University of Rajasthan
Jaipur
SYLLABUS
M.Sc. BIO-CHEMISTRY
(Annual Scheme)
M.A./M.Sc. (Previous) Examination  2021
M.A./M.Sc. (Final) Examination  2022

[Raj Vain]
Dy. Registrar (Acad.)
University of Rajasthan
UNIVERSITY OF RAJASTHAN
JAIPUR- 302 004
(TWO YEAR COURSE-ANNUAL SYSTEM)
CURRICULUM OUTLINE AND SCHEME OF EXAMINATION FOR
M.Sc. BIOCHEMISTRY

<table>
<thead>
<tr>
<th>Title of the Paper</th>
<th>Hours of Exam</th>
<th>Max. Marks</th>
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<tbody>
<tr>
<td>Cell Biology and Physiology</td>
<td>3</td>
<td>100</td>
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<tr>
<td>Chemistry of Biomolecules</td>
<td>3</td>
<td>100</td>
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<td>General Metabolism</td>
<td>3</td>
<td>100</td>
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<td>Enzymology and Bioenergetics</td>
<td>3</td>
<td>100</td>
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<td>Endocrine Biochemistry</td>
<td>3</td>
<td>100</td>
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<td>Biochemical techniques and Computational Methods</td>
<td>3</td>
<td>100</td>
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<tr>
<td></td>
<td>12</td>
<td>200</td>
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<td>(Spread up in two days)</td>
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Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR
PAPER-I: CELL BIOLOGY AND PHYSIOLOGY

UNIT-I: CELL STRUCTURE AND COMPOSITION


UNIT-II: WATER ELECTROLYTE AND ACID BASE BALANCE


UNIT-III: LIVER AND KIDNEY FUNCTIONS AND THEIR TESTS

Functions of liver, tests based on the secretory, excretory.
Syllabus: M.Sc. Biochemistry


UNIT II - LIPIDS

UNIT III - Porphyrinns and Vitamins
Structure and functions, porphyrins, heme and chlorophyll. Vitamins-Discovery and Importance of vitamins. Classification, chemistry. Biological role and deficiency disorders of vitamins.

UNIT IV - Chemistry of Amino Acids and Proteins, Structure and Conformation


UNIT V - Nucleic Acids-I
UNIT-IV LIPID METABOLISM-II

UNIT-V AMINO ACID AND NUCLEOTIDE METABOLISM

PAPÉR-IV : ENZYMOLOGY AND BIOENERGETICS
UNIT-I BIOCatalysis
Introduction to enzymology, nomenclature and classification of enzymes, properties of enzymes, enzyme assay and units of activity, isolation and purification of enzymes. Factors affecting the rate of enzyme catalyzed reactions. Isoenzymes and zymogens. Enzyme inhibitors. Feed-back inhibition and repression. Allosteric inhibition catalytic RNA.

UNIT-II ENZYME KINETICS
Chemical kinetics, Michaelis-Menten and Briggs-Haldane kinetics. Determination of $K_m$, Analysis of kinetic data. Importance of
University of Rajasthan

SYLLABUS : M.Sc. Biochemistry

UNIT-I ENZYMEOLOGY
Classification of catalytic mechanisms. Acid-base, covalent, transition state and metal ion effects on enzyme catalysis. Metal ion and electrostatic catalysis. Structure and nature of active site. Chemical modification of active site. Mechanism of catalysis of Rhase, lysozyme, pepsin, trypsin, trypsinogen, papain and carboxypeptidase.

UNIT-II ENZYMEOLOGY-II

UNIT-III BIOENERGETICS AND PHOTOSYNTHESIS

PAPER-V : ENDOCRINE BIOCHEMISTRY
UNIT-I ENDOCRINE SYSTEM

UNIT-II HYPOTHYSUS, HYPOTHALAMUS AND RELATIONSHIP, PINEAL

UNIT-III THYROID, PARATHYROID, THYMIC AND OTHER GLANDS

UNIT-IV PANCREAS AND ADRENALS

UNIT-V GONADS AND REPRODUCTION

PAPER-VI : BIOCHEMICAL TECHNIQUES AND COMPUTATIONAL METHODS
UNIT-I SPECTRO-PHOTOMETRY AND CHROMATOGRAPHY
Basic principles and applications of UV, IR, ESR, NMR and mass spectroscopy. Chromatography, Principles and partition, Paper and thin layer chromatography, Ion exchange chromatography, Gel permeation chromatography, GC and HPLC.

UNIT-II METABOLIC TECHNIQUES


UNIT-III RADIOACTIVITY


UNIT-IV ELECTROPHORESIS AND MICROSCOPY


UNIT-V STATISTICS AND COMPUTER SCIENCE


Syllabus: M.Sc. Biochemistry

Elements of computer science, general awareness of development of computers, Mainframe, minis, micro's and super computer systems. CPU and peripherals I/O auxillary storages. Software and programming languages (Machine, assembly and higher level) popular software packages for use in biology. Networking concepts and its use in data search.

LAB COURSE-I

A. BASIC BIOCHEMICAL METHODS


4. Thin layer chromatography. Separation of lipids, purines, pyrimidines and their quantitation. Ion exchange chromatography. Quantitative separation of amino acids, nucleosides using Dowex 1 and Dowex 50 resins, Gel filtration; Separation of blue dextran and cobalt chloride on Sephadex G25 or similar experiment.

B. CLINICAL BIOCHEMISTRY

Lectus: M.Sc. Biochemistry

PAPER VII: BIOCHEMICAL GENETICS AND DNA REPLICATION

UNIT I HERIDITY AND GENETIC ANALYSIS


Somatic and germinal cell mutations. Different kinds of mutation (Forward and back, point, frameshift, deletion mutations).
Conditioned mutants, resistance mutants. Suppressor mutations.


UNIT II GENOME ORGANIZATION

Genome organization in prokaryotes and eukaryotes. Plasmids, transposons, insertion sequences and retrotransposons. Mitochondrial and chloroplast DNA. Benzene's fine structures of rRNA loci.

Organisation of eukaryotic chromosomes. Histones and non-histone type DNA binding proteins. Nucleosomes and higher order structures. C-value paradox and the significance of introns.

Single copy genes, repeating sequences, tandem gene clusters. rRNA genes, histone genes and immunoglobulin genes. Selfish DNA.

UNIT III MUTATIONS, RECOMBINATION AND GENE TRANSFER


UNIT-IV DNA REPLICATION-I


UNIT-V DNA REPLICATION-II AND REPAIR


PAPER-VIII: PROTEIN SYNTHESIS AND REGULATION

UNIT-I TRANSCRIPTION


UNIT-II TRANSLATION


UNIT-III REGULATION OF GENE EXPRESSION


UNIT-IV PROTEIN TARGETING


UNIT-V SIGNAL TRANSDUCTION

UNIT-I MICROBIOLOGY INCLUDING PARASITOLOGY


UNIT-II FERMENTATION


Basic design of fermentors. Production of enzymes (amylases, proteases, lipases, and cellulases) and high fructose syrups. Microbial transformations of steroids and steroids. Environmental applications of microorganisms in sewage and effluent treatment (thermophile and anaerobic digesters). Downstream processing of valuable products.

UNIT-III VIROLOGY-I


UNIT-IV VIROLOGY-II


UNIT-V PLANT AND ANIMAL VIRUSES

General features: Host-virus interactions, permisive/non-permissive hosts, structure of naked and enveloped viruses, cytopathic effects, assay methods (Pock assay, haemagglutination assay, transformation assay) and purification methods (ultrafiltration, ultracentrifugation and affinity methods).

UNIT-X IMMUNOLOGY

UNIT-I BASIC IMMUNOLOGY


UNIT-II APPLIED IMMUNOLOGY-I

Hybridoma technique and monoclonal antibodies. Antibody-antigen interactions. Immuno-analytical methods based on Ag-Ab interactions (Gel diffusion techniques, immunoelectrophoresis, immunofluorescence, RIA, ELISA and western blotting).

Vaccines. Methods of vaccine production. DNA vaccines, synthetic vaccines.

UNIT-III APPLIED IMMUNOLOGY-II


UNIT-IV IMMUNO ANALYTICAL METHODS

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UNIT V CYTOKINES
Effector molecules, cytokine receptors. Complement, classical and alternate pathways of complement activation, regulation of complement activation pathways. Immunological tolerance, hyperreactivity, autoimmunity, immunity in cancer and AIDS, Vaccines.

PAPER XI BIOTECHNOLOGY

UNIT I PROTEIN ENGINEERING
Immobilized enzymes and cells. Methods of immobilization and applications. Resolution of amino acid racemates. Synthesis of improved penicillin's increased protein stability and enhanced specific activity. Altering the kinetic properties and pH.

UNIT II MICROBIAL BIOTECHNOLOGY

UNIT III ANIMAL BIOTECHNOLOGY

UNIT IV PLANT BIOTECHNOLOGY
Introduction to plant biotechnology. Plant cell culture and plant protoplast and protoplast fusion, plant viruses as vectors. Ti plasmid as vector and transgenic plants. Transgenic technology. Sense RNA and DNA.

SYLLABUS: M.Sc. Biochemistry

UNIT V MICROBIAL PATHOGENS AND ANTIMICROBIAL AGENTS-III
Antibiotics: Assay of antibiotics, chemistry and biosynthesis of important antibiotic compounds. First, second, third and fourth generation antibiotics with reference to modified penicillins. Antibiotic resistance. Biochemical modes of action of antibiotics acting as inhibitors of ribosomal function (e.g., aminoglycosides, tetracyclines, puromycin, chloramphenicol etc.) inhibitors of nucleic acid metabolism, actinomycin D, mitomycin C etc.) inhibitors of cell wall biosynthesis (penicillins, bacitracins etc.) and inhibition of membrane function (polyenes, peptide antibiotics etc.)

PAPER XII GENETIC ENGINEERING

UNIT I GENETIC ENGINEERING-I

UNIT II GENETIC ENGINEERING-II

UNIT III DNA CLONING, TOOLS AND TECHNIQUES
Production of recombinant proteins with examples of insulin, somatostatin and interferon. PCR and its applications. RFLP and its applications. DNA fingerprinting, trans genics and cloning techniques.

A. ANALYTICAL METHODS AND ENZYMOLGY
1. Qualitative tests for salivary amylase. Determination of enzyme activities (V_max and specific activity) of the following enzymes.
   a. Sweet potato amylase, horseradish peroxidase, liver catalase, arginase.
2. Qualitative tests for inhibition of enzyme activity with above enzymes. Determination of order of a Chemical reaction.
4. Determination of pk of amino acids. Polarimetric experiments: Respirometry, study of tissue respiration by tissue slices and effect of inhibitors on oxygen consumption.

B. PROTEIN ANALYSIS
2. Isolation of a protein by salt or solvent or isoelectric precipitation.
3. Purification of protein and determination of molecular weight by SDS-PAGE. End group analysis by DABITC method.
4. Incorporation of labeled amino acids into proteins (demonstration). Protein phosphorylation (demonstration). Western transfer. Identification of proteins on membranes using avidin-biotin and/or antibodies.

M.Sc. BIOCHEMISTRY
(Previous and Final)

Instructions to examiners to all theory papers.
Max. Marks of each theory paper is 100
Time 3 hrs.

Note:
1. Ten questions will be set in all selecting two questions from each unit.
2. Candidates have to attend five questions, one from each unit.
M.Sc. BIOCHEMISTRY
(Previous and Final)

Max. Marks : 200

Duration of Exam : 12 hrs.
(Spread in 2 days)

4 Exercises to be performed selecting one exercise from each section.

Two quantitative exercises  = 50 x 2 = 100
Two qualitative exercises  = 25 x 2 = 50
Viva  = 30
Record  = 20

= 200

Note—The practical examination will be conducted by the board of two external and one internal examiners who will conduct practical on both days.

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