

**HEMCHAND YADAV VISHWAVIDYALAYA,**

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**SCHEME OF EXAMINATION  
&  
SYLLABUS  
of  
M.Sc. (Microbiology) Semester Exam  
UNDER  
FACULTY OF LIFE SCIENCE  
Session 2021-23**

**(Approved by Board of Studies)  
Effective from June 2021**

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20/11/2021

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15

## M. Sc. Microbiology

### FIRST SEMESTER

#### PAPER I: CELL BIOLOGY

Max. Mark 80

(There will be 5 questions of equal marks. First question will be based on complete syllabus with no internal choice, whereas rest questions will be unit wise).

#### UNIT I

Molecular organization of membranes- asymmetrical organization of lipids, proteins and carbohydrates. Osmosis, ion channels, membrane pumps and electrical properties of membranes. Active transport by ATP- powered pumps: types, properties and mechanisms.

#### UNIT II

Transport of proteins into mitochondria, chloroplast and endoplasmic reticulum. Transport of proteins into and out of nucleus. Transport by vesicle formation: exocytosis, endocytosis and its molecular mechanism

#### UNIT III

Cell signaling: Signaling via G-protein linked and enzyme linked cell surface receptors, MAP kinase pathways. Eukaryotic cell division cycle: different phases and molecular events, regulation and control of cell cycle. Apoptosis. Oncogenes and tumor suppressor genes: viral and cellular Oncogenes,

#### UNIT IV

Organization of chromosomes: Structure of chromosomes, centromere and telomere. States of chromosomes during cell cycle. Mitotic chromosome. Organization of genes in chromosomes Banding. Pattern of chromosomes. Lampbrush and Polytene chromosomes. Chromatin, nucleosomes, DNA packaging, heterochromatin and euchromatin.

#### Lab Course:

1. Study of chromosome behaviour during Mitosis and meiosis (Onion / Garlic root tips, Onion buds, human lymphocytes, rat or bird testis /grass hopper testis or any other materials).
2. Calculation of mitotic index in growing Onion / Garlic root tips
3. Squash preparation: Polytene chromosome (in chironomus / Drosophila or other insect salivary gland) and Barr body (in buccal epithelial cells).
4. Demonstration of secretory granules in the salivary gland cells of insect.
5. Demonstration of mitochondria by vital staining.
6. Study of permanent slides.
7. Estimation of DNA
8. Estimation of RNA
9. Sub-cellular fractionation and marker enzymes
10. Identification of biomolecules in different tissues by histochemical techniques
11. Preparation of mitotic plate by carmine squashing method and phase identification.
12. Demonstration of the nuclear matrix networks in onion cells.
13. Study of the effect of chemical agents on chromosomes plant cells.
14. Isolation of protoplast, measurement of cell density plating efficiency.
15. Preparation of Karyotype of metaphase plate.

**Books Recommended:**

1. H Lodish et al Molecular Cell Biology B Alberts et al. Essential Cell Biology H Lodish et al. Molecular Cell Biology
2. B Alberts et al. Molecular Biology of the Cell
3. G Karp Cell and Molecular Biology: Concepts and Experiments

**M. Sc. Microbiology****FIRST SEMESTER**

PAPER II: BIOMOLECULES

Max. Mark 80

(There will be 5 questions of equal marks. First question will be based on complete syllabus with no internal choice, whereas rest questions will be unit wise).

**UNIT I**

Carbohydrates: structure, classification, properties and function; derivatives of monosaccharides, homo and hetero-polysaccharides, Peptidoglycan, glycoproteins and liposaccharide. Lipids: Classification, structure and function. Nucleic Acid: Structure of purine and pyrimidine bases, nucleoside and nucleotide; DNA- structure and conformation; RNA - Structure, types and functions.

**UNIT II**

Amino acids: structure, classification and functions; Synthesis of peptides and protein sequencing. Proteins- properties, covalent structure; secondary, tertiary and quaternary structure of proteins,

**UNIT III**

Enzyme classification, coenzymes, active site of enzyme, factors contributing to the catalytic efficiency of enzyme; enzyme kinetics- Michaelis-Menten equation, determination of  $K_m$ , enzyme inhibition, allosteric enzymes, isoenzymes, ribozyme, multienzyme complexes

**UNIT IV**

Chemistry of porphyrins: Importance of porphyrins in biology; structure of hemoglobin and chlorophyll porphyrins, structure and biological role of animal hormones, structure and biological role of water soluble and fat soluble vitamins.

**Lab Course:**

1. Specific tests for sugars, amino acids and lipids
2. Formal titration of amino acids
3. Estimation of proteins using ninhydrin and biuret method
4. Estimation of sugar by anthrone and Folin-Wu method.
5. Saponification value and iodine number of fat.
6. Estimation of ascorbic acid.
7. Achromic point determination using salivary amylase
8. Effect of ions on salivary amylase activity.
9. Enzyme assay and kinetics (ex. Amylase, Protease)

**Books Recommended:**

1. Principles of Biochemistry by Nelson, Cox and Lehninger
2. Biochemistry by G. Zubay
3. Biochemistry by Stryer
4. Biochemistry by Garrett and Grosham
5. Text book of Biochemistry by West, Tood, Mason & Bruglen
6. Biochemistry by White, Handler & Smith
7. Biochemistry by D. Voet and J C Voet

*Amata*

*DR K. K. Patel*  
29/05/2020

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## M. Sc. Microbiology

### FIRST SEMESTER

#### PAPER III: MICROBIOLOGY

Max. Mark 80

(There will be 5 questions of equal marks. First question will be based on complete syllabus with no internal choice, whereas rest questions will be unit wise).

#### UNIT I

General characteristics of fungi, classification of fungi, life cycle of selected fungal genus (*Aspergillus*, *Pencillium*, *Fusarium* and *Mucor*). Economic importance of fungi. Fungi and bioremediation, parasitism, mutualism and symbiosis with plants and animals. Heterothallism, sex hormone in fungi, Mycorrhiza, VAM. Algae: Distribution, classification, reproduction, ecology and importance.

#### UNIT II

Morphology and ultra-structure of bacteria, morphological types, cell wall of archaebacteria, gram negative, gram positive eubacteria, eukaryotes.

Cell membranes – structure, composition and properties. Structure and function of flagella, cilia, pili, gas vesicles. Cyanobacteria, protozoa, mycoplasma and Rickettsia.

Gene transfer mechanisms, transformation, transduction, conjugation and transfection. Plasmids F: factors colicins and col factors, plasmids as a vector for gene cloning.

#### UNIT III

Nutritional types (autotrophs, heterotrophs, phototrophs, chemotrophs), growth curves, measurement of growth, factors affecting growth, generation time, growth kinetics. Batch and continuous culture, asynchronous and synchronous culture.

Basis of microbial classification, classification and salient feature of bacteria according to Bergey's manual of determinative bacteriology, cyanobacteria, prochlorons and cyanelles.

#### UNIT IV

Viruses: Structure and classification of viruses; morphology and ultra-structure; capsids and their arrangements, types of envelopes, viral genome, their types and structure, virus related agents (viroids, prions). General feature of virus reproductions, early events in virus multiplication, virus restriction and modification of host, virus mRNA. General overview of bacterial viruses, RNA and DNA bacteriophages (MS2, X174, M13, T3, T4). Lysogeny and Lytic phase. General account of plant and animal viruses

#### Lab Course:

1. Glassware preparation and sterilization techniques- wet heat- dry heat- filter types- laminar flow chamber types- CDC- safety levels.
2. Preparation of liquid & solid media, plating, pouring, inoculation and incubation for growth of microorganism
3. Methods of obtaining pure culture of microorganisms (a) streak plate (b) Pour plate, and (c) spread plate methods
4. Microscopic examination of the microorganisms, identification and staining methods
5. Micrometry and camera lucida drawings
6. Study of bacterial growth by turbidimetry/ spectrophotometry
7. Biomass measurement for fungi
8. Isolation and enumeration of microorganisms from soil by serial dilution agar plating method.
9. Enumeration of viruses by plaque assay technique.
10. Motility of bacteria by hanging drop technique.

DR. K. K. P. P. P.  
29/05/2022

15

**Books Recommended:**

Microbiology: L.M. Prescott, J.P. Harley and D.A. Klein, McGraw Hill Publication.  
General Microbiology: Stanier, Ingrahamana, Wheelis and Painter, Mac Millian Press  
Principles of Microbiology: R.M. Atlas  
Microbiology: Peleczar, Chan & Krieg  
General Virology: Luria, Darnell, Baltimore and Campell  
Introduction to Mycology: CJ Alexopoulos and CW Mims, Wiley Eastern Ltd, New Delhi

**M. Sc. Microbiology****FIRST SEMESTER****PAPER IV: BIOLOGY OF IMMUNE SYSTEM**

Max. Mark 80

(There will be 5 questions of equal marks. First question will be based on complete syllabus with no internal choice, whereas rest questions will be unit wise).

**UNIT I**

Innate immune mechanism and characteristics of adaptive immune response. Cells of immune system: Hematopoiesis and differentiation, mononuclear cells and granulocytes. Antigen presenting cells. Primary and Secondary lymphoid organs and tissues. Ontogeny and phylogeny of lymphocytes. Lymphocyte traffic.

**UNIT II**

Antigen receptor molecules: B-cell receptor complex, Immunoglobulin- structure, types and function. T-cell receptor complex. Major Histocompatibility Complex- types, structural organization, function and distribution. Transplantation and Rejection. Complements in immune function.

**UNIT III**

Antigens: nature of antigens, factor affecting immunogenicity, Haptens and super antigens. Antigenic determinants. Recognition of antigens by T and B cell. Antigen processing. Role of MHC molecules in antigen presentation and co-stimulatory signals. Antigen and antibody interaction.

**UNIT IV**

Cell mediated immune response. Cytokines and interleukins- structure and function. Immunity to infections. Hypersensitive reactions and their types. Immunodeficiency disorders. Autoimmunity

**Lab Course:**

1. Identification of cells of immune system
2. Separation of mononuclear cells by Ficoll-Hypaque
3. Identification of Lymphocytes and their subsets
4. Lymphoid organs and their microscopic organization
5. Isolation and purification of Antigens
6. Purification of IgG from serum
7. Estimation of Levels of gamma globulins and A/G ratio in blood
8. Antigen antibody interaction

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29/05/2022

15

**Books Recommended:**

Kuby's Immunology: R.A. Goldsby, Thomas J Kindt and Barbara A. Osborne

Immunology- A short Course: E. Benjamini, R. Coico and G. Sunshine

Immunology: Roitt, Brostoff and Male

Fundamentals of Immunology: William Paul

Immunology: Tizard

Immunology: Abbas *et al*