# P.G. Curriculum
# MD Biochemistry
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# PG Curriculum
# MD Biochemistry

The composition of the department in terms of units, no. of beds, faculty strength, other staff, no. of PG residents will be as per MCI regulations.

## 1. Goals

The goal of MD course in Biochemistry is to produce a competent medical biochemist who

- Is able to demonstrate comprehensive understanding of biochemistry as well as applied disciplines.
- Has acquired the competence pertaining to basic instrumentation and procedures pertaining to biochemistry that are required to be practiced in community and at all levels of health care system.
- Has acquired skills effectively in interpreting all laboratory reports.
- Has the competence to perform relevant investigations which will help to diagnose important medical conditions.
- Has acquired skills effectively in communicating the diagnosis to the patients and families.
- Should be able to demonstrate empathy and have a human approach towards patients & respect their sensibilities.
- Is oriented to principles of research methodology.
- Has acquired skills in educating medical & paramedical professionals.
- Is able to organize and equip Biochemistry Lab.

## 2. Objectives

At the end of MD course the student should be able to:

- Develop skills as a self-directed learner, recognize continuing educational needs; use appropriate learning resources and critically analyze relevant published literature in order to practice evidence-based biochemistry.
- Demonstrate competence in basic concepts of research methodology and epidemiology.
- Practice the specialty of biochemistry in keeping with the principles of professional ethics.
- Organize and supervise the desired managerial and leadership skills.
- Function as a productive member of a team engaged in health care, research and education.
- Perform recent investigations and procedures for patients.
- Demonstrate skills in documentation of reports.
- Facilitate learning of medical/nursing students, practicing physicians & paramedics as Teacher-Trainee.
- Play the assigned role in implementation of national health programs, effectively & responsibly.
- Demonstrate communication skills of a high order in explaining management and prognosis, providing counselling and giving health education message to patients, families & communities.
- Design, fabricate & use indigenous methods/gadgets for experimental purpose.

# 3. Syllabus

## 3.1. Theory

## Introduction

Introduction to medical biochemistry, role of biochemistry in health care, ethics & responsibilities.

- **Foundation of Biochemistry**

  Cellular, chemical, physical, genetic & evolutionary foundations.

- **Physical chemistry**

  Water interactions in aqueous system, ionization of water, concept of pH, weak acids & weak bases, Henderson Hasselbach equation, buffers, solutions, diffusion, osmosis, Donnan's membrane equilibrium.

- **Protein Chemistry: Amino acids**

  Classification, structure & properties of amino acids, Zwitter ion & isoelectric pH, titration curve.

- **Peptides & protein**

  Structure & bonds maintaining protein structure, X-ray crystallography, NMR spectroscopy, Protein folding, Chaperones, perturbations of protein conformation, peptides of biomedical importance. Structure of collagen, elastin, myoglobin, haemoglobin, fibronectin, laminin, $O_2$ dissociation curves for myoglobin & haemoglobin, factors affecting release of $O_2$, mutant haemoglobins

- **Plasma proteins**

  Albumin, globulin, haptoglobin, transferrin, cerruloplasmin etc., functions of plasma proteins.

- **Carbohydrate Chemistry**

  Introduction-Defination, functions, classification, Types- monosaccharides, disaccharides, oligosaccharides & polysaccharides, Isomers (Stereo & optical isomerism, epimers, anomers, mutarotation, enantiomers), Reducing properties (oxidation & reduction), dehydration, osazone formation, ester formation, Glycosides.

- **Proteoglycans & Glycosaminoglycans**

  Biosynthesis, structure, distribution & functions, Mucopolysaccharidoses.

- **Glycoproteins**

  Classification, biosynthesis, functions of glycoproteins, abnormalities in synthesis of glycoproteins.

- **Lipid Chemistry**

  Introduction-Definition, functions, classification & properties of lipids (Phospholipids, Glycolipids, FFA, Triglycerides, Steroids (Structure of Cholesterol etc.), Lipid peroxidation (source of free radicals).

- **Nucleic Acids**

  Concept of nucleosides, common derivatives of purines & pyrimidines, syntheic nucleotide analogues used in chemotherapy, synthetic derivatives of nucleotide triphosphate analogues as research tools, Structure of RNA & DNA.

- **Enzymes**

  - General properties, kinetics, mechanisms of action and regulation of activities

    Definition, classification, properties of enzymes, coenzymes, cofactors, prosthetic groups, Factors affecting enzymes activity in vitro, Units of Enzymes activity, Application of enzymes (Therapeutic, Analytical, Diagnostic enzymes), enzyme inhibition, enzyme regulation, Isoenzymes (Defination and Types), Enzymes pattern in diseases (MI, liver diseases, Muscle diseases, Cancer etc.).

❖ **Micronutrients**

✶ Vitamins

Structure, sources, synthesis, biochemical roles of various fat & water soluble vitamins. Recommended dietary allowances. Diseases caused by deficiency & excess. Role of vitamins as anti-oxidants.

✶ Minerals

Biochemical role of minerals (sodium, potassium, magnesium, fluorine, calcium, phosphorus, iron, iodine, chloride, Sulphor, Zinc Molybdenum Manganese, copper & selenium etc.), sources, Recommended dietary allowances, Clinical disorders associated with metabolism of these minerals.

✶ Bioenergetics & Biological Oxidation

Free energy, exergonic & endergonic processes, Redox potential High energy compounds, enzymes involved, electron transport chain (process & inhibitors), oxidative phosphorylation, Chemiosmotic theory, Shuttles, Uncouplers.

✶ Nutrition, digestion & absorption

Digestion & absorption of carbohydrates, lipids, proteins, vitamins & minerals. Energy balance, over & under nutrition.

❖ **Metabolism:-**

✶ Carbohydrates

Regulation & process of Glycolysis, PDH complex, TCA, Gluconeogenesis, Glycogen metabolism (Glycogenesis, Glycogenolysis) Glycogen storage diseases, Hormonal regulation, Details of HMP (Bioenergetics, Biomedical importance and metabolic disorder and regulation), Glucose Tolerance Test, Galactose and Fructose metabolism & their disorders, Uronic acid pathway with its biomedical importance. Regulation of blood sugar & biochemical basis of complications of diabetes, Metabolism of carbohydrates in fed & fasting state.

✶ Lipids

Details of fatty acid oxidation along with inborn errors, Details of fatty acids synthesis and oxidation, ketogenesis, Metabolism of unsaturated fatty acids and eicosanoids, Metabolism and disorders of acylglycerols and sphingolipids, Lipid transport and storage disorders of lipids (hyperlipidemia, atherosclerosis, obesity).

✶ Details of Cholesterol

Synthesis, Catabolism, Regulation, treatment. Details and disorders of lipoproteins, fatty liver.

✶ Protein and Amino acids

Biosynthesis of the nutritionally nonessential amino acids, catabolism of proteins and amino acids nitrogen, catabolism of carbon skeletons of amino acid, conversion of amino acids to specialized products Oxidative and nonoxidative deamination, Transamination and decarboxylation, Transamidation, Transport and toxicity of ammonia, Urea cycle with inborn errors of metabolism, Specialized products and inborn errors of glycine, Phenylalanine, Tyrosine, Tryptophan, Methionine, Cysteine, Histidine, Branch chain amino acid metabolism, Creatine metabolism. Polyamines.

✶ Intermediary metabolism of Carbohydrates, Lipids and Proteins

⊙ Nucleosies and Nucleotides

Functions, metabolism of purine and pyrimidine nucleotides. Hyperuricemia & other inborn errors.

❖ **Molecular Biology**

Metabolism of nucleotides, function of Nucleic acids (DNA & RNA), DNA Organization into Chromosomes, Replication & Repair, RNA Synthesis, Processing and Modification, Flow of genetic information, Genetic Code, Mutations, Protein Synthesis, Posttranslational Processing, Biochemical basis of action of anticancer drugs, Antibiotics etc. Regulation of gene expression, Genetic & Biochemical basis of diseases and neuropsychiatric disorders.

- **Recombinant DNA Technology**

  Restriction enzymes, DNA Library, Blotting Techniques, Polymerase Chain Reaction, Gene Mapping, Restriction FragmentLlength Polymorphism, Gene Knockout, Gene Therapy, Human Genome Project.

- **Cancer, Cancer genes & Growth Factors**

  Etiology of cancer, Biochemical changes in cancer cells, Role of oncogenes, proto-oncogenes & tumor suppressor genes, Action of Growth Factors on cell cycle and mitosis, Cancer Chemotherapy, Biochemical basis of metastsis, Evaluation of Tumor Markers in cancer management.

- **Extracellular Matrix**

  Membrane Structure & Function, Transport processes, Mutations affecting membrane proteins.

- **Endocrinology**

  Hormone Receptors, Pathways of signal transduction, Hormone Metabolism & its regulation, Mechanism of action, Pathophysiology, Function tests (Pituitary & Hypoothalamic, Thyroid, Adrenal Cortical and Medullary Hormones, pancreatic, Gastrointestinal & Gonadal hormones).

- **Homeostasis of Thrombasis**

  Intrinsic & Extrinsic pathways, Haemophilia, RBC & White cells, ABO Blood group system, Haemolytic Anemias.

- **Muscle and Cytoskeleton**

  Concept of Actin & myosin, contraction of muscle, Role of calcium in contraction of muscles, myopathies. Role of cytoskeleton in cellular functions.

- **Radioisotopes**

  Introduction, Properties, Detection of radiation, Hazards, Role in metabolic processes, Diagnostic and Therapeutic applications.

- **Porphyrias**

  Porphyrins and bile pigments, Definition, Classification and their disorders.

- **Organ Function Tests:-**
  - Gastric function tests
  - Liver function tests
  - Kidney function tests
  - Thyroid function tests
  - Pancreatic function tests

- **Detoxification of Xenobiotics**

  Role of Cytochrome P450, Various mechanisms of Detoxification.

- **Separative Procedures**

  Chromatography-Basic concepts, separation, mechanisms, resolution, planar & column chromatography, qualitative & quantitative analysis.

- **Electrophoresis**

  Basic concepts & definitions, theory, description of techniques, types & technical considerations.

- **Immunochemistry**

Concept of immunity, Antigen, Antibodies, Ag-Ab reaction, Complement system, Structure & functions of immune system. Immune response of the body, immune deficiency diseases, hypersensitivity, autoimmunity, immunology of transplantation & malignancy.

- **Statistics**
  Sampling, Mean, SD, CV, Normal distribution, Probability etc.
- **Quality control of Clinical investigations**
  External & internal quality control
- **Automation in Clinical biochemistry**
- **Environmental biochemistry**
- **Bioinformatics**
  - Basic Concepts.

## 3.2. Practical

## Introduction to Clinical Chemistry

Concepts, definition, characterization of diagnostic accuracy of tests.

- **Introduction to principles of Laboratory analysis**
  Concept of solute & solvents, units of measurements, basic techniques & procedures, Weighing (use of mechanical & electronic balance), preparation of reagents.
- **Specimen collection & other pre-analytical variables**
  Specimen collection, handling of specimens, other pre-analytical variables, preservative & anticoagulants, normal biological variability.
- **Safety measures & First aid**
  Corrosive chemicals, Toxic chemicals, Carcinogens, Explosive & inflammable chemicals, Electrical apparatus (Centrifuges machines, Water baths, Hotplates, Spectrophotometers, Flame photometers) etc. distillation plant maintenance, Glass apparatus, Dispensers, Radiation hazards, Low pressure systems (vacuum desiccators), Chemical injuries, Mechanical and thermal injuries, Electrical injuries. Obtaining help for Emergency drug supply, First aid boxes. Special procedures common to several emergency conditions and taking care of treatment of shock, unconscious patients, Artificial respiration, Cardiac message.
- **Waste Disposal**
  Infectious material (Biological material) with special consideration for AIDS and Hepatitis B&C, Disposal of specimens and contaminated materials, laboratory waste etc.
- **Analytical Techniques and Instrumentation**
  - Optical Techniques
    Photometry and Spectrophotometry, Instrumentation, Flame Emission Spectrophotometry, Nephelometry and Turbidimetry.
  - Maintenance of Laboratory Records
  - Electrochemistry and Chemical Sensors
    Potentiometry, Biosensors.
  - Electrophoresis
    Basic Concepts and Definitions, Theory of Electrophoresis, Description of Technique, Types of Electrophoresis, Technical Considerations.

- ✶ Chromatography
  Basic Concepts, Separation Mechanisms, Resolution, Planar Chromatography, Column Chromatography, Qualitative and Quantitative Analyses.
- ✶ Principles of Clinical Enzymology
  Basic Principles, Enzyme Kinetics (Effect of temperature on enzyme activity, Effect of pH on enzyme activity, Effect of Inhibitors on enzyme activity, Km, Specific activity), Analytical Enzymology.
- ✶ Principles of Immunochemical Techniques
  Basic Concepts and Definitions, Antigen-Antibody Binding, Qualitative Methods, Quantitative Methods, Other Immunochemical Techniques.
- ✶ Automation in the Clinical Laboratory
  Basic Concepts, Automation of the Analytical Processes, Integrated Automation for the Clinical Laboratory, Practical Considerations, other Area of Automation.
- ✶ Point-of-Care Testing
  Analytical and Technological Considerations, Implementation and Management Considerations.

❖ **Laboratory Operations**

- ✶ Routine Biochemistry Investigations
  Blood Glucose Estimation, RFT, LFT, Lipid Profile, Cardiac Markers, Bone Markers, Pancreatic Markers, Anemia Profile, Trace Elements, Urine CSF, Fluid Biochemistry.
- ✶ Special Investigations
  Hormones, Tumor markers, Troponins, Vitamins, Antioxidants, Special proteins like CRP, Haptoglobin, Ceruloplasmin etc.
- ✶ Drugs Analysis
  Drug of Abuse and Therapeutic drugs.
- ✶ Blood gases.

❖ **Selection and Analytical Evaluation of Methods-With Statistical Techniques**

Method Selection, Basic Statistics, Basic concepts in Relation to analytical Methods, Analytical Goals, method Comparison, Monitoring Serial Results, Trace ability and Measurement Uncertainty, Guidelines, Regulatory Demands and Accreditation, Software packages.

❖ **Establishment and Use of Reference Values**

Establishment and use of Reference Values, Use of Reference Values.

❖ **Quality Management**

Fundamentals of Total Quality Management, Implementing TQM, The total testing process, Control of Preanalytical Variables. Control of Analytical Variables, External Quality Assessment and Proficiency Testing Programs, New Quality Initiatives.

# 4. Teaching Programme

## 4.1 General Principles

Acquisition of practical competencies being the keystone of postgraduate medical education, postgraduate training is skills oriented.

Learning in postgraduate programme is essentially self-directed and primarily emanating from clinical and academic work. The formal sessions are merely meant to supplement this core effort.

## 4.2 Teaching Sessions

In addition to daily routine reporting with consultants in every section, there are one hourly formal teaching sessions of PG per week. This is in addition to UG teaching classes, which they are required to attend to gain basic knowledge of biochemistry.

- Clinical case discussion
- Seminars/Journal Club
- Statistical meetings – monthly/weekly
- Inter departmental meetings
- Guest Lectures/Vertical Seminars or central stat meetings

## 4.3 Teaching Schedule

The suggestive departmental teaching schedule is as follows:-

| | | |
|---|---|---|
| 1. | Journal Club | Once a week |
| 2. | Case discussion | Once a week |
| 3. | Stat meeting/Thesis work | Once a week |
| 4. | Inter departmental meeting or Mock examination | Once a week |
| 5. | Practical | Once a week |
| 6. | Central session on CPC, guest lectures | Once a week, |

Student seminar, biostatistics, teaching on research methods, medical ethics etc.

- All sessions are attended by faculty members.
- All the teaching sessions are assessed by the consultants at the end of session and marks are considered for internal assessments.
- Attendance of the residents at various sessions has to be at least 75%.
- In addition they also perform & demonstrate all UG practicals.

# 5. Postings

(1) Teaching (2) Clinical Lab Posting

## 5.1 Teaching

i) Attend all UG classes theory & teach as & when assigned & Practical classes.
ii) Self study on all aspects of biochemistry mentioned in syllabus.
iii) Learning all basic biochemistry techniques like photometry, flame photometry etc.
iv) Standard calibration curves for all routine analytes.
v) Undertake classes for nursing & paramedical staff.
vi) Posted in allied departments like Transfusion medicines, Microbiology, Pathology, and Endocrinology.

## 5.2 Clinical Laboratory Posting

- **Pre-Analytical Laboratory**
  Collection Centre
- **Analytical Lab:**
  - Semiautoanalyser/Autoanalyser Lab
  - Immuno-chemical Lab
  - Chemiluminescence Lab
  - Chromatography
  - Electrophoresis
  - Blood gas analysis
  - Point of care testing Lab
  - Mass spectrometry
  - Emergency Lab
  - PCR Lab

**Post-Analytical Lab**

- Selection & analytical evaluation of method with statistical techniques (Basic statistics, Method comparison, Accreditation, Trace ability)
- Quality management

# 6. Thesis

6.1. Every candidate shall carry out work on an assigned research project under the guidance of a recognized Postgraduate Teacher, the project shall be written and submitted in the form of a Thesis.

6.2 Every candidate shall submit thesis plan to the university within nine months from the date of admission.

6.3 Thesis shall be submitted to the university six months before the commencement of theory examination i.e. for examination May/June session, 30th November of the proceeding year of examination and for November/December session 31st May of the year of examination.

6.4 The student will identify a relevant question; (ii) conduct a critical review of literature; (iii) formulate a hypothesis; (iv) determine the most suitable study design; (v) state the objectives of the study; (vi) prepare a study protocol; (vii) undertake a study according to the protocol; (viii) analyze and interpret research data and draw conclusions; (ix) write a research paper.

# 7. Assessment

All the PG residents are to be assessed daily for their academic activities and also periodically.

## 7.1. General Principles

- The assessment is valid, objective and reliable.
- It covers congnitive, psychomotor and affective domains.

- Formulative, continuing and summative (final) assessment is also conducted in theory as well as practicals/clinicals. In addition, thesis is also assessed separately.

## 7.2. Formative Assessment

The formative assessment is continuous as well as end of term. The former is be based on the feedback from the senior residents and the consultants concerned. End of the term assessment is held at the end of each semester (upto the 5th semester). Formative assessment will not count towards pass/fail at the end of the program, but will provide feedback to the candidate.

## 7.3. Internal Assessment

The performance of the Postgraduate student during the training period should be monitored throughout the course and duly recorded in the log books as evidence of the ability and daily work of the student. Marks should be allotted out of 100 as followed.

| Sr. No. | Items | Marks |
|---|---|---|
| 1. | Personal Attributes | 20 |
| 2. | Practical Work | 20 |
| 3. | Academic activities | 20 |
| 4. | End of term theory examination | 20 |
| 5. | End of term practical examination | 20 |

**1. Personal attributes**

- **Behavior and Emotional Stability:** Dependable, disciplined, dedicated, stable in emergency situations shows positive approach.
- **Motivation and Initiative:** Takes on responsibility, innovative, enterprising, does not shirk duties or leave any work pending.
- **Honesty and Integrity:** Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.
- **Interpersonal Skills and Leadership Quality:** Gets on well with colleagues and paramedical staff, is respectful to seniors, has good communication skills.

**2. Practical Work:**

- **Availability:** Punctual, available continuously on duty, responds promptly on assignments and takes proper permission for leave.
- **Diligence:** Dedicated, hardworking, does not shirk duties, leaves no work pending, does not sit idle, competent in practical work.
- **Academic ability:** Intelligent, shows sound knowledge and skills, participates adequately in academic activities, and performs well in oral presentation and departmental tests.
- **Performance:** Proficient in presentations and discussion during academic sessions in the department.

**3. Academic Activity:** Performance during presentation at Journal club/ Seminar/ Case discussion/ Stat meeting and other academic sessions. Proficiency in skills as mentioned in job responsibilities.

4. **End of term theory examinations** conducted at end of 1st, 2nd year and after 2 years 9 months.

5. **End of term practical/oral examinations** after 2 years 9 months.

Marks for **personal attributes** and **work done** should be given annually by all the consultants under whom the resident was posted during the year. Average of the three years should be put as the final marks out of 20.

Marks for **academic activity** should be given by the all consultants who have attended the session presented by the residents.

The Internal assessment should be presented to the Board of examiners for due consideration at the time of Final Examinations.

## 7.4. Summative Assessment

- Ratio of marks in theory and practical will be equal.
- The pass percentage will be 50%.
- Candidate will have to pass theory and practical examinations separately.

## A. Theory Examination (Total = 400)

| Paper | Title | Marks |
|---|---|---|
| Paper 1 | Introductory Biochemistry & molecular Biochemistry | 100 |
| Paper 2 | Biochemistry of body metabolism | 100 |
| Paper 3 | Biochemistry of hormones, vitamins, minerals, enzymes & Clinical biochemistry | 100 |
| Paper 4 | Recent advantages in Clinical Biochemistry & Biochemical methodologies | 100 |

## B. Practicals & Viva voce Examination (Total = 400)

| | |
|---|---|
| Long case study | 100 |
| Enzyme kinetics/Electrophoresis | 100 |
| Short case study | 50 |
| Standard Curve/Paper Chromatography/TLC | 50 |
| Grand Viva | 100 |

# 8. Job Responsibilities

**For Teaching**

- Should be able to take a class using audiovisual aids right from blackboard & chalk to that with laptop & multimedia session.

- Should be able to make short lectures under senior teacher's supervision.
- Should have learnt to make Power Point presentation.
- Should have learnt to make multiple-choice questions.
- Must attend all undergraduate theory and practical classes. They must play an active role in table teaching in all practical classes.

**For Research Work**

- Should have skill to look up references from journals and present seminars.
- Should have computer skills.
- Will be expected to be familiar with standards methods of preparing a bibliography and for preparing manuscripts and illustrations for publications.

**For Clinical Work**

- Should have skill to work in Clinical Biochemistry Lab in all areas: Pre-analytical, analytical and post analytical.
- Will be expected to perform all investigations and interpret all investigative data.
- Should be able to set up new experiments and methods for diagnosis and research.
- Should be expected to maintain quality control at all levels.
- Should be familiar with collection and processing of data.

# 9. Suggested Books:

## 9.1. Core Books:

- Text book of Biochemistry by Lippincott
- Harper's Illustrated Biochemistry
- Text Book of Biochemistry by Lehninger
- Biochemistry by Dr. D. Puri
- Clinical chemistry by Tietz

## 9.2. Reference Books:

- Clinical Biochemistry by Varley
- Text Book of Biochemistry by Vasudevan
- Text Book of Biochemistry by Styrer

## 9.3. Journals:

- Clinical chemistry
- Indian Journal of AMBI.

# 10. Model Test Papers

# MODEL QUESTION PAPER

MD (Biochemistry)
Paper-I
Introductory Biochemistry and Molecular Biochemistry

*Max. Marks:100* *Time: 3 hrs*

- ***Attempt ALL questions***
- ***Answer each question & its parts in SEQUENTIAL ORDER***
- ***ALL questions carry equal marks***
- ***Illustrate your answer with SUITABLE DIAGRAMS***

I Discuss the genetic regulation of protein biosynthesis.

II Describe recombinant DNA technology. What are the important clinical applications of the technique?

III What is genetic code? Enumerate the salient features of genetic code.

IV Give detailed account of the transcription process. How is it regulated? Name inhibitors of transcription.

V What are the sources of Carbon and Nitrogen atoms of purine & pyrimidine rings? How is the de novo synthesis regulated? Indicate the clinical uses of inhibitors of purine nucleotide synthesis.

VI Name the important buffer systems in the body. Describe the role of kidney and lungs in the maintenance of acid-base balance.

VII What is meant by detoxification? Give an account of various detoxifications processes with examples.

VIII Enumerate the salient features of active transport. Give two examples where drugs inhibit active transport.

IX What are isotopes? Mention the medical uses of isotopes.

X Differentiate between primary & secondary gout. Discuss various causes of both types.

# MODEL QUESTION PAPER

MD (Biochemistry)
Paper-II
Biochemistry of Body metabolism

*Max. Marks:100* *Time: 3 hrs*

- ***Attempt ALL questions***
- ***Answer each question & its parts in SEQUENTIAL ORDER***
- ***ALL questions carry equal marks***
- ***Illustrate your answer with SUITABLE DIAGRAMS***

I Describe the diverse biochemical effects of insulin. Mention the biochemical tests for diagnosing and monitoring of a case of diabetes mellitus.

II Describe the transport of ammonia and highlight how ammonia is detoxified in brain and liver. Explain biochemical basis of ammonia toxicity.

III Classify Lipoproteins and discuss the synthesis and catabolism of various lipoprotein fractions. Explain role of various lipoproteins in atherogenesis.

IV Describe the synthesis & oxidation of ketone bodies. How the process of ketogenesis regulated?

V Discuss the role of various factors involved in maintenance of normal blood glucose level.

VI List the components of pyruvate dehydrogenase multienzyme complex. How is entry of acetyl CoA into TCA cycle regulated at this complex?

VII Discuss the pathway for metabolism of alcohol and the biochemical changes it leads to. Explain metabolic consequences of alcoholism.

VIII Differentiate between the primary and the secondary gout. Explain the biochemical basis of clinical abnormalities in primary gout and their treatment.

IX Describe the importance of serum enzymes in the diagnosis of diseases.

X Describe eicosanoids and their functions. Write various drugs that inhibit eicosanoids synthesis?

MODEL QUESTION PAPER

MD (Biochemistry)
Paper-III
Biochemistry of hormones, vitamins, minerals, enzymes & Clinical Biochemistry

*Max. Marks:100* *Time: 3 hrs*

- ***Attempt ALL questions***
- ***Answer each question & its parts in SEQUENTIAL ORDER***
- ***ALL questions carry equal marks***
- ***Illustrate your answer with SUITABLE DIAGRAMS***

I Describe the sources, biochemical functions, requirement & deficiency manifestations of pyridoxal phosphate.

II What is the normal blood level of calcium? What are the mechanisms by which calcium homeostasis is maintained?

III What is cycle AMP? What is the metabolic role of c-AMP?

IV Enumerate the thyroid function tests. Describe any one of them in detail.

V Discuss visual cycle. What are the deficiency manifestations of vitamin D?

VI Name trace elements. Discuss biochemical functions of two of them.

VII Define BMR and SDA? What are the factors that affect BMR?

VIII Classify enzymes. Give two examples of each. What are the different types of enzymes inhibition? Explain with suitable examples.

IX Explain the mechanisms of allosteric regulation using phosphofructokinase as an example.

X Indicate the importance of enzyme studies in
a) Myocardial Infarction
b) Liver diseases
c) Bone Diseases
d) Pancreatic Diseases
e) Malignant Diseases

MODEL QUESTION PAPER

MD (Biochemistry)
Paper-IV
Recent Advances in Clinical Biochemistry & Biochemical Methodologies

*Max. Marks:100* *Time: 3 hrs*

- ***Attempt ALL questions***
- ***Answer each question & its parts in SEQUENTIAL ORDER***
- ***ALL questions carry equal marks***
- ***Illustrate your answer with SUITABLE DIAGRAMS***

I What is POCT? What are its advantages and disadvantages?

II What are preanalytical variables and how do they affect the results?

III What is the principle of colorimeter? How will you differentiate it from spectrophotometer & flame photometer? Write advantages & disadvantages of each.

IV What are the characteristics of a tumor marker? Write a note on carbohydrate markers.

V Give the types and salient features of electro phoresis. What are the abnormalities that you could detect in serum electrophoresis?

VI What is metabolic acidosis? Explain the causes and compensatory mechanisms in the body.

VII Discuss the biochemical investigations done in case of anemia.

VIII What do you understand by bone markers? Discuss the methods of analysis of any two of these.

IX List various endocrine parameters in case of male infertility. Describe the methodology, its advantages & limitations of two parameters.

X What is ISE? Differentiate between direct and indirect ISE.