

“Education for Knowledge, Science and Culture”
-Shikshanmaharshi Dr.Bapuji Salunkhe
Shri Swami Vivekanand Shikshan Santha’s
VIVEKANAND COLLEGE (AUTONOMOUS), KOLHAPUR



Department of Microbiology

B.Sc.Part-II CBCS Syllabus with effect from June,2019

Semester: III

Microbiology- Paper –III

MICROBIOLOGY-DSC – 1010 C

Microbial Physiology and Metabolism

Theory : 72 Hours Credits -4

B.Sc. Part II Microbiology

SEMESTER-III

Course Outcome:

After completion of this course student will be able to-

CO1 : Describe mechanism of energy generation in bacteria.

CO2: Predict effect of various environmental factors on the growth of microorganism.

CO3: Explain various methods of food preservation.

Paper III	DSC- 1010C : Microbial Physiology and Metabolism (CREDITS:04; TOTAL HOURS : 72) Section I	No. of Hours per Unit/Credit
Unit I/ Credit I	Microbial Physiology & Metabolism	18
	<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 i) pH Neutrophiles, Acidophiles and Alkalophiles ii) Osmotic pressure – Isotonic, hypotonic and hypertonic environments, xerophiles and halophiles. iii) 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	18
	<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		18
	<p>A] Air Microbiology:</p> <ul style="list-style-type: none"> a. Sources of microorganisms in air. b. Definitions of - i) Infectious dust, ii) Droplets, iii) Droplet nuclei c. Sampling methods for microbial examination of air <ul style="list-style-type: none"> i) Solid impaction - Sieve device ii) Liquid Impingement – Bead-bubbler device d. Gnotobiology- Introduction, Concept, methods and applications <p>B] Food Microbiology:</p> <ul style="list-style-type: none"> a) General principles of microbial spoilage of food b) Spoilage of fruits, bread and meat. c) General principles and methods of food preservation. <ul style="list-style-type: none"> i) Asepsis ii) Removal of microorganisms - trimming, filtration, centrifugation. iii) Dehydration methods. iv) Use of heat – low temperature and high temperature. v) Irradiation vi) Anaerobiosis d) Use of Na-benzoate, NaCl, Vinegar, Sugar. <p>C] Biostatistics:</p> <ul style="list-style-type: none"> i. Introduction ii. Data presentation – Tables and Graphs (Line and Histogram) iii. Applications. <p>D] Bioinformatics : Introduction and applications.</p>	
Unit IV Credit IV	Industrial Microbiology	18
	<p>A . Basic concepts of fermentation.</p> <ol style="list-style-type: none"> 1. Definition, concept of primary and secondary metabolites. 2. Types of fermentations – <ul style="list-style-type: none"> a. Submerged, b. surface c. solid state 3. Typical Fermentor design – Parts and their functions. 4. Process of fermentation- Batch, continuous, dual and multiple fermentation 5. Factors affecting fermentation process 	

	<p>B. Screening - Primary and secondary screening</p> <p>C. Fermentation media -</p> <p>a. Water, carbon source, nitrogen source, precursors, growth factors, antifoam agents, chelating agents.</p>	
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B.Sc. Part II Microbiology

SEMESTER-IV

Course Outcome:

After completion of this course student will be able to-

CO1: Distinguish between various forms of DNA.

CO2: Explain the gene regulation.

CO3: Define various terminologies used in medical microbiology.

Paper IV	DSC- 1010D : Microbial Genetics and Medical Microbiology (CREDITS:04; TOTAL HOURS : 72) Section I	No. of Hours per Unit/Credit
Unit I/ Credit I	Microbial Genetics	18
	<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, decipheration and properties of genetic code. 4. Organization of Chromosomal DNA in <i>E.coli</i>. <p><u>B] Mutation:</u> -</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, fluctuation test. 3. Induced mutations – Definition , Mechanism of mutagenesis by – <ol style="list-style-type: none"> i. Base analogues : 5-Bromouracil and 2- aminopurines <ol style="list-style-type: none"> ii. Mutagens modifying nitrogen bases- a. Nitrous acid <ol style="list-style-type: none"> b. Hydroxylamine c. Alkylating agents iii. Mutagens that distort DNA - a. Acridine dyes <ol style="list-style-type: none"> b. UV light 	
Unit II/ Credit II	Molecular Biology	18
	<p>A] Gene transfer in bacteria;-</p> <ol style="list-style-type: none"> 1. Fate of exogenote in recipient cell. 2. Modes of gene transfer – <ol style="list-style-type: none"> I. Natural modes- <ol style="list-style-type: none"> a. Transformation. b. Conjugation 	

	<p>c. Transduction d. Cell fusion</p> <p>II. Artificial modes-</p> <p>a. Transfection</p> <p>B] 1. Plasmids – a. Discovery, Nomenclature, Properties, types, structure and applications of Plasmid. b. Example of Artificial plasmid – pBR 322- structure and applications</p> <p>2. DNA repair : i) Photoreactivation ii) Dark repair mechanism (Excision repair) iii) SOS repair mechanisms</p>	
<p>Unit III/ Credit III</p>	<p style="text-align: center;">Section II</p> <p style="text-align: center;">Medical Microbiology</p>	
	<p>a) Definitions – Host, Parasite, Commensal, Infection, Etiological agent, Disease, Pathogen, Opportunistic pathogen, True pathogen, Virulence, Pathogenicity, Fomite, Incubation period, Carriers, vectors, Morbidity rate, Mortality rate, epidemiology, etiology, Prophylaxis, Antigen, Immunogen, Antibody, Hapten, Vaccine, Immunity .</p> <p>b) Virulence factors (production of endotoxins, exotoxins, enzymes, escaping from 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. Air-borne transmission, 2. Food born transmission 3. Water born transmission 4. Contact transmission 5. 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>	<p style="text-align: center;">18</p>

Unit IV/ Credit IV	Immunology	18
	<ol style="list-style-type: none"> 1. Immunity <ol style="list-style-type: none"> i) Defintion -Immunogen,Antigen,Antibodies. 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 – Lattice hypothesis. 8.Types of antigen antibody reaction- Agglutination & Precipitation . 9. Organs of Immune system: Types of Primary and secondary lymphoid organs 	

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 :</p> <p style="padding-left: 20px;">i) Spore staining (Darner's method) ii) Flagella staining (Bailey's method)</p> <p style="padding-left: 20px;">iii) Nucleus staining (Giemsa's method) using yeast cells.</p> <p>3. Preparation of media :</p> <p>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. Tributyrin agar.</p> <p>4. Biochemical tests :</p> <p style="padding-left: 20px;">(i) Gelatin hydrolysis test.</p> <p style="padding-left: 20px;">(ii) Amino acid decarboxylation test</p> <p style="padding-left: 20px;">(iii) Amino acid deamination test</p> <p style="padding-left: 20px;">(iv) Arginine hydrolysis test</p> <p style="padding-left: 20px;">(v) Urea hydrolysis test</p> <p style="padding-left: 20px;">(vi) Nitrate reduction test</p> <p style="padding-left: 20px;">(vii) Hugh and Leifson's test</p> <p style="padding-left: 20px;">(viii) Oxidase test</p> <p style="padding-left: 20px;">(ix) Lipase detection test.</p> <p style="padding-left: 20px;">(x) Coagulase test</p> <p style="padding-left: 20px;">(xi) Lecithinase test</p>	30

Paper IV	(CREDITS:02; TOTAL HOURS : 30)	
	<p>1. Effect of environmental factor on microorganisms :</p> <p style="padding-left: 20px;">(i) Temperature</p> <p style="padding-left: 20px;">(ii) pH</p> <p style="padding-left: 20px;">(iii) Heavy metals – Copper</p> <p style="padding-left: 20px;">(iv) Salt (NaCl)</p>	30

	<p>2. Primary Screening of -</p> <p>(i) Antibiotic producers – crowded plate technique. (ii) Amylase producers.</p> <p>3. Isolation and identification of pathogenic microorganisms from clinical sample.</p> <p>(a) <i>Salmonella species</i> (b) <i>Proteus species</i></p> <p>4. Determination of Blood groups – ABO and Rh.</p> <p>5. Determination of growth phases of <i>E.coli</i> by absorbancy.</p> <p>6. Study of diauxic growth</p> <p>7. Serological tests - Widal test – qualitative slide test.</p> <p>8. Biostatistics – Measures of central tendency : Mean, Median and Mode</p> <p>9. Survival curve</p> <p>10. Isolation of Lac negative mutants of <i>E.coli</i></p>	
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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/micrometry	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 / Survival curve	10
Q.7 Spot tests (on culture media)	10
Q.9 Journal	10
Q.10 Tour report	10

Total marks – 100

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.

Vivekanand College (Autonomous), Kolhapur
B.Sc. (Part-II) (Sem. III) Examination, 2019
Microbiology
Sec -I

Day and Date: Thursday,
40

Total Marks:

Time: 2 hrs

Instructions: 1) All questions are compulsory
2) Figures to the right indicate full marks.
3) Draw neat labelled diagrams wherever necessary

Q.1 Rewrite the following sentences by selecting the correct answer from the given alternatives:

(Marks -08)

Q.2 Attempt any two

(Marks-16)

Q.3 Write short note on -

(Mark-16)