SUMANDEEP VIDYAPEETH

(Declared as Deemed to be University under Section 3 of the UGC Act 1956)
Accredited by NAAC with a CGPA of 3.53 out of four-point scale at 'A' Grade
Category – I deemed to be university under UGC Act - 2018
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CURRICULUM
Master of Science
(M.Sc)
MEDICAL BIOCHEMISTRY

Attested CTC

15/2/2021

Vice-Chancellor
Sumandeep Vidyapeeth
An Institution Deemed to be University
Vill. Piparia, Taluka: Waghodia.
Dist. Vadodara-391 760. (Gujarat)

Dean
Smt. B. K. Shah Med. Instt. & Res. Centre

AMENDED UP TO DECEMBER -2020

PROGRAMME OUTCOME : M.SC. MEDICAL

The Master of Science in Medical field provides the candidate with knowledge, general competence, and analytical skills on an advanced level, needed in consultancy, education, research.

Programme specific outcome : M.SC. MEDICAL

POS 1. A post graduate student after undergoing the required training should be able to deal with the allied departments and render services in advanced laboratory investigations.

POS 2. The PG student should acquire basic skills in teaching medical/para-medical students

POS 3. The student should have knowledge about the principles of research methodology and self-directed learning for continuous professional development.

POS 4. The student should be able to carry out a research project from planning to publication and be able to pursue academic interests.

COURSE OUTCOME (CO) : At the end of the M.Sc. training programme in Biochemistry, the post graduate student should have acquired competencies in the following areas, as detailed below:

1. The student should be able to explain clearly concepts and principles of biochemistry and cell biology, including correlations of these with cellular and molecular processes involved in health and disease.
2. The student should be able to effectively teach undergraduate students in medicine and allied health science courses so they become competent health care professionals and able to contribute to training of postgraduate post graduate students.
3. The student should be able to set up/supervise/manage a diagnostic laboratory in Biochemistry in a hospital, ensuring quality control, and providing a reliable support service.The student should be able to provide clinicians with consultation services for diagnostic tests in biochemistry and in interpretation of laboratory results.
4. The student should be able to carry out a research project from planning to publication and be able to pursue academic interests and continue life-long learning to become more experienced in all the above areas and to eventually be able to guide postgraduates in their thesis work.

GOAL:

The broad goal of teaching & training of postgraduate students in Medical Biochemistry is to make them understand the scientific basics of the life processes at the molecular level and to orient them towards the applications of the knowledge acquired in solving clinical problems. At the end of his/her training, the student shall be able to take up a career in Teaching Institution or in diagnostic laboratory or in Research.

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OBJECTIVES:

A) KNOWLEDGE:

At the end of the course the students shall be able to:

1) Explain the structure, function & inter-relationships of bimolecules & their deviation from normal & their consequences.
2) Summarize the fundamental aspects of enzymology & alteration on enzymatic activity with reference to clinical applications.
3) Explain the molecular & biochemical basis of inherited disorders with their associated sequel.
4) Explain the mechanisms involved in maintenance of body fluids & pH homeostasis.
5) Integrate the various aspects of metabolism & their regulatory pathways.
6) Outline the molecular mechanisms of gene expression & regulation, the principles of genetic engineering & their application in medicine.
7) Explain the molecular concept of body defenses & their applications in medicine
8) Explain the biochemical basis of environmental health hazards, biochemical basis of cancer & Carcinogenesis.
9) Familiarize with the principles of various conventional & specialized laboratory investigations & instrumentation analysis and interpretation of a given data.
10) Effectively organize & supervise diagnostic laboratory to ensure quality control/Assurances.
11) Describe the fundamentals of evidence based medicine and its correlation with biochemistry

B) SKILLLS:

At the end of the course the students shall be able to:

1) Make use of conventional techniques/instruments to perform biochemical analysis relevant to clinical screening & diagnosis.
2) Analyze & interpret investigative data.
3) Demonstrate the skills of solving scientific & clinical problems and decision making.
4) Develop skills as a self-directed learner, recognize continuing educational needs, select & use appropriate learning resources.
5) Demonstrate competence in basic concept of research methodology & be able to critically analyze relevant published research literature as per the evidence based principles

C) INTEGRATION:

The knowledge acquired in Biochemistry shall help the students to integrate molecular event with structure & function of the human body in health & disease.

Eligibility for Admission

A candidate seeking admission to M.Sc. medical science course should have a bachelor degree under recognized university.

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Qualifications

The candidate must have passed B.Sc with atleast one subject of biological Sciences or BAMS or MBBS or BHMS or BPT or B.Pharm or any other professional graduates from a recognized University.

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Duration of course: 3½ (Three half) years from the date of admission

PERIOD OF TRAINING:

It will be conducted in two parts: Part-I (one and half years) and Part-II (two years).

Part-I

Aim: It is to impart basic knowledge of all pre-clinical & para-clinical subjects including Anatomy, Physiology, Biochemistry, Pathology, Microbiology & Pharmacology. Therefore Part-I course is common for all M. Sc. (Medical) candidates. Teaching is mainly in the form of theory lectures.

Syllabus for part-I

Theory

- Cell biology
- Carbohydrate chemistry and functions
- Amino acids chemistry and functions
- Protein chemistry and functions
- Lipids chemistry and functions
- Nucleic acids chemistry and functions
- Enzymology chemistry and functions
- Vitamins and minerals
- Biological oxidation
- Connective tissue proteins chemistry and functions
- Nutrition
- Metabolism of carbohydrates, proteins, lipids, nucleic acids
- Integrated metabolism

Practicals

- Student will have to prepare all the necessary reagents and chemicals for undergraduate MBBS practicals
- Students will have to perform all the practicals of undergraduate MBBS course
- Prepare journal for the same.

Hospital posting

- Student will be posted in clinical biochemistry laboratory, Dhiraj hospital on rotational basis

- P.G. student shall maintain a record (log) book of the work carried out by them & will be checked & assessed by his/her P.G. teacher & H.O.D.
- P.G. students shall work in central laboratory & would carry out routine, emergency & special investigations during training period.
- They will be required to participate in the teaching & training programmes of U.G. students.

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Scheme of examination of part-I:

Two internal assessment tests, one each at the end of First & Second term respectively. One preliminary examination will be conducted at the end of third term, consisting of full course.

Internal credit marks: 30 Marks (Best of two internal tests + Preliminary exam)

Final University examination:

Theory paper (1)	70 Marks
Internal Credit	30 Marks
Total	100 Marks
Passing standard:	**50%**

Note: Only Theory examination. No practical examination.

To introduce 3 years duration of M.Sc Medical from academic year 2020-21 onwards. (Board of Studies letter no.: SBKSMIRC/Dean/2234, dated 23/12/2019 and Vide Notification of Board of Management Resolution Ref: No. SVDU/NOTYN/061/2019-20 dated 02/03/2020)

Theory Paper Pattern of part-I examination

Total Marks: 70, time: 3 hours

Section-I

Q.1- Describe briefly on any Two	(15)
Q.2- Describe briefly on any Two	(10)
Q.3-Write short notes on any Two	(10)

Section-II

Q.4- Describe briefly on any Two	(15)
Q.5- Describe briefly on any Two	(10)
Q.6- Write short notes on any Two	(10)

Part-II (two years)

Syllabus

Revision aspects of part-I with the inclusion of following detailed aspects:

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, oxygen dissociation curves myoglobin & haemoglobin, factors affecting release of Oxygen
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, synthetic 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.).

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Micronutrients

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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).

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.

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.

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Porphyrias

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

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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.

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

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

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. Immunochemistry

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.

Dissertation:
Every candidate pursuing M.Sc. degree course is required to carry out work on a selected research project under the guidance of a recognized post graduate teacher in their respective subjects in **second and final year**. The results of such a work shall be submitted in the form of a dissertation six months before the University examination. The candidate will be allowed to appear in University examination only after acceptance of dissertation.

Theory Paper Pattern of Part-II examination

Theory Examination: (300 Marks)

Paper number	Topics	Marks	Time
I	General Biochemistry, Instrumentation, techniques, nutrition	100	3 Hours
II	Metabolism and Molecular Biology	100	3 Hours
III	Clinical Biochemistry and recent advances	100	3 Hours

Note: The distribution of topics in each paper is arbitrary. There may be overlapping of relevant topics in question papers

Each Paper shall have 5 Questions, all questions compulsory & no options.

Question-1: Long Question (1 or 2 parts)	20 marks
Question-2: Long Question (1 or 2 parts)	20 marks
Question-3: Long Question (1 or 2 parts)	20 marks
Question-4: Long Question (1 or 2 parts)	20 marks
Question-5: Long Question (1 or 2 parts) OR Short notes – (4)	20 marks OR (4*5 marks=20)

M.Sc. Medical Biochemistry part-II University Practical Exam Pattern

Day-1			**Marks**
i.	I.	Major case study including quantitative analysis –Long Case	100
	II.	Major case study including quantitative analysis –Short Case	50
	III.	Statistical QC Exercises	25
Day-2			
	IV.	Qualitative analysis	25
	V.	Viva Voce (Thesis Presentation and discussion, pedagogy-Microteaching, Grand Viva)	100
Total			300

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