JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)

"A"Road,Churchgate,Mumbai-400020,India.

Affiliated to
University of Mumbai

Program: B.Sc. Microbiology

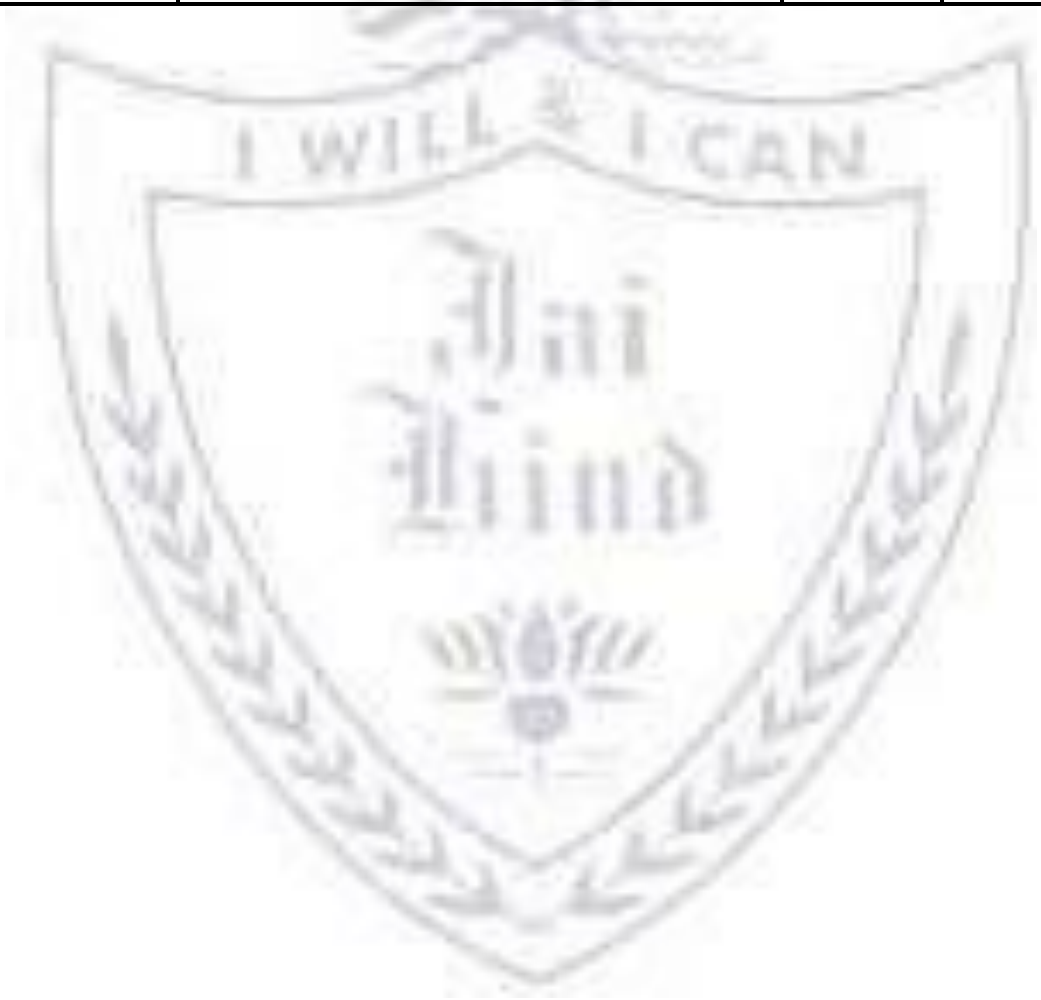
Course: Microbial Diversity

Semester II

Credit Based Semester and Grading System (CBSGS) with effect from the academic year 2021-2022

F.Y. B.Sc. Microbiology Syllabus

Semester II			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SMIC 201	Microbial Diversity	2	3



Semester II–Theory

Course Code: SMIC201	Course Title: MICROBIAL DIVERSITY Lectures/Week: 03	(45L)
Course Objectives	**1.** Open minds to the diversity of microbes in nature and to study their importance. **2.** Use various methods to study the growth of micro-organisms. **3.** Learn how various environmental factors affect the growth of organisms	
Course Outcome:	**1.** Explain general properties, structure and cultivation of Viruses. **2.** Illustrate the lytic cycle and lysogeny in bacteriophages. **3.** Discuss the general features and biological significance of Rickettsia, Coxiella, Chlamydia, Mycoplasma, archaebacteria an dcyanobacteria. **4.** Give an account of types of cellwall found in actinomycetes andstate their importance. **5.** Compare the different categories/groups/divisions of protozoa, algae and fungi. **6.** Differentiate between algae and cyanobacteria. **7.** Describe the biological and economic importance of algae and fungi. **8.** Compare and contrast between cellular and acellular slime molds. **9.** Define growth and explain the various phases of the growth curve. **10.** Classify and explain the methods for measurement of microbial growth. **11.** Discuss the influence of environmental parameters such as pH, oxygen, temperature, pressure, salt concentration and radiation on growth of microorganisms. **12.** Describe bio film formation and Quorum sensing techniques.	
Unit – I	**Study of Different Groups of Microbes-I**	**15L**
1.	**Viruses:** **a.** Early developments of Virology, General properties of viruses, prions, viroids **b.** Structure of Viruses**:** Capsids, envelopes, genomes, **c.** Cultivation of Viruses**:** an over view **d.** Bacteriophages**:** Lytic cycle, Lysogeny, Structure and Life cycle of theT4 Bacteriophage	**07**
2.	**Rickettsia, Coxiella, Chlamydia, Mycoplasma** General features and medical significance	**03**
3.	**Actinomycetes** General Characteristics, Cell Wall types and importance	**02**
4.	**Archaebacteria** Characteristics of major archaeal groups	**02**

5.	**Cyanobacteria**	**01**
Unit – II	**Study of Different Groups of Microbes-II**	**15L**
1.	**Protozoa** **a.** Ecology and Morphology of Protozoa	**05**
	b. Major categories of Protozoa based on motility, reproduction **c.** Medical importance of Protozoa ***d.*** Life cycle of *Entamoeba histolytica*	
2	**Algae** Characteristics of algae**:** morphology, pigment, reproduction **a.** Cultivation of algae **b.** Major groups of algae**:** an overview **c.** Biological and economic importance of algae **d.** Lichen symbiosis **e.** Differences between Algae and Cyanobacteria	**04**
3.	**Fungi** **a.** Characteristics**:** structure, reproduction **b.** Cultivation of fungi **c.** Major fungal divisions**:** an overview **d.** Life cycle of yeast **e.** Biological and economic importance	**05**
4.	**Slime Molds**	**01**
\ Unit – III	**Microbial Growth**	**15 L**
1.	Definition of growth, Growth curve, Mathematics of growth	**03**
2.	Measurement of microbial growth **a.**Direct microscopic count**:** Breed's Petroff – Hausser counting chamber, Hemocytometer, Coulter Counter, **b.** Viable count**:** Spread plate and Pour plate technique **c.** Measurements of cell constituents. **d.** Turbidity measurements**:** Nephelometer and spectro Photo meter techniques	**05**
3.	Synchronous growth, Continuous growth (Chemostat and Turbidostat)	**01**
4.	Influence of environmental factors on growth.	**04**
5.	Microbial growth in natural environment, Bio films, Quorum sensing techniques.	**02**

References :	· Willey, J. M., Sherwood, L. &Woolverton, C. J. (2011). *Prescott, Harley and Klein's Microbiology7th ed.* New York: McGraw-Hill · Pelczar, M., Reid, R. and Chan, E. (1986). *Microbiology 5thed*. New York: McGraw-Hill · Madigan, M. T., Martinko, J. M. (2009). *Brock biology of microorganisms 12th ed*. Upper Saddle River, NJ: Prentice Hall/Pearson Education · Bauman, R. W., Machunis-Masuoka, E., & Montgomery, J. E. (2015). *Microbiology: With diseases by body system* 4th ed. Boston: Benjamin Cummings · Willey, J. M., Sherwood, L., Woolverton, C. J., Prescott, L. M., & Willey, J. M. (2011). *Prescott's microbiology 8thed*. New York: McGraw-Hill.

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Program: B.Sc. Microbiology

Course: Exploring Microbiology

Semester II

Credit Based Semester and Grading System (CBSGS) with effect from the academic year 2021-2022

F.Y. B.Sc. Microbiology Syllabus

Semester II			
Course Code	**Course Title**	**Credits**	**Lectures/Week**
SMIC 202	Exploring Microbiology	2	3

Course Code SMC202	Course Title: EXPLORING MICROBIOLOGY Lectures/Week:03	2Credits (45L)
Course Objectives	**1.** Learn and understand the principle adapplications of electron microscopes, con focal and fluorescent microscopes. **2.** Acquire competency in using Colorimeter, Spectrophotometer and Ph meter. **3.** Have basic knowledge in preparing solutions of different types and pH. **4.** Enlist the types of micro bialinter action and study the impact on human health	
Course Outcome:	**1.** Discuss the construction, working, principle and applications of electron, con focal and fluorescent microscope. **2.** State Beer Lambert's law and differentiate between colorimeter and spectrophotometer. **3.** Explain the principle of pH meter, solve problems using Henderson Hassalbach equation and solution preparation of various weight byvolume units. **4.** Enlist different types of microbial interactions with examples. **5.** Define phyllosphere, rhizosphere, rhizoplane and mycorrhizae. **6.** Elaborate on microbial associations with plant vasculature using Rhizobium, Actinorhizae and Agrobacterium as examples. **7.** Illustrate the significance of normal flora of humans and give Examples of micro organisms residing in different an atomic alsites. **8.** Give significance and characteristics of Gnotobiotic animals. **9.** Explain the types of infections, process of infection and the carrierstates. Discuss the basic principles of Epidemiology	
Unit I	**Tools of the Laboratory**	**15L**
1.	**Advances in Microscopy** **a. Electron Microscopy:** Construction, Principle & Application **i.** The Transmission Electron Microscope **ii.** The Scanning Electron Microscope **iii.** Specimen preparation in TEM**:** Staining, Shadowing with metals, Freeze Etching **b. Con focal Microscopy:** Construction, Principle & Application **c. Fluorescence Microscopy:** Construction, Principle & Application	**07**

2.	**Colorimetry & Spectrophotometry** **a.** Instrument construction, **b.** Principle-Beer and Lambert's Law, **c.** UV-Vis Spectrophotometer **d.** Application	**04**
3.	**pH, Buffers & Solutions** **a.** Concept of pH **b.** Ion product of pKa & pKb **c.** Henderseon & Hasselbalch Equation **d.** Buffers **e.** Buffercapacity	**04**
	f. Physiological buffers (Bicarbonate, Phosphate and protein buffers) **g.** Determination of pH using indicator & pH meter **h.** Construction, Principle and Working of pH meter **i.** Solutions: Concepts of ppm, normality and molarity **j.** Problems based on the above	
Unit – II	**Microbial Interactions**	**15L**
1.	**Types of Microbial Interactions:** **a.** Mutualism **b.** Cooperation **c.** Commensalism **d.** Predation **e.** Parasitism **f.** Amensalism **g.** Competition	**07**
2.	**Microbial associations with vascular plants** **a.** Phyllosphere **b.** Rhizosphere & Rhizoplane **c.** Mycorrhizae **d.** Nitrogen fixation**:** Rhizobia, Actinorhizae, Stem Nodulatingrhizobia **e.** Fungal & Bacterial endophytes **f.** Agrobacterium & other plant pathogens	**08**
Unit – III	**Microbe-Human Interactions: Infection and Disease**	**15L**
1.	**The Human Host** **a.** Contact, Infection, Disease **b.** Resident Flora: The Human as a habitat **c.** Gnotobiotic animals **d.** Indigenous flora of a specific region **e.** Introduction to human microbiome	**04**

2.	**The Progress of an infection** **a.** The Portal of entry **b.** The Size of the Inoculum **c.** Mechanism of Invasion and Establishment of thePathogen **d.** Signs and Symptoms **e.** The Portal of Exit **f.** The persistence of microbes and pathologic conditions	**05**
3.	**Epidemiology: The Study of Disease in Populations** **a.** Tracking Disease in the population **b.** Reservoir: where pathogens persist **c.** The acquisition and transmission of infectious agents **d.** Nosocomial Infections **e.** Using Koch's Postulates to determine etiology	**05**
4.	**Biological Warfare and Bioterrorism**	**01**
CA	**1.** Test **2.** Presentation/ Case study	
References:	**1.** Willey,J.M.,Sherwood,L.,Woolverton,C.J.,Prescott,L.M., &Willey,J.M.(2011).*Prescott'smicrobiology8th ed*.NewYork:McGraw-Hill **2.** Plummer, D.T.(1997).*An introduction to practical biochemistry 3rd ed* .New Delhi: Tata Mc Gaw-Hill **3.** Williams, B.L. &Wilson, K.(1981).*A Biologist's guide to Principles and techniques of practical biochemistry 2nd ed.* London: Edward Arnold **4.** Garrett, R.H., &Grisham, C.M. (2010).*Biochemistry 5th ed*. Belmont,CA: Brooks/Cole, Cengage Learning **5.** Boyer, R. F. (2012). *Modern Experimental Biochemistry*. *3rd ed*. NewDelhi : Pearson **6.** Sawhney, S.K.& Singh, R. (2001).*Introductory Practical biochemistry*. New Delhi :Narosa **7.** Talaro, K.P., & Talaro, A.(2009).*Foundations in microbiology: Basic principles 7th ed*. Boston: WCB/McGraw-Hill. **8.** Bauman,R.W., Machunis-Masuoka, E.,& Montgomery, J.E. (2015).*Microbiology: With diseases by body system* 4th ed. Boston: Benjamin Cummings	

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Program: B.Sc. Microbiology

Course: Practical

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F.Y. B.Sc. Microbiology Syllabus

Semester II			
Course Code	**Course Title**	**Credits**	**Lectures/Week**
SMIC2PR	Practical	2	6

Semester II–Practical

SMIC2PR	**Practical** **(Based on SMIC 201 and SMIC 202)** **(Credits:2; Practical/Week:Equivalentto6 Lectures/Week)**
Course Objectives:	**1.** To develop the techniques to isolate and enumerate different group of organisms **2.** To observe the effect of environmental parameters on the growth of microorganisms. **3.** To understand the significance of virulence factors present in pathogens. **4.** To develop the skill to calibrate and operate pH meter and colorimeter
Course Outcome:	**1.** Study the characteristics of fungi and actinomycetes using isolation and slide culture techniques. **2.** Plot the growth curve of *E.coli*and calculate its generationtime. **3.** Calculate the viable count of micro organisms usings preadplate and pour plate methods. **4.** Enumerate yeast cells using Haemocytometer and Breed's count methods. **5.** Design an experiment to show the effect of pH, temperature and osmotic pressure on the growth of microorganisms. **6.** Demonstrate the activity of virulence factors like coagulase, haemolysis and lecithinase present in pathogens. **7.** Calculate the pH of a buffer solution and prepare laboratory solutions of different concentrations. **8.** Determine the lambda max and verify Beer Lambert's law using a colorimeter.

	PRACTICAL– I **1.** Study of Bacteriophages: Spot assay and (plaque assay of Bacteriophage -Demonstration) **2.** Isolation of Yeasts and FungionSabouraud's agar **3.** Study of Fungi (Slide culture and Wet Mount - Study of Morphological Characteristics: Mucor, Rhizopus, Aspergillus, Penicillium) **4.** Isolation of Actinomycetes from soil and slide culture of Actinomycetes **5.** Enrichment and Isolation of algae **6.** Wet mount of Hay Infusion and Pond water for observing bacterial, algal and protozoan forms **7.** Study of growth of organisms under static and shaker conditions ***8.*** Growth curve of *E.coli* **9.** Direct microscopic count by Breed's Count and Haemocytometer **10.** Viable count: Spread plate and pour plate **11.**McFarland's Standard opacity tubes **12.**Effect of pH, temperature and osmotic pressure on growth **13.**Cultivation of anaerobes
	PRACTICAL– II **1.** Normal flora of the Skin & Saliva **2.** Wet Mount of Lichen (Demonstration) **3.** Bacteroid Staining & Isolation of Rhizobium **4.** Study of virulence factors – Enzyme Coagulase **5.** Study of virulence factors – Enzyme Hemolysin **6.** Study of virulence factors – Enzyme Lecithinase **7.** Demonstration of microbes in air, table surface, finger tips **8.** Use of standard buffers for calibration and determination of pH of a given solution **9.** Preparation of buffers and solutions **10.** Determination of λ max &Verification of Beer Lambert's law **11.** Visittoa Microbiology Laboratory in a Research Institute

EVALUATION SCHEME:

Examination		Marks
EVALUATION SCHEME FOR THEORY COURSES (2 PAPERS)		
I. Continuous Assessment (C.A.)		**40**
C.A.I Test	MCQ, 1M answers etc	**20**
C.A.II Test	Assignment/Project /Posters/Presentations etc	**20**
II. Semester End Examination (SEE)		**60**
Each Theory Paper		**40+60=100**
Semester End practical Examination		**100**
For Each Practical Course		**50**
Practical Course (2 Courses)		**100**