

**GUJARAT UNIVERSITY**  
**Syllabus for First Year Microbiology**  
**Semester I and II**  
**Effective from June 2017**

1. A student offering Microbiology programme will be offered two theory papers of core course MI 101 and MI103; each paper of 100 marks and practical papers MI102 and MI104 of 100 marks each as prescribed here under
2. Each theory paper at the external examination shall be of 3 hours duration and carry 70 marks. Each practical examination shall be of two consecutive days each of four hours duration. Total marks for practicals shall be 70 each
3. Internal assessment will be of 30 marks for each theory and practical papers
4. For each theory papers there will four lectures of 55 minutes per week. For practical there will be four lectures (two/practical) each of 55 minutes per week.
5. Each theory paper is divided into four units and from each unit one question shall be set. The fifth question will be of objective type covering contents of all four units
6. Practical batch shall consist of 25 to maximum 30 students
- 7. The teaching shall be based upon listed textbooks**
8. The numeric on the right depicts the number of lectures allotted

**Course MI 101 Introduction to Microbial world**

	<b>(Hours)</b>
<b>1. Development of Microbiology as a new discipline of Biological Science</b>	
a. Discovery of microbial world	(04)
I) Establishment of theory of biogenesis	
II) Discovery of viruses	
III) Developments in pure culture techniques.	
b. Establishment of germ theory:	(04)
I) Germ theory of diseases and fermentation	
II) Work of Lister and principles of aseptic surgery	
III) Discovery and developments of vaccines and modern chemotherapy	
c. Discovery in Soil and Agriculture Microbiology	(02)
I) Work of Winogradsky and Beijerinck	
II) Discovery of microorganisms as plant pathogens	
<b>2. The Microbial world</b>	
a. Distribution of microorganisms in natural habitats	(01)
b. Introduction to prokaryotes	(03)
c. Introduction to eukaryotes	(04)
d. Acellular entities (viruses, viroids, prions)	(02)
<b>3. A) Significance of Microbiology</b>	(04)
a. Branches of Microbiology	
b. Thrust areas of Microbiology: Genetic engineering and Biotechnology	
<b>B) Pure culture techniques</b>	(06)
a. Definition: Pure culture and Axenic culture	
b. Principles and methods of obtaining pure culture	
c. Preservation of pure culture, culture collection centers	

#### 4. Techniques used to study microorganisms

- a. Microscopy (05)
- I) Principles of Microscopy, magnification and resolving power
  - II) Light microscopy: Simple and compound microscope, bright field and dark field microscopy
  - III) Principles and applications of phase contrast, fluorescent and Electron microscopy
- b. Staining (05)
- I) Dyes and stains: Definition, acidic, basic dyes and leuco compounds
  - II) Smear: Fixation, use of mordents, intensifiers and decolourizers
  - III) Mechanism of staining, Types of staining: Simple and differential staining

**Text book:** Pelczar Jr, M J, Chan E C S, Krieg N R, (1986), *Microbiology: An Application Based Approach*, 5th edn. McGraw-Hill Book Company, NY

#### Suggested readings:

- Ingraham J L and Ingraham C A **Introduction to Microbiology**: Thomson Brooks/Cole
- Atlas R M, (2015), **Principles of Microbiology** 2<sup>nd</sup> Edition, McGraw Hill education, Mumbai

### MI-102 (Practicals)

1. Study of principles and working of laboratory instruments: Light microscope, Autoclave, Hot air oven, Incubator, Bacteriological filters, Rotary shaker, pH meter, Spectrophotometer, Centrifuge.
2. Cleaning and preparation of glassware for sterilization.
3. Disposal of laboratory waste and cultures.
4. Study of Hay infusion.
5. Staining of Bacteria: a. simple staining: i) Positive staining. ii) Negative staining.  
b. Differential staining: Gram staining.
6. Study of permanent slides of different groups of microorganisms
  - a. Prokaryotes – bacteria: Cocci, Short rods, Bacilli, Spirochetes, Curved bacteria, Filamentous bacteria – Actinomycetes
  - b. Eukaryotic microorganisms i) Fungi: Yeast, *Mucor*, *Rhizopus*, *Aspergillus*, and *Penicillium*
    - ii. Algae: Diatoms, *Spirogyra*
    - iii. Protozoa: *Amoeba*, *Paramecium*, *Plasmodium*
7. Preparation of Nutrient media: Nutrient agar and Nutrient broth.
8. pH adjustment of media by use of pH strip and pH meter.
9. Isolation of bacteria by streak plate method from water, soil, curd and surface of table.

### Scheme for Practical Examination

	(Marks)
Ex 1 Staining of Bacteria	(15)
Ex 2 Isolation of bacteria	(15)
Ex 3 General Exercise	(10)
1. Preparation of Nutrient media	
2. pH adjustment	
3. Operation of laboratory instrument	
4. Study of hay infusion	
Ex 4 Spotting	(15)
Ex 5 Vive voce	(10)
Ex 6 Journal and slides	(05)

**Course MI 103**  
**Basic Bacteriology**

	<b>Hours</b>
<b>1. Typical Prokaryotes: Taxonomy and cellular organization</b>	
A) Taxonomy:	(04)
I) Principles of binomial system of nomenclature	
II) Introduction to different systems of bacterial classification	
B) Cellular organization:	(04)
I) Size, shape and arrangement of bacteria	
II) Bacterial endospore: Spore structure, Sporulation and Spore germination	
<b>2. Structure of typical bacterial cell</b>	
<b>A) Surface appendages:</b>	(02)
I) flagella	
II) pili and fimbriae	
III) Prosthecae and stalks	
<b>B) Surface layers:</b>	(04)
I) Capsule and slime layer	
II) Cell wall	
III) Cytoplasmic membrane and mesosomes	
<b>C) Cytoplasm and cell organelles:</b>	(04)
I) Cytoplasm	
II) Ribosome	
III) Nuclear material and Plasmid	
IV) Cellular reserve food material	
<b>3. Introduction to Bacterial nutrition</b>	
A) Nutritional diversities in bacteria	(02)
B) Nutritional requirements of bacteria	(02)
C) Culture media:	(04)
I) Principles of media formulation	
II) Media ingredients	
III) Types of media	
D) Cultivation methods of bacteria, Growth characteristics in broth and solid media	
<b>4. Principles of Microbial control</b>	
A) General principles: Control by killing, inhibition and removal	(02)
B) Physical agents of microbial control:	(04)
I) Heat	
II) Radiation	
III) Osmotic pressure	
IV) Filtration	
C) Chemical agents of microbial control:	(04)
Ideal antimicrobial agent, Major groups of antimicrobial agents:	
I) Phenols	

- II) Halogens
- III) Surfactants
- IV) Alcohols
- V) Heavy metals
- VI) Gaseous agents

**Text book:** Pelczar Jr, M J, Chan E C S, Krieg N R, (1986), *Microbiology: An Application Based Approach*, 5th edn. McGraw-Hill Book Company, NY

Suggested readings:

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## MI-104 (Practicals)

### 1. Cultivation methods for bacteria

- a. Broth culture
- b. Agar slope/slant culture
- c. Agar plate method
  - i. Streak plate method
  - ii. Pour plate method
  - iii. Spread plate method

### 2. Cultivation of anaerobic bacteria by use of

- a. Robertson's cooked meat media
- b. Thioglycollate broth
- c. Anaerobic jar (Demonstration)

### 3. Preservation of microbial cultures

- a. Periodic sub culturing and storage at refrigeration temperature
- b. Preservation in soil (fungi/*Azotobacter*)

### 4. Study of pigmented bacteria

- a. *Staphylococcus aureus*
- b. *Staphylococcus epidermidis*
- c. *Micrococcus luteus*
- d. *Serratia marscecens*
- e. *Pseudomonas aeruginosa*

### 5. Study of bacterial structure by structural staining

- a. Endospore by Dorner's method
- b. Cell wall by Dyar's method
- c. Capsule by Hiss's method
- d. Granule by Albert's method

### 6. Use of special staining technique to study bacteria

- a. *Spirocheates* by Fontana's method

### 7. Study of effect of various physical agents on growth of bacteria

- a. Effect of pH
- b. Effect of temperature
- c. Effect of osmotic pressure (NaCl and Sucrose)

## Scheme for Practical Examination

	<b>Marks</b>
Ex 1 Staining of Bacteria: Structural and special	(20)
Ex 2 Study of effect of physical agent on growth of bacteria/Isolation and cultivation of bacteria	(20)
Ex 3 Spotting	(15)
Ex 4 Vive voce	(10)
Ex 5 Journal and slides	(05)