DEVI AHILYA VISHWAVIDYALAYA, INDORE 2017-18

M.Sc. (Microbiology): Four Semester Course

(Duration: Two years)

M. Sc. Sem. I 2016-17

Paper	Subject	Maximum Marks		Minimum Passing Marks	
		Theory	C. C. E.	Theory	C. C. E.
I	Bacteriology	85	15	28	05
II	Virology, Mycology and Phycology	85	15	28	05
III	Immunology	85	15	28	05
IV	Microbial Biochemistry	85	15	28	05
Practical	Lab course – I (Paper I and II)	50		20	
Practical	Lab course – II (Paper III and IV)	50		20	
	Total Marks	500			

M. Sc. Sem. II 2016-17

Paper	Subject	Maximum Marks		Minimum Passing Marks	
		Theory	C. C. E.	Theory	C. C. E.
I	Microbial Genetics	85	15	28	05
II	Microbial Physiology	85	15	28	05
III	Instrumentation	85	15	28	05
IV	Bioprocess Technology	85	15	28	05
Practical	Lab course – I (Paper I and II)	50		20	
Practical	Lab course – II (Paper III and IV)	50		20	
	Total Marks	500			

M. Sc. Sem. III 2017-18

Paper	Subject	Maximum Marks		Minimum Passing Marks	
		Theory	C. C. E.	Theory	C. C. E.
I	Molecular Biology & Genetic Engineering	85	15	28	05
II	Medical Microbiology	85	15	28	05
III	Biostatistics and Bioinformatics	85	15	28	05
IV	Applied Microbiology	85	15	28	05
Practical	Lab course – I (Paper I and II)	50		20	
Practical	Lab course – II (Paper III and IV)	50		20	
	Total Marks	500			

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M. Sc. (Microbiology) Semester-I

Paper I – Bacteriology

UNIT-I **10 lectures**

Contributions made by eminent scientists in Microbiology

Classification of microorganisms – Haeckel's three kingdom concept, Whittaker's five kingdom concept, Three domain concept of Carl Woese

Salient features Bergey's Manual of Determinative Bacteriology, Bergey's Manual of Systematic Bacteriology

Modern trends in prokaryote taxonomy:

- Polyphasic taxonomy- Phenetic classification, phylogenetic classification, genotypic classification
- Techniques for determining microbial taxonomy and phylogeny
- Phylogenetic basis-construction and interpretation of phylogenetic trees
- Numerical taxonomy

UNIT-II **10 lectures**

Morphology of bacteria-morphological types of bacteria

Ultra structure of bacteria-cell walls of eubacteria (Gram negative and Gram positive) and archaebacteria, L-forms, sphearoplast and protoplast.

Capsule – composition and function.

Cell membrane-structure, composition and properties.

UNIT-III **10 lectures**

Structure and function of flagella, pili, gas vesicles, chromosomes, carboxysomes, magnetosomes, phycobolisomes and nucleoid.

Spores and Cysts.

Reserve food materials-Polyhydroxybutyrate, polyphosphate granules, oil droplets, cyanophycin granules and sulphur inclusions.

UNIT-IV **10 lectures**

Cultivation of bacteria – Aerobic and anaerobic cultivation

Nutritional types of bacteria.

Bacteriological media and its types.

Bacterial growth-Growth curve, growth kinetics. Generation time and growth rate.

Batch and continuous cultivation, synchronous and diauxic growth.

Measurement of bacterial growth, Factors affecting microbial growth.

UNIT-V **10 lectures**

Microbial death curve under adverse conditions

Concepts of bioburden, thermal death constant and decimal reduction time.

Control of microbes by physical and chemical agents and mechanisms of their microbicidal activity.

Evaluation of antimicrobial potency of disinfectants and antiseptics-tube dilution method, agar diffusion method, phenol coefficient.

REFERENCES:

1. Fundamental Principles of Bacteriology-Salle AJ, 7th edition (Tata McGraw-Hill, New Delhi)
2. Prescott, Harley & Klein's Microbiology-Willey JM, Sheerwood LM & Woolverton CJ, 8th edition (McGraw-Hill)
3. Microbiology-Pelczar MJ, Chan ECS & Kreig NR, 5th edition (Tata McGraw-Hill, New Delhi)
4. Text Book on Principles of Bacteriology, Virology & Immunology (Vol. IV)-Parker MT & Collier LH, 8th edition (Topley and Wilson)
5. Elementary Microbiology -Modi, HA (Vol. I & II), 1st edition (Akta Pakashan, Nadiad)
6. A Handbook of Elementary Microbiology-Modi, HA, 1st edition (Shanti Pakashan, Rohtak)
7. General Microbiology-Stainer RY, Ingharam JL, 5th edition (Macmillan Press Ltd, London)
8. Bergey's Manual of Determinative Bacteriology, Holt JG, 9th edition (Lippincott Williams & Wilkins)
9. Bergey's Manual of Systematic Bacteriology (Vol.1 to 5), 2nd edition (Springer, New York)
10. General Microbiology-Boyd RF, 2nd edition (Times Mirror/Mosby College Publishers)
11. Practical Microbiology- Dubey RC & Maheshwari DK, 1st edition (S. Chand & Co. Ltd., New Delhi)
12. Microbiology – A Practical Approach – Patel B and Phanse N, 1st edition (Print Care, Indore)
13. Microbiology- A Laboratory Manual- Cappuccino J & Sherman N, 6th edition (Pearson Education Publication, New Delhi)

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M. Sc. (Microbiology) Semester-I

Paper II-Virology, Mycology and Phycology

10 lectures

UNIT-I

Discovery, nomenclature and general characters of viruses.
Classification of virus – Baltimore, ICTV.
Morphology and ultra structure, capsids and their arrangements, types of envelopes and their composition.
Viral genome, their types and structures.
Virus related agents-Viroids and prions.

10 lectures

UNIT-II

Bacteriophages: Organization and life cycle.
One step growth curve; Lytic cycle, Lysogenic cycle
Bacteriophage typing.
Application in bacterial genetics.
Brief details on T phages and Lambda phages

10 lectures

UNIT-III

Cultivation of viruses in embryonated eggs, experimental animals and cell cultures.
Assay of viruses: Physical and chemical methods-Protein, nucleic acid, radioactivity tracers, electron microscopy.
Infectivity assay-Plaque method and end point method.

10 lectures

UNIT-IV

Mycology-
General characters of fungi, structure and composition of fungal cells, reproduction of fungi.
Classification of fungi, Economic significance of fungi.
Symbiotic associations of fungi- mycorrhiza, lichens.
Life cycle of *Penicillium* and *Saccharomyces*

10 lectures

UNIT-V

Phycology:
General characters of algae, algal cell structure, nutrition, reproduction, distribution of algae.
Classification of algae
Salient features of green algae, diatoms, euglenoids, brown algae, red algae, microalgae.
Economic significance of algae

REFERENCES

1. General Virology- Luria SE, 3rd edition (John Wiley & Sons)
2. Introduction to Modern Virology- Dimmock NJ, 7th edition (John Wiley & Sons)
3. Virology- Levy JA, Conrat HF & Owens RA, 3rd edition (Prentice Hall)
4. Microbiology-Pelczar MJ, Chan ECS & Kreig NR, 5th edition (Tata McGraw-Hill, New Delhi)
5. Text Book on Principles of Bacteriology, Virology & Immunology (Vol. IV)-Parker MT & Collier LH, 8th edition (Topley and Wilson)
6. Introduction to Mycology-Alexopoulous CJ & Mims CW, 4th edition (Wiley Eastern Limited)
7. An Introduction to Mycology-Mehrotra RS & Ancja KR, 2nd edition (New Age International)
8. Fundamentals of Mycology-Burnett JH, 2nd edition (Edward Arnold)
9. The Fungi-Charlile MJ, Watkinson SC & Gooday GW, 2nd edition (Academic Press, Elsevier)
10. Fundamentals of the Fungi-Moore-Landeekeer E, 4th edition (Benjamin Cummings)
11. The Algae: A Review, Prescott GW, Otto Koeltz Science Publishers
12. Algae-An Introduction to Phycology-Hoek C, Mann D and Jahns HM, 1996 (Cambridge University Press)
13. Textbook of Algae- Sarabhai BP and Arora CK, 2002 (Anmol Publications Pvt. Ltd.)
14. Practical Microbiology by R. C. Dubey and D. K. Maheshwari. S. Chand & Co.

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M. Sc. (Microbiology) Semester-I

Paper III-Immunology

UNIT-I **10 lectures**

Structure, composition and types of cells and organs involved in immune system.
Innate and acquired immunity.
Types, structure and functions of MHC molecules, antigen processing and presentation
Humoral and cell mediated immune responses.
Immunization – Modern methods of vaccine production

UNIT-II **10 lectures**

Antigens – Structure, properties and types. Haptens and adjuvants.
Immunoglobulins- structure, heterogeneity, types and subtypes.
Physico-chemical and biological properties of immunoglobulins.
Theories of antibody production, generation of antibody diversity.
Complement – Structure, components, properties and functions of complement components,
Complement pathways and biological consequences of complement activation.

UNIT-III **10 lectures**

Antigen-Antibody interactions-
In vitro methods - Agglutination, Precipitation, Complement fixation.
Immunofluorescence, ELISA, Radioimmunoassays, Immuno blotting.
In vivo methods: Skin tests and their applications.
Hybridoma technology - Production and applications of monoclonal antibodies.

UNIT-IV **10 lectures**

Transplantation immunology-HLA and tissue transplantation, types of grafts, immunologic basis of graft rejection, clinical aspects of graft rejection, HLA typing methods for organ and tissue transplantations in humans
Tumor immunology- Cancer: origin and terminology, oncogenes, tumor antigens, immune response to tumors, tumor evasion of the immune system, immunodiagnosis of tumors.
Immunohaematology-blood group systems, medical importance of blood groups: ABO and Rh incompatibility

UNIT-V **10 lectures**

Type I IgE – Mediated Hypersensitivity,
Type II Antibody – Mediated Cytotoxic Hypersensitivity.
Type III Immune Complex – Mediated Hypersensitivity.
Type IV Delayed – Type Hypersensitivity.
Autoimmunity – mechanism and diseases.

REFERENCES

1. Essentials of Immunology-Roitt IM, 11th edition, (Blackwell Pub, USA)
2. Immunology- Klaus DE, 2nd edition (Wiley Blackwell)
3. Text Book on Principles of Bacteriology, Virology & Immunology, 9thedition-5 volumes (Topley & Wilson)
4. The Experimental Foundations of Modern Immunology-Clark WR, 4th edition (John Willey & Sons)
5. Fundamental Immunology- Paul WE, 7th edition (Lippincott Williams & Wilkins, USA)
6. Fundamentals of Immunology-Coleman RM, Lombord MF & Sicard RE, 2nd edition (WMC Brown, USA)
7. Immunology- Weir DM & Steward J, 8th edition (Churchill Livingstone)
8. Microbiology – A Practical Approach – Patel B and Phanse N, 1st edition (Print Care, Indore) Hand book of Handbook of Experimental Immunology-Weir DM, 4th edition (Blackwell Scientific Co.)
9. A Hand Book of Practical Immunology (1983) GP Talwar ,Vikas Publishing House, India.
10. Lecture Notes in Immunology- Reeves W G & Todd I, 2nd edition (Blackwell Scientific Publications Ltd., Oxford)

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M. Sc. (Microbiology) Semester-I

Paper IV- Microbial Biochemistry

10 lectures

UNIT-I

Carbohydrates-definition and classification of carbohydrates, stereoisomerism and optical isomerism of sugars.
Structure, properties and chemical reactions of monosaccharides
Structure, properties and functions of disaccharides oligosaccharides and polysaccharides.
Structure, occurrence and biological importance of carbohydrate derivatives-peptidoglycan, blood group lipopolysaccharides.

10 lectures

Unit-II

Definition and classification of lipids.
Building blocks of lipids- fatty acids, glycerol
Fatty acids: distribution in nature, classification, physico-chemical properties, separation, characterization
Saponification and iodine number.
Phospholipids-Structure, properties and functions.
Lipoproteins - classification, composition and their importance.
Sphingosine- Structure and function.
Role of lipids in cellular architecture and functions.

10 lectures

UNIT-III

Amino Acids : Structure, classification and properties. Handerson Hasselbach equation for ionization of amino acids.
Primary, secondary, tertiary and quaternary structures of proteins, structure of myoglobin and hemoglobin. Ramachandran Plot.
Chemical reactions of amino acids.
Lab synthesis of poly peptides.
Determination of amino acid sequence in proteins / polypeptides.

10 lectures

Unit-IV

Enzymes as biocatalysts- Enzyme classification.
Mechanism of enzyme action - specificity, active site, activity unit and isozymes.
Factors affecting enzyme efficiency, enzyme activators, coenzymes and cofactors.
Enzyme kinetics : Michaelis- Menton equation, Determination of kinetic parameters, multi-step reactions.
Enzyme inhibition- reversible, irreversible, competitive, noncompetitive and uncompetitive
Allostersim- kinetic analysis of allosteric enzymes, principles of allosteric regulation.

10 lectures

UNIT-V

Vitamins : Discovery of vitamins
Properties and functions of fat soluble vitamins-vitamins A, D, E and K.
Properties and functions water soluble vitamins-Pantothenic acid, niacin, pyridoxine, biotin, riboflavin, cyanocobalamine, folic acid and ascorbic acid.

REFERENCES

1. Lehniger-Principles of Biochemistry-Nelson DL & Cox MM, 4th edition (CBS Publishers, New Delhi)
2. Biochemistry- Berg JM, Tymoczko JL & Stryer L, 6th edition (W. H. Freeman)
3. Harper's Biochemistry- Rodwell VW, Bender D, Botham KM Kennelly PJ & Weil PA 30th edition (McGraw-Hill Education)
4. Principles of Biochemistry- Zubey GL, Parson WW & Vance DE, 1995 (McGraw-Hill Education)
5. Introduction to Protein Structure- Branden CI & Tooze J, 2nd edition (Garland Science)
6. An Introduction to Practical Biochemistry-Plummer DT, 3rd edition (McGraw-Hill Book Company)
7. Experiments in Biotechnology- Nighojkar S & Nighojkar A, 1st edition (Satprachar Press, Indore)

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M.Sc. (MICROBIOLOGY) - SEMESTER I

LAB COURSE I

Paper I-Bacteriology
Paper II-Virology Mycology and Phycology

Suggested List of Praeticals

1. General instrumentation
2. Preparation of media
3. Staining techniques: differential and structural staining methods
4. Isolation techniques
5. Determination of standard plate count
6. Preparation of McFarland scale
7. Study of bacterial growth-
   i. Factors affecting bacterial growth
   ii. Growth curve of bacteria, calculation of growth rate and generation time (Demonstration)
   iii. Diauxic growth pattern of bacteria (Demonstration)
8. Anaerobic cultivation -
   i. Anaerobic cultivation methods- GasPak anaerobic jar/Candle jar method
   ii. Isolation of *Clostridium* from soil and its identification
9. Microbiological study of actinomycetes-
   i. Isolation and characterization of actinomycetes
   ii. Cover slip culture study for study of morphological characters of actinomycetes
10. Study of bacterial virus
    i. Isolation of coliphage from sewage
    ii. Determination of phage titre
11. Study of fungi
    i. Isolation and identification of economically important fungi
    ii. Measurement of fungal growth by biomass (mycelial dry weight) method
12. Study of algae
    i. Isolation of algae from natural sources
    ii. Morphological studies of economically important algae (permanent slides)
    iii. Microscopic observation of lichen symbiosis (permanent slides)

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M.Sc. (MICROBIOLOGY) - SEMESTER I

LAB COURSE II

Paper III-Immunology
Paper IV-Microbial Biochemistry

Suggested List of Practicals

1. Differential leucocyte count for morphological characteristics of lymphocytes, neutrophils, monocytes, eosinophils and basophils.
2. Separation of lymphocytes from blood by Ficoll-Hypaque density gradient method
3. Preparation of antigens of *Salmonella typhi*
4. Diagnostic immunological methods-
   i. Flocculation reaction-serodiagnosis of syphilis by VDRL test (Qualitative & Quantitative)
   ii. Agglutination reaction-serodiagnosis of enteric fever by Widal test (Qualitative & Quantitative)
   iii. Latex agglutination for detection of C reactive protein /Rheumatoid factor etc.
5. Determination of ABO and Rh blood group type
6. Immunodifussion techniques-
   i. Radial Immuno Diffusion (RID)
   ii. Outerlony Double Diffusion technique (ODD)
   iii. Immunoelectrophoresis
7. Enzyme Linked Immuno Sorbent Assay (ELISA)
8. Preparation of buffers and volumetric solutions
9. Analysis of carbohydrates-
   i. Qualitative tests for carbohydrates
   ii. Quantitative estimation of carbohydrates
10. Analysis of proteins-
    i. Qualitative tests for proteins
    ii. Quantitative estimation of proteins
11. Analysis of lipids-
    i. Qualitative tests for lipids
    ii. Determination of saponification value of fat
12. Quantitative estimation of DNA by Diphenyl amine (DPA) method
13. Quantitative estimation of RNA by Orcinol method
14. Study of factors affecting enzyme activity
15. Determination of specific activity of enzymes
16. Study of enzyme kinetics
    i. Study the effect of substrate concentration on enzyme activity
    ii. Construction of Lineweaver Burk plot
    iii. Determination of V_{max} & K_M values

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