

SHIVAJI UNIVERSITY, KOLHAPUR.



Revised Syllabus for

B. Sc. Part – II (MICROBIOLOGY)

(CBCS Pattern)

To be implemented from June, 2019

B.Sc. Part II (Microbiology)

SEMESTER-III

Paper V	DSC- C 25 Microbial Physiology & Metabolism (CREDITS:02; TOTAL HOURS : 30)	No. of Hours per Unit / Credit
Unit I / Credit I	Microbial Physiology & Metabolism	15
	<p>A) Growth : Growth phases, measurement of growth, continuous growth, synchronous growth and diauxic growth</p> <p>B) Effect of environmental factors on microbial growth :</p> <p style="padding-left: 20px;">i. Temperature : Mesophiles, psychrophiles, thermophiles and hyperthermophiles. Thermal destruction of bacteria – D, F and Z values, TDP and TDT</p> <p style="padding-left: 20px;">ii. pH: Neutrophiles, Acidophiles and Alkalophiles</p> <p style="padding-left: 20px;">iii. Osmotic pressure -Isotonic, hypotonic and hypertonic environments, xerophiles and halophiles.</p> <p style="padding-left: 20px;">iv. Heavy metals</p> <p>C) Transport across cell membrane - Diffusion, passive diffusion, facilitated diffusion and active transport and group translocation</p>	
Unit II / Credit II	Microbial Metabolism	15
	<p>A) Catabolism of glucose - EMP, HMP, ED, Pentose phosphate pathway and TCA cycle</p> <p>B) Fermentation - Homolactic & Heterolactic fermentation</p> <p>C) Electron Transport Chain in Bacteria – Components, flow of electrons & mechanism of ATP generation</p>	
Paper VI	DSC- C 26 : Applied Microbiology (CREDITS:02; TOTAL HOURS : 30)	No. of Hours per Unit / Credit
Unit I / Credit I	Applied Microbiology	15
	<p>A) Air Microbiology:</p> <p style="padding-left: 20px;">a) Sources of microorganisms in air.</p> <p style="padding-left: 20px;">b) Definitions of - Infectious dust, Droplets & Droplet nuclei</p> <p style="padding-left: 20px;">c) Sampling methods for microbial examination of air</p> <p style="padding-left: 40px;">i) Solid impaction - Sieve device</p> <p style="padding-left: 40px;">ii) Liquid Impingement – Bead-bubbler device</p>	

	<p>B) Water Microbiology:</p> <ul style="list-style-type: none"> a) Sources of microorganisms in water. b) Fecal pollution of water, Indictors of fecal pollution – <i>E. coli</i> c) Routine Bacteriological analysis of water. <ul style="list-style-type: none"> 1) SPC & 2) Tests for coliforms - <ul style="list-style-type: none"> 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. <p>C) Food and Milk Microbiology:</p> <ul style="list-style-type: none"> a) General principles of microbial spoilage of food b) Spoilage of fruits and milk. <ul style="list-style-type: none"> i) General principles of food preservation -Prevention of entry of microorganisms, Removal of microorganisms, Killing of microorganisms and inhibition of growth of microorganisms e) General composition of Milk. f) Microbiological examination of Milk – SPC and dye reduction test- MBRT test g) Pasteurization - Definition, Methods – LTH , HTST ,UHT, Efficiency of Pasteurization– Phosphatase test (Qualitative) 	
Unit II/ Credit II	Industrial Microbiology	15
	<p>A) Basic concepts of fermentation.</p> <ul style="list-style-type: none"> 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 <p>B) Screening and Fermentation Media</p> <ul style="list-style-type: none"> 1. Primary and secondary screening 2.Fermentation media - Water, carbon source, nitrogen source, precursors, growth factors , antifoam agents, chelating agents. 	

SEMESTER-IV

Paper VII	DSC- D 25 : Microbial Genetics & Molecular Biology (CREDITS:02; TOTAL HOURS : 30)	No. of Hours per Unit / Credit
Unit I / Credit I	Microbial Genetics	15
	<p>A) Basic concepts -</p> <ul style="list-style-type: none"> a) Forms of DNA b) Gene, genome, genotype, phenotype, mutagen, recon, muton , cistron c) Split genes. d) Lac operon - structure e) Genetic code – definition and properties of genetic code. <p>B) Mutation -</p> <ul style="list-style-type: none"> a) Basic Concepts of Mutation: Base pair substitutions, Frame shift , Missense , nonsense, neutral, silent , pleiotropic and suppressor mutations. b) Spontaneous mutation – Definition and basic concepts. c) Induced mutations – Definition , Mechanism of mutagenesis by- <ul style="list-style-type: none"> i. Base analogues : 5-Bromouracil and 2- aminopurines ii. Mutagens modifying nitrogen bases- <ul style="list-style-type: none"> a. Nitrous acid b. Hydroxylamine c. Alkylating agents iii. Mutagens that distort DNA - <ul style="list-style-type: none"> a. Acridine dyes b. UV light 	
Unit II / Credit II	Molecular Biology	15
	<p>A) 1. Genetic recombination in bacteria. 2. Fate of exogenote in recipient cell. 3. Modes of gene transfer - Transformation, Conjugation, Transduction</p> <p>B) 1. Plasmids – <ul style="list-style-type: none"> a. Natural – Properties, types , structure and applications b. Artificial – pBR 322- structure and applications </p> <p>2. DNA repair : i) Photoreactivation ii) Dark repair mechanism (Excision repair)</p>	
Paper VIII	DSC- D 26 : Basics in Medical Microbiology & Immunology (CREDITS:02; TOTAL HOURS : 30)	No. of Hours per Unit / Credit
Unit I / Credit I	Medical Microbiology	15
	a) Definitions – Host, Parasite, Saprophytes, Commensal, Infection, Etiological agent, Disease, Pathogen, Opportunistic pathogen, True	

	<p>pathogen, Virulence, Pathogenicity , Fomite, Incubation period, Carriers, Morbidity rate, Mortality rate, epidemiology, etiology, Prophylaxis, Antigen, Antibody, Hapten, Vaccine, Immunity.</p> <p>b) Virulence factors (production of endotoxins, exotoxins, enzymes, escaping of phagocytosis)</p> <p>c) Types of diseases – i) Epidemic, ii) Endemic, iii) Pandemic, iv) Sporadic.</p> <p>d) Types of infections – Chronic, acute, primary, secondary, reinfection, Iatrogenic, congenital, local, generalized, Covert, Overt, Simple, Mixed, Endogenous, Exogenous, Latent, Pyogenic, Nosocomial.</p> <p>e) Modes of transmission of diseases</p> <ol style="list-style-type: none"> 1. Transmission by air, water & food 2. Contact transmission 3. Vector borne transmission <p>f) General principles of prevention and control of microbial diseases.</p> <p>g) Normal flora of human body & its significance (flora of skin, throat, GI tract & Urogenital tract)</p>	
Unit II/ Credit II	Immunology	15
	<ol style="list-style-type: none"> 1. Immunity <ol style="list-style-type: none"> i) Defintion ii) Innate Immunity- types, factors influencing innate immunity iii)Acquired Immunity – Active & passive 2. Non Specific defense mechanisms of the vertebrate body <ol style="list-style-type: none"> i) First line of defense ii) Second line of defense 3. Antigen : Chemical nature, types of antigens, factors affecting antigenicity. 4. Antibody : Types of antibodies – Structure, properties and functions. 5. Theories of antibody production. 6. Immune Response : Primary and secondary immune responses. 7. Mechanism of antigen – antibody reaction 	

PRACTICAL COURSE

Paper V & VI	Practical Course III : Microbial Physiology & Metabolism ; Applied Microbiology (CREDITS:02; TOTAL HOURS : 30)	No. of Hours per Unit / Credit
Unit I / Credit I	Microbial Physiology & Metabolism	15
	<ol style="list-style-type: none"> 1. Micrometry. 2. Stains and staining procedures : <ol style="list-style-type: none"> i) Spore staining (Dorners method) ii) Flagella staining (Bailey’s method) iii) Nucleus staining (Giemsa’s method) using yeast cells. 3. Preparation of media : Tributyryn agar, Gelatin agar, Amino acid decarboxylation medium, Amino acid deamination medium, Arginine broth, Christensen’s medium, Peptone nitrate broth, Hugh and Leifson’s medium, Mannitol salt agar , Wilson and Blair’s medium, Tetrathionate broth. 4. Biochemical tests : <ol style="list-style-type: none"> i) Gelatin hydrolysis test. ii) Amino acid decarboxylation test iii) Amino acid deamination test iv) Arginine hydrolysis test v) Urea hydrolysis test vi) Nitrate reduction test vii) Huga and Leifson’s test viii) Oxidase test ix) Lipase detection test. 5. Effect of environmental factor on microorganisms : <ol style="list-style-type: none"> i) Temperature ii) pH iii) Heavy metals – Copper iv) Antibiotics – Penicillin v) Salt (NaCl) 	
Unit II / Credit II	Applied Microbiology	15
	<ol style="list-style-type: none"> 1. Bacteriological analysis of water <ol style="list-style-type: none"> a. Qualitative tests – Presumptive , confirm and completed test b. Quantitative - MPN 2. Primary Screening of - <ol style="list-style-type: none"> i. Antibiotic procedures – crowded plate technique ii. Amylase procedures 3. Determination of growth phases of <i>E. coli</i> by Optical density. 4. Study of diauxic growth 	

Paper VII & VIII	Practical Course IV : Microbial genetics & Molecular Biology ; Basics in Medical Microbiology & Immunology (CREDITS:02; TOTAL HOURS : 30)	No. of Hours per Unit / Credit
Unit I / Credit I	Microbial Genetics & Molecular Biology	15
	<ol style="list-style-type: none"> 1. Isolation of lac negative mutants of E.coli 2. Isolation of streptomycin mutants 3. Isolation of chromosomal DNA by J.Marmur's method 4. Study of UV survival curve 	
Unit II/ Credit II	Basics in Medical Microbiology & Immunology	15
	<ol style="list-style-type: none"> 1. Isolation and identification of pathogenic microorganisms from clinical sample. <ol style="list-style-type: none"> (a) <i>Salmonella species</i> (b) <i>S. aureus</i> 2. Determination of Blood groups – ABO and Rh. 3. Serological tests - Widal test – qualitative slide test 	

Practical Examination

- (A) The practical examination will be conducted on two consecutive days for six hours per day per batch of the practical examination.
- (B) Each candidate must produce a certificate from the Head of the Department in her/his college, stating that he/she has completed in a satisfactory manner the practical course on lines laid down from time to time by Academic Council on the recommendations of Board of Studies and that the journal has been properly maintained. Every candidate must have recorded his/her observations in the laboratory journal and have written a report on each exercise performed. Every journal is to be checked and signed periodically by a member of teaching staff and certified by the Head of the Department at the end of the year. Candidates must produce their journals at the time of practical examinations.
- (C) Candidates have to visit at least one place of microbiological interest (pharmaceutical / industry/dairy/research institute etc.) and submit the report of their visit

Nature of the Practical Examination Question Paper and Distribution Marks

	Marks
Q.1 Determination of lag phase / diauxic growth / staining	15
Q.2 Isolation and identification of pathogen from clinical sample	20
Q.3 Serology / blood groups	05
Q.4 Primary screening technique / isolation of lac negative mutant	10
Q.5 Biochemical tests	10
Q.6 Effect of environmental factors	10
Q.7 Spot tests (on culture media)	10
Q.9 Journal	10
Q.10 Tour report	10

Total marks – 100

Nature of Theory Question Paper and Distribution of Marks

Q.1 Objective type (The multiple choice – 8 questions)	10
Q.2 Attempt Any Two (A) Descriptive question (B) Descriptive question (C) Descriptive question	20
Q.3 Attempt Any 4 out of 6 (Short Notes)	20

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Books Recommended for Theory Papers

1. Foundation in Microbiology – by Kathleen Park talaro, Arther Talaro.
2. Introduction to Microbiology – John I. Ingraham, Catherine A. Ingraham A. Ingraham A. Ingraham, Ronald M; Second edition.
3. Zinsser's Microbiology – by Wolfagang K. Joklik, (1995) Mc Graw-Hill Co.
4. Microbial Genetics – by Stanley R. Maloy, David Freifelder and John E. Cronan.
5. Molecular Genetics of Bacteria – by Larry Snyder, Wendy Champness.
6. Microbiology – Pelczar, Reid and Chan
7. Fundamentals of Microbiology – Frobisher et al.
8. Fundamental principles of Bacteriology – A. G. Salle.
9. Industrial microbiology – Prescott and Dunn
10. Industrial microbiology – Casida, E.
11. Industrial microbiology – Miller and Litsky
12. General Microbiology – R. Y. Stainer
13. Chemical Microbiology – A. H. Rose.
14. General Microbiology – Vol. I and Vol. II – Pawar and Diganawala
15. Text book of Microbiology – Ananthnarayan
16. Biochemistry – Lehninger.
17. Outlines of Biochemistry – Cohn and Stumph
18. A Text book of Microbiology – R. Dubey, D. K. Maneshwari, S. Chand Co. Ltd. Ramnagar New Delhi 110055

Books recommended for Practicals

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.
9. Medical Lab Technology – Mukharji Vol. II
10. Medical Lab Technology – Godkar
11. Medical Microbiology – Cruickshank et al. Vol. II.

List of the minimum equipments for B.Sc. II Microbiology Course

All the equipments required for B.Sc. Part I Microbiology course and following additional equipments.

1. Serological Waterbath ,U. V. Chamber , Micrometer slides - Four per batch