harper's biochemistry-Murray etal (Lange Medical Book, prentice Hall)
2.Principles of biochemistry-Lehninger etal (CBS Publications,New Delhi)
3.Out lines of Biochemistry-conn, E.E andStumpf.P.K.(Willey Eastern Pvt Ltd.New Delhi)
4.Review of Medical physiology-Gaining, M.F (Lange Medical Book, prentice Hall)
6. Text book of biochemistry--Harrow&Mazur (W.B Saunder's company.a division of Harcourt Brace&company ,London)
7. Concise text Book of biochemistry-T.N.Pattabhiraman(All India publishers &Distributors,Chennai-84)
8. Text Book of biochemistry for Medical students-D.M.Vasudevan and S.Sreekumari (Jaypee brothers,medical publishers,New Delhi-2)
9. Practical clinical Biochemistry-Methods and interpretations-Ranjana choula jaypee brothers,medical publishers,New Delhi-2)
10. Biochemistry-Lubert stryer (W.H.Free man&company ,Newyork)
11. Lippincott's illustrated Reviews in biochemistry-Pamela C.champe,Richard A.Harvey(Lippin cott -Ravin publishers)
12. Text Book of Biochemistry-U.Sathya Narayana (Booka and allied (P) LTD ,Calcutta)
13. Text book of biochemistry and Human Biology-G.P.Talwar;L.M.Srivasthava (Prentice Hall of India, New Delhi)
14. Biochemistry-Debajyothi Dasd (Academic publishers-Calcutta)

15. Biochemistry ,A concise Text for Medical students-
D.K.Apps,B.B.Cohin,C.M.Steel (Elbs) Win Bailliere Tindall
16. Tietz Text book of Clinical Biochemistry (Carl A Burtls.Edward R.Ashwiood W.B Saunder's company.a division of Harcourt Brace&company ,London
17. Text book of Medical Biochemistry-M.n.chatterjee and Rana Shinde (jaypee brothers, medical publishers, New Delhi-2)
18. Principles of Mamalian biochemistry - Emil M.Smith, Robert L Itile (Mc Graw Hill International Book company, New Delhi)
19. Principles of Biochemistry-General aspects-Smith etal (Mc Graw Hill International Book company, New Delhi)
20. Practical clinical biochemistry (volume 1 &2)-Varley.h, Gowenlock, A.H&Bell, M. (Heinemann medical books-London)
21. Biochemistry-The national Medical series, V.L.and Sittman, D.B (E.I.Vaverly Pvt. ltd., New Delhi) Physical chemistry-Daniels and Alberty (Wiley publishers)
22. Toxicology-The basic signs of poisons-Cassertt and doulla.
23. Industrial microbiology-Prescot and denn (ACV publications)
24. An introduction to practical Biochemistry-plummer, D.T (Mc Graw Hill International Book company,New Delhi)
25. Text book of medical Laboratory Technology-Praful.B.Godkar (Bhalani publishers, Bombay)
26. text book of Biochemistry with clinical correlations-Thomas M.Devlin(Wiley Medical publishers,Newyork)
27. Molecular Medicine-an introductory text for students-R.J.Trent (Churchill Livingstone)
28. Fundamentals of urine and body fluid analysis-Nancy A Brunzel (W.B.Saunders company)
29. Text book of Medical Microbiology-Ananthanarayanan & Jayarampanicker (Orient Longmont)
30. Text book of biochemistry-Dr.A.C.Deb (New Central Book Agency (P) Ltd, Calcutta.

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