

B.Sc. (Hons) Microbiology Part I

Paper I - HISTORY OF SCIENCE AND THE MICROBIAL WORLD

Section A: History of Science and Microbiology

History of Science : Life sketches & contributions of following scientists : John Dalton, Albert Einstein, G. J. Mendel, William Harvey, Marie Curie, C.V.Raman, Issac Newton, Galileo, Euclid, Landsteiner.

Contributions of some recent eminent scientists : Alec Jeffrey, Stanley Cohn, Arber and Smith, Watson and Crick, Barbara McClintock, S. Tonegawa, Francis Collins, Karry Mullis, Craig Venter.

History of Microbiology : Contributions of Anton van Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Martinus w. Beijerinck, Sergei N. Winogradsky, Alexander Fleming, Selman A. Waksman, Elie Metchnikoff, Anand M. Chakraborty.

The spontaneous generation controversy, outbreak of bacterial and viral diseases, Germ theory of disease, use of Petridish and agar, isolation of pure cultures and its significance, immunization, microbes and fermentation, developments in Microbiology in 20th century.

Section B: (Diversity and Scope of Microbiology)

Diversity: Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility, acellular (Prions, Viroids, Viruses) and cellular microorganisms.

Bacteria: General characters with emphasis on morphology and cell structure with reference to *E. coli*, *Bacillus*, *Staphylococcus*, *Streptococcus*, *Spirillum*, *Streptomyces* and *Nostoc*.

Fungi: General characteristics of fungi with emphasis on their occurrence, distribution and structure with reference to *Neocallimastix*, *Rhizopus*, *Aspergillus*, *Saccharomyces*, *Agaricus*, *Neurospora*.

Algae: General characteristics of algae with emphasis on their occurrence, distribution with reference to *Chlamydomonas*, *Volvox*, *Spirogyra*, and *Ectocarpus*

Virology: General characteristics of viruses and economic importance with special reference TMV, poliovirus, T4 and lambda phages, hepatitis B virus.

Protozoology: Classification, occurrence, morphology, nutrition, perennation, locomotion, reproduction and economic importance of protozoa. A brief account of *Amoeba*, *Plasmodium*, *Leishmania*, *Trypanosoma*, *Tetrahymena*, *Euglena*, *Paramecium*.

Scope of Microbiology

Basic Microbiology: Virology, Bacteriology, Mycology, Phycology, and Protozoology

Environmental Microbiology including microbial ecology: Terrestrial microbiology, *Rhizobium*, Mycorrhiza, PGPR, biofertilizers, microbes in soil environment, rhizoplane, phylloplane, actinorhiza. Biodiversity, Biogeochemical (C, N, P, S) cycling, microbial interactions (mutualism, symbiosis, commensalisms, predation, parasitism, amensalism, competition), bioluminescence, biomagnification, biodegradation, biofilms. Definition of aeromicrobiology, air-borne pathogens and allergens. Cleaning oil spills, superbug, microbes in

composting, landfills, bioinsecticides & biopesticides, biodeterioration, bioremediation, bioleaching. Role of microbes in BOD reduction and secondary sewage treatment.

Medical Microbiology and Immunology: List of human diseases and their causative agents. Antigen, antibody, structure and types of antibody, hapten, adjuvant, immune response.

Industrial Microbiology: Fermentation, producer microbes of alcoholic beverages (beer, wine, whisky), antibiotics, amino acids and organic acids. Bioassay, biosurfactants, bioconversion, biopolymers, biochips, biosensors, and microbial enzymes.

Food and Dairy Microbiology: Production and importance of SCP, fermented foods (eg Sauerkraut), bread, cheese, producer microbes of fermented milk products (kefir, kumiss, curd, yogurt, and Bulgarian buttermilk).

Biotechnology and Recombinant DNA Technology : Definition, basic concept and applications in the present day world. Artificial sweeteners, transgenic plants and animals, protein engineering, genetically engineered products (insulin, somatostatin, interferons, vaccines).

Space Microbiology : Exploration of life in space and microbes in spacecrafts.

PRACTICALS:

1. Study the life history and contributions of the following scientists using photographs:
John Dalton, Albert Einstein, G.J. Mendel, William Harvey, Marie Curie, C.V. Raman, Iasac Newton, Galileo, Euclid, Landsteiner, Barbara McClintock, Anton van Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Martinus W. Beijerinck, SergeiN. Winogradsky, Alexander Fleming, Elie Metchnikoff, Anand M. Chakraborty.
2. Isolation of bacteria, algae and fungi from natural sources using specific media:
 - a) Nutrient agar
 - b) Potato dextrose agar
 - c) BG-11
3. Study the following with the help of temporary mounts:
 - a) *Rhizopus*, *Mucor*, *Aspergillus*, *Penicillium*.
 - b) *Chlamydomonas*, *Volvox*, *Spirogyra*, and *Ectocarpus*.
4. Study the permanent mounts of protozoa :
Balantidium, *Paramecium*, *Plasmodium*, *Euglena*, *Giardia*, *Leishmania*, *Trypanosoma*.
5. Study the following viruses using electron micrographs :
TMV, Poliovirus, T4 phage and lambda phages, HIV, Hepatitis B virus.

SUGGESTED READING:

1. Microbiology, by Pelczar, Chan and Krieg. Mc.Graw Hill Book Company
2. Microbiology, by Prescott, Hailey and Klein. Wm.C Brown Publishers
3. Principles of Microbiology, by R. M. Atlas. Macmillan Publishing Co. New York
4. Brock Biology of Microorganisms by M. T. Madigan, J. M. Martinko and J. Parker. Prentice Hall, Englewood Cliffs, New Jersey
5. Microbiology: A laboratory Manual, by Cappucino and Sherman. Benjamin/Cummings Publishing Co. Inc.