Proposed syllabus for F.Y. B.Sc Microbiology SEM I and II submitted to the Gujarat University effective from June 2011

Course MI-101
Introduction to microbial world

1. **Development of microbiology as a new discipline of biological science(10 Hrs)**
    a. Discovery of microbial world: Establishment of theory of biogenesis, Discovery of viruses. Developments in pure culture techniques.
    b. Establishment of germ theory of diseases and fermentation. Work of Lister and principles of aseptic surgery. Discovery and developments of vaccines and modern chemotherapy.
    c. Work of Winogradsky and Beijerinck. Discovery of microorganisms as plant pathogens.
2. **The Microbial World (10 Hours)**
    a. Distribution of microorganisms in nature.
    b. Diversity in microbial habitat. Types of microorganisms.
    c. Introduction to prokaryotic world, eukaryotic microorganisms, viruses and other acellular microorganisms.
3. **A Significance of Microbiology (10 Hours)**
    a. Impact of microorganisms in environment and its impact on human life.
    b. Branches of microbiology
    c. Thrust areas of microbiology: genetic engineering and biotechnology

    B Pure culture techniques
    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 (10 Hours)**
    a. Microscopy
        i. Principles of microscopy, magnification and resolving power
        ii. Light microscopy: simple and compound microscope. Bright field and dark field microscopy. Principles and application of phase contrast and fluorescent microscopy
        iii. Electron microscopy: general principles. Types of electron microscopy, their principles working and limitations.
    b. Staining
        i. Dyes and stains: Definition, acidic basic dyes and leucocompounds.
        ii. Smear: Fixation use of mordent, intensifiers and decolorizer.
        iii. Mechanism of staining. Types of staining: simple and differential staining
        iv. Application of stains and dyes in study of microbiology

Text book:

Microbiology: Pelczar M J, Chan E C S and Kreig N R Tata Mc Grow Hill

Suggested reading:

- **General Microbiology**: R Y Stanier, Adelberg E A and J L Ingraham, Mac Millan Press Inc.
- **Introduction to microbiology**: Ingraham J L and Ingraham C A Thomson Brooks/ Cole
- **Principles of microbiology** R M Atlas Wm C brown Publishers
- **Brock's biology of Microorganisms** Madigan M T and Martinko J M Pearson Education Inc
- **Microbiology: An introduction**: Tortora G J, Funke B R and Case C L Pearson Education Inc

MI102 (Practicals)

1. Study of principles and working of laboratory instruments
   Light microscope, Autoclave, Hot air oven, Incubator, Bacteriological filter, Rotary shaker, pH meter, Spectrophotometer, Centrifuge.
2. Cleaning and preparation of glass ware for sterilization
3. Disposal of laboratory waste and cultures
4. Study of Hay infusion
5. Study of bacterial motility
6. Measurement of size of bacteria and yeast by use of micrometer
7. Staining of bacteria
   a. Simple staining
      i. Positive staining
      ii. Negative staining
   b. Differential staining: Gram staining
8. Study of permanent slides of different groups of microorganisms
   a. Prokaryotes – bacteria
      Cocci, Short rods, Bacilli, Spirochetes, Curved bacteria, Filamentous bacteria – Actinomycetes,
   b. Eukaryotic organisms
      a. Fungi: Yeast, Mucor, Rhizopus, Aspergillus, Penicillium,
      b. Algae: Diatoms, Spirogyra
   c. Protozoa: Amoeba, Paramecium, Plasmodium
10. Preparation of nutrient media: Nutrient agar and Nutrient broth
11. pH adjustment of media by use of pH strip and pH meter
12. Study of presence of microorganisms in different habitat – environment
    Air, Water, Soil, Food, Milk, Curd, Skin, Surface of table,
13. Isolation of bacteria by streak plate method

Scheme for practical examination

Ex 1	Staining of bacteria	15 Marks
Ex 2	Isolation of bacteria	15 Marks
Ex 3	General exercise: pH adjustment / Operation of laboratory Instrument / Study of Hay infusion / Micrometry	10 marks
Ex 4	Spotting	15 Marks
Ex 5	Viva voce	10 Marks
Ex 6	Journal	05 Marks

Course MI-103
Basic Bacteriology

1. **Typical prokaryotic organization** **(10 Hours)**
    a. Shape, size and arrangement of bacteria.
    b. Structure of bacterial cell
        i. Surface appendages of bacteria: General nature, arrangement, structure and role of flagella, General nature and significance of pili, prosthecae and stalks
        ii. Surface layers of bacteria: General nature and significance of capsule and slime layer, bacterial cell wall, Cell membrane and Mesosomes
        iii. Bacterial cytoplasm and cell organelles: Cytoplasm, cytoplasmic inclusions, nuclear material
    c. Bacterial endospore: Spore structure, sporulation and spore germination
2. **Introduction to bacterial nutrition.** **(10 Hours)**
    a. Nutritional diversities in bacteria.
    b. Nutritional requirements of bacteria.
    c. Culture media: Principles of media formulation. Media ingredients. Types of culture media.
    d. Cultivation methods of bacteria. Characteristics of growth in broth and solid media
3. **Principles of microbial control.** **(10 Hours)**
    a. General principles: Control by killing, inhibition and removal.
    b. Physical agents of microbial control: Heat, Radiation, Osmotic pressure, Filtration
    c. Chemical agents of microbial control: Ideal antimicrobial chemical agent. Major groups of antimicrobial chemical agent: Phenolics, Halogens, Surfactants, Alcohols, Dyes, Heavy metals and gaseous agents
4. **Introduction to bacterial taxonomy and nomenclature** **(10 Hours)**
    a. Principles of binomial system of nomenclature
    b. Introduction to different systems of bacterial classification, Whittaker's and Carl Woese system of classification
    c. Introduction to Bergey's Manual of systematic bacteriology.

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Course MI-104 (Practicals)

1. Preparation and study of different types of culture media
   Mac-Conkeys's agar medium, Glucose yeast agar medium, Thioglycolate broth medium, Robertson'scooked meat medium, Potato dextrose agar medium, Rose Bengal agar medium
2. 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
3. Cultivation of anaerobic bacteria by use of
   a. Robertson's cooked meat medium
   b. Thioglycolate broth
   c. Anaerobic jar (Demonstration only)
4. Preservation of microbial cultures
   a. Periodic sub culturing and storage at refrigeration temperature
   b. Soil culture method for fungi
5. Study of pigmented bacteria
   a. *Staphylococcus aureus*
   b. *Staphylococcus epidermidis*
   c. *Micrococcus luteus*
   d. *Serratia marscecens*
   e. *Pseudomonas aeruginosa*
6. Study of bacterial structure by use of structural staining
   a. Endospore by use of Doerner's method
   b. Cell wall by use of Dyer's method
   c. Capsule by use of Hiss's method
7. Use of special staining technique to study bacteria
   a. Spirochetes by use of Fontana's staining method
8. Study of effect of various physical and chemical agents on growth of microorganisms
   a. Study of effect of temperature and osmotic pressure on growth of microorganisms
   b. Study of effect of chemicals on microbial growth
      i. Study of effect of heavy metal ions and their oligodynemic action on bacteria
      ii. Use of agar cup method to study effect of chemicals: phenol, $HgCl_2$, Crystal violet

Scheme for practical examination

Ex 1 Staining of bacteria: Structural staining or special staining	20 Marks
Ex 2 Study of effect of physical or chemical agent on growth of bacteria/ Isolation and Cultivation of bacteria	20 Marks
Ex 3 Spotting	15 Marks
Ex 4 Viva voce	10 Marks
Ex 5 Journal	05 Marks