VANITA VISHRAM WOMEN'S UNIVERSITY

SCHOOL OF SCIENCES

DEPARTMENT OF MICROBIOLOGY

BACHELOR OF SCIENCE (B.Sc.) HONOURS MICROBIOLOGY PROGRAMME

under Learning Outcomes-based Curriculum Framework (LOCF) for Under Graduate (UG) Education

SEMESTERS 3

Core Courses (CC), Discipline Specific Elective (DSE), Skill Enhancement Course (SEC), Generic Elective Courses (GE), Ability Enhancement Compulsory Courses (AECC)

Syllabus applicable to the students seeking admission in the B.Sc.- Microbiology (Honours)

under LOCF

w.e.f. the Academic Year 2022-2023

5. Credit Structure of the Programme:

B.Sc. MICROBIOLOGY (HONOURS) STRUCTURE AND DISTRIBUTION OF COURSES						
Semester	**CC Total Credits (84)**	**DSE Total Credits (24)**	**GE Total Credits (24)**	**SEC Total Credits (08)**	**AECC Total Credits (08)**	**Total Credits**
1	MB11010 MB11020 MB11030 MB11040		MB31010 MB31020* (For non-Microbiology discipline)		EN12010 BT12010	**84+ 24+ 24+ 8 +8 = 148**
2	MB11050 MB11060 MB11070 MB11080		MB31030 MB31040* (For non-Microbiology discipline)		EN12020 BT12030	
3	MB11090 MB11100 MB11110 MB11120 MB11130 MB11140		MB31070 MB31080* (For non-Microbiology discipline)	MB14010 (MB14020)		
4	MB11150 MB11160 MB11170 MB11180 MB11190 MB11200		MB31090 MB31100* (For non-Microbiology discipline)	MB14030 (MB14040)		

5	MB11210 MB11220 MB11230 MB11240	MB12010 MB12020 OR MB12030 OR MB12040 MB12050 MB12060				
6	MB11250 MB11260 MB11270 MB11280	MB12070 MB12080 OR MB12090 OR MB12100 MB12110 MB12120				

- **1 Credit Theory = 1 hour; 1 Credit Practical = 2 hours**
- **CC- Core Course, GE- Generic Elective, DSE: Discipline Specific Elective, SEC- Skill Enhancement Course, AECC- Ability Enhancement Core Course**

6. Course Structure

Core Course	Discipline Specific Elective	General Elective	Skill Enhancement Course	Ability Enhancement Core Course
B.Sc. Microbiology (Honours) (SEMESTER-1)				
MB11010 Microbial World and Principles of Microbiology MB11020 Practical I MB11030 Prokaryotic Microbes (Archaea & Bacteria): Basics and Systematics MB11040 Practical II		MB31010 Microbial World and Microbial Diversity MB31020* (For non-Microbiology discipline)		EN12010 Communication Skills I BT12010 Environmental Studies
B.Sc. Microbiology (Honours) (SEMESTER-2)				
MB11050 Basic Biochemistry MB11060 Practical III MB11070 Microbial techniques & Instruments MB11080 Practical IV		MB31030 Bacteriology and Virology MB31040* (For non-Microbiology discipline)		EN12020 Communication Skills II BT12030 Environmental Studies
B.Sc. Microbiology (Honours) (SEMESTER-3)				
MB11090 Virology MB11100 Practical V MB11110 Mycology & Phycology MB11120 Practical VI MB11130 Cell and Molecular Biology MB11140 Practical VII		MB31070 Medical Microbiology and Immunology MB31080* (For non-Microbiology discipline)	MB14010 Biofertilizers and Biopesticides/ Microbial Diagnostics and Public Health (MB14020)	

B.Sc. Microbiology (Honours) (SEMESTER-4)				
MB11150 Microbial Genetics MB11160 Practical VIII MB11170 Microbial Physiology and Metabolism MB11180 Practical IX MB11190 Microbial Ecology and Environmental Microbiology MB11200 Practical X		MB31090 Microbes in sustainable Agriculture & Development MB31100* (For non-Microbiology discipline)	MB14030 Microbiological Analysis of Air and Water & Soil /Food Fermentation Technique (MB14040)	
B.Sc. Microbiology (Honours) (SEMESTER-5)				
MB11210 Industrial Microbiology MB11220 Practical XI MB11230 Medical and Veterinary Microbiology, and Immunology MB11240 Practical XII	MB12010 MB12020 OR MB12030 OR MB12040 MB12050 MB12060			
B.Sc. Microbiology (Honours) (SEMESTER-6)				
MB11250 Agriculture, Food and Dairy Microbiology MB11260 Practical XIII Recombinant MB11270 DNA Technology MB11280 Practical XIV	MB12070 MB12080 OR MB12090 OR MB12100 MB12110 MB12120			

B.Sc. Microbiology (Honours) (SEMESTER-3)

Core Courses

Course Objectives – Course Outcomes – Course Contents

MB11090 Virology		
Course Objectives: Course objectives are understanding Virus- structure, taxonomy, nomenclature and classification. Isolation, purification and cultivation of bacterial viruses, types of bacteriophages, viral transmission, replication cycle, study of some notable human and plant pathogenic viruses and role of virus in causation of cancer, concept of viroids, virusoids, satellite viruses and Prions. Lab course is structured with objectives of affirming study of animal, plant and bacterial viruses, isolation and enumeration of bacteriophages, cytopathic effects of viruses.		
Course learning outcomes: Students have- **Outcome 1**. Understood what are viruses and the chemical nature of viruses, different types of viruses infecting animals, plants and bacteria **Outcome 2**. Understanding the biology of bacteriophages. **Outcome 3**. Gained knowledge of a variety of plant viruses and animal viruses. **Outcome 4.** The ability to describe the role of viruses in the causation of cancer.		
THEORY COURSE **(4 Credits)**		
Unit-1	Virology: Discovery of viruses, nature and definition of viruses, general properties, concept of viroids, virusoids, satellite viruses and Prions. Theories of viral origin; Structure of Viruses. Viral taxonomy- Classification and nomenclature of different groups of viruses. Baltimore system of classification	**15 Lectures**
Unit-2	Isolation, purification and cultivation of bacterial viruses. Study of one step growth curve of bacterial viruses. Types of bacteriophages, lytic and lysogenic phages (lambda phage) concept of early and late proteins, regulation of transcription in lambda phage. T even, T odd, ϕX174 and M13 phages.	**15 Lectures**
Unit-3	Modes of viral transmission: Persistent, non- persistent, vertical and horizontal. Replication, Assembly, Maturation and Release of viruses. Salient features of viral nucleic acid and the presence of unusual bases. Study of Influenza and Hepatitis B virus, HIV, Polio virus, Rabies Virus, Hemorrhagic fever virus, Coronavirus. TMV, Cauliflower Mosaic Virus.	**15 Lectures**
Unit-4	Introduction to oncogenic viruses. Types of oncogenic DNA and RNA viruses: Concepts of oncogenes and proto-oncogenes. Antiviral compounds and their mode of action. Interferon and their mode of action; Viral vaccines; Introduction to use of viral vectors in cloning and expression.	**15 Lectures**
LAB. COURSE: MB11100 Practical V **(2 Credits)**		

1. Study of the structure of important animal viruses (influenza, adeno, vaccinia, rhabdo, corona, paramyxo, hepatitis and retroviruses) using electron micrographs.
2. Study of the structure of important plant viruses (tobacco mosaic virus, cucumber mosaic and alpha-alpha mosaic viruses etc) using electron micrographs.
3. Study of the structure of some important bacterial viruses using electron micrograph.
4. Isolation and enumeration of bacteriophages (PFU) from water/sewage samples using double agar layer technique.
5. One step growth curve of bacteriophage (Demonstration).
6. Study of cytopathic effects of viruses using photographs.

Reference Books

1. Pelczar M., Chan E.C.S. and Krieg, N.R. Microbiology. Tata Mcgraw Hill Publishing Co. Ltd., New Delhi.
2. Stainier R.V., Ingraham, J.L., Wheelis, M.L. and Painter P.R. The Microbial World. Prentice-Hall of India (Pvt.) Ltd., New Delhi
3. Christopher Burrell Colin Howard Frederick Murphy. Fenner and White's Medical Virology 5th Edition.Academic Press
4. Cowan M. K. and Talaro K. P. Microbiology-A systems Approach. McGraw Hill Higher Education. (2006)
5. R. Ananthanarayana, CK Jayaram Paniker. Ananthanarayan and Panikar's Textbook of Microbiology, Orient Longman
6. Madigan, T. M., & Martinko, J. M. Brock Biology of Microorganisms . Benjamin Cummings.

MB11110 Mycology & Phycology

Course Objectives: Course is designed with an objective of familiarizing structure and characteristics of fungi and algae, study of some of the important fungal genera, useful and harmful activity of fungi and their uses. Lab course is designed with the objective of study of mycological media, isolation from natural samples, cultivation and preservation of algae and fungi, study of some important fungi- pathogenic and non-pathogenic.

Course learning outcomes: By the completion of this course the student able to-

Outcome 1. Describe useful and harmful activities of fungi and algae.

Outcome 2. Identify commonly available fungi and algae and their characteristics.

Outcome 3. Discuss how fungi and algae are used as biofertilizers in agriculture and as biopesticides.

Outcome 4. Use of fungi using modern biotechnological approaches

THEORY COURSE
(4 Credits)

Unit-1	**Mycology**: Characteristics, classification and cellular & thallus organization of fungi. General features, structure, nutrition, reproduction of different fungi groups - Chytridiomycetes, Zygomycete, Ascomycetes, Basidiomycetes and concept of Deuteromycetes. Heterothallism and Para- sexuality.	**15 Lectures**

Unit-2	General features, taxonomic status and evolutionary significance, economic importance of: Mucor, Rhizopus, Aspergillus, Penicillium, Candida, Saccharomyces, Neurospora, Fusarium, Alternaria, Curvularia. General account and importance of lichen. Important plant diseases caused by fungi-symptoms, disease cycles and control (Late & Early blight, Black rust, Smut, Wilt and Red rot).	**15 Lectures**
Unit-3	Role of fungi in biotechnology, Application of fungi in food industry (Flavour & texture improvement, Fermentation- Alcohols, Organic acids, Enzymes, Mycoproteins, Baking); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides). Mushroom- types and structure.	**15 Lectures**
Unit-4	General characteristics, evolution, classification and reproduction of algae. Occurrence, thallus organization, algae cell ultrastructure, pigments, flagella, eye- spot food reserves and vegetative. General features, structure and reproduction and economic importance of *Chlamydomonas*, *Chlorella*, Diatoms, *Microcystis*, *Oscillatoria*, *Spirulina*, *Anabaena*, *Nostoc*, *Rivularia* and *Scytonema*. Mass cultivation of algae as a source of protein	**15 Lectures**

LAB. COURSE: MB11120 Practical VI
(2 Credits)

1. Study and preparation of Mycological media.
2. Isolation and identification of pathogenic and non-pathogenic fungi.
3. Study of the vegetative and reproductive structures of following genera through temporary and permanent slides: *Mucor*, *Saccharomyces*, *Penicillium*, *Agaricus* and *Alternaria*
4. Isolation of common algae from natural samples.
5. Cultivation and preservation of pure cultures of common algae and fungi

Reference Books

1. Alexopoulus, C.J., Mims, C.W. and Blackwell, M, Introductory Mycology. John Wiley, New York.
2. Mehrotra, R.S. and K.R.Aneja. An Introduction to Mycology. New Age International Press, New Delhi.
3. Bessey E.A. Morphology and Taxonomy of fungi. Vikas Publishing House Pvt. Ltd., New Delhi.
4. John Webster and R W S Weber. Introduction to Fungi. Cambridge University Press 2007.
5. V. S. S. Sambamurty. A Textbook of Algae. I.K. International Publishing House Pvt. Limited, 2010
6. H.D. Kumar and H.N. Singh.A Textbook on Algae (Macmillan international college edition)

MB11130 Cell and Molecular Biology

Course Objectives: Course is designed with an objective of imparting knowledge about Eukaryotic and Prokaryotic cell structure and organization, structure of DNA, DNA replication, Eukaryotic Cell Cycle, transcription and other molecular biology concepts. Lab course is designed with objectives of studying plant and animal cell structure, mitosis & meiosis.

Course learning outcomes: After completing this course student will be able to-

Outcome 1: Exhibit a knowledge base in genetics, cell and molecular biology, and anatomy and physiology.

Outcome 2: Revelation clear and concise communication of scientific data.

Outcome 3: Engage in the review of scientific literature in the areas of biomedical sciences critique and professionally present primary literature articles in the general biomedical sciences field.

THEORY COURSE

(4 Credits)

Unit-1	**Prokaryotic & Eukaryotic cell Structure & its nuclear material**: Cellular organization of Prokaryotic cell & Eukaryotic cell. Experimental evidence for nucleic acids genetic material. Structure of DNA; Models of DNA replication. Mechanism of DNA replication in prokaryotes. Superhelicity in DNA, linking number, topological properties, mechanism of action of topoisomerases. Plasmids: Concept, Properties, types and application	**15 Lectures**
Unit-2	**Cell cycle**: Eukaryotic Cell Cycle, Regulation of Cell cycle progression, Events of Mitotic Phase, Meiosis and Fertilization. Cell cycle and Programmed cell death-Control system, intracellular control of cell cycle events, extracellular control of cell growth and apoptosis. Growth phase in Bacteria. Concept of VBNC, their significance and methods of detection	**15 Lectures**
Unit-3	**Transcription**: Definition, difference from replication, promoter - concept and strength of promoter RNA Polymerase and the transcription unit. Transcription in Prokaryotes: RNA polymerases & their types, general Transcription factors	**15 Lectures**
Unit-4	**Translation**: Translational machinery, Charging of tRNA, aminoacyl tRNA synthetases. Mechanisms of initiation, elongation and termination of polypeptides in prokaryotes, Fidelity of translation, Inhibitors of protein synthesis in prokaryotes, regulation at initiation with examples from *lac* and *trp* operons. Post Translation modifications	**15 Lectures**

LAB. COURSE: MB11140 Practical VII

(2 Credits)

1. Study of plant and animal cell structure by microscopy.
2. Study of the structure of cell organelles through electron micrographs.
3. Cytochemical staining of DNA–Feulgen
4. Demonstration of the presence of mitochondria using vital stain Janus Green B
5. Study of polyploidy in Onion root tip by colchicine treatment.

6. Study of different stages of Mitosis (Demonstration).
7. Study of different stages of Meiosis (Demonstration)

Reference Books

1. Benjamin Lewin, Gene VII, Oxford University Press, (2000). B
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, Molecular biology of the Cell, 4th Edition. Garland publishing Inc. (2002).
3. Darnell, Lodish and Baltimore, Molecular Cell Biology, Scientific American Publishing Inc. (2000).
4. Watson. J.D, Baker. T.A, Bell. S.P, Gann. A. Levine .M. Losick. R, Molecular Biology of Gene, 5th Edition. The Benjamin Cummings Pub. Co. Inc. (2003).
5. Brown T.A. Gene Cloning and DNA analysis. 2nd Edition, ASM press. (2004).
6. Sandy Primrose. Principles of Gene Manipulation and Genomics. 7th Ed., Blackwell Publishers. (2006).
7. Glick BR and Pasternak JJ, Molecular Biotechnology, 2nd Ed.ASM press. (2003).
8. Gardner E J, Simmons M J and Snustad DP, Principles of genetics, 8th edition John Wiley & Sons, (2006).

David Baltimore and Harve Lodish. Molecular and Cell Biology. Macmilan learning. 2016