UNIVERSITY OF RAJASTHAN
JAIPUR

SYLLABUS

M.Sc. BIO-CHEMISTRY

(ANNUAL SCHEME)

M.Sc. (Previous) Examination 2020
M.Sc. (Final) Examination 2021
UNIVERSITY OF RAJASTHAN  
JAIPUR- 302 004  
(TWO YEAR COURSE-ANNUAL SYSTEM)  
URSE OUTLINE AND SCHEME OF EXAMINATION FOR  
M.Sc. BIOCHEMISTRY  

(Previous) 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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<tr>
<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</td>
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<td>Computational Methods</td>
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<td>12 (Spread up in two days)</td>
<td>200</td>
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Dy. Registrar  
(Academic)  
University of Rajasthan  

[Signature]
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,
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UNIT-II LIPIDS


UNIT-III Porphyrins 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

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UNIT IV: LIPID METABOLISM-II

UNIT V: AMINO ACID AND NUCLEOTIDE METABOLISM

PAPÁR IV: ENZYMEOLOGY 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 andzymogens. Enzyme inhibitors. Feed-back inhibition and regression. 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
Syllabus: M.Sc. Biochemistry

Mechanism of hormone action. Hormone receptors. Up and down regulation of receptors. Insulin, glucocorticoid and adrenergic receptors. Super family of steroid and thyroid hormone receptors. Growth factors, chemistry and functions of IGF-I and II NGF, EGF and PDGF.

UNIT-II HYPOPHYSIS, HYPOTHALAMUS AND RELATIONSHIP, PINEAL

UNIT-III THYROID, PARATHYROID, THYMUS AND OTHER GLANDS

UNIT-IV PANCREAS AND ADRENALS

UNIT-V GONADS AND REPRODUCTION

UNIT-VI: BIOCHEMICAL TECHNIQUES AND COMPUTATIONAL METHODS

A. ENDOCRINE BIOCHEMISTRY
UNIT-1: ENDOCRINE SYSTEM
Organization of the endocrine system. Biosynthesis, processing and secretion of hormones. Classification of hormones. Disorders of endocrine function. The second messenger concept and...
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, minicomputers, micros and supercomputer systems. CPU and peripherals I/O auxiliary 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
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Lab Course I

A. ANALYTICAL METHODS

1. Preparation of buffers
2. Biochemical preparations. Preparations of egg albumin, casein, 
e, , , ATP, glycojen, preparation of DNP amino 
e, , , and separation by TLC and quantitative identification.
3. Determination of calcium as calcium oxalate. Determination of 
food stuffs by colorimetry. Use of atomic absorption 
ephotometer to determine Na and K in serum.
4. Determination of bone by flame photometry. Determination 
VL in biological samples. Methods of cell destruction.
5. Preparation of tissue homogenates using different homogenizers.
6. Fat analysis. Determination of lipid content in oil seeds. 
Urine composition by TLC in germinating seeds.

B. CARBOHYDRATE AND LIPID ANALYSIS

1. Preparation of glycogen from liver. End group analysis by periodate 
, and determination of average chain length of glycogen.
2. Differential analysis of sugars in a mixture. Use of polarimetry 
for configurational analysis of carbohydrates. Estimation of 
fructose.
3. Extraction and adsorption column chromatography of plant 
pigments. TLC and GC analysis of lipids. Determination of iodine 
numbers, saponification and acid value of a fat.
4. Determination of cholesterol from brain and its estimation. Preparation 
and analysis of sphingomyelin.

Yours truly:

M.Sc. Biochemistry

PAPER-VII: BIOCHEMICAL GENETICS AND DNA REPLICATION

UNIT-I HEREDITY AND GENETIC ANALYSIS

- Basic concepts of Mendelian and non-Mendelian inheritance.
- Importance of meiosis in heredity. Sex linked inheritance. Polygenic 
and maternat inheritance.
- Somatic and germinal cell mutations. Different kinds of mutation ( 
forward and back, point, frameshift, deletion mutations).
- Conditional mutants, resistance mutants. Suppressor mutations.
- Chromosomal mutations. Detection, selection and isolation of 
- Polyploidy. Site directed mutagenesis. Photoactivation and 
mechanisms for repair of UV damaged DNA (Post replication 
and SOS repair).

UNIT-II GENOME ORGANIZATION

- Genome organization in procaryotes and eukaryotes. Plasmids, 
transposons, insertion sequences and retrotransposons. Mitochondrial 
and chloroplast DNA. Benzer’s fine structures of rII loci.
- Organization 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, and tandem gene clusters.
- r-RNA genes, histone genes and immunoglobulin genes. Selfish 
DNA.

UNIT-III MUTATIONS, RECOMBINATION AND GENE TRANSFER

- Mutations. Different kinds of mutations. Isolation of mutants, 
phage mutants, host range rapidilysis and temperature sensitive 
mutants. Mechanism of mutants. Gene transfer mechanisms, 
transformation, transduction. (generalized, abortive and specialized).
- Conjugation. F+ x F- Hfr strains. Mechanism of recombinant 
cross over. Elements of gene mapping. Mapping by recombination 
analysis, multiple cross over and interference. Circular 
chromosome and mapping by conjugation. Tetrad and complement 
analysis. Mapping by transformation and transduction. Map units 
and cytological maps of eukaryotic chromosomes. Somotic cell 
genetics.
UNIT-IV DNA REPLICATION-I

UNIT-V DNA REPLICATION-II AND REPAIR

PAPER-VIII: PROTEIN SYNTHESIS AND REGULATION
UNIT-I TRANSCRIPTION

UNIT-II TRANSCRIPTION
The genetic code, elucidation, experimental, codon degeneracy, editing. In vitro translation systems. tRNA structure.

UNIT-III REGULATION OF GENE EXPRESSION

UNIT-IV PROTEIN TARGETTING

UNIT-V SIGNAL TRANSDUCTION
PAPER IX: MICROBIAL BIOCHEMISTRY AND VIROLOGY

UNIT-I MICROBIOLOGY INCLUDING PARASITOLOGY


UNIT-II FERMENTATION


Basic design of fermentors. Production of enzymes (amyloses, proteases, lipases and cellulases) and high fructose syrup. Microbial transformations of sterols and steroids. Environmental applications of microorganisms in sewage and effluent treatment (anaerobic and anaerobic digestors). Downstream processing of valuable products.

UNIT-III VIROLOGY-I


UNIT-IV VIROLOGY-II


Syllabus: M.Sc. Biochemistry

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


UNIT-III APPLIED IMMUNOLOGY-II


UNIT-IV IMMUNO ANALYTICAL METHODS

Production and immunology technology and purification of polyclonal antibodies. Antigen-antibody interactions-gel diffusion, immuno electrophoresis, immunofluorescence, RIA, ELISA, Western blotting and FACS techniques. Vaccines-types and their applications. (DNA, recombinant DNA, peptide and antitypical vaccines).
UNIT V CYTOKINES

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
Introduction to microbial biotechnology. Large-scale cultivation of microbes, problem of oxygen supply, basic fermenter design, current design of stirred tank reactor, aseptic operation, control systems, batch versus continuous operation, down-stream processing. Production of biomass (microbial insecticides, starter cultures, single cell proteins production). Production of low molecular weight compounds—primary and secondary metabolites, antibiotics, end products. Bioconversions. Microbial polynucleotides and production of microbial enzymes. Microbiological mining. Introduction to drug design and delivery.

UNIT III ANIMAL BIOTECHNOLOGY

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

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UNIT V MICROBIAL PATHOGENS AND ANTIMICROBIAL AGENTS
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 inhibitors of membrane function (polymyxins, 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 finger printing, trans genics and cloning techniques.

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.
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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 = 50×2 = 100
Two qualitative exercises = 25×2 = 50
Viva = 30
Record = 20

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= 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.

[Signature]

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(2) JAIPUR