EKLAVYA UNIVERSITY
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School of Basic and Applied Sciences

Class				**M.Sc. (Microbiology)**
Semester/Year				**II Semester**
Subject & Subject Code				**Microbiology - MMBIO20S201**
Paper				**Bacteriology and Virology – 201**
Max. Marks				**30 (ETE) + 20 (IA) = 50**
Credit			**Total Credits**	
L	**T**	**P**	**3**	
3	0	0		

Course Objectives:

This course explores bacteriology- the study of bacteria that infect all types of living organisms on earth.This course explores Virology- the study of Viruses that infect all types of living organisms on earth.Study about benefical and harmful forms of life.

Course Outcome:

At the end of the course, learners will be able to:

1. Describe characteristics of bacterial cells, cell organelles, cell wall composition and various appendages like capsules, flagella or pili.
2. Differentiate a large number of common bacteria by their salient characteristics; classify bacteria into groups.
3. Describe the nutritional requirements of bacteria for growth; developed knowledge and understanding that besides common bacteria there are several other microbes which grow under extreme environments.
4. Perform basic laboratory experiments to study microorganisms; methods to preserve bacteria in the laboratory; calculate generation time of growing bacteria.
5. Understood what are viruses and the chemical nature of viruses, different types of viruses infecting animals, plants and bacteria (bacteriophages)
6. Understanding about the biology of bacteriophages.
7. Gained knowledge of a variety of plant viruses and animal viruses.

Student Learning Outcomes (SLO):

Students will:

1.Understand the architecture of viruses
2.Know the methods used in studying viruses
3.Discern the replication strategies of representative viruses from the seven Baltimore classes
4.Comprehend the intricate interaction between viruses and host cells.
5.Describe characteristics of bacterial cells, cell organelles, cell wall composition and various appendages like capsules, flagella or pili.
6.Differentiate a large number of common bacteria by their salient characteristics; classify bacteria into groups.
7.Describe the nutritional requirements of bacteria for growth; developed knowledge and understanding that besides common bacteria there are several other microbes which grow under extreme environments.
8.Perform basic laboratory experiments to study microorganisms; methods to preserve bacteria in the laboratory; calculate generation time of growing bacteria.

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Unit	Syllabus	Periods
UNIT - I	Identification of bacteria – cultural, biochemical and molecular basis for identification. Classification and salient features of bacteria according to Bergey's manual of determinative bacteriology. Components of Eubacteria - cell wall, cytoplasmic membrane, capsule, flagella, pili, nucleoid and other cytoplasmic inclusions. endospore, Bacterial transport system.	12
UNIT - II	Archaebacteria- Classification, Characteristic features and importance. Actinomycetes- Classification, Characteristic features and importance. Molicutes, Spirochetes, Chlamydia and Rickettsia. Recombination in bacteria- Conjugation,Transformation and Transduction.	12
UNIT - III	General morphology and ultra structure of viruses. Related viral agents: Viroids and Prions. Cultivation of viruses in embryonated eggs, experimental animals and Cell culture. Identification and Assay of viruses. Serological methods for Haemagglutination. Complement fixation, IFA, ELISA, RIA.	12
UNIT - IV	General idea of plant viruses, Animal viruses: classification and nomenclature. Life cycles of viruses: Herpes, adeno and SV 40, Picorna, orthomyxo, paramyxo and adenovirus. Oncoviruses, cell transformation.	12
UNIT - V	Bacteriophage: Classification morphology and ultrastructure with special reference to T- phages, X174, M 13 and Mu phage. One step growth curve, Lytic and lysogenic cycles of bacteriophages. Bacteriophages in applied microbiology and biotechnology.	12

REFERENCE BOOKS –

1. Prescott, M.J.,Harley,J.P.andKlein,D.A.Microbiology. 5th Edition WCB Mc Graw Hill, New York, (2002).
2. Tortora, G.J., Funke ,B.R. and Case, C.L. Microbiology : An Introduction. Pearson Education, Singapore, (2004).
3. Alcomo,I.E.FundamentalsofMicrobiology.VIEdition, JonesandBartlettPublishers.Sudbury.Massachusetts, (2001).
4. Black J.G.Microbiology-Principlesand Explorations.JohnWiley&SonsInc.NewYork, (2002).
5. Tom Besty,D.C Jim Koegh.Microbiology Demystified McGRAW-HILL.1. Pelczar M., Chan E.C.S. and Krieg, N.R. Microbiology. Tata Mc Grew Hill Publishing Co. Ltd., New Delhi.
2. Stainier R.V., Ingraham, J.L., Wheelis, M.L. and Painter P.R. The Microbial World. Printice-Hall of India (Pvt.) Ltd., New Delhi
3. Ellen Strauss, James Strauss.Viruses and Human Disease 2nd Edition. Academic Press
4. Christopher Burrell Colin Howard Frederick Murphy. Fenner and White's Medical Virology 5th Edition.Academic Press.
5. Bernard N. Fields.Fields Virology Lippincott Williams & Wilkins
6. S. Jane Flint. Principles of Virology.American Society for Microbiology.

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School of Basic and Applied Sciences

Class	**M.Sc. (Microbiology)**
Semester/Year	**II Semester**
Subject & Subject Code	**Microbiology - MMBIO20S202**
Paper	**Microbial Physiology – 202**
Max. Marks	**30 (ETE) + 20 (IA) = 50**

Credit			Total Credits
L	T	P	3
3	0	0	

Course Objectives:

1. To learn and understand the microbial diversity in the living world.
2. To know the various physical and chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.
3. To understand, learn and gain skills of isolation, culturing and maintenance of pure culture.
4. To know various Culture media and their applications.
5. To understand microbial metabolism starting from anabolism to catabolism.

Course Outcome:

At the end of the course, learners will be able to:

1. The student develops understanding of the laws of thermodynamics, concepts of entropy, enthalpy and free energy changes and their application to biological systems and various biochemical studies and reactions.
2. Conceptual knowledge of aerobic and anaerobic respiration and various intermediary mechanisms involved, oxidative phosphorylation.
3. Discuss the biosynthesis and the degradation pathways involved in the physiology of microbes.

Student Learning Outcomes (SLO):

Students will:

1. Describe how microorganisms are used as model systems to study basic biology, genetics, metabolism and ecology.
2. Explain why microorganisms are ubiquitous in nature; inhabiting a multitude of habitats and occupying a wide range of ecological habitats.
3. Demonstrate that microorganisms have an indispensable role in the environment, including elemental cycles, biodegradation, etc.

Unit	Syllabus	Periods
UNIT - I	Basic aspects of bioenergetics. First and second law of thermodynamics. Concept of free energy, ATP as a high energy compound. Electron transport (Dolin's electron transport system) and oxidative phosphorylation.	12
UNIT - II	Autotrophic and heterotrophic modes of nutrition. Nutritional requirements of different groups of microorganisms including keratinophilic, coprophilic and thermophilic microorganisms. Physiology and importance of specialized groups of microorganisms: psychrophilic, thermophilic, osmophilic, xerophilic, halophilic, acidophilic and barophiles microorganisms. Specific metabolic pathways for generation of hydrogen, methane and flourensence.	12

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Unit	Syllabus	Periods
UNIT - III	Microbial growth : Mathematical nature and expression of growth phase, growth curve of bacteria. Generation time. Measurement of growth : cell mass, cell number and cell constituents. Bacterial growth in batch and continuous cultures, chemostats and turbidostats, synchronous growth. culture of anaerobic bacteria.	12
UNIT - IV	Photosynthetic microorganisms: Purple bacteria, green bacteria and Cyanobacteria. A general account of bacrerial photosynthesis and photo metabolism. Basis of chemoautotrophy: sulphar, iron and hydrogen bacteria. Fermentation of carbohydrates. Modes of aerobic and anaerobic respiration. Fixation of molecular Nitrogen: nitrification and denitrification. Microbial leaching of minerals.	12
UNIT - V	Factors affecting growth of microorganisms. Mechanism of antibacterial action. Antibiotics and drugs affecting: cell wall, cell membrane, inhibition of DNA synthesis and protein synthesis. Drug resistance in bacteria. Radiation sensitivity.	12

REFERENCE BOOKS –

1. Stanier, Ingraham, Wheelis and Painter. The Microbial world. Mc Millan Educational Ltd., London.
2. Moat and Foster, Microbial Physiology. Wiley.
3. Umbreit. Essentials of Bacterial Physiology.
4. Skokatch. Bacterial Physiology and Metabolism.
5. Kushner, D.J. Microbial life in Extreme Environments. Academic Press.
6. Pawar. C.B. Cell Biology.
7. Sturart. Harris and Harris. The control of Antibiotic Resistance in Bacteria.
8. Franklin and Snow, Biochemistry of Antimicrobial Action. Chapman and Hall, New York.
9. Philipp. G. Mannual of Methods for General Bacteriology.
10. David T. Plummer. An Introduction to Practical Biochemistry.
11. Subba Rao, N.S. Soil Microorganisms and Plant Growth.
12. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.
13. Willey,Sherwood,Woolverton. Prescott,Harley, and Klein's Microbiology McGraw-Hill publication
14. Tortora,Funke,Case. Microbiology.Pearson Benjamin Cummings.
15. Jacquelyn G. black. Microbiology Principles and explorations. John Wiley and Sons, INC.
16. Madigan,Martinko, Bender,Buckley,Stahl.Brock Biology of Microorganisms. Pearson
17. Tom Besty,D.C Jim Koegh.Microbiology Demystified McGRAW-HILL.
18. J. R. Sokatch Bacterial Physiology and Metabolism.Academic Press
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School of Basic and Applied Sciences

Class				**M.Sc. (Microbiology)**
Semester/Year				**II Semester**
Subject & Subject Code				**Microbiology - MMBIO20S203**
Paper				**Immunology and Medical Microbiology – 203**
Max. Marks				**30 (ETE) + 20 (IA) = 50**
Credit			**Total Credits**	
L	**T**	**P**	**3**	
3	0	0		

Course Objectives:

The candidate will gain knowledge about immunity, organs of immunity and cells involved; Types of antigens and properties; immunoglobulin – types; MHC and its significance; hypersensitivity reactions.The candidate will gain hands-on knowledge and acquire adequate skill required to perform precipitation reactions and purify immunoglobulins and detect antigens via western blotting. The candidate will gain knowledge about the pathogenesis, identification, and treatment of bacterial, fungal and viral diseases.

Course Outcome:

At the end of the course, learners will be able to:

1. Conceptualized the protective role of the immune system of the host and developed an understanding of the basic components as well as the mechanisms underlying the immune system and its response to pathogenic microorganisms.
2. Conduct experiments for growing common bacteria in different microbiological media, antibiotic sensitivity determination and antigen antibody reaction (precipitation test in the agarose)
3. Define, describe and use the fundamental terms and concepts of modern microbiology as evidenced by the ability to present, discuss and answer questions about a scientific article in the field of microbiology.
4. Learn immune diagnostic tests and assays against pathogens.

Student Learning Outcomes (SLO):

Students will:

1. Compare and contrast innate and adaptive immunity.
2. Describe which cell types and organs present in the immune response.
3. Ilustrate various mechanisms that regulate immune responses and maintain tolerance.
4. Exemplify the adverse effect of immune system including Allergy, hypersensitivity and autoimmunity.
5. Apply basic techniques for identifying antigen-antibody interactions.
6. Use knowledge of the fundamental terms and concepts of microbiology.
8. Perform basic microbiological lab techniques.
9. Identify blood groups and types
10. Diagnose syphilis by performing TPHA test
11. Analyze the components of human sera by performing agarose and polyacrylamide gel electrophoresis

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Unit	Syllabus	Periods
UNIT - I	History of Immunology. Structures, composition and functions of cells and organs involved in immune system. Host parasite relationships: microbial infections, virulence and host resistance. Immune responses- innate and acquired immunity. Immunohematology: bloodgroups, blood transfusion and Rh incompatibilities.	12
UNIT - II	Antigens: structure, properties and types of antigens.Haptens and adjuvants. Vaccines and toxoids. Immunoglobulins: structure, properties and types of antibodies. Theories of antibody production. Antigen- antibody reactions: *In vitro* methods: agglutination, precipitation complement fixation, immunofluorescence. ELISA. RIA; *In vivo* methods: skin tests and immune complex tissue demonstration. Application of these methods in diagnosis of microbial diseases.	12
UNIT - III	Bacteriology: Important diseases caused by Corynebacterium, Pneunocci, Staphylococci, Neisseria, Clostridia, Enterobacteriaceae, Vibrio, Mycobacteria, Actinomycetes, Spirochetes, Rickettsia, Chlamydia and Oral microbiology.	12
UNIT - IV	Mycology and Virology: Host defenses against fungi and viruses. Important human diseases caused by fungi and viruses with special reference to their prevalence in local slum areas and cure. Clinical forms: Epidemiology, diagnosis and treatment of the mycoses.	12
UNIT - V	Sterilization and disinfection. Chemotherapy of bacterial and fungal diseases. Control of viral infection. Antibiotics, Vaccines and their use in diseases control and therapy.	12

REFERENCE BOOKS –

1. Ananthanarayan R and Paniker CKJ. Textbook of Microbiology. 7th Edition. University Press Publication. (2005).
2. Brooks GF, Carroll KC, Butel JS and Morse SA. Jawetz, Melnick and Adelberg's Medical Microbiology. 24th edition. McGraw Hill Publication. (2007).
3. Goering R, Dockrell H, Zuckerman M and Wakelin D. Mims Medical microbiology. 4th edition. Elsevier. (2007).
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5. Roitt I. Essential Immunology. 10th Ed. Blackwell Science.
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7. Ellen Strauss, James Strauss. Viruses and Human Disease 2nd Edition.Academic Press
8. Christopher Burrell Colin Howard Frederick Murphy.Fenner and White's Medical Virology 5th Edition.Academic Press
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10. Jawetz.Medical microbiology.Mc. Graw Hill
11. Kenneth, J. Ryan.Medical microbiology, Sherri's an introduction to infectious diseases.Mc. Graw Hill

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School of Basic and Applied Sciences

Class	**M.Sc. (Microbiology)**
Semester/Year	**II Semester**
Subject & Subject Code	**Microbiology - MMBIO20S204**
Paper	**Agricultural Microbiology – 204**
Max. Marks	**30 (ETE) + 20 (IA) = 50**

Credit			Total Credits
L	T	P	3
3	0	0	

Course Objectives:

1. To impart in-depth information on soil and agriculture.
2. To make the students understand the role of microbes in agriculture.
3. To give an overview on plant microbe interaction. To understand infection process and control measures.
4. To know the importance of biofertilizers and biopesticides.
5. To make the students to know about various techniques involved in biofertilizers and biopesticides production.

Course Outcome:

At the end of the course, learners will be able to:

1. Develop a clear understanding of the multifarious roles of microorganisms in soil, in association with plants and thus in the field of agriculture.
2. Develop basic concepts of causation of diseases in plants by the different types of microorganisms namely bacterial, fungal and viral.
3. Gain knowledge of important plant diseases, their etiology, salient characteristics and control measures.
4. Develop skills to analyze the diseased plant samples in the laboratory and are able to identify the salient features of the disease-causing microbe and the lesions produced on the plant part.

Student Learning Outcomes (SLO):

Students will:

1. Understand the role of microbes in the different cycles and their role in agriculture.
2. Understand biological nitrogen fixation in symbiotic and non symbiotic associations with plants.
3. Know the value, production, application and crop response of biofertilizers and biopesticides.
4. Have an indepth knowledge on biopesticides and their role in pest control.
5. Skilled on study of microbes in Biofertilizers and gain the knowledge on Isolation of Bacteria, Fungi, Algae and Actinomycetes from soil.

Unit	Syllabus	Periods
UNIT - I	Plant Pathology: Pathogenesis, factors affecting plant disease development, casual agents, disease cycle and etiology of important diseases of cereals crops (wheat, maize, paddy),oil seed crops (groundnut, soybean) and pulses (Arhar). Role of Enzymes and Toxins in plant diseases.	12

Unit	Syllabus	Periods
UNIT - II	Disease resistance in plants: Structural and chemical protection, absence of nutrients, common antigens. Defensive mechanisms: historical accumulation of nutrients and toxic substances. Synthesis of phenolic and non-phenolic substances.	12
UNIT - III	Plant disease control: Principles protection of crops against diseases, avoidance of pathogen and elimination of pathogen. Plant quarantine regulation in India. Physical methods of plant disease control, chemical control of plant diseases. Topical and systemic chemotherapy.	12
UNIT - IV	Biofertilizers and Biopesticides: Applications in agriculture. Mass production: Rhizobium and algal biofertilizers, phosphate solubilizing microorganisms. Biological Control: Principle and practice of biological control. Principle of organic farming, concept of integrated pest management and integrated agriculture management.	12
UNIT - V	Microbiology of stored products: Spoilage of cereal grains and oil seeds during storage.Methods of controlling storage losses in cereal grains and oil seeds. Problem of mycotoxins in agricultural commodities and their control. Microbiology of biogas production and organic manuring.	12

REFERENCE BOOKS –

1. Agrios,G.N.Plant pathology. Harcourt Asia Pvt.Ltd. (2000).
2. Buchanan.B.B.,Gruissem, W.and Jones,R.L Biochemistry and Molecular Biology of Plants. I.K. International Pvt.Ltd. (2000).
3. Mehrotra R S and Ashok Agrawal. Plant Pathology. Tata Mc Graw Hill ,6th reprint (2006).
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School of Basic and Applied Sciences

Class				**M.Sc. (Microbiology)**
Semester/Year				**II Semester**
Subject & Subject Code				**Practical Microbiology - MMBIO20S205**
Paper				**Paper- I and II, Practical- I Sitting**
Max. Marks				**30 (ETE) + 20 (IA) = 50**
L	**T**	**P**	**2**	
0	0	2		

PRACTICALS

1 Study of colonial characters of bacteria.

2 Differential staining of bacteria : Gram's staining and simple staining.

3 Bacterial identification based on biochemical characteristics: indole production test, MRVP test, citrate utilization, catalase test, to differentiate among members of enterobacteriaceae on the basis of sugar fermentation (TSIA), phosphate solubilization test.

4 Isolation of bacteriophages : plaque formation.

5 Drug sensitivity test study.

6 Determination of minimum inhibitory concentration (MIC) of an antibiotic.

7 Isolation of keratinophilic fungi from soil by keratin Bait technique.

8 Isolation of Rhizobium from soil/root nodules.

9 Determination of growth curve of bacteria.

10 Effect of temperature on bacterial growth.

11 Determination of thermal death point (TDP) and thermal death time (TDT) of an organism.

12 Germicidal effect of U.V. light on bacterial growth.

13 Effect of heavy metals or oligodymamic action of bacteria.

14 Filter paper disc method for enaluation of antiseptic.

15 Measurement of Fungal growth by colony diameter method.

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School of Basic and Applied Sciences

Class				**M.Sc. (Microbiology)**
Semester/Year				**II Semester**
Subject & Subject Code				**Practical Microbiology - MMBIO20S206**
Paper				**Paper- III and IV, Practical- II Sitting**
Max. Marks				**30 (ETE) + 20 (IA) = 50**
L	**T**	**P**	**2**	
0	0	2		

PRACTICALS

1 Study of the blood grouping Rh typing.

2 Heamocytometery : RBC/WBC/spore count.

3 Determine the bleeding time and clotting time.

4 Widal test for identification of Typhoid.

5 VDRL test for identification of syphilis.

6 Detection of specific antigen by using ELISA technique.

7 Study of immunological cells by smear preparation.

8 To study percentage of hemoglobin in given blood sample.

9 Identification of fungi.

10 Isolation of storage fungi by blotter technique.

11 Isolation of phosphate solubilising microorganisms form soil.

12 Isolation of fungal pathogens from soil/diseased plants.