

UNIVERSITY OF MUMBAI
No.UG / 147 of 2008

CIRCULAR :-

A reference is invited to the Ordinances, Regulations and Syllabi relating to the Bachelor of Science degree course vide pamphlet No.136 and to this office Circular No.UG/127 of 2002 dated 11th March,2002 and the Principals of the affiliated colleges in Science are hereby informed that the recommendation made by the Board of Studies in Microbiology at its meeting held on 8th January,2008 has been accepted by the Academic Council at its meeting held on 27th February,2008 vide item No.4.11 and that, in accordance therewith, the syllabus and pattern of question paper in the subject of Microbiology at the F.Y.B.Sc. (Theory and Practical) examination is revised as per Appendix and that the same will be brought into force with effect from the academic year 2008-2009.

MUMBAI-400 032
April,2008

for I/c. REGISTRAR

The Principals of the affiliated colleges in Science

C/4.11/27.02.2008

No.UG/ 147 - A of 2008, MUMBAI-400 032 4th April,2008

Copy forwarded with compliments for information to :-

- 1) The Dean, Faculty of Science
- 2) The Chairperson, Board of Studies in Microbiology
- 3) The Controller of Examinations,
- 4) The Co-Ordinator, University Computerization Centre,

for I/c. REGISTRAR

Copy to :-

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri for information.

The Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies), Record Section (5 copies), Publications Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical Unit (2 copies), the Deputy Registrar (Accounts Section), Vidyanaagari (2 copies), the Deputy Registrar, Affiliation Section (2 copies), the Director, Institute of Distance Education, (10 copies) the Director University Computer Center (IDE Building), Vidyanaagari, (2 copies) the Deputy Registrar (Special Cell), the Deputy Registrar, (PRO) the Assistant Registrar, Academic Authorities Unit (2 copies) and the Assistant Registrar, Executive Authorities Unit (2 copies). They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above Circular and that, no separate Action Taken Report will be sent in this connection. the Assistant Registrar Constituent Colleges Unit (2 copies) BUCT (1 copy), the Deputy Account, Unit V (1 copy), the In-charge Director, Centralize Computing Facility (1 copy) the Receptionist (1 copy), the Telephone Operator (1 copy), the Secretary MUASA (1 copy), the Superintendent, PG Graduate Section (2 copies), the Superintendent, Thesis Section (2 copies)

UNIVERSITY OF MUMBAI



Revised Syllabus
and
Pattern of Question Papers
in
Microbiology
at
F.Y.B.Sc.

(With effect from the academic year 2008-2009)

REVISED SYLLABUS FOR
F.Y.B.Sc. MICROBIOLOGY

PAPER I - FUNDAMENTALS OF MICROBIOLOGY

90 Lectures

UNIT I - INTRODUCTION TO MICROBIOLOGY AND PROCARYOTIC CELL
STRUCTURE AND FUNCTION

15 Lectures

- 1.1. History and scope of Microbiology 2 L
- 1.2. Procaryotic cell membranes- Plasma membrane and internal membrane 2 L
- 1.3. Cytoplasmic Matrix – Inclusion bodies, ribosome 2 L
- 1.4. Bacterial chromosome and plasmids – source of information. 2 L
- 1.5. Cell Wall 2 L
- 1.6. Components external to cell wall – Capsule, slime layer, S layer, pili, Fimbriae, Flagella 3 L
- 1.7. Bacterial endospores and their formation. 2 L

UNIT II - EUKARYOTIC CELL STRUCTURE AND FUNCTION

15 lectures

- 2.1. Overview of Eucaryotic cell structure and functions 1 L
- 2.2. The cytoplasmic matrix, microfilaments, intermediate filaments and microtubules 2 L
- 2.3. Endoplasmic reticulum and Golgi apparatus 1 L
- 2.4. Lysosomes and Endocytosis. 2 L
- 2.5. Eucaryotic ribosomes, Mitochondria and Chloroplasts 2 L
- 2.6. Nucleus, Nucleolus, Cell division, Mitosis and Meiosis 4 L
- 2.7. External cell coverings. 2 L
- 2.8. Comparison between Procaryotic and Eucaryotic cell 1 L

UNIT III - MICROBIAL NUTRITION, CULTIVATION, ISOLATION AND
PRESERVATION.

15 lectures

- 3.1. Nutritional requirements - Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulfur and growth factors. 2 L
- 3.2. Nutritional types of microorganisms 2 L
- 3.3. Nutrient uptake mechanisms 3 L
- 3.4. Types of Culture media with examples 3 L
- 3.5. Isolation of microorganisms and pure culture techniques. 3 L
- 3.6. Preservation of microorganisms 2 L



UNIT IV - MICROBIAL GROWTH.

1. Definition of growth, Mathematical expression, Growth curve	15 lectures
2. Measurement of growth	3 L
a) Direct microscopic count - Breed's, Petroff-Hausser counting chamber, Haemocytometer.	6 L
b) Viable count - Spread plate and Pour plate technique	
c) Measurement of cell mass	
d) Turbidity measurements - Nephelometer and spectrophotometer techniques	
e) Measurements of cell constituents	
3. Synchronous growth, Continuous growth (Chemostat and Turbidostat)	2L
4. Growth yield	1L
5. Influence of environmental factors on growth.	1L
6. Microbial growth in natural environment.	1L
7. Counting viable non-culturable organisms- Quorum sensing techniques	1L

UNIT V - STUDY OF YEAST, MOLDS, ALGAE AND PROTOZOA.

15 lectures

1. Classification, Morphological characteristics, cultivation, reproduction and significance	
a) Yeast and molds	7 L
b) Algae	4 L
c) Protozoa	4 L

UNIT VI - STUDY OF VIRUSES, RICKETTSIA, CHLAMYDIA, ACTINOMYCETES AND ARCHAEABACTERIA

15 lectures

6.1. Viruses : Classification of viruses, General characteristics, Structure of T4 phage, viral cultivation, inclusion bodies and their significance, Life cycle of coliphages lytic cycle and lysogeny.	6 L
6.2. Rickettsia : General characteristics, Diseases and vectors	2 L
6.3. Chlamydia: General characteristics	1 L
6.4. Actinomycetes: General properties, cell wall types, whole cell sugar patterns. Characteristics as per new classification and significance	3 L
6.5. Archaea : Characteristics of major archaeal groups	3 L

APPLIED MICROBIOLOGY

MICROSCOPY

90 Lectures

15 Lectures

- 1. Principles of handling of light
- 2. Light Microscope
- 3. Bright Field Microscope
- 4. Resolution of the Microscope
- 5. Electron Microscope
- 6. The Transmission Electron Microscope
- 7. The Scanning Electron Microscope
- 8. Techniques in Microscopy
- 9. Confocal Microscopy
- 10. Scanning Probe Microscopy
- 11. The Scanning Tunneling Microscope
- 12. The Atomic Force Microscope

1L
2L
6L

4L

2L

CONTRAST ENHANCEMENT TECHNIQUES

15 Lectures

- 1. Dark Field Microscope
- 2. Phase Contrast Microscope
- 3. Differential Interference Contrast Microscope
- 4. Fluorescence Microscope
- 5. Staining of specimens
 - a. Fixation
 - b. Dyes & simple staining
 - c. Differential staining
 - d. Staining specific structures
- 6. Specimen preparation in TEM
 - a. Staining, Shadowing with metals, Freeze etching

1L
1L
1L
1L
8L

3L

UNIT III: CONTROL OF MICROORGANISMS

15 Lectures

1. Definitions of frequently used terms 1L
2. Factors/Rate of Microbial Death 1L
3. Conditions influencing the effectiveness of Antimicrobial Agents 1L
4. Physical methods of Microbial Control 6L
 - a) Heat : Moist & Dry
 - b) Low temperature
 - d) High pressure
 - f) Osmotic pressure
5. Filtration
6. Desiccation
7. Radiations 5L
8. Chemical methods of Microbial Control
 - a) Phenolics
 - b) Biguanides-Chlorhexidine
 - d) Halogens
 - f) Quaternary ammonium compounds
 - h) Aldehydes
 - j) Peroxygens
9. Alcohols
10. Heavy Metals
11. Surface active agents
12. Sterilising gases
13. Chemotherapeutic agents
14. Evaluation of effectiveness of Antimicrobial agent 1L

UNIT IV : MICROORGANISMS IN AIR & SOIL

15 Lectures

1. Air Microbiology 2L
 - a) Types & Significance of organisms
 - b) Techniques of studying Air Microflora
2. Microorganisms in Terrestrial Environments 4L
 - a) Soil as an environment
 - b) Soils, Plants & Nutrients
 - c) Diversity of soil microorganisms
 - d) Formation of different soils
3. Biogeochemical cycling 5L
 - a) Carbon cycle
 - b) Nitrogen cycle
 - c) Phosphorous cycle
 - d) Sulfur cycle
 - e) Iron cycle
 - f) Manganese cycle
 - g) Metal toxicity
4. The Physical environment 2L
 - a) The Microenvironment & Niche
 - b) Biofilms & Microbial mats
 - c) Microorganisms & ecosystems
5. Examination of Microbial Populations 2L
 - a) Examination Techniques
 - b) Examination of Community structure
 - c) Microbial activity & turnover
 - d) Recovery or addition of individual microbes



UNIT V: MICROORGANISMS IN WATER & WASTEWATER

15 Lectures

- Marine & Fresh water environments
 - a) Water as a microbial habitat)
 - b) Nutrient cycling)
- c) Fresh Water environments
 - Glaciers & permanently frozen lakes
 - Streams & rivers
 - Lakes
- d) Marine environments
 - Estuaries & Salts marshes
 - The Photic zone
 - The Benthic zone
- e) Water purification & Sanitary analysis
- f) Waste water Microbiology
 - a) Measurement of waste water quality
 - b) Waste water treatment

1L

2L

2L

6L

4L

UNIT VI: MICROBIAL INTERACTIONS

15 Lectures

- 1. Types of Microbial Interactions
 - Mutualism, Cooperation, Commensalisms, Predation
 - Parasitism, Amensalism, Competition
- 2. Human Microbe Interactions
 - a) Normal Flora of the human body:
 - Skin, Nose & nasopharynx, Oropharynx, Respiratory tract,
 - Eye, External ear, Mouth, Stomach, Small intestine,
 - Large intestine, Genitourinary tract
 - b) Relationship between microbiota & the host
 - c) Gnotobiotic animals
- 3. Microbial associations with vascular plants
 - a) Phyllosphere
 - b) Rhizosphere & Rhizoplane
 - c) Mycorrhizae
 - d) Nitrogen fixation : Rhizobia, Actinorrhizae, Stem nodulating rhizobia
 - e) Fungal & Bacterial endophytes
 - f) Agrobacterium & other plant pathogens

2L

8L

5L

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List of books for Paper I and Paper II

- Prescott, Harley, Klein – Microbiology 5th and 6th Edn. International Edn. 2002 and 2006
McGraw Hill.
- Kathleen Park Talaro and Arthur Talaro – Foundations in Microbiology 4th international Ed.
2002, McGraw Hill.
- Michael T. Madigan, John M. Martinko – Brock Biology of Microorganisms 11th Ed.
International Edn. 2006 Pearson Prentice Hall
- A. J. Salle – fundamental Principles Of Bacteriology.
- Stanier, Ingraham et al, General Microbiology – 4th and 5th Ed. 1987, Macmillan education Ltd.

PRACTICAL I

1. Safety in Laboratory
2. Prokaryotic and Eucaryotic Cell Structure :
 - a. Monochrome staining
 - b. Negative staining
 - c. Differential staining : Gram's staining
 - d. Staining of specific structures of bacteria :
Cell-wall, capsule, endospores, metachromatic granules, lipid granules, flagella, spirochaete staining
 - e. Permanent slides of Cyanobacteria (Anabena, Nostoc, Rivularia, Oscillatoria)
 - f. Permanent slides of Protozoa (Amoeba and Paramoecium)
3. Preparation of culture media:
 - a. Liquid Medium (Nutrient broth)
 - b. Solid Media (Nutrient agar, Sabouraud agar)
 - c. Preparation of slants, butts and plates
4. Inoculation Techniques :
 - a. Liquid medium
 - b. Solid media (slants, butts and plates)
 - c. Study of Colony Characteristics
 - d. Study of Motility (Hanging drop preparation)
 - e. Use of differential, selective and enriched media
 - i. MacConkey's agar
 - ii. Superimposed blood agar
5. Determination of Optimum Growth conditions (Temperature, pH)
6. Cultivation of Yeasts and Molds:
 - a. Cultivation on Sabouraud agar
 - b. Static and Shaker cultures
 - c. Fungal wet mounts and study of morphological characteristics
 - i. Mucor
 - ii. Rhizopus
 - iii. Aspergillus
 - iv. Penicillium
 - d. Slide-culture Technique
7. Measurement of Microbial growth
 - a. Microscopic cell count (Haemocytometer)
 - b. Preparation of opacity tubes and determination of cell count
 - c. Viable count (Pour plate and surface spread)
 - d. Growth curve of *E. coli* and determination of generation time (Grp. Expt)
8. Micrometry: Measurements of cell dimensions (Yeast)
9. Assignment: Contributions of a scientist in the field of Microbiology

PRACTICAL II

1. Compound Microscope
2. Physical Methods of control of micro-organisms :
 - a. Heat : Autoclaving, Fractional sterilization, Dry heat
 - b. Bacteria proof filtration (Demonstration of Membrane Filtration)
 - c. Effect of U-V rays
 - d. Effect of desiccation
 - e. Effect of high osmotic pressure
3. Chemical Methods of control of micro-organisms:
 - a. Effect of phenolics (Disc Method)
 - b. Oligodynamic action
 - c. Tween 80
 - d. Dyes (Disc Method)
 - e. Chemotherapeutic agents
4. Study of Air microflora and determination of sedimentation rate
5. Study of Soil microflora (Bacteria, Yeast and Molds, Actinomycetes)
6. Winogradsky Column- Demonstration of Sulphur cycle
7. Analysis of water : Potability
8. Study of Raw sewage
9. Study of Azotobacter
10. Study of Rhizobia
11. Crowded Plate Technique
12. Normal flora of : a. Skin b. Intestine

GENERAL GUIDELINES FOR THE SYLLABUS :

- 1) There are two theory papers of 60 marks each.
- 2) There are 2 practicals based on theory papers of 40 marks each.
- 3) Paper I contains VI UNITS and Paper II contains VI UNITS.
- 4) UNIT I, II and III is to be covered in the FIRST TERM
- 5) UNIT IV, V and VI is to be covered in the SECOND TERM.

EXAMINATION PATTERN

	PAPER I	PAPER II
FIRST TERM	30 marks	30 marks
SECOND TERM	30 marks	30 marks
PRACTICALS at the end of second term	40 marks	40 marks
TOTAL MARKS	100	100

* Student will be permitted to appear for the annual practical examination only after submission of a completed and duly certified journal.

F.Y.BSc. MICROBIOLOGY PRACTICAL EXAMINATION

Paper I

- | | |
|------------------------|----------|
| 1. Gram staining | 10 Marks |
| 2. Special staining | 10 Marks |
| 3. Isolation Technique | 15 Marks |
| 4. Journals | 05 Marks |

40 Marks

Paper II

- | | |
|------------------------------|----------|
| 1. Bacteriological Technique | 25 Marks |
| 2. Spots & Quiz (5 nos) | 10 Marks |
| 3. Journals | 05 Marks |

40 Marks

Total Practicals Paper I + Paper II

80 Marks
