

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

B.Sc. Part-II

MICROBIOLOGY

THEORY; 60 hrs (75lectures)

Total Marks-100

SEMESTER III

Paper – III DSC- 1010C : Microbial Physiology , Metabolism and Applied Microbiology

Credit IV

Marks -100

Section I - (30hrs)

Section II - (30 hrs)

SEMESTER IV

Paper IV DSC- 1010D : Microbial Genetics, Molecular Biology , Basics in Medical Microbiology &

Immunology

Credit IV

Marks100

Section I - (30hrs)

Section II - (30 hrs)



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Marks100

Section I - (30hrs)

Section II - (30 hrs)



Programme Specific Outcomes

- Upon completion of B.Sc. Microbiology programme, student will be able to –
- Perform the basic techniques related to screening, isolation and cultivation of microorganism from various sources Understand microorganisms and their relationship with the environment
- Understand microorganisms and their relationship with the environment
- Conduct the basic research with this microorganism and perform the diagnostic procedures required in food, milk and pharmaceutical industries.
- Follow the aseptic techniques and conduct the process of sterilization as well as perform the techniques to control the microorganism
- Produce and analyze the microbial product at laboratory level



Structure of Course

Sr. No	Course code	Title of the course	Theory	Internal	Total Marks
Semester III					
1	DSC-1010C	Microbial Physiology , Metabolism and Applied Microbiology	80	20	100
2	SEC -SC	Microbiological analysis of air and water	50	-	50
3	AECC-ENV	Environmental Science			50
Semester IV					
4	DSC-1010D	Microbial Genetics, Molecular Biology , Basics in Medical Microbiology & Immunology	80	20	100
5	SEC- SD	Microbial diagnosis in health clinics	50	-	
6	AECC-ENV	Environmental Science			50
7	Practical Paper - III	Practical Course III	50	-	50
8	Practical Paper- IV	Practical Course IV	50	-	50



B.Sc. Part II Microbiology

SEMESTER-III

DSC- 1010C : Microbial Physiology , Metabolism and Applied Microbiology

(CREDITS:04; TOTAL HOURS : 60)

Expected Course Outcomes –

Upon successful completion of course, students are expected to be able to-

- Know the applications and limitations of different bioinformatics and statistical methods in biology.
- Apply their knowledge to control microbial load present in the air at various industrial work places as well as for preservation of food.
- Design and control bioreactor for maximizing the production.
- Explain various phases of growth in bacteria and various environmental factors affecting it.

Paper III	SECTION I	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> <ul style="list-style-type: none"> i) Temperature: - Mesophiles, psychrophiles, thermophiles and hyperthermophiles. Thermal destruction of bacteria – D, F and Z values, TDP and TDT ii) pH Neutrophiles, Acidophiles and Alkalophiles iii) Osmotic pressure – Isotonic, hypotonic and hypertonic environments, xerophiles and halophiles. iiii) Heavy metals iv) Radiations - U. V rays <p>C] Transport across cell membrane : Diffusion, active transport and group translocation.</p>	
Unit II/ Credit II	Microbial Metabolism	15
	<p>1] Catabolism of glucose – EMP, HMP, ED and TCA cycle.</p> <p>2] Fermentation: - Homolactic & Heterolactic fermentation</p> <p>3] Bacterial electron transport chain: Components, flow of electrons & mechanism of ATP generation – Chemiosmotic hypothesis.</p>	



Section II		
Unit III Credit III	Applied Microbiology, Biostatistics and Bioinformatics	15
	<p>A] Air Microbiology:</p> <p>a. Sources of microorganisms in air.</p> <p>b. Definitions of - i) Infectious dust, ii) Droplets, iii) Droplet nuclei</p> <p>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>d. Gnotobiology- Introduction</p> <p>B] Food Microbiology:</p> <p>a) General principles of microbial spoilage of food</p> <p>b) Spoilage of fruits, bread and meat.</p> <p>c) General principles and methods of food preservation.</p> <p style="padding-left: 40px;">i) Asepsis</p> <p style="padding-left: 40px;">ii) Removal of microorganisms - trimming, filtration, centrifugation.</p> <p style="padding-left: 40px;">iii) Dehydration methods.</p> <p style="padding-left: 40px;">iv) Use of heat – low temperature and high temperature.</p> <p style="padding-left: 40px;">v) Irradiation</p> <p style="padding-left: 40px;">vi) Anaerobiosis</p> <p>d) Use of Na-benzoate, NaCl, Vinegar, Sugar.</p> <p>C] Biostatistics:</p> <p style="padding-left: 40px;">i. Introduction</p> <p style="padding-left: 40px;">ii. Data presentation – Tables and Graphs (Line and Histogram)</p> <p style="padding-left: 40px;">iii. Central tendency: Mean, Median and Mode</p> <p style="padding-left: 40px;">iv. Applications.</p> <p>D] Bioinformatics : Introduction and applications.</p>	
Unit IV Credit IV	Industrial Microbiology	15
	<p>A . Basic concepts of fermentation.</p> <p>1. Definition, concept of primary and secondary metabolites.</p> <p>2. Types of fermentations – Batch, continuous, dual and multiple fermentation.</p> <p>3. Typical Fermentor design – Parts and their functions.</p> <p>4. Factors affecting fermentation process.</p> <p>B. Screening - Primary and secondary screening</p> <p>C. Fermentation media -</p> <p style="padding-left: 40px;">a. Water, carbon source, nitrogen source, precursors, growth factors, antifoam agents, chelating agents.</p> <p>D. Culture preservation</p>	



“Education for Knowledge, Science and Culture”

-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE (AUTONOMOUS), KOLHAPUR



B.Sc.Part-II CBCS

Syllabus

With effect from

June, 2019

Semester: IV Microbiology- Paper IV

MICROBIOLOGY-DSC – 1010 D

**MICROBIAL GENETICS, MOLECULAR BIOLOGY, BASICS IN
MEDICAL MICROBIOLOGY & IMMUNOLOGY**

Theory : 60 Hours (75 Lectures) Credits - 4



SEMESTER-IV

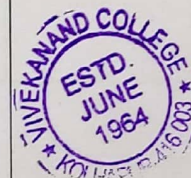
**DSC- 1010D : Microbial Genetics, Molecular Biology , Basics in Medical
Microbiology & Immunology
(CREDITS:04; TOTAL HOURS : 60)**

Expected Course Outcomes –

Upon successful completion of course, students are expected to be able to-

- Understand basic concepts of gene, mutation and recombination.
- Explain various terms used in medical microbiology, different modes of transmission, prevention and control of microbial diseases.
- Describe the types of cells and organs involved in immune system.
- Know various methods used in diagnosis of various diseases.

Paper IV	SECTION I	No. of Hour per Unit/Credit
Unit I/ Credit I	Microbial Genetics	15
	<p>A) Basic concepts-</p> <ol style="list-style-type: none"> 1. Forms of DNA. 2. Basic concepts – Gene, genome, genotype, phenotype, mutagen, recon, muton, cistron, split genes. 3. Genetic code – definition and properties of genetic code. 4. Organization of Chromosomal DNA in <i>E.coli</i>. <p>B) Mutation: -</p> <ol style="list-style-type: none"> 1. Basic Concepts of Mutation: Base pair substitutions, Frame shift , missense, nonsense, neutral, silent , pleiotropic and suppressor mutations. 2. Spontaneous mutation – Definition and basic concepts. 3. Induced mutations – Definition , Mechanism of mutagenesis by – <ol style="list-style-type: none"> 1. Base analogues : 5-Bromouracil and 2- amino purines 2. Mutagens modifying nitrogen bases- <ol style="list-style-type: none"> a. Nitrous acid b. Hydroxylamine c. alkylating agents 3. Mutagens that distort DNA – <ol style="list-style-type: none"> a) acridine dyes b) UV light 	
Unit II/ Credit II	Molecular Biology	15
	<p>A] 1. Gene transfer in bacteria.</p> <ol style="list-style-type: none"> 2. Fate of exogenote in recipient cell. 3. Modes of gene transfer – <ol style="list-style-type: none"> a. Transformation. b. Conjugation c. Transduction <p>B] 1. Plasmids –</p> <ol style="list-style-type: none"> a. Natural – Properties, types , structure & applications b. Artificial – pBR 322- structure and applications <p>2. DNA repair :</p> <ol style="list-style-type: none"> i) Photoreactivation ii) Dark repair mechanism (Excision repair) 	



SECTION II

Unit III/ Credit III	Medical Microbiology	15
	<p>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.</p> <p>b) Virulence factors (production of endotoxins, exotoxins, enzymes, escaping of phagocytosis)</p> <p>c) Types of diseases –</p> <p style="padding-left: 40px;">i) Epidemic ii) Endemic</p> <p style="padding-left: 40px;">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> <p style="padding-left: 80px;">1. Air-borne transmission,</p> <p style="padding-left: 80px;">2. Vehicle transmission</p> <p style="padding-left: 80px;">3. Contact transmission</p> <p style="padding-left: 80px;">4. Vector borne transmission</p> <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 & Urinogenital tract)</p>	
Unit IV/ Credit IV	Immunology	15
	<p>1. Immunity -i) Definition</p> <p style="padding-left: 40px;">ii) Innate Immunity- types, factors influencing innate immunity</p> <p style="padding-left: 40px;">iii) Acquired Immunity – Active & passive</p> <p>2. Non Specific defense mechanisms of the vertebrate body</p> <p style="padding-left: 40px;">i) First line of defense</p> <p style="padding-left: 40px;">ii) Second line of defense</p> <p>3. Antigen : Chemical nature, types of antigens, factors affecting antigenicity.</p> <p>4. Antibody : Types of antibodies – Structure, properties and functions.</p> <p>5. Theories of antibody production.</p> <p>6. Immune Response : Primary and secondary immune responses.</p> <p>7. Mechanism of antigen – antibody reaction – Lattice hypothesis.</p> <p>8. Types of antigen antibody reaction- Agglutination & Precipitation</p> <p>9. Organs of Immune system: Types of Primary and secondary lymphoid organs</p>	



SEC II	MICROBIAL DIAGNOSIS IN HEALTH CLINICS	No. of Hours per Unit/Credit
<p>Expected Course Outcomes – Upon successful completion of course, students are expected to be able to-</p> <ul style="list-style-type: none"> • Apply the knowledge of laboratory diagnosis of pathogen. • Understand different clinical sample collection techniques and its preservation. • Understand the importance of diagnosis of diseases • Understand Method of transport of clinical samples to laboratory and storage. 		
	<p>Unit 1 Importance of Diagnosis of Diseases Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis.</p> <p>Unit 2 Collection of Clinical Samples How to collect clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.</p> <p>Unit3 Microbial examination of clinical samples Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria Serological Methods-Agglutination ,ELISA, immune fluorescence.</p> <p>Unit4:Kits for Rapid Detection of Pathogens Typhoid, Dengue and HIV, Swine flu</p>	<p>30</p>

SUGGESTED READING

- Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
- Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology, 26th edition. McGraw Hill Publication
- Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd
- Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby
- Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier.



PRACTICAL COURSE

Paper III	Practical Course III : (CREDITS:02; TOTAL HOURS : 30)	No. of Hours per Unit/Credit
	<p>1. Micrometry.</p> <p>2. Stains and staining procedures : i) Spore staining (Dorner's method) ii) Flagella staining (Bailey's method) iii) Nucleus staining (Giemsa's method) using yeast cells.</p> <p>3. Preparation of media : Triple sugar iron agar, Blood agar, Gelatin agar, Amino acid decarboxylation medium, Amino acid deamination medium, Arginine broth, Christensen's medium, Peptone nitrate broth, Hugh and Leifson's medium, Egg-Yolk agar, Mannitol salt agar, Chromogenic coliform agar, Proline asparagine agar, Chloramphenicol Glucose Yeast Extract Agar</p> <p>4. Biochemical tests : (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) Hugh and Leifson's test (viii) Oxidase test (ix) Lipase detection test. (x) Coagulase test (xi) Lecithinase test</p>	30

Paper IV	Practical Course IV : (CREDITS:02; TOTAL HOURS : 30)	No. of Hours per Unit/Credit
	<p>1. Effect of environmental factor on microorganisms : (i) Temperature (ii) pH (iii) Heavy metals – Copper (iv) Antibiotics – Penicillin, Streptomycin (v) Salt (NaCl) (vi) U.V. light</p> <p>2. Primary Screening of - (i) Antibiotic producers – crowded plate technique. (ii) Amylase producers.</p> <p>3. Isolation and identification of pathogenic</p>	30



microorganisms from clinical sample.

(a) *Salmonella species* (b) *S. aureus*

(c) *Proteus species*

4. **Determination of Blood groups – ABO and Rh.**
5. **Determination of growth phases of *E.coli* by Optical density.**
6. **Study of diauxic growth**
7. **Serological tests - Widal test – qualitative slide test, RPR test, Dot ELISA - demonstration**
8. **Biostatistics – Measures of central tendency : Mean, Median and Mode**



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 / 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 Question Paper

- Instructions:** 1) All the questions are **compulsory**.
2) Figures to the right indicate **full** marks.
3) Draw neat labeled diagrams **wherever** necessary.
4) Use of calculator is allowed.

Time : 3 hours

Total Marks: 80

SECTION-I/ SECTION-II

Q.1. Select correct alternative.

(8)

- i) a) b) c) d)
ii) a) b) c) d)
iii) a) b) c) d)
iv) a) b) c) d)
v) a) b) c) d)
vi) a) b) c) d)
vii) a) b) c) d)
viii) a) b) c) d)

Q.2. Attempt any Two.

(16)

- i)
ii)
iii)

Q.3. Attempt any Four

(16)

- i)
ii)
iii)
iv)
v)

SECTION-II

Q.4. Select correct alternative.

(8)

- i) a) b) c) d)
ii) a) b) c) d)
iii) a) b) c) d)
iv) a) b) c) d)
v) a) b) c) d)



vi) a) b) c) d)

vii) a) b) c) d)

viii) a) b) c) d)

(16)

Q.5. Attempt any Two.

i)

ii)

iii)

(16)

Q.6. Attempt any Four

i)

ii)

iii)

iv)

v)



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.

