"Dissemination of Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur (Empowered Autonomous)

DEPARTMENT OF MICROBIOLOGY

SYLLABUS
(Draft)

B.Sc. Part-II

Semester- III & IV

Under NEP 2020 Phase -I
SYLLABUS TO BE IMPLEMENTED from June 2024

STRUCTURE OF COURSE

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-III										
1	DSC-V	DSC03MIC31	Applied Microbiology	2	-	40	10	-	50	2
2	DSC-VI	DSC03 MIC 32	Microbial Physiology	2	-	40	10	-	50	2
3	MIN-V	MIN03 MIC 31	Water and food Microbiology	2	-	40	10	-	50	2
4	MIN-VI	MIN03 MIC 32	Immunology	2	-	40	10	-	50	2
5	VSC-PR-II	VSC03 MIC 39	Analytical Microbiology	-	4	-	-	25	25	2
6	DSC-PR-III	DSC03 MIC 39	DSC-Microbiology Lab-3	-	8	-	-	50	50	4
7	MIN-PR-III	MIN03 MIC 39	MIN- Microbiology Lab-3	-	4	-	-	25	25	2
Semester –III Total				**8**	**16**	**160**	**40**	**100**	**300**	**16**
Semester-IV										
1	DSC-VII	DSC03MIC41	Medical Microbiology -I	2	-	40	10	-	50	2
2	DSC-VIII	DSC03 MIC 42	Microbial Genetics -I	2	-	40	10	-	50	2
3	MIN-VI	MIN03 MIC 41	Basic Biochemistry –II	2	-	40	10	-	50	2
4	MIN-VIII	MIN03 MIC 42	Introduction to Medical Microbiology.	2	-	40	10	-	50	2
5	VSC-PR-III	VSC03 MIC 49	Microbial analysis of air and water	-	4	-	-	25	25	2
6	DSC-PR-IV	DSC03 MIC 49	DSC-Microbiology Lab-4	-	8	-	-	50	50	4
7	MIN-PR-IV	MIN03 MIC 49	MIN-Microbiology Lab-4	-	4	-	-	25	25	2
Semester –IV Total				**8**	**16**	**160**	**40**	**100**	**300**	**16**

SEMESTER- III

Paper V	**DSC03MIC31 : Applied Microbiology - I**	**No. of Hours per Unit/ Credit**

Course Outcomes: Upon successful completion of course, students are expected to be able to

CO1: Determine potability of water

CO2: Explain role of microorganisms in food spoilage.

CO3: Understand principle and working of various instruments used in laboratory.

CO4: Understand and design sampling methods for microbial examination of air.

Unit I	Water Microbiology	**8**

A. Water Microbiology:

1. Sources of microorganisms in water.
2. Fecal pollution of water.
3. Indicators of fecal pollution
4. Routine Bacteriological analysis of water.
   a. SPC
   b. Tests for Coli forms
   i) Qualitative test
   Detection of coliforms –
   - Presumptive test,
   - Confirmed Test,
   - Completed test.

   Differentiation between coliforms –
   - IMViC test,
   - Eijkman test.

   ii) Quantitative test –
   - MPN
   - Membrane filter technique
5. Municipal water purification process and its significance.

Unit II	Food Microbiology	7
	A. Food Microbiology a) Principles of microbial spoilage of food b) Spoilage of fruits , breads and meat c) General principles and methods of food preservation i) Asepsis ii) Removal of microorganism – trimming , filtration , centrifugation iii)Dehydration method iv)Irradiation v) Anaerobiosis	
Unit III	Air Microbiology	7
	A]Air Microbiology: i)Sources of microorganisms in air. ii)Definitions of- a)Infectious dust, b) Droplets, c) Droplet nuclei iii)Sampling methods for microbial examination of air - a) Solid impaction-Sieve device b) Liquid Impingement–Bead-bubbler device iv)Gnotobiology Introduction	
Unit IV	Biostatistics and Bioinformatics	8
	B] Bioinstrumentation: Principle, working and application of- i)Electrophoresis(Agarosegel, PAGE) ii)UV–visible spectrophotometer.	

	C]Biostatistics: i)Introduction ii)Data presentation–Tables and Graphs(Line and histogram) iii)Central tendency :Mean, Median and Mode iv)Applications. D] Bioinformatics: i) Introduction of basic terminologies-Database, Genomicsand Proteomics. ii) Applications of bioinformatics	

Reference Book :

1. General Microbiology– Vol.I and Vol.II– Pawar and Daginawala
2. A Textbook of Microbiology–R.Dubey,D.K.ManeshwarS.ChandCo.Ltd.RamnagarNewDelhi110055
3. Fundamentals of Microbiology– Frobisher et al.
4. General Microbiology –R.Y.Stainer

Paper VI	DSC03 MIC 32 : Microbial Physiology	No. of Hoursper Unit/ Credit
Course Outcomes- Upon successful completion of course ,students are expected to be able to- CO1: Explain various phases of growth in bacteria and various environmental factors affecting it. CO2: Explain the microbial physiology, patterns of growth and various methods of bacterial growth measurement. CO3: Understand metabolic pathways & mode of energy generation. CO4: Understand nutrient uptake and transport across the cell membrane.		
Unit I	Microbial Growth	8
	A] Growth: i) Definition of growth ii) Phases of growth B] Measurement of growth i)Measurement of growth by cell number ii) Measurement of growth by cell mass C] Types of Growth i) Continuous growth ii) Synchronous growth iii) Diauxic growth D]Transport across cell membrane– i) Diffusion ii) Active transport iii) Group translocation	
Unit II	Effect of environmental factors on microbial growth	8
	A] Effect of environmental factors on microbial growth : i) Temperature:- a) Mesophiles, psychrophiles, thermophiles andhyperthermophiles. b) 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. iv) Heavymetals v)Radiations-U.V rays	
Unit III	Microbial Metabolism	8
	A] Basic concept of metabolism B] Catabolism of glucose – i) EMP pathway ii)HMP pathway iii) ED pathway iv) TCA cycle C] Fermentation:- i) Homolactic fermentation ii) Heterolactic fermentation	
Unit IV	Bacterial electron transport chain	6
	A] Oxidative phosphorylation B] Bacterial electron transport chain i) Components of ETC ii) Flow of electrons iii Mechanism of ATPgeneration - Chemiosmotic hypothesis	

ReferenceBooks:

1. General Microbiology– Vol.IandVol.II– Pawar and Daginawala
2. Biochemistry–Lehninger.
3. Outlines of Biochemistry– Cohn and Stumph
4. A Textbook of Microbiology–R.Dubey, D.K.Maneshwari, S.ChandCo.Ltd.RamnagarNewDelhi110055
5. Fundamentals of Microbiology– Frobisher et al.
6. IntroductiontoMicrobiology–JohnI.Ingraham,CatherineA.IngrahamA.IngrahamA.Ingraham,Ronald M;Second edition

SEMESTER-IV

Paper VII	**DSC03 MIC41 : Medical Microbiology -I**	**No. of Hours per Unit**
Course Outcomes: Upon successful completion of course, students are expected to be able to- CO1: Understand basic principles of medical microbiology& infectious disease. CO2: Explain various ways of prevention and control of microbial diseases. CO3: Understand the silent features of Ag-Ab reaction & its uses. CO4: Describe the types of organs involved in immune system.		
Unit I	Medical Microbiology	8
	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, ability to escape from phagocytosis. G]Normal flora of human body& its significance - i)flora of skin, throat, GI tract &Urinogenital tract. ii) Beneficial and harmful aspects of normal flora iii) Concept of antibiosis	
Unit II	Types of infection , Diseases and mode of Transmission	7
	A] Types of infections– Chronic, acute, primary ,secondary, reinfection, Iatrogenic, congenital, local, generalized, Covert, Overt, Simple, Mixed, Endogenous, Exogenous, Latent, Pyogenic, Nosocomial. B] Types of diseases– i)Epidemic–e.g. Influenza, Cholera ii)Endemic–E.g. Common cold, Typhoid iii)Pandemic–E.g. SARS ,Corona iv) Sporadic–E.g. Polio C] Modes of transmission of diseases - i)Air-borne transmission, ii)Vehicle transmission iii)Contact transmission	

	iv) Vector borne transmission F] General principles of prevention and control of microbial diseases.	
Unit III	Immunology	7
	A]Immunity i) Definition ii)Innate Immunity-types, factors influencing innate immunity iii)Acquired Immunity–Active & passive B] Non Specific defense mechanisms of the vertebratebody i) First line of defense ii) Second line of defense C] Organs of Immune system-Types of Primary and secondary lymphoid organs	
Unit IV	Antigen and Antibodies	8
	A] Antigen-Chemical nature, types of antigens, factorsaffecting antigenicity. B] Antibody-Structure , properties and functions, typesof antibodies. C] Theories of antibody production. D] Mechanism of antigen–antibody reaction–Latticehypothesis. E]Types of antigen antibody reaction-Agglutination &Precipitation. Immune Response: Primary and secondary immune responses	

ReferenceBooks:

1. Foundation in Microbiology–by Kathleen Parktalaro, Arther Talaro.
2. Zinsser's Microbiology–by Wolf aging K.Joklik,(1995)McGraw-Hill Co.
3. Microbiology–Pelczar, Reid and Chan
4. Fundamentals o fMicrobiology– Frobisheretal.
5. Fundamental principles of Bacteriology–A.G.Salle.
6. Textbook of Microbiology– Ananthnarayan

Paper VIII	DSC03 MIC 42 :Microbial Genetics -I	No. of Hours per Unit

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

CO1: Understand basic concepts of gene, mutation and DNA repair and recombination.

CO2: Describe the importance of genetic code &discuss molecular mechanism underlying mutation.

CO3: Understand & explain the various gene transfer mechanisms in bacteria.

CO4: Understand Natural and artificial plasmids

Unit I	Basic concepts of genetics	7
	A]Basic concepts of genetics– i)Basic terminologies–Gene,genome, genotype,phenotype, mutagen, recon, muton, cistron,split genes. ii)Forms of DNA iii)Genetic code–definition and properties of geneticcode. iv)Organization of Chromosomal DNA in *E.coli*.	
Unit II	Mutation	8
	A] Mutation:- i)Basic Concepts of Mutation: Base pair substitutions, Frame shift , missense, nonsense, neutral, silent, pleiotropic and suppressor mutations. ii)Spontaneous mutation–Definition and basic concepts. iii)Induced mutations– Definition and mechanism of mutagenesisby– a) Baseanalogues : • 5-Bromouraciland • 2- aminopurines b) Mutagens modifying nitrogen bases- Nitrous acid • Hydroxyl amine • Alkylating agents c)Mutagens that distort DNA– • acridine dyes • UV light	
Unit III	Gene transfer in bacteria	8
	A] Gene transfer in bacteria. i) Fate of exogenote in recipient cell.	

	ii)Modes of gene transfer– a) Transformation. b) Conjugation c) Transduction	
Unit IV	DNA Repair and plasmid	7
	A] DNA repair : i)Photo reactivation ii)Dark repair mechanism(Excision repair) B] Plasmids– i)Natural–Properties, types, structure&applications ii)Artificial -pBR 322- structure and applications	

Reference Book :

1.MicrobialGenetics–byStanleyR.Maloy,DavidFreifelderandJohnE.Cronan.

2.Molecular Genetics of Bacteria–by Larry Snyder, Wendy Champness.

3.General Microbiology –Vol.Iand Vol.II–Pawar and Diganawala

4. Biochemistry–Lehninger.

5.A Text book of Microbiology – R. Dubey, D. K. Maneshwari, S. Chand Co. Ltd. Ramnagar New Delhi 110055

SEMESTER-III

VSCII	**VSC 03 MIC 39 Analytical Microbiology**	No. of Hours per Unit
Course Outcomes: Upon successful completion of course, students are expected to be ableto- CO1: Prepare buffer solutions CO2: Use and explain principle and working of spectrophotometer and pH meter CO3: Estimate the various macromolecules likes DNA , RNA & carbohydrates in given sample CO4: Explain various analytical methods used for separations.		
	1.Preparation of Molar and Normal Solution of HCL and NaOH 2. Preparation of Phosphate buffer 3. Demonstration of analytical instruments- i. pH meter ii. Spectrophotometer. 4. Estimation of protein by Biuret method 5. Estimation of carbohydrates by Molish methods. 6. Estimation of RNA by Orcinol method 7. Estimation of DNA by diphenyl amine method 8. Estimation of amino acids by Ninhydrine method 9. Dry weight analysis of bacterial cell mass by indirect method 10. Paper chromatography method 11. Thin layer chromatography 12.Calibration of colorimeter (Verification of Beer's law) 13.Determination of absorption maxima . 14. Determination of Molar extinction coefficient .	30

SEMESTER-IV

VSC III	**VSC 03 MIC 49 Microbial analysis of air and water**	No. of Hours per Unit/Credit
Course Outcomes: Upon successful completion of course, students are expected to be ableto- CO1: Learn about applied microbiology techniques related to air & water microbiology CO2: Perform and demonstrate different methods used to determine the quality of water CO3: Learn about role of microbes in air & water CO4: Describe air monitoring methods		
	1. Enumeration of bacteria from water by SPC method.. 2. MPN of water 3.Enrichment of coliform from water by MacConkeys broth. 3.Presumptive test for coliform. 4. Total viable count of microorganisms present in water by membrane filter techniques 5. Total viable count of microorganisms present in air 6. Sterilization of air by fumigation . 7. Air sampling methods 8. Demonstration of presence of microflora in air by exposure of nutrient agar plates to the air. 9.Determination of dissolved oxygen concentration of water 10.Determination of residual free chlorine in water. 11.Detection of coliform in water by using biochemical test.(IMViC)	30

SEMESTER-III

DSC – PR- III	DSC 03 MIC 39 Microbiology Lab - 3	No. of Hours perUnit
	1. Effect of environmental factor on microorganisms: (i) Temperature (ii) pH (iii) Heavy metals – Copper (v) Salt (NaCl) 2. Primary Screening of- (i) Antibiotic producers–crowded plate technique. (ii) Amylase producers. 4. Determination f growth phases of *E.coli* by Optical density. 5. Study of diauxic growth 6. Biostatistics – Measures of central tendency : Mean, Median and Mode 7Micrometry. 8. Stains and staining procedures: i) Spore staining (Dorner's method) ii) Flagella staining (Bailey'smethod) iii) Nucleus staining (Giemsa's method) using yeast cells.	30

SEMESTER-IV

DSC –PR - III	**DSC 03 MIC 49 Microbiology Lab - 4**	**No. of Hours perUnit**
	1. Preparation of media: Tripal sugar iron 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. 2. 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) Lecithinase test (x) Coagulase test 3. Isolation and identification of pathogenic microorganisms from clinical sample. (a)*Salmonella species* (b)*S.aureus* (c)*Proteus species* 4. Determination of Blood groups –ABO and Rh. 5. Serological tests-Widal test–qualitative slide test .	30

Books recommended for Practicals:

1. Manual of Diagnostic Microbiology–Wadherand 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–Cruick Shanket al.Vol.II.

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

	Mark
Q.1 Primary screening technique / staining/ Isolation and identification of pathogen from clinical sample	20
Q.2 Determination of lag phase/Diauxic growth phase / Effect of environmental factors / Serology/blood groups / Biochemical tests	15
Q.3 Spots	05
Q.4 Journal	05
Q.5 Viva / Tour report	10

Total marks–50

EVALUATION PATTERN
Scheme of Marking: Theory

Sem.	Core Course	Marks	Evaluation	Answer Books	Standard of passing
III	DSC- 03 MIC31	40	Semester wise	As per Instruction	40% (16 marks)
III	DSC- 03 MIC32	40	Semester wise	As per Instruction	40% (16 marks)
IV	DSC- 03 MIC41	40	Semester wise	As per Instruction	40% (16 marks)
IV	DSC- 03 MIC42	40	Semester wise	As per Instruction	40% (16 marks)

SCHEME OF MARKING (CIE) Continuous Internal Evaluation

Sem.	Core Course	Marks	Evaluation	Answer Books	Standard of passing
III	DSC- 03 MIC31	10	Semester wise	As per Instruction	40% (4 marks)
	DSC- 03 MIC32	10	Semester wise	As per Instruction	40% (4 marks)
IV	DSC- 03 MIC41	10	Semester wise	As per Instruction	40% (4 marks)
	DSC- 03 MIC42	10	Semester wise	As per Instruction	40% (4 marks)

SCHEME OF MARKING (PRACTICAL)

Sem	Course Code	Marks	Evaluation	Sections	Standard of Passing
III and IV	DSC 03 MIC 39	**50**	Semester wise	As per Instruction	40%
	DSC 03 MIC 49	50			

***A separate passing is mandatory**

Question Paper Format:

Seat No.		Ques. paper code	

VIVEKANAND COLLEGE, KOLHAPUR

(EMPOWERED AUTONOMOUS)

B.Sc. Part- I (Microbiology) (Semester-I) Examination……..

Course Code and Name: DSC03MIC11: Analog Electronics-I

Day: Time: 2 hours

Date: --/--/---- Marks : 40

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 log table/calculator is allowed.

Q. 1. Select correct alternative (One mark each): [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 (Eight marks each): [16]

i)

ii)

iii)

Q.3. Attempt any FOUR (Four marks each): [16]

i)

ii)

iii)

iv)

v)

vi)

For Continuous Internal Examination: (20 marks)

Mandatory 1) Presently ------- **(5 marks)**

***Select any one for B. Sc. II-------(10 marks)**

1) Unit test
2) Home assignment
3) Project
4) Seminar

*Yet it is not finalized

Books Recommended for Theory Papers:

1. Foundation in Microbiology–by Kathleen Parktalaro,ArtherTalaro.
2. Introduction to Microbiology–JohnI.Ingraham, CatherineA.IngrahamA.IngrahamA.Ingraham, Ronald M; Second edition.
3. Zinsser's Microbiology–by WolfagangK. Joklik,(1995)McGraw-HillCo.
4. Microbial Genetics –byStanleyR.Maloy,DavidFreifelderandJohnE. Cronan.
5. Molecular Genetics of B acteria –by Larry Snyder, Wendy Champness.
6. Microbiology–Pelczar,Reid and Chan
7. Fundamentals of Microbiology–Frobisheretal.
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.Iand Vol.II–Pawar and Diganawala
15. Textbook of Microbiology – Ananthnarayan
16. Biochemistry–Lehninger.
17. Outlines of Biochemistry–Cohnand Stumph
18. A Text book of Microbiology – R. Dubey, D. K. Maneshwari, S. Chand Co. Ltd.Ramnagar New Delhi 110055

Books recommended for Practicals:

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13. Diagnostic Microbiology–Fingold.
14. Introduction to Microbial technique –Gunasekaran.
15. Biochemical methods–Sadashivam and Manickam.
16. Basic and Practical Microbiology–Atlas.
17. Bacteriological techniques F.J.Baker.
18. Laboratory Fundamentals of Microbiology–Alcamo,I.E.
19. Clinical Microbiology–Ramnik Sood.
20. Medical Lab Technology–Mukharji Vol.II
21. Medical Lab Technology–Godkar
22. Medical Microbiology–Cruick Shanket al.Vol.II.