

**SCIENCE FACULTY**

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**



**SYLLABUS FOR**  
**S.Y.B.Sc.**  
**MICROBIOLOGY**

**(With effect from JUNE, 2013)**

**North Maharashtra University, Jalgaon**  
**Syllabus S. Y. B. Sc. Microbiology**  
**[With effect from June 2013]**

1. Each theory course has to be completed in 60 lectures in each semester.
1. Practical examination of laboratory course shall be conducted annually.
2. Each Theory course will be of 50 marks  
(10 marks internal and 40 marks external examination)
3. Practical course will be of 100 marks  
(20 marks internal and 80 marks external examination)
4. MB YSC [Y for year, S for semester and C for course number].

### Theory Courses

<b>FIRST SEMESTER</b>	
<b>MB 211: Fundamental Biochemistry</b>	<b>MB 212: Genetics and Immunology</b>
1.1 Biomolecules	1.1 Genomics
1.2 Microbial enzymes	1.2 Mutation
1.3 Microbial metabolism	1.3 Elementary immunology

<b>SECOND SEMESTER</b>	
<b>MB 221: Microscopy and Microbial Ecology</b>	<b>MB 222: Basic microbial biotechnology</b>
2.1 Microscopy	2.1 Basics of fermentation technology
2.2 Microbial Interaction	2.2 Bioreactor
2.3 Environmental Microbiology	2.3 Downstream processing in fermentation

### Practical Course (Annual)

<b>Annual</b>
<b>203 : Methods in Microbiology</b>

**First semester****MB 211: Fundamental Biochemistry**

<b>Unit 1.1</b>	<b>Biomolecules</b>	<b>(20 Lectures/14 marks)</b>
	• Carbohydrates	
	➤ Definition and classification	
	➤ Structure & biological significance - Glucose, Lactose, Starch, peptidoglycan.	
	• Lipid	
	➤ Definition, classification	
	➤ Structure & biological significance- Glycerol, Phospholipid, Cholesterol, Palmitic acid, Oleic acid	
	• Proteins	
	➤ General properties and classification based on R group	
	➤ Basic structure of amino acid	
	➤ Definition, classification of protein	
	➤ Structural levels of protein	
	• Nucleic acid :	
	➤ Structure of basic constituents of Nucleic acids	
	➤ Watson-Crick model of DNA	
	➤ Structure and significance of - mRNA, rRNA , tRNA	
<b>Unit 1.2</b>	<b>Microbial enzymes</b>	<b>(20 Lectures/13 marks)</b>
	• Definition of enzyme	
	• General properties of enzymes	
	• Enzyme classification (IUB) and nomenclature	
	• Mechanism of enzymes catalysis:	
	➤ Lowering of activation energy	
	➤ Lock & key model	
	➤ Induced fit model	
	• Factors affecting on enzyme activity	
	➤ Substrate concentration	
	➤ Temperature	
	➤ pH	
<b>Unit 1.2</b>	<b>Microbial metabolism</b>	<b>(20 Lectures/13 marks)</b>
	• Concept of metabolism(Anabolism& Catabolism)	
	• Pathways with energetics	
	➤ Glycolysis	
	➤ Kreb's cycle	
	➤ Glyoxylate cycle	
	➤ Gluconeogenesis	

**Second semester****MB-221: Microscopy and Microbial Ecology**

<b>Unit:2.1</b>	<b>Microscopy</b>	<b>(20 Lectures/13 marks)</b>
	<ul style="list-style-type: none"> <li>• Principle, Working, Ray diagram and applications of:               <ul style="list-style-type: none"> <li>➤ Phase contrast microscope</li> <li>➤ Fluorescence Microscope</li> <li>➤ Transmission electron microscope (TEM)</li> <li>➤ Scanning Electron microscope (SEM)</li> </ul> </li> </ul>	
<b>Unit:2.2</b>	<b>Microbial Interactions</b>	<b>(20 Lectures/13 marks)</b>
	<ul style="list-style-type: none"> <li>• Importance and types of symbiosis</li> <li>• Establishment of symbiosis : a. Direct b. Re-infection</li> <li>• Study of some important interactions:               <ul style="list-style-type: none"> <li>➤ Legume-rhizobium</li> <li>➤ Mycorrhiza</li> <li>➤ Lichen</li> <li>➤ Ruminant symbiosis</li> <li>➤ Bacterial bioluminescence</li> </ul> </li> </ul>	
<b>Unit: 2.3</b>	<b>Environmental Microbiology</b>	<b>(20 Lectures/14 marks)</b>
	<ul style="list-style-type: none"> <li>• Air Microbiology               <ul style="list-style-type: none"> <li>➤ Microflora of air</li> <li>➤ Concept of aerosols and droplet nuclei.</li> <li>➤ Enumeration of bacteria in air: Liquid impingement, Solid impingement</li> </ul> </li> <li>• Water microbiology               <ul style="list-style-type: none"> <li>➤ Microflora of water</li> <li>➤ Microbial indicators of water pollution.</li> <li>➤ Bacteriological examination of potable water (Presumptive, confirmative and completed tests)</li> </ul> </li> <li>• Soil Microbiology               <ul style="list-style-type: none"> <li>➤ Soil Microflora</li> <li>➤ Rhizosphere</li> </ul> </li> </ul>	

## First Semester

### MB-212: Genetics and Immunology

<b>Unit1.1</b>	<b>Genes and chromosomes</b>	<b>(20 Lectures/13 marks)</b>
	<ul style="list-style-type: none"> <li>• Concept of gene, genome, intron, exon</li> </ul>	
	<ul style="list-style-type: none"> <li>• Typical structure of chromosome</li> </ul>	
	<ul style="list-style-type: none"> <li>• Genetic code &amp; its properties</li> </ul>	
	<ul style="list-style-type: none"> <li>• Chromosome : Haploid, diploid, partially diploid, homologous, allele</li> </ul>	
	<ul style="list-style-type: none"> <li>• Plasmid : Definition, properties and types</li> </ul>	
<b>Unit 1.2</b>	<b>Mutations</b>	<b>(20 Lectures/13 marks)</b>
	<ul style="list-style-type: none"> <li>• Definition and significance of mutation</li> </ul>	
	<ul style="list-style-type: none"> <li>• Types of mutation</li> </ul>	
	<ul style="list-style-type: none"> <li>• Methods to study mutation</li> </ul>	
	➤ Replica plate technique	
	➤ Fluctuation test	
	<ul style="list-style-type: none"> <li>• Mechanism of Spontaneous mutations</li> </ul>	
	<ul style="list-style-type: none"> <li>• Mechanism of mutations Induced by -UV rays, Base analogues, Deaminating agents, alkylating agent, intercalating agent</li> </ul>	
<b>Unit 1.3</b>	<b>Immunology</b>	<b>(20 Lectures/14 marks)</b>
	<ul style="list-style-type: none"> <li>• Infection : Types &amp; mode of transmissions</li> </ul>	
	<ul style="list-style-type: none"> <li>• Types of Immunity</li> </ul>	
	<ul style="list-style-type: none"> <li>• Specific immune response</li> </ul>	
	<ul style="list-style-type: none"> <li>• Non-specific immune response</li> </ul>	
	<ul style="list-style-type: none"> <li>• Properties and types of Antigen, Concept of hapten, immunogen, eptiope and paratope.</li> </ul>	
	<ul style="list-style-type: none"> <li>• Properties and types of Antibody</li> </ul>	

## Second semester

### MB 222: Basic Microbial Biotechnology

<b>Unit 2.1</b>	<b>Basics of fermentation technology</b>	<b>(20 Lectures/13 marks)</b>
	• Characteristic of industrial strain	
	• Screening of industrially important microbes: Primary & Secondary	
	• Fermentation media: Composition, Raw materials, screening of media, antifoam, buffer.	
	• Inoculum – stock, working culture	
	• Inoculum development	
	• Preservation methods for industrially important microbes	
<b>Unit2.2</b>	<b>Bioreactor &amp; fermentation Process</b>	<b>(20 Lectures/13 marks)</b>
	• Fermentor & its parts.	
	• Criteria for fermentor designing	
	• Batch fermentation	
	• Continuous fermentation:	
	➤ Chemostat	
	➤ Turbidostat.	
	• Synchronous culture and its applications.	
<b>Unit 2.3</b>	<b>Downstream Processing</b>	<b>(20 Lectures/14 marks)</b>
	• Recovery & Purification of fermentation products :	
	➤ Cell removal by: precipitation, filtration & centrifugation	
	➤ Cell disruption : physical & chemical method	
	• Solvent recovery process	
	• Chromatography: Types and significance in industrial recovery	
	• Drying & crystallization	
	• Packing of product	

**MB 203 Practical Course**

1. Use of micro-pipette and calibration of pipette	1
2. Handling/operation and precautions in using spectrophotometer and verification of Beer's and Lamberts law.	1
3. Cell wall staining (Ringers et al OR Chance's method)	1
4. Endospore Staining (Dorners OR Schaeffer-Fulton method)	1
5. Capsule Staining (Hiss OR Manevals method)	1
6. Volutin granules (Alberts OR Neisser's method)	1
7. Flagella staining (Bailey's OR Loefflers method)	1
8. Detection of enzyme production : Amylase, lipase, gelatinase, catalase, urease, nitrate reductase (any four)	1
9. Replica plate technique	1
10. Screening of microbes: Crowded plate technique and Indicator dye method	1
11. Demonstration of flagella by Hanging drop OR swarming growth	1
12. Estimation of acetic acid from vinegar by titrimetric method	1
13. Determination of potability of water by MPN	1
14. Determination of microflora of air	1
15. Determination of blood group and demonstration of cross matching	1
16. Determination of pKa value	1
17. Qualitative tests for carbohydrates, protein, nucleic acid (any one method for each)	1
18. Permanent slides observation: Root nodules	1
19. Demonstration of fermentor (virtual OR model OR instrument )	1
20. Study tour : Visit to Dairy/ industry / research institute / pathology laboratory / field visit for isolation of microbes etc.	1

**References for theory courses**

	<b>Title of Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Edition and Year</b>
1.	Foundations in microbiology ( ISBN 978-0-07-337529-8)	Kathy Talaro and Barry Chess	The McGraw-Hill Companies, Inc.,	8th Edition (2012)
2.	Microbiology ISBN 10: 0-321-55007-2;	Tortora, Funke and Case	Brenjamin Cummings Inc. California	10th Edition (2010)
3.	DESK ENCYCLOPEDIA OF MICROBIOLOGY	EDITOR-IN-CHIEF MOSELIO SCHAECHTER	Elsevier	2nd edition (2009)
4.	Microbiology 0-07-282905-2	Prescott, Harley and Klein's	The McGraw-Hill Companies, Inc.,	5th Edition (2002)
5.	General Microbiology Vol.I and II	Pawar and Daginawala	Himalaya Publishing House, Mumbai	First Edition
6.	General Microbiology	Stainer, R. Y., Ingraham, J.L., Wheelis M.L., Painter R.K.	MacMillan Press Ltd. London.	5 <sup>th</sup> Edition (1995),
7.	Fundamental Principals of Bacteriology	Salle, S.J.	Tata McGraw Hill Publishing Co. Ltd. New Delhi	1974)
8.	Fundamentals of Microbiology,	Frobisher M. Hinsdill, Crabtree and Goodheart	Edition, WB Saunder's Co. USA.	9 <sup>th</sup> Edition (1974)
9.	Microbiology	Pelczar MJ, Chan ECS, Krieg NR	Tata McGraw Hill Publishing Co.Ltd. New Delhi.	5 <sup>th</sup> Edition (1998)
10.	Foundations in Microbiology (ISBN: 976-81-85790-53-4)	Ulhas Patil, JS Kulkarni, AB Chaudhari and SB Chincholkar	Nirali Prakashan	7th Edition (2011)
11.	Textbook of Microbiology	Ananthanarayanan, R and Jayaram Panicker C.K	University press (India) pvt. Ltd, Hyderabad	8 <sup>th</sup> ed. (2009)
12.	Industrial microbiology,	Casida, L.E	New Age International Publishers, New Delhi.	1998
13.	Biotechnology: A textbook of industrial microbiology,	Crueger, W. and Crueger, A.	Panima Publ Co., New Delhi.	2nd edn., (2000)
14.	Principles of fermentation technology,	Stanbury, P.F., Whitaker, A. and Halt G.	Aditya Books, New Delhi or Pergamon Press, New York.	2 <sup>nd</sup> edn., (1995)
15.	Principles of biochemistry	Leninger, A.L	CBS Publ.Pvt Ltd., New Delhi.	1994
16.	Elementary Microbiology, Vol 1, 2.	Modi H. A	Ekta Prakashan, Ahemdabad	1995
17.	Industrial Microbiology,	Patel A. H.	McMillan Publication, New Delhi	(1996)
18.	Industrial microbiology	Prescott S.C and Dunn C.G.	International students edn, McGraw Hill Book Co. Inc., New York.	(1983) 3rd edn.,



## References for practical course

	<b>Title of Book</b>	<b>Author/s</b>	<b>Publication</b>	<b>Edition and Year</b>
1.	Methods in Microbiology Volume 1	Edited by J. R. Norris, d. W. Ribbons	Academic press inc. (london) ltd	First Edition (1969)
2.	Laboratory Exercises in Microbiology,	John P. Harley Lansing M. Prescott	The McGraw–Hill Companies,	Fifth Edition (2002)
3.	Microbiological Applications Lab Manual,	H. Benson	The McGraw–Hill Companies,	Eighth Edition (2001)
4.	Experiments in Microbiology,	Aneja K.R.	Wishwa Prakashan, New Delhi.	3rd Edition (1996)
5.	Text Book of Practical Microbiology	Parija S.C.	Ahuja Publishing House, New Delhi.	First edition (2005)
6.	Manual of Microbiology Tools and techniques	Sharma Kanika	Ane's Book India, New Delhi	2nd Ed. ( 2007)
7.	Practical Microbiology	Dubey R.C. and Maheshwari D.K.	S. Chand and Co. Delhi.	(2004)
8.	A laboratory manual in biochemistry	Jayraman J	New Age international publication	(2001)
9.	In introduction to practical biochemistry	David Plummer	Tata McGraw Hill Ed, New Delhi	(2001)