DEPARTMENT OF MICROBIOLOGY

B. Sc. I Semester I Syllabus
Microbiology 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- Leeuenhoek, Robert Hook. b. Controversy over Spontaneous, generation, Contributions of Aristotle, Redi, Needham, Schulze and Schwan, 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, Ramscden, Hyperplane and compensating. iv) Condenser- Functions, Abbe, parabolic v) Iris diaphragm B. Principles, construction, ray diagram and applications: i) Compound Microscope, ii) Dark field Microscope, iii) Phase Contrast microscope iv) Fluorescent Microscope, v) Electron Microscope. C. Staining: Dyes and Staining, - Definitions, auxochrome, Chromophore, mordents, chromogens, Leucostains, Principles and Methods of the following techniques: i. Simple staining ii. Differential- Gram, Acid fast, iii. Structural-Endospore, flagella.

UNIT III: Classification of Microorganisms:

A. Bacterial Classification: i. Definition- Taxonomy, Classification, Taxonomic rank, Identification, Nomenclature, ii. Bergey'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 Eukaryotic 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 equipment's;
   i. Autoclave
   ii. Hot air oven
   iii. Bacteriological Incubator
   iv. pH meter
   v. Centrifuge
   vi. vi. Colorimeter/ spectrophotometer
   vii. vii. Anaerobic Jar
   viii. viii. Bacteriological filters
   ix. ix. Laminar air flow
   x. x. Air sampler
   xi. 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 cerevisiae*, Candida albicans. ii. Molds- Mucor, Rhizopus, Penicillium, Aspergillus
9. Demonstration of a) Protozoa-*E. histolytica*, Paramecium b) Algae – Anabaena, 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 Practicals 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 50 Marks

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 & Daginawala. (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) Microbiology: L. Mckane & J. Kandel (Essentials & Applications)
13) Basic Microbiology: Volk
14) Chemical Microbiology: Rose
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: Ronald M., Atlas, & Alfred Microbiology 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) Fundamentals of Biostatistics: Satguru Prasad, Emkay (Biometry) Publications, Delhi.
23) Text Book of Microbiology: Dubey & Maheshwari (S. Chand, Publication)
24) Introduction to Computer: Shrivastav (Macmillan)
25) Fundamentals of Computer: Rajaraman (PHL)
26) Office automation: Bajaj (Macmillan)
27) Computer made simple: Taxilli.

List of Books for PRACTICALS:

1) Microbes in Action: Seely, Wander Mark Tarporewala, Bombay
2) A Manual 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.

B. Sc. I Semester II Syllabus

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, Microbiostatics, 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 & Pharmaceutical) – List of Microbial products (and producing organisms) iv) Environmental – Biodegradation and Bioleaching.

UNIT-IV: BASIC BIOCHEMISTRY:

i) Carbohydrates – Classification, different types of Glycosidic linkages e.g.- 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: COMPUTER 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 e-mails.

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

Distribution of Practicals Marks

1. Major Experiment - 15 Marks
2. Minor Experiment - 10 Marks
3. Viva –Voce - 08 Marks
4. Spotting - 07 Marks
5. Laboratory Journal - 05 Marks
6. Study Tour Report - 05 Marks ---------- Total 50 Marks