

Shri Acharyaratna Deshbhooshan Shikshan Prasarak Mandal, Kolhapur

Mahavir Mahavidyalaya, Kolhapur **(Autonomous)**

Affiliated to Shivaji University, Kolhapur



Syllabus for Choice Based Credit System (NEP 1.0) **Bachelor of Science (B. Sc.) Programme**

Part	II	Course	Microbiology
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Under the Faculty of Science & Technology

(To be introduced from Academic Year 2024 – 25 onwards)

Subject to the revisions & modifications made from time to time

Mahavir Mahavidyalaya, Kolhapur (Autonomous)
Affiliated to Shivaji University, Kolhapur
 (New syllabus under Autonomy to be introduced from June, 2024 onwards)

Primary Information:			
Programme	Bachelor of Science (B. Sc.) NEP 1.0		
Part	II	Semester	III
Course	Microbiology	Course Code	DSC I5
Paper No.	V	Course Type	Semester
Total Marks	50 Marks	Implementation	2024 – 25
Total Credits	02	Contact Hours	02/ Week
Course Title	Microbial Physiology & Metabolism		

Course Objectives:	
i)	To understand growth phases and measurement of growth
ii)	To understand effect of environmental factors on microbial growth
iii)	To understand catabolism of glucose
iv)	To understand basic concept of fermentation

Course Syllabus (CR = Credits / IH: Instructional Hours)		
Modules	CR	IH
Module I : Microbial Physiology	01	15
A) Growth : Growth phases, measurement of growth, continuous growth, synchronous growth and diauxic growth B) Microorganisms at extreme environment and their strategies- i) Temperature ii) pH ii) Osmotic pressure iv) Heavy metals v) Radiations C) Transport across cell membrane – Diffusion, active transport and group translocation		
Module II : Microbial Metabolism	01	15
A) Catabolism of glucose - EMP,HMP, ED and TCA cycle B) Fermentation – Homolactic & Heterolactic fermentation C) Bacterial electron transport chain – Components, flow of electrons & mechanism of ATP generation - Chemiosmotic hypothesis		

Course Outcomes:
On completion of the course, students will be able to :
Know the growth phases and measurement of growth
Understand effect of environmental factors on microbial growth
Understand catabolism of glucose
Understand the basics of fermentation

Primary Information:			
Programme	Bachelor of Science (B. Sc.) NEP 1.0		
Part	II	Semester	III
Course	Microbiology	Course Code	DSC I6
Paper No.	VI	Course Type	Semester
Total Marks	50 Marks	Implementation	2024 – 25
Total Credits	02	Contact Hours	02 / Week
Course Title	Microbial Genetics & Molecular Biology		

Course Objectives:	
i)	To understand forms of DNA and detail structure of DNA
ii)	To understand basic concept of mutation
iii)	To understand types of mutations
iv)	To understand modes of gene transfer

Course Syllabus (CR = Credits / IH: Instructional Hours)		
Modules	CR	IH
Module I : Basics of Genetics	01	15
A) Basic concepts - a) Forms of DNA b) Gene, genome, genotype, phenotype, mutagen, recon, muton, cistron c) Split genes. d) Genetic code – definition and properties of genetic code. B) Mutation - a) Basic Concepts of Mutation: Base pair substitutions, Frame shift, Missense, nonsense, neutral, silent, pleiotropic and suppressor mutations. b) Spontaneous mutation – Definition and basic concept. c) Induced mutations – Definition, Mechanism of mutagenesis by- i) Base analogues : 5-Bromouracil and 2-aminopurines ii) Mutagens modifying nitrogen bases- a) Nitrous acid b) Hydroxylamine c) Alkylating agents iii) Mutagens that distort DNA – a) Acridine dyes b) UV light C) DNA repair : i) Photoreactivation ii) Dark repair mechanism (Excision repair)		
Module II : Microbial Genetics	01	15
A) Gene transfer in bacteria. a) Fate of exogenote in recipient cell.		

b) Modes of gene transfer - Transformation, Conjugation, Transduction		
B) Plasmids –		
a) Natural – Properties, types, structure and applications		
b) Artificial – pBR 322- structure and applications		
D) Lac operon – structure and working		

Course Outcomes:
On completion of the course, students will be able to :
Understand forms of DNA and detail structure of DNA
Understand basic concept of mutation
Understand types of mutations
Understand modes of gene transfer by transformation, conjugation and transduction.

Primary Information:			
Programme	Bachelor of Science (B. Sc.) NEP 1.0		
Part	II	Semester	IV
Course	Microbiology	Course Code	DSC I7
Paper No.	VII	Course Type	Semester
Total Marks	50 Marks	Implementation	2024 – 25
Total Credits	02	Contact Hours	02/ Week
Course Title	Applied Microbiology		

Course Objectives:	
i)	To understand sources of microorganisms in air
ii)	To understand the routine bacteriological analysis of water
iii)	To understand contamination of milk and examination of milk
iv)	To understand fermentation and types of fermentation

Course Syllabus (CR = Credits / IH: Instructional Hours)		
Modules	CR	IH
Module I: Applied Microbiology		
A) Air Microbiology: a) Sources of microorganisms in air. b) Definitions of - Infectious dust, Droplets & Droplet nuclei c) Sampling methods for microbial examination of air i) Solid impaction - Sieve device ii) Liquid Impingement – Bead-bubbler device B) Microbiology for potable water : a) Sources of microorganisms in water. b) Fecal pollution of water, Indictors of fecal pollution of water – <i>E. coli</i> c) Routine Bacteriological analysis of water. 1) SPC & 2) Tests for coliforms - i. Qualitative-Detection of coliforms - Presumptive test, Confirmed Test, Completed test. Differentiation between Coliforms - IMViC test, Eijkman test. ii. Quantitative – MPN, Membrane filter technique d) Municipal water purification process and its significance. C) Milk Microbiology: a) Sources of microorganisms in milk b) General composition of Milk. c) Microbiological examination of Milk – DMC, SPC and dye reduction test- MBRT test d) Pasteurization - Definition, Methods – LTH , HTST ,UHT, Determination of efficiency of Pasteurization– Phosphatase test (Qualitative)	01	15

Module II: Industrial Microbiology		
A) Basic concepts of fermentation. 1. Definition, concept of primary and secondary metabolites 2. Types of fermentations – Batch, continuous, dual and multiple 3. Typical Fermentor design – Parts and their functions. 4. Factors affecting fermentation process B) Screening - Primary and secondary screening C) Fermentation Media - Water, carbon source, nitrogen source, Precursors, growth factors, antifoam agents & chelating agents.	01	15

Course Outcomes:
On completion of the course, students will be able to :
Understand sources of microorganisms in air
Understand the source of microorganisms in water and routine bacteriological analysis of water
Understand contamination of milk and examination of milk
Understand fermentation and types of fermentation

Primary Information:			
Programme	Bachelor of Science (B. Sc.) NEP 1.0		
Part	II	Semester	IV
Course	Microbiology	Course Code	DSC I8
Paper No.	VIII	Course Type	Semester
Total Marks	50 Marks	Implementation	2024 – 25
Total Credits	02	Contact Hours	02/ Week
Course Title	Basics in Medical Microbiology & Immunology		

Course Objectives:	
i)	To understand the basic terms and concept of medical microbiology
ii)	To understand types of diseases and mode of transmission of diseases
iii)	To understand basic concept of immunology
iv)	To understand theories antibody production and antigen-antibody reaction

Course Syllabus (CR = Credits / IH: Instructional Hours)		
Modules	CR	IH
Module I: Basics in Medical Microbiology		
A) Definitions – Host, Parasite, Saprophytes, Commensal, Infection, Etiological agent, Disease, Pathogen, Opportunistic pathogen, True pathogen, Virulence, Pathogenicity, Fomite, Incubation period, Carriers, Morbidity rate, Mortality rate, Epidemiology, Etiology, Prophylaxis, Antigen, Antibody, Hapten, Vaccine, Immunity. B) Virulence factors (production of endotoxins, exotoxins, enzymes, escaping of phagocytosis) C) Types of diseases – i) Epidemic ii) Endemic iii) Pandemic iv) Sporadic. D) Types of infections – Chronic, acute, primary, secondary, Reinfection, Iatrogenic, congenital, local, generalized, Covert, Overt, Simple, Mixed, Endogenous, Exogenous, Latent, Pyogenic, Nosocomial. E) Modes of transmission of diseases - 1. Transmission by air, water & food 2. Contact transmission 3. Vector borne transmission F) General principles of prevention and control of microbial diseases. G) Normal flora of human body & its significance	01	15
Module II: Basics in Immunology		
A) Immunity	01	15

i) Definition ii) Innate Immunity- types, factors influencing innate immunity iii) Acquired Immunity – Active & passive B) Non Specific defense mechanisms of the vertebrate body i) First line of defense ii) Second line of defense C) Antigen: Chemical nature, types of antigens, factors affecting antigenicity. D) Antibody: Types of antibodies – Structure, properties and functions. E) Theories of antibody production. F) Immune Response: Primary and secondary immune responses. G) Mechanism of antigen – antibody reaction- Lattice hypothesis H) Types of antigen-antibody reaction-Precipitation and Agglutination		
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Course Outcomes:
On completion of the course, students will be able to :
Understand the basic terms in medical microbiology
Understand types of diseases and mode of transmission of diseases
Understand basic concept of immunology
Understand theories antibody production and antigen-antibody reaction

Practical Course Semester III

Course Objectives:

This course is designed to demonstrate practical skills in the use of tools and techniques commonly used in microbiology.

1) Micrometry 2) Stains and staining procedures : i) Flagella staining (Bailey's method) ii) Nucleus staining (Giemsa's method) using yeast cells. 3) Preparation of media : i) Gelatin agar ii) Amino acid decarboxylation medium iii) Amino acid deamination medium iv) Arginine broth v) Christensen's medium vi) Peptone nitrate broth vii) Hugh and Leifson's medium	Cr 02	30 Hr
4) Biochemical tests : i) Gelatin hydrolysis test. ii) Amino acid decarboxylation test iii) Amino acid deamination test iv) Urea hydrolysis test v) Nitrate reduction test vi) Huge and Leifson's test vii) Arginin hydrolysis viii) Oxidase test 2) Effect of environmental factor on microorganisms : i) Temperature ii) pH iii) Heavy metals – Copper iv) Antibiotic – Penicillin/Streptomycin v) Salt – NaCl 3) Determination of growth phases of <i>E. coli</i> by Optical density		

Semester IV		
1) Bacteriological analysis of water a. Qualitative tests – Presumptive , confirm and completed test b. Quantitative - MPN 2) Primary Screening of - i. Antibiotic producers – crowded plate technique ii. Organic acid producer 3) MBRT test.		
4) Isolation of lac negative mutants of <i>E.coli</i> by visual detection method 5) Effect of U.V. light on growth of bacteria 6) Isolation and identification of pathogenic microorganisms from clinical sample. i) <i>Salmonella</i> species ii) <i>Proteus</i> species 7) Determination of Blood groups – ABO and Rh. 8) Serological tests - Widal test – qualitative slide test		

Course Outcomes:
Students will be understood flagella and nucleus staining.
Students will be able to prepare culture media and know its use.
Students will be able to perform various biochemical tests.
Students will understand the various effect of environmental factors on microbial growth
Students will be able to isolate and identify the pathogens
Students will be able to perform serological tests.

Reference Materials -	
Text Books for Reading	
1.	Microbiology – Pelczar, Reid and Chan
2.	Industrial microbiology – Prescott and Dunn
3.	General Microbiology – R. Y. Stainer
4.	Industrial microbiology – Casida, E.
5.	General Microbiology – Vol. I and Vol. II – Pawar and Diganawala
6.	Text book of Microbiology – Ananthnarayan
Books for Reference	
1.	Introduction to Microbial technique – Gunasekaran.
2.	Outlines of Biochemistry – Cohn and Stumph
3.	Foundation in Microbiology – by Kathleen Park talaro, Arther Talaro.
4.	Introduction to Microbiology – John I. Ingraham, Catherine A. Ingraham A. Ingraham A.

5.	Ingraham, Ronald M; Second edition.
6.	Zinsser's Microbiology – by Wolfgang K. Joklik, (1995) Mc Graw-Hill Co.
7.	Microbial Genetics – by Stanley R. Maloy, David Freifelder and John E. Cronan.
Books for Practical	
1.	Manual of Diagnostic Microbiology – Wadher and Boosreddy.
2.	Diagnostic Microbiology – Fingold.
3.	Introduction to Microbial technique – Gunasekaran.
4.	Biochemical methods – Sadashivam and Manickam.
5.	Basic and Practical Microbiology – Atlas.
6.	Bacteriological techniques F. J. Baker.
7.	Laboratory Fundamentals of Microbiology – Alcamo, I. E.
8.	Clinical Microbiology – Ramnik Sood.

Suggested methods of Teaching:	
i)	Offline Traditional Board Teaching
ii)	Power Point Presentation
iii)	Online Teaching on platform of Zoom or Google Meet

Scheme of Course Evaluation		
1.	End Semester Examination (ESE)	40
2.	Continuous Internal Evaluation (CIE)	10
3.	Total Marks	50

Suggested techniques for Continuous Internal Evaluation (10 Marks)	
1.	Seminar
2.	Field Report
3.	Assignments
4.	Open book test
5.	Offline / online MCQ test
6.	Diagram test
7.	Visit/Tour report
8.	Surprise test

Question Paper Pattern (40 Marks) Theory Exam		
Q. No.	Nature / Type of Question	Marks
1.	Multiple Choice Questions (MCQ) 6 Questions	6 Marks (1 Marks for each question)
2.	Write answers in short 5 Questions	10Marks (2 Marks for each question)
3.	Write Short Notes Attempt any 3 out of 5 questions	12Marks (4 Marks for each question)
4.	Write descriptive question Attempt any 1 out of 2 questions	6 Marks
5.	Write descriptive question Attempt any 1 out of 2 questions	6 Marks
6.	Total Marks	40