

MICROBIOLOGY

B.Sc.I_Sem_I

Fundamentals of Microbiology and Microbial Physiology

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks. The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-I (8 marks).

UNIT I :

A. History of Microbiology:

- a. Discovery of microscope- Leeuwenhoek, Robert Hook.
- b. Controversy over Spontaneous, generation, Contributions of Aristotle, Redi, Needham, Schulze and Schwann, Schroder & Vandusch, Louis Pasteur, John Tyndall
- c. Germ theory of diseases- Joseph Lister, Koch postulates, River postulates.
- d. Pure culture concept- Joseph Lister, Koch, DeBarry.

B. Scope of Microbiology as a modern Science.

- a. Industrial Microbiology, Environmental Microbiology, Medical microbiology, Food and Dairy Microbiology, Genetic engineering and Biotechnology.
- b. Different types of Microorganisms (outline)
- c. Distribution of Microorganisms in nature, and their beneficial and harmful activities.

UNIT II :

A. Microscopy:

- i) Definitions- Magnification, Resolving power, numerical aperture, focal length, Working Distance Aberrations,
- ii) Objectives- Functions, low and high power objectives, Oil Immersion objectives,
- iii) Ocular- Functions, Huygenian, Ramsden, Hyperplane and compensating.
- iv) Condensor- Functions, Abbe, parabolic
- v) Iris diaphragm

B. Principles, construction, ray diagram and applications:

- i) Compound Microscope,
- ii) Darkfield Microscope,
- iii) Phase Contrast microscope
- iv) Fluorescent Microscope,
- v) Electron Microscope.

C. Staining:

Dyes and Staining,- Definitions, auxochromes, Chromophore, mordents, chromogens, Leucostains,

Principles and Methods of the following techniques:

- i. Simple staining
- iii. Structural-Endospore, flagella.

UNIT III: Classification of Microorganisms:

A. Bacterial Classification:

- i. Definition- Taxonomy, Classification, Taxonomic rank, Identification, Nomenclature,
- ii. Bergy's manual of systematic Bacteriology, General characteristics enlisting all parts with major characters and examples(Vol.I to IV)
- iii. Methods of Classification: Intuitive, Numerical taxonomy, Genetic relatedness,

B. General characteristics of :

- i. Viruses,
- ii. Fungi (Including yeasts)
- iii. Actinomycetes,
- iv. Mycoplasma and Rickettsia
- v. Algae

UNIT IV: Structural Organization of Bacteria:

- a) Concept of prokaryotes and Eukaryotes; Comparison and Differences.
- b) Typical Bacterial cell
- c) Shape, Size and Arrangement of Bacteria
- d) Structure and functions of following:
 - i. Capsule and slime layer
 - ii. Cell wall- Gram positive and Gram negative bacteria.
 - iii. Cytoplasmic membrane- fluid mosaic model
 - iv. Flagella- Arrangement, Mechanism of flagellar movement.
 - v. Pili-Arrangement and function
 - vi. Ribosomes- Prokaryotic and Eucaryotic
 - vii. Plasmid- Definition, General characters, classes
 - viii. Bacterial chromosome
 - ix. Endospores- Structure and arrangements.

UNIT V:

A. Microbial Nutrition:

- i. Basic Nutritional Requirements: Sources of C, N, O, P, S, Energy, Macronutrients, Growth factors, water etc.
- ii. Media; Synthetic, Nonsynthetic, Liquid and Solid, Semisolid, Differential, Enriched, Selective media. Role of beef extract, yeast extract, peptone, agar and gelatin.
- iii. Determination of nutritional requirements: Auxanographic technique, Replica plating technique.
- iv. Nutritional classification; on the basis of source of carbon and energy

B. Pure Culture Techniques:

- i. Definition- Pure and Mixed culture:
- ii. Methods of Isolation of Pure culture, Serial dilution, Streak plate, pour plate, spread plate, Enrichment culture, and Single cell isolation method.
- iii. Methods of preservation of pure culture- Agar slants, Saline suspension, Overlaying with oil, Freeze drying.

UNIT VI: Reproduction and Growth of Bacteria:

- a) Reproduction: Binary fission, Budding, Fragmentation, Sporulation,
- b) Growth rate and generation time- Definition, mathematical expression.
- c) Bacterial growth curve
- d) Synchronous culture: Definition, methods of isolation (Helmstetter- Cummings Technique) and application.
- e) Continuous culture: Definition, method (chemostat, and Turbidostat Techniques) and Application.
- f) Measurement of Growth:
 - i. Cell number measurement- Breed method, Colony count
 - ii. Cell mass measurement- Dry weight and Turbidity measurement.
 - iii. Cell activity measurement- Biochemical activity
 - iv. Factors influencing bacterial Growth- Temperature, pH, Gaseous.

Microbiology Practicals

1. Microscopy:
 - i. Different parts of compound microscope
 - ii. Use and Care of compound microscope
2. Construction, operation and utility of Laboratory equipments;
 - i. Autoclave
 - ii. Hot air oven
 - iii. Bacteriological Incubator
 - iv. pH meter
 - v. Centrifuge
 - vi. Colorimeter/ spectrophotometer
 - vii. Anaerobic Jar
 - viii. Bacteriological filters
 - ix. Laminar air flow
 - x. Air sampler
 - xi. BOD incubator
3. Preparation of Nutrient media:
 - i. Nutrient broth
 - ii. Nutrient agar
 - iii. PDA
4. Demonstration of bacteria from; Soil, Water, Air, Milk, Skin
5. Microscopic Examination of bacteria
 - i. Monochrome staining
 - ii. Gram's staining

- iii. Acid fast staining
- iv. Negative staining
- v. Endospore staining
- 6. Hanging drop technique to demonstrate Bacterial motility
- 7. Measurement of size of bacteria
- 8. Cultivation and Demonstration of
 - i. Yeast- *Saccharomyces cereviceae*, *Candida albicans*.
 - ii. Molds- *Mucor*, *Rhizopus*, *Penicillium*, *Aspergillus*
- 9. Demonstration of
 - a) Protozoa-*E.histolitica*,*Paramecium*
 - b) Algae – *Anabena* , *Nostoc*, *Spirogyra*
- 10. Isolation of Pure culture by
 - i) Streak plate ii) Pour plate iii) Spread plate .
- 11. Enumeration of bacteria in the given sample by standard plate count
- 12. Demonstration of Replica plate technique / auxanography.

Distribution of Marks

1st Semester Microbiology Practical's

| SN | Distribution | Marks |
|----|--------------------|-----------|
| 1. | Major Experiment | 15 Marks |
| 2. | Minor Experiment | 10 Marks |
| 3. | Viva –Voce | 10 Marks |
| 4. | Spotting | 10 Marks |
| 5. | Laboratory Journal | 05 Marks |
| | Total Marks | 50 |

MICROBIOLOGY

B.Sc.I Semester: II

Microbiology, Biochemistry, Biostatistics & Computers

UNIT I : VIRUSES

- i) Discovery of viruses
- ii) Structure of viruses
- iii) Classification of viruses (LHT System)
- iv) Replication of viruses – Lytic cycle (T4), Lysogeny (Lambda phage)
- v) Cultivation of viruses – Embryo culture, Tissue culture method .
- vi) Interferon

UNIT-II MICROBIAL CONTROL

- i) Definition and Terms- Sterilization, disinfection, Antiseptic, Sanitizer, Germicide, Microbiostatis, Antimicrobial agent.
- ii) Mechanism of cell Injury - Damage of cell wall, cell membrane, Inhibition of metabolic reactions.
- iii) Physical Control :- Temperature, osmotic pressure, Radiation, filtration.
- iv) Chemical Control – Chemistry and mode of action of halogens, heavy metals and their derivatives, Alcohols, Detergents and Gaseous Sterilization.
- v) Chemotherapeutic agents.- Definition and mode of action of penicillin , tetracycline, Norfloxacin

UNIT-III APPLIED ASPECTS OF MICROORGANISMS IN -

- i) Agriculture – Biofertilizers & Biopesticides.
- ii) Human and Animal Health – Antibiotics, Vaccines
- iii) Industry (Food, Chemical & Pharamaceutical) – List of Microbial products (and producing organisms)
- iv) Environmental – Biodegradation and Biobleaching.

UNIT-IV BASIC BIOCHEMISTRY –

- i) Carbohydrates – Classification, different types of Glycosidic linkages eg- Maltose sucrose, Lactose, starch
- ii) Lipids – Classification, concept of saturated and unsaturated fatty acids, outline of conjugated & derived lipids
- iii) Proteins – Classification of Amino acids, concept of peptide bond , elementary concept of protein structure.
- iv) Nucleic acid – Purine & pyrimidine bases, nucleotides , & nucleosides , structure of DNA, structure of RNA (mRNA , tRNA, rRNA)

UNIT-V BIOSTATISTICS

- i) Importance & application – Tabulation & Classification of data, Frequency distribution & graphical distribution of data.
- ii) Measures of central tendencies – Mean , Mode, Median & their Properties
- iii) Co relation & their Linear regression – Coefficient of correlation, linear least square Fit method of regression.
- iv) Hypothesis testing- (chi square test) x² test, t-test
- v) Different models of data presentation with special reference to Biological samples.

UNIT-VI COPUTER CONCEPTS :-

- i) Components of computer system – Hardware, input devices, CPU, output devices , Monitor, software.
- ii) Memory concept- Computer memory primary & secondary memory in computers
- iii) Window Operating systems :- Introduction graphical user interface systems, desktop menus, launching a program through start menu.
- iv) MS-Word- creating, saving operating editing, closing a document, entering & editing texts.
- v) Using Internet explorer, MS power point, creating emails.

Microbiology Practicals

- 1) Demonstration of viruses – By plaque formation / chick embryo cultivation.
- 2) Effect of salt & sugar concentration, PH & Temperature on bacterial growth
- 3) Demonstration of oligodynamic action (copper, silver)
- 4) Anaerobic culture method – by Anaerobic Jar method / RCMM.
- 5) Slide culture techniques for fungi
- 6) Determination of antibiotic resistance of bacteria.
- 7) Industrial utilization of yeast for fermentation activity
- 8) Word processing
- 9) Use of MS- Excel
- 10) Creating e-mail
- 11) Use of Internet
- 12) Statistical data processing
- 13) Microbiological study tour to visit Research centre, / Institutions / Industries

LIST OF BOOKS RECOMMENDED FOR 1S AND 2S MICROBIOLOGY

- 1) General Microbiology : Stainer, Roger et. al. .
- 2) General Virology : Luria, S.E.
- 3) Handbook of Genetics : Esser, K.
- 4) Fundamentals Principles of : A.J. Salle. bacteriology
- 5) Microbiology : Pelczar, Chan, Krieg.(TMH)
- 6) Fundamental of Microbiology : Frobisher
- 7) General Microbiology Vol. I & II: Power & Dagainawala. (Himalaya Publication)
- 8) Zinsser Microbiology : W.K. Joklik

- 9) General Microbiology : W.G. Walter
- 10) Elements of Microbiology : M.J. Pelozar & E.C.S. Chan
- 11) Essays in Microbiology : J.N. Norris & M.H. Richmond
- 12) 12) Microbiology : L. Mckane & J. Kandel (Essentials & Applications)
- 13) Basic Microbiology : Volk
- 14) Chemical Microbiology : Rose
- 15) 15) Microbiology : Paul A. Ketchum. (Introduction to Health of Professional)
- 16) Molecular Biology of the gene : J.D. Watson.
- 17) Molecular Genetics : Taylor J.H.
- 18) Gene Expression Vol. I, II III, IV : Lewin
- 19) Elementary Microbiology : Modi (Akta Prakashan) Vol. I & II
- 20) Basic experimental Microbiology: Ronald M., Atlas, & Alfred Miller E.Brown,
Kenneth W. Dobra, Lionas (1986) (Prentice Hall - 316 PP)
- 21) General Microbiology : Robert F.Boyd (1984) times mirror / mosby college, Pub. 22
PP.
- 22) 22) Fundamentals of Biostatistics : Satguru Prasad, Emkay (Biometry) Publications,
Delhi.
- 23) Text Book of Microbiology : Dubey & Maheshwari (S.Chand, Publication)
- 24) Introduction to Computer by : Shrivastav (Macmillan)
- 25) Fundamentals of Computer : Rajaraman (PHL)
- 26) Office automotion : Bajaj (Macmillan)
- 27) Computer made simple : Taxilli.

LIST OF BOOKS FOR PRACTICALS

- 1) Microbes in Action : Seely, Wander Mark Tarporewala, Bombay
- 2) A Mannual of Microbiology : A.J. Salle. Methods
- 3) Medical Microbiology Vol. II : R. Cruickshank
- 4) Microbiology Methods : Collins
- 5) Difco mannual
- 6) Bacteriological Techniques : F.J.Baker
- 7) Introduction to Microbial : Gunasekaran Techniques
- 8) Biochemical methods : Sadashivam & Manickam
- 9) Laboratory Fundamentals of : Alcamo, I.E., Jones and Microbiology Bartlett Publishers