UNIVERSITY OF RAJASTHAN
JAIPUR

SYLLABUS

M.Sc. BIO-CHEMISTRY

(ANNUAL SCHEME)

M.Sc. (Previous) Examination  2018
M.Sc. (Final) Examination     2019

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR
Syllabus: M.Sc. Biochemistry

UNIVERSITY OF RAJASTHAN
JAIPUR- 302 004
(TWO YEAR COURSE-ANNUAL SYSTEM)
COURSE OUTLINE AND SCHEME OF EXAMINATION FOR
M.Sc. BIOCHEMISTRY.

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Title of the Paper</th>
<th>Hours of Exam.</th>
<th>Max. Marks</th>
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<tbody>
<tr>
<td>P-I</td>
<td>Cell Biology and Physiology</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>P-II</td>
<td>Chemistry of Biomolecules</td>
<td>3</td>
<td>100</td>
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<tr>
<td>P-III</td>
<td>General Metabolism</td>
<td>3</td>
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<tr>
<td>P-IV</td>
<td>Enzymology and Bioenergetics</td>
<td>3</td>
<td>100</td>
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<tr>
<td>P-V</td>
<td>Endocrine Biochemistry</td>
<td>3</td>
<td>100</td>
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<tr>
<td>P-VI</td>
<td>Biochemical techniques and Computational Methods</td>
<td>3</td>
<td>100</td>
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Lab Course | 12 (Spread up in two days) | 200

Total | 800

NOTICE
The Ordinance governing the examinations in the faculties of Arts, Fine Arts, Social Sciences, Science, Commerce and Law are contained in a separate booklet. The students are advised to refer to the same.

1. Changes in Statutes-Ordinances/Rules/Regulations/Syllabus and Books may, from time to time, be made by amendment or re-making and a candidate shall, except as far as the University determines otherwise comply with any change that applies to years he has not completed at the time of change.

2. All court cases shall be subject to the jurisdiction of the Rajasthan University headquarter at Jaipur only and not any other place.

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(1-A)
# M.Sc. (Previous) BIOCHEMISTRY

## PAPER-1 : 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

PAPER-III: GENERAL METABOLISM

UNIT-I CARBOHYDRATE METABOLISM-I

UNIT - II CARBOHYDRATE METABOLISM-II

UNIT-III LIPID METABOLISM-I

UNIT-IV LIPID METABOLISM-II

UNIT-V AMINO ACID AND NUCLEOTIDE METABOLISM

PAPER-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. Isozymes and zymogens. 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

UNIT-I ENZYMEOLOGY

Classification of catalytic mechanisms. Acid-base, covalent, proximity and orientation. Transition state binding 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 RNase, lysosome, chymotrypsin, trypsin, papain and carboxypeptidase.

UNIT-IV ENZYMEOLOGY-IV


UNIT-V BIOENERGETICS AND PHOTOSYNTHESIS


PAPER-V : ENDOCRINE BIOCHEMISTRY

UNIT-I ENDOCRINE SYSTEM


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


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, micros and super computer 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-J
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
M.Sc. (Final) BIOCHEMISTRY

PAPER VII: BIOCHEMICAL GENETICS AND DNA REPLICATION

UNIT-I HEREDITY AND GENETIC ANALYSIS


UNIT-II GENOME ORGANIZATION


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
PAPER-IX MICROBIAL BIOCHEMISTRY AND VIROLOGY

UNIT-I MICROBIOLOGY INCLUDING PARASITOLOGY
- Isolation, cultivation and identification of bacteria. The bacterial cell wall structure. Gram positive and gram negative bacteria.
- Microbial nutrition and growth. Bacterial growth and kinetics.

UNIT-II FERMENTATION
- Introduction to fermentation. Fermentative production of ethanolic, lactic, riboflavin, glutamic acid, lye, amylases and proteases.
- Solid state fermentation. Antibiotics: chemistry and mode of action of penicillin, streptomycin, chloramphenicol, tetracyclines, and niacin.
- Basic design of fermentors. Production of enzymes (amyloses and proteases, lipases and cellulases) and high fructose syrup. Microbial transformations of steroids and steroids. Environmental applications of microorganisms in sewage and effluent treatment (aerobic and anaerobic digestors). Downstream processing of valuable products.

UNIT-III VIROLOGY-I

UNIT-IV VIROLOGY-II

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UNIT-V PLANT AND ANIMAL VIRUSES
- General features: Host-virus interactions, permissive/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).

PAPER-X: IMMUNOLOGY

UNIT-I BASIC IMMUNOLOGY

UNIT-II APPLIED IMMUNOLOGY-I

UNIT-III APPLIED IMMUNOLOGY-II

UNIT-IV IMMUNO ANALYTICAL METHODS
- Production and immuno technology and purification of polyclonal antibodies. Antigen-antibody interactions-gel diffusion, immuno electrophoresis, immuno fluorescence, RIA, ELISA Western blotting and FACS techniques. Vaccines-types and their applications. (DNA, recombinant DNA, peptide and antidipitic 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, aspetic 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. Metabolic end products. Microbial polysaccharides 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 fusion, plant viruses as vectors. Ti plasmid as vector and transgenic plants. Transgenic technology. Antisense RNA and DNA.

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UNIT-V MICROBIAL PATHOGENS AND ANTIMICROBIAL AGENTS-II

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 inhibitory 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 finger printing, trans genics and cloning techniques.


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UNIT-III GENE REGULATION AND HUMAN DISEASE


UNIT-IV REGULATION OF GENE EXPRESSION IN PROKARYOTES AND EUKARYOTES

Negative and positive control of gene expression (Lac operon). Dual operators (Gal operon). Dual function of repressor (ara operon). Transcriptional control by attenuation (trp operon). Phase variation (Salmonella flagellar protein synthesis). Translational feedback.

LAB COURSE-I

A. ANALYSIS OF BIOMOLECULES


Hypermethylation. Correlation of Tm and base composition. Incorporation of 3H thymidine into DNA. Plasmid mini-preparations.

Large scale isolation of a plasmid DNA. Use of restriction nucleases and ligase. Agarose gel electrophoresis.

Insertion of foreign DNA into a vector and transformation. Blot analysis for RNA and DNA. DNA sequencing by Sanger's method (demonstration).

B. ENZYME KINETICS AND IMMUNOLOGY

1. Determination of blood groups. Ouchterlony double immunodiffusion.
2. Immuno electrophoresis. RIA and ELISA methods (demonstrations).
4. Isolation and purification of enzymes (lysozyme from egg white, urease from jack bean meal, arginase from liver, pyrophosphatase from yeast).
5. Kinetic studies including determination of K_m and K_M-Metal ion activation of enzymes. Determination of activation energy of an enzyme. Turnover number of catalase or trypsin. Enzyme inhibition.

UNIT-V: M.Sc. Biochemistry

LAB COURSE-II

A. ANALYTICAL METHODS AND ENZYMOLGY

1. Qualitative tests for salivary amylase. Determination of enzyme activities (V_max and specific activity) of the following enzymes.
2. Sweet potato amylase, horse gram urease, liver catalase, arginase.
4. Qualitative tests for inhibition of enzyme activity with above enzymes. Determination of order of a Chemical reaction.

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.
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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

= 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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