

Deccan Education Society's  
**FERGUSSON COLLEGE, PUNE**  
**(AUTONOMOUS)**

**FIRST YEAR B. Sc. Microbiology**  
**SYLLABUS**  
**(2016 pattern)**  
**Revised in 2017-18**

**SEMESTER – I**

**Deccan Education Society's  
Fergusson College (Autonomous), Pune**

**Department of Microbiology  
F. Y. B.Sc. – Microbiology**

**Programme Structure**

<b>Year</b>	<b>Paper Code</b>	<b>Title of the Paper</b>	<b>No. of Credits</b>
<b>F.Y. B.Sc.</b>	<b>Semester I</b>		
	MIC1101	Introduction to Microbial World	2
	MIC1102	Basic Techniques in Microbiology	2
	MIC1103	Practicals based on 'Introduction to Microbiology'	2

**PAPER CODE: MIC1101**

**PAPER –I: TITLE: INTRODUCTION TO MICROBIAL WORLD**

[No. of Credits -2

No. of Lectures = 36]

<b>Unit No</b>	<b>Title and Contents</b>	<b>No. of Lectures</b>
<b>Unit -I</b>	<b>Origin of Microbial life:</b> Biogenesis Vs Abiogenesis (Hypothesis and experiments) Miller's experiments, Ubiquitous nature of microbial life. Development from simple to complex life forms.	<b>6</b>
<b>Unit -II</b>	<b>Significance of Scientific contributions in development in Microbiology as a discipline:</b> <b>A. Early contributions</b> Robert Hook, Anton Van Leeuwenhoek, Louis Pasteur, Robert Koch, John Tyndall. <b>B. Scientific contribution leading to diversification of Microbiology</b> i. Medical Microbiology and Immunology- Edward Jenner, Paul Ehrlich, Ellie Metchnikoff, Lister. ii. Food Microbiology and Fermentation- Alexander Fleming, Louis Pasteur, Selman Waksman iii. Soil Microbiology- Winogradsky, Martinus Beijerinck iv. Microbial Genetics – Watson and Crick, Hargobind Khurana, Griffith, Avery, McCarty, and Macloed. <b>C. Frontiers in Microbiology</b> Nanobiotechnology, rDNA Technology, Bioinformatics, Proteomics, Genomics, Neutraceuticals.	<b>15</b>
<b>Unit –III</b>	<b>Diversity of Microbial World:</b> <b>A.</b> Systems of Classification- Binomial nomenclature, three kingdom, five kingdom classification and utility. <b>B.</b> Differences in Cellular and Acellular microorganisms Differences in prokaryotic and eukaryotic (Occurrence, morphology, mode of reproduction and economic importance) <b>C.</b> Different groups microorganisms- Bacteria, Yeast, Fungi, Actinomycetes, Algae, Viruses, Protozoa, Viroids and Prions (Morphological and differential characteristics, Nutrition and cultivation methods, habitats, economic importance, harmful and beneficial activities)	<b>15</b>

**References:**

1. Daniel Lim, Microbiology, 2nd Edition; McGraw-Hill Publication
2. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3rd Edition. Thomson Brooks / Cole.
3. Madigan M.T., Martinko J.M. (2006). Brock's Biology of Microorganisms. 11th Edition. Pearson Education Inc.
4. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata

MacGraw Hill Press.

5. Prescott L.M., Harley J.P., and Klein D.A. (2005). Microbiology, 6th Edition. MacGraw Hill Companies Inc.

6. Prescott, Lansing. M., John, P. Harley and Donald, A. Klein (2006) Microbiology, 6th Edition, McGraw Hill Higher Education

7. Willey J. M., Sherwood L. M. and Woolverton C. J. (2013) Prescott's Microbiology, 8th Edition, McGraw-Hill Higher Education

8. Salle A.J. (1971) Fundamental Principles of Bacteriology. 7th Edition. Tata MacGraw Hill Publishing Co.

9. Stanier R.Y., Adelberg E.A. and Ingraham J.L. (1987) General Microbiology, 5th Edition. Macmillan Press Ltd.

10. Tortora G.J., Funke B.R., Case C.L. (2006). Microbiology: An Introduction. 8th Edition. Pearson Education Inc

11. Wilson K. and Walker J.M. (2005) Principles and Techniques of Biochemistry and Molecular Biology. 6th Edition. Cambridge University Press.

12. Hans G. Schlegel (1993) General Microbiology, 8th Edition, Cambridge University Press

13. David T. Plummer (1993) An Introduction To Practical Biochemistry, 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.

**PAPER CODE: MIC1102**

**PAPER –II: Basic Techniques in Microbiology**

**[No. of Credits -2**

**No. of Lectures = 36]**

<b>Unit No.</b>	<b>Title and Contents</b>	<b>No. of Lectures</b>
<b>Unit -I</b>	<b>Scope and fundamental principles in Microbiology</b> <ul style="list-style-type: none"><li>• Interdisciplinary approach</li><li>• SI units of measurements – (Length , Volume, Weight )</li><li>• Properties of light, Spectrum, Wavelength, Frequency, Amplitude</li><li>• Molar and Normal solutions, Avogadro’s Number</li></ul>	<b>6</b>
<b>Unit -II</b>	<b>Microscopy and Staining Techniques</b> <p>A) Microscopy</p> <ul style="list-style-type: none"><li>• History of microscopy</li><li>• Terms in microscopy – Magnification, Refractive index, Numerical aperture ,Resolving power</li><li>• Aberrations in lenses</li><li>• Principle, working, ray diagram and applications of<ol style="list-style-type: none"><li>1. Bright field microscopy</li><li>2. Dark field microscopy</li><li>3. Phase contrast microscopy</li><li>4. Fluorescence microscopy</li></ol></li><li>• Introduction to<ol style="list-style-type: none"><li>1. Confocal microscopy</li><li>2. Electron microscopy – SEM, TEM</li></ol></li></ul> <p>B) Stain and staining techniques</p> <ul style="list-style-type: none"><li>• Stain – Definition, Concept of chromophore and auxochrome group, Acidic and basic stains</li><li>• Role of fixatives, accentuators, mordants and decolorisers</li><li>• Principle and applications of<ol style="list-style-type: none"><li>1. Negative staining</li><li>2. Monochrome staining</li><li>3. Differential staining – Gram’s staining and Acid fast staining</li></ol>Special staining – Capsule staining</li></ul>	<b>15</b>
<b>Unit –III</b>	<b>Sterilization and disinfection</b> <p>A)Physical agents – Mode of action and application of<ol style="list-style-type: none"><li>1.Heat</li><li>2. Radiation</li><li>3.Filtration</li></ol></p> <p>B)Chemical agents -</p> <ol style="list-style-type: none"><li>a)Characteristics of an ideal disinfectant</li><li>b)Mode of action and application of - Aldehydes , Halogens, Quaternary ammonium compounds , Phenol and Phenolic compounds, Heavy metals, Alcohols, Dyes , Detergents and Ethylene oxide</li></ol> <ul style="list-style-type: none"><li>• Checking of efficiency of sterilization – Biological</li></ul>	<b>15</b>

	and Chemical indicators Checking efficiency of disinfectant – Phenol coefficient- Rideal Walker coefficient,Chick Martin test.	
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**Note : Numericals and problem solving related to topics will be conducted**

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1. Daniel Lim, Microbiology, 2nd Edition; McGraw-Hill Publication
2. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3rd Edition. Thomson Brooks / Cole.
3. Madigan M.T., Martinko J.M. (2006). Brock's Biology of Microorganisms. 11th Edition. Pearson Education Inc.
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7. Willey J. M., Sherwood L. M. and Woolverton C. J. (2013) Prescott's Microbiology, 8th Edition, McGraw-Hill Higher Education
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	<p><b>PAPER CODE: MIC1103</b>  <b>PAPER –III: Practicals based on ‘Introduction to microbial world’</b>  <b>[No. of Credits - 2 No. of Practicals = 10]</b>  <b>1 Practical=4 hrs</b></p>
<b>S.No.</b>	<b>Title of Experiment/ Practical</b>
<b>1</b>	<p>Introduction to Microbiology laboratory –</p> <p>a. GLP and Biosafety</p> <p>b. To study Principle and applications of instruments: Microscope, Autoclave, Hot-air oven, Centrifuge, pH meter, Incubator, Refrigerator, Distillation apparatus, Laminar Air-flow system, Water-bath, Colorimeter, Spectrophotometer and SOP writing</p>
<b>2</b>	Preparation and sterilization of culture media
<b>3</b>	Aseptic Transfer Techniques
<b>4</b>	<p>Assessment of Sterility -</p> <p>a. Assessment of sterility of glassware and nutritional media (Hot air oven and Autoclave)</p> <p>b. Sterilization by membrane filtration and sterility assessment</p>
<b>5</b>	Cultivation of photosynthetic organisms using Winogradsky’s column
<b>6</b>	<p>Observation of organisms -</p> <p>a. <i>Rhizopus, Penicillium, Aspergillus</i> using different natural samples</p> <p>b. Observation of permanent slides of Protozoans: <i>Amoeba, Paramoecium, Plasmodium, Entamoeba</i></p>
<b>7</b>	Observation of actinomycetes by slide culture technique and coverslip technique.
<b>8</b>	Demonstration of microflora from air and preservation of bacterial and fungal cultures.
<b>9</b>	Primary demonstration of effect of sanitizers on microflora
<b>10</b>	Measurement of cell dimension by Micrometry
<p><b>References :</b></p> <ol style="list-style-type: none"> <li>1. Fundamental Principles Of Bacteriology by Salle,A.J. Publisher McGraw Hill Book Company Inc.</li> <li>2. Experiments in Microbiology, Plant Pathology and Biotechnology Aneja, K.R.</li> <li>3. Benson's Microbiological Applications, Laboratory Manual in General Microbiology, Short Version Alfred Brown; Heidi Smith</li> <li>4. Microbiology: A Laboratory Manual, 10th Edition James G. Cappuccino</li> <li>5. Handbook Media Stains Reagents Microbiology by A. M. Deshmukh</li> </ol>	

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**FIRST YEAR B.Sc. Microbiology**  
**SEMESTER –II**

**Academic Year 2017-2018**



## Programme Structure

Year	Paper Code	Title of the Paper	No. of Credits
F.Y. B.Sc.	<b>Semester II</b>		
	MIC1201	Microbial World: A detailed study	2
	MIC1202	Bacteriology	2
	MIC1203	Practicals based on 'Basic Techniques in Microbiology'	2

**PAPER CODE: MIC 1201**

**Microbial World: A detailed study**

**[No. of Credits -2**

**No. of Lectures=36]**

<b>Unit No.</b>	<b>Title and Contents</b>	<b>No. of Lectures</b>
<b>Unit –I</b>	Interdisciplinary approach of Microbiology, Recent developments in Microbiology. Associations in Microorganisms	<b>6</b>
<b>Unit –II</b>	<p><b>Algae</b></p> <p>History of phycology with emphasis on contributions of Indian scientists; General characteristics of algae including occurrence, thallus organization, algae cell ultra structure, pigments, flagella, eyespot</p> <p>food reserves and vegetative, asexual and sexual reproduction. Different types of life cycles in algae with suitable examples: Haplobiontic, Haplontic, Diplontic, Diplobiontic and Diplohaplontic life cycles. Applications of algae in agriculture, industry, environment and food.</p> <p><b>Fungi</b></p> <p>Historical developments in the field of Mycology including significant contributions of eminent mycologists.</p> <p>General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra-structure, thallus organization and aggregation, fungal wall structure and synthesis,</p> <p>Reproduction: Asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism.</p> <p><b>Fungal taxonomy</b></p> <p>Economic importance of fungi with examples in agriculture, environment, industry, medicine, food, biodeterioration and mycotoxins.</p>	<b>15</b>
<b>Unit –III</b>	<p><b>Protozoa</b></p> <p>General characteristics with special reference to <i>Amoeba</i>, <i>Paramecium</i>, <i>Plasmodium</i>, <i>Leishmania</i> and <i>Giardia</i></p>	<b>15</b>

	<p><b>Virus</b></p> <p>Viral taxonomy: Classification (ICTV and Baltimore) and nomenclature of different groups of viruses</p> <p>Modes of viral transmission: Persistent, non-persistent, vertical and horizontal, Salient features of viral Nucleic acid</p> <p><b>Bacteriophages:</b> Diversity, classification, one step growth curve, lytic (T even and Todd Phages) and lysogenic phages (lambda phage), lysogenic conversion phenomenon(Diphtheria/Salmonella/Vibrio)</p>	
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**References:**

1. Daniel Lim, Microbiology, 2<sup>nd</sup> Edition; McGraw-Hill Publication
2. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3<sup>rd</sup> Edition. Thomson Brooks / Cole.
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13. David T. Plummer (1993) An Introduction To Practical Biochemistry, 3<sup>rd</sup> Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi

**PAPER CODE: MIC1202**

**PAPER –II: Bacteriology**

**[No. of Credits -2:**

**No. of Lectures = 36]**

<b>Unit No.</b>	<b>Title and Contents</b>	<b>No. of Lectures</b>
<b>Unit -I</b>	<b>Diversity of bacteria based on nutrition and environmental conditions</b> <ul style="list-style-type: none"><li>• Nutritional requirements and nutritional classification(Fastidious organisms)</li><li>• Extremophiles and their significance</li></ul>	<b>6</b>
<b>Unit -II</b>	<b>Bacterial Cytology</b> <ul style="list-style-type: none"><li>• Cell wall: Composition and detailed structure of Gram positive and Gram negative cell walls, archaeobacterial cell wall, Lipopolysaccharide, Sphaeroplasts, protoplasts and L: forms. Effect of antibiotics and enzymes on the cell wall</li><li>• Cell membrane : Structure , function and chemical composition of bacterial and archael cell membranes</li><li>• Endospore :Structure , formation and stages of sporulation</li><li>• Capsule : Structure , composition and function</li><li>• Flagella : Structure , composition and function</li><li>• Fimbriae and pili : structure , composition and function</li><li>• Cytoplasm : Ribosomes, mesosomes, nucleoid, chromosome and plasmids, Cell inclusion - gas vesicles, carboxysomes , PHB granules , metachromatic granules and glycogen bodies</li></ul>	<b>15</b>
<b>Unit –III</b>	<b>Bacterial growth and nutrition</b> <b>Nutrition :</b> <ul style="list-style-type: none"><li>• Design and preparation of media :Common ingredients</li><li>• Various media used for the cultivation of bacteria :General (Synthetic and complex media), Selective, differential , enriched, enrichment media, Minimal and complete media</li></ul> <b>Bacterial growth -</b> <ul style="list-style-type: none"><li>• Definition of growth, generation time, growth rate, specific growth rate. Growth curve and growth kinetics</li></ul>	<b>15</b>

	<ul style="list-style-type: none"> <li>• Factors affecting growth – pH , temperature , solute concentration( salt and sugar) and heavy metals</li> </ul> <p>Methods of enumeration, Merits and demerits of each method</p> <ol style="list-style-type: none"> <li>1. Microscopic</li> <li>2. Plate counts</li> <li>3. Estimation of biomass: Dry mass and wet mass. Merits and demerits</li> <li>4. Optical density measurement (Mac-Ferland standard)</li> <li>5. Miscellaneous methods(Chemical methods – cell carbon and nitrogen estimation,ATP,PCV )</li> </ol> <ul style="list-style-type: none"> <li>• Diauxic growth</li> <li>• Synchronous growth</li> <li>• Continuous growth – concept of chemostat and turbidostat</li> </ul>	
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2. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3<sup>rd</sup> Edition. Thomson Brooks / Cole.
3. Madigan M.T., Martinko J.M. (2006). Brock's Biology of Microorganisms. 11<sup>th</sup> Edition. Pearson Education Inc.
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**PAPER CODE: MIC1203**

**PAPER –III: Practicals based on ‘Basic Techniques in Microbiology’**

**[No. of Credits -2**

**No. of Practicals =10]**

<b>Sr. no.</b>	<b>Title of Experiment/ Practical</b>
<b>1</b>	Purification of bacteria by streak plate technique and study of colony characteristics
<b>2</b>	Enumeration of bacteria TVC: Spread plate
<b>3</b>	Enumeration of bacteria TVC: Pour plate technique
<b>4</b>	Enumeration of yeasts cells / bacterial cells using counting chamber
<b>5</b>	Observation of morphology of bacteria by Negative staining technique Monochrome staining technique
<b>6</b>	Differential staining: Gram staining technique, Acid fast staining
<b>7</b>	Observation of bacterial motility by a. Hanging drop technique ( Using cavity slide and clay method) b. Swarming growth on agar surface c. Cragie’s tube method
<b>8</b>	Growth curve of bacteria
<b>9</b>	Effect of environmental parameters on bacterial growth: pH and temperature
<b>10</b>	Effect of environmental parameters on bacterial growth: Salt and Heavy metals

**References:**

1. Fundamental Principles Of Bacteriology by Salle,A.J. Publisher McGraw Hill Book Company Inc.
2. Experiments in Microbiology, Plant Pathology and Biotechnology Aneja, K.R.
3. Benson's Microbiological Applications, Laboratory Manual in General Microbiology, Short Version Alfred Brown; Heidi Smith
4. Microbiology: A Laboratory Manual, 10th Edition James G. Cappuccino
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