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: Fundamentals of Microbiology

Semester I

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

F.Y. B.Sc. Microbiology Syllabus

Semester I			
Course Code	**Course Title**	**Credits**	**Lectures/Week**
SMIC101	Fundamentals of Microbiology	2	3

SEMESTERI–THEORY

Course Code: SMIC101	**FUNDAMENTALS OF MICROBIOLOGY** **(Credits:2;Lectures/Week:3)**	**(45L)**
Course Objectives	**1.** To study the historical developments in the fields of Microbiology **2.** Be aware of the scope and relevance of Microbiology **3.** Learn the structure and function of prokaryotic cells and basic bio molecules **4.** To understand the bio safety measures to be adopted in Microbiology laboratories.	
Course Outcome	**1.** Describe the historical development and scope of microbiology. **2.** Explain the structure and function of prokaryotic cells. **3.** Compare Bacterial, Archaebacterial and Eukaryotic cells. **4.** Outline the basic safety measures to be adopted in a microbiology laboratory. **5.** Discuss types of bonds and their importance. **6.** Explain the structure and properties of water. **7.** Define bio molecules and classify them. State the biological importance of carbohydrates, lipids and proteins. **8.** Describe the 3D structure of proteins. **9.** Outline the structure and function of different types of nucleic acids. **10.** Differentiate between DNA and RNA. **11.** Illustrate the structural organization of chromo somesin eukaryotes.	
Unit I	**Introduction To Microbiology and Prokaryotic cell structure**	**15L**
1.1	**History and Scope of Microbiology:** **a.** Micro scopy and the discovery of micro-organisms **b.** The conflict over spontaneous generation **c.** The golden age of Microbiology: Koch's Postulates, Medical Microbiology, Immunology **d.** The development of Industrial Microbiology and Microbial Ecology **e.** The Scope and Relevance of Microbiology	**05**
1.2	**The Place of Micro-organisms in the Living world:** **a.** Haeckel's Kingdom Protista **b.** Prokaryotic and Eukaryotic Protists **c.** Whitaker's 5Kingdom concept **d.** Carl Woese's three kingdom Classification	**01**
1.3	**Prokaryotic Cell Structure and Function:** **a.** Morphology of Bacteria **b.** Prokaryotic Cell Membranes-Bacteria and Archaebacteria	**09**

	c. The Cyto plasmic matrix: cytoskeleton, inclusion bodies, ribosomes **d.** The Nucleoid, Plasmids **e.** The Bacterial, My cobacterial and Archaebacterial Cell wall **f.** Components external to the cell wall: Capsules, Slime layers, S-layers, Pili and Fimbriae, Flagella **g.** The Bacterial Endospore **h.** Comparison of Bacterial, Archaebacterial and Eucaryotic cell.	
Unit II	**Bio safety and Bio molecules**	**15L**
2.1	**Bio safety in the Microbiology Laboratory:** **a.** Routes of infection in the laboratory **b.** Hazardous procedures **c.** Exposure control plan **i.** Employee education and orientation **ii.** Disposal of hazardous waste **iii.** Universal/Standard Precautions **iv.** Engineering controls (Laboratory environment, biological safety cabinet) **d.** Personal Protective equipment **e.** Post exposure control **f.** Bio safety levels **g.** Mishaps with infective material	**03**
2.2	**Bio molecules**	**12**
2.2.1 **2.2.2**	**The Hierarchy of Molecular organization of cells Types of bonds and their importance** **a.** Covalent (ester, phosphateester, thioester, peptide, glycosidic) **b.** Non-Covalentinter actions (Hydrogen bonds, Vander Waalsinter action, ionic interactions, hydrophobic interactions)	**01**
2.2.3	**Water: Structure and properties**	**01**
2.2.4	**Carbohydrates:** **Definition, Classification, Biological importance and Structures** **a. Monosaccharides** **i.** Aldoses and ketoses **ii.** Occurrence, structure and significance of Glucose, Fructose, Galactose and Mannose **iii.** Fischer and Haworth Projection **iv.** Stereo isomers (D and L isomers, Epimers, Anomers) **b. Oligosaccharides** **i.** Formation of glycosidic bonds(α,β) **ii.** Occurrence, structure and significance of Maltose, Lactose and Sucrose.(disaccharides)	**04**

	c. Polysaccharides **i.** Classification based on composition: Homo polysaccharides and Hetero polysaccharides **ii.** Occurrence, structure and significance of storage (Starch, Glycogen) and structural Polysaccharides (Cellulose, Chitin)	
2.2.5	**Lipids:** **a. Definition and Bloor's classification: (**Simple, Complex, Derived and Miscellaneous) **b. Fatty Acids** **i.** Classification (saturated, unsaturated) **ii.** Structure and Nomenclature of Palmitic acid, Stearic acid, MUFA–Oleicacid, PUFA–Linoleic and Linolenic acid **c. Triacylglycerol** **i.** General structure **ii.** Properties (hydrolysis, saponification and rancidity) **d. Functions of compound lipids** **i.** Phospholipids (glycerophospholipids and spingophospholipids) **ii.** Glycolipids **e. Steroids**:(Structure and significance)	**02**
2.2.6	**Amino Acids and Proteins:** **a. AminoAcids** **i.** General structure: D and L forms of amino acids **ii.** Classification based on (Structure, nutritional classification, metabolic fate) **iii.** Properties: Physical and chemical **b. Peptides and Proteins** **i.** Classification and Properties **ii.** 3-D Structure of Proteins: primary, secondary, tertiary And quaternary	**04**
Unit III	**Nucleic acid structure and chemistry**	**15L**
3.1	**Nucleic acid structure:** **a.** Definition and functions of Nucleotides and Nucleic acids **b.** Structure and nomenclature: Purines, Pyrimidines, Ribose, Deoxyribose, Nucleosides and Nucleotides **c.** Formation of Poly nucleotidestr and **d.** DNA and RNA **e.** Watson and Crick model of DNA **f.** A and Z forms of DNA **g.** Unusual structures of certain DNA sequences **h.** Types, structures and functions of RNA: mRNA, tRNA, rRNA, snRNA ,miRNA, hnRNA	**10**
3.2	**Nucleic acid chemistry:** **a.** Denaturation of double helical DNA and RNA	**04**
	b. Hybrid formation of nucleic acid from different species **c.** Non enzymatic transformations of nucleotides and nucleic acids **d.** Methylation of nucleotide bases in DNA	

3.3	**Over view of Structure of Chromosomes**	**01**

Text books and Additional References:

1. Pelczar M., Reid R. And Chan E., Microbiology, McGraw-Hill 5th Ed.,1977.
2. BlackB., Jacquelyn G.& Laura J. O, Microbiology: principles and explorations, Hoboken, NJ :Wiley,8th Ed.,2013.
3. Mackie T.J., Collee J.G & Mc Cartney J.E., Mackie & Mc Cartney practical medical microbiology, New York: Churchill Livingstone,14th Ed.,1996.
4. Forbes B.A., Sahm D. F.& Weissfeld A.S., Bailey and Scott's Diagnostic Microbiology, Mosby, Inc,11th Ed.,2002.
5. Mahon C.R., Lehman D.C.& Manuselis G, Text book of Diagnostic Microbiology, Saunders, 3rd Ed., 2007.
6. Garrett R.H. & Grisham C.M. Biochemistry, Belmont, CA: Brooks/Cole, Cengage Learning, 2010.
7. FrobisherM., Fundamentals ofmicrobiology,Philadelpia:Saunders,9th Ed.,1974.
8. Lehninger A.L., Nelson D.L.& Cox M.M., Lehninger principles of biochemistry, New York: Worth Publishers,5th Ed.,2008.
9. Conn E & Stumpf P.K., Outlines of Biochemistry, New York: Wiley,2005.
10. Satyanarayana U.& Chakrapani U., Essentials of Biochemistry, Kolkatta: Books and allied,2nd Ed.,2008.
11. Pierce B.A, Genetics: A conceptual approach, New York: W.H,3rd Ed.,2008.
12. Das D., Biochemistry, Academic Publishers,14th Ed.,2012.

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Program: B.Sc. Microbiology

Course: Basic Techniques in Microbiology

Semester I

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

F.Y. B.Sc. Microbiology Syllabus

Semester1			
Course Code	**Course Title**	**Credits**	**Lectures/Week**
SMIC102	Basic Techniques in Microbiology	2	3

Course Code: SMIC102	Course Title: BASIC TECHNIQUES IN MICROBIOLOGY (Credits:2; Lectures/Week:3)	(45L)
Course Objectives	**1.** Learn the basic principles under lying the working of different micro scopes. **2.** Understand the various types of staining and their principles. **3.** To demonstrate the roles of various physical and chemical agents in control of micro-organisms. **4.** Learn the methods used to cultivate and preserve micro-organisms.	
Course Outcome	**1.** Explain the construction, principle, working and applications of Compound, Dark Field and Phase Contrast Microscope. **2.** Classify different types of stains and staining methods. **3.** Discuss the principle of Gram's staining and give significance of each step of the staining method. **4.** Choose an appropriate staining method to demonstrate special structures of bacteria. **5.** Define sterilization, disinfection, a sepsis sanitization, germicide and justify the conditions influencing the effectiveness of antimicrobial agents. **6.** State the principle under lying sterilization instruments. **7.** Enlist the different methods of sterilization and their applications. **8.** Evaluate the effectiveness of an antimicrobial agent. **9.** Classify microorganisms on the basis of nutritional requirements. **10.** Describe various culturing and preservation methods of microorganisms.	
Unit I	**Microscopy and Staining**	**15L**
1.	**a.** Lenses & bending of light **b.** Resolution of the Microscope	**02**
2.	**The Light Microscope** **a.** Bright Field Microscope **b.** The Dark Field Microscope **c.** The Phase Contrast Microscope **d.** Micrometry	**07**
3.	**Staining of Specimens** **a.** Dyes and stains**:** Types (natural, synthetic, acidic, basic, neutral) **b.** Fixation (heat and chemical) **c.** Simple staining (positive and negative staining) **d.** Differential staining (gram staining) **e.** Staining of specific structures (Cell wall, Capsules, Spores, Meta chromatic granules, Flagella)	**06**

Unit II	Controlling Microbial Growth in the environment	15L
1.	**a.** General Considerations in Microbial Control **b.** Terminology and Methods of Microbial Control **c.** Microbial Death and factors affecting microbial death **d.** How Antimicrobial agents work**:** Mode of action	02
2.	**Physical methods of Microbial Control** **a.** Heat**:** Moist & Dry **b.** Low temperature **c.** Filtration **d.** Radiations	06
3.	**Chemical methods of Microbial Control** **a.** Choosing a Microbicidal Chemical **b.** Factors that affect the germicidal activity of chemicals **c.** Germicidal Categories **i.** Halogens **ii.** Phenols **iii.** Alcohols **iv.** Hydrogen Peroxide **v.** Detergents **vi.** Heavy Metals **vii.** Aldehydes **viii.** Gaseous Sterilants **ix.** Dyes	05
4.	**Evaluation of effectiveness of anti microbial agent** **a.** Agar diffusion **b.** Tube dilution **c.** Phenol co-efficient **d.** Use dilution	02
Unit III	**Microbial Nutrition, Cultivation, Isolation and Preservation**	**15L**
1.	**a.** Nutritional requirements: Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulphur and growth factors. **b.** Physicochemical parameters for growth (pH, temperature, Oxygen requirement and Osmotic pressure) **c.** Nutritional types of microorganisms	06
2.	**a.** Types of Culture media with examples **b.** Isolation of micro organisms and pure culture techniques.	06
3.	**a.** Preservation of microorganisms **b.** Culture Collection Centers	03

Text books and Additional References:

1. Willey J.M., Sherwood L., Woolverton C.J., Prescott L.M., & Willey J.M., Prescott's microbiology, New York: Mc Graw-Hill,8thEd.,2011.
2. Pelczar M., Reid R.and Chan E., Microbiology, New York: Mc Graw-Hill,5thEd.,1977.
3. Talaro K. P.& Talaro A., Foundations in microbiology: Basic principles, Boston: WCB/Mc Graw Hill,7thEd.,2009.

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Program: B.Sc. Microbiology

Course: Microbiology Practical

Semester I

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

F.Y. B.Sc. Microbiology Syllabus

Semester1			
Course Code	**Course Title**	**Credits**	**Lectures/Week**
SMIC1PR	Microbiology Practical	2	6

SEMESTER I-PRACTICAL

Course Code: SMICIPR	**Microbiology Practical (Credits:2Practical/Week:Equivalentto6 Lectures/Week)**
Course Objectives	**1.** Learn the principles and protocols underlying different staining techniques. **2.** Detect presence of bio molecules qualitatively **3.** Study the use of physical and chemical agents to control micro-organisms. **4.** Efficiently carry out aseptic transfer techniques, prepare media, use them to isolate organisms and study their growth characteristics.
Course Outcome	**1.** Perform special staining to demonstrate the different structures of bacteria like cell wall, capsule, spore and meta chromatic granules. **2.** Qualitatively detect the presence of carbohydrates, proteins, amino acids, nucleic acids using appropriate tests. **3.** Measure the cell dimensions using micrometry. **4.** With the help of Gram's staining, demonstrate themorphology of various microorganisms. **5.** Demonstrate the effect of UV light on different types of bacteria. **6.** Show the effect of heavy metals, dyes and phenolic compounds on bacteria. **7.** Aseptically transfer culture media and prepare slants and plates. **8.** Isolate microorganisms on Nutrient agar and Mac Conkey's agar and study its colony characteristics.

	PRACTICALI: **1.** Assignment: Contribution of Scientists to the field of Microbiology since the last 20 years **2.** Special Staining: Cell wall, Capsule, Endo spores, Meta chromatic granules, Flagella staining **3.** Bio safety in Laboratory (Handling corrosive chemicals using rubberteat method for pipetting and use of auto-pipettes, safety inoculation hood and laminar air flow) **4.** Qualitative detection: **a.** Carbohydrates: Molisch's, Benedict's tests **b.** Proteins and amino acids: Biuret, Ninhydrin **c.** Nucleic acid detection: DPA and Orcinol **5.** Isolation of DNA from onion **6.** Qualitative detection of bio molecules from celllysate **PRACTICALII:** **1.** Microscopy: Parts of a microscope **2.** Measurement of cell dimensions: Micrometry **3.** Dark field and Phase Contrast Microscope: Demonstration Monochrome and differential staining procedures: Gram Staining and negative staining

	4 Introduction to laboratory equipment's, disinfection and discarding techniques in the laboratory **5** Methods of preparation of glassware for sterilization (pipettes, petriplates, plastic wares, flasks, micropipettes, micro titreplates)and Control of micro-organisms using moist heat and dry heat sterilization.(Sterilization of dry powders, rubber gloves, bandages, screw capped tubes, sterilizable plastic wares) **6** Determination of the performance efficiency of the Autoclave and Hot air oven **7** Effect of UV light on bacteria **8** Effect of heavy metal s(Oligodynamic action)on bacteria **9** Effect of dyes and phenolic compounds on bacteria **10** Preparation of culture media: **a.** Conversions mg-g, ml-L,%, w/w and w/v **b.** Liquid medium (Nutrient broth) **c.** Solid media(Nutrient agar, Sabouraud's agar) **d.** Aseptic transfer of liquid media and preparation of slants, Butts and plates. **11** Inoculation techniques and study of growth: **a.** Inoculation of liquid medium **b.** Inoculation of solid media (slants, butts and plates) **c.** Study of colony characteristics of pigment and non-pigmented producing bacteria **d.** Studyofmotilitybystabinoculationand(hangingdropprepar ation–demonstration) **12** Use of Differential and Selective media (Mac Conkey's agar) **13** Methods of Preservation of cultures **a.** Subculturing **b.** Mineraloiloverlay **c.** Soilstockmethod **d.** Glyceroltockmethod

EVALUATION SCHEME

Examination		Marks
EVALUATION SCHEME FOR THEORY COURSES (2PAPERS)		
I. Continuous Assessment (C.A.)		**40**
C.A.I	MCQ,1M answers etc	**20**
C.A.II	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**