

SEMESTER III

GBMB-301 ENVIRONMENTAL MICROBIOLOGY

Course Objectives:

On the completion of this course the students will be able to describe following subject matters: Environmental microbes can affect so many aspects of life, and are easily transported between environments, the field of environmental microbiology interfaces with a number of different subspecialties, including soil, aquatic, and aero microbiology, as well as bioremediation, water quality, occupational health." After completion of this course students will learn about the application of microbiology in the environment and living system."

Course Contents

UNIT I

History, significance and developments in the field of microbial ecology, Contributions of Beijerinck, Winogradsky, Kluver, Van Niel, Martin Alexander, Selman A. Waksman.

UNIT II

Microorganisms & their natural:

A. *Terrestrial Environment*: Soil characteristics, Soil profile, Soil formation, Soil as a natural habitat of microbes, Soil microflora. B. *Aquatic Environment*: Stratification & Microflora of Freshwater & Marine Habitats. C. *Atmosphere*: Stratification of the Atmosphere, Aero-microflora, Dispersal of Microbes.

UNIT III

Environmental pollution: Air pollution; Water pollution; Noise pollution; Waste Water treatment; Thermal Pollution; Marine pollution; Soil pollution; Nuclear Hazards.

UNIT IV

Natural resources: Renewable and non-renewable resources: Forest resources; Water resources; Mineral resources; Food resources; Energy resources; Land resources.

Suggested Reading:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad -380013, India, Email: mapin@icenet.net (R).
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
4. Clerk B.S., Marine Pollution, Clanderson Press Oxford (TB).
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)

GBMB-302 IMMUNOLOGY

Course Objectives

"At the end of this course the students will be able to describe: 1. What is active and passive immunity: Structure, Functions and Properties of Immune Cells and Immune Organs. 2. Haptens, Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants. 3. What is Auto immunity and hypersensitivity, Hybridoma technology: Introduction, production of monoclonal antibodies; vaccines. 4. Immuno-techniques - Blood grouping, Antigen-Antibody reactions.

Course Contents:

UNIT I

Historical aspects of immunology. Concept of Innate and Adaptive immunity; Active and passive immunity: Structure, Functions and Properties of Immune Cells and Immune Organs Characteristics of an antigen; Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants

UNIT II

Immunoglobulins: Types, Structure, Functions and Properties of antibodies. Structure and Functions of MHC I & II molecules; Antigen processing and presentation.

Cytokines, Complement System, Primary and Secondary Immune Response; Generation of Humoral and Cell Mediated Immune Response. Killing Mechanisms by CTL and NK cells,

UNIT III

Types of Auto immunity and Hypersensitive: Tissue transplantation and graft rejection Diseases of immune system and Immuno-deficiencies

Hybridoma technology: Introduction, production of monoclonal antibodies; Applications.

Vaccines: Introduction to conventional and modern vaccines (DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines); Advantages, mechanism of action.

UNIT IV

Immuno-techniques - Blood grouping, Antigen-Antibody reactions: agglutination, precipitation, immuno-electrophoresis, Coombs' test, ELISA, RIA. Immunodiffusion, Western blotting, Immunofluorescence, Flow cytometry.

SUGGESTED READINGS

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley- Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinburgh.
6. Richard C and Geffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

GBMB-303 VIROLOGY

Course Objectives:

"At the end of this course the students will be able to describe: a student that able to examine, study, and explore viruses and viral diseases. They are also able to studying the growth, development, characteristics, and structure of various viruses' disease.

Course Contents:

Unit 1.

Classification and nomenclature of viruses in general, their properties, morphology and ultrastructure typical bacteriophage, animal virus and plant virus, types of envelope, their composition, Viroids and Prions.

Unit 2.

Classification of animal viruses, life cycle and pathogenicity of important viruses, genome organization and replication of DNA viruses, RNA viruses, Adeno virus, Pox virus, SV40, Vaccinia, Lentivirus. Clinical diagnosis and treatment of HIV, Influenza and Hepatitis.

Unit 3.

Classification plant viruses, life cycle and pathogenicity of important viruses. Genome organization and replication of common plant viruses, such as; TMV CaMV, Potato X Virus, Gemini Virus. Transmission of plant viruses by vectors and other means. Diagnostic techniques in seed, seed stocks and diseased plants.

Unit 4.

Structure and organization of bacteriophages, lytic and lysogenic life cycles –T4 and lambda. Genetic switch for control of lytic and lysogenic of lambda phage. Genome organization, infection and multiplication of T odd and T even phages. Lambda phage, M13, Mu phage.

References:

1. General Virology by S. E. Luria

2. Molecular Virology, pathogenesis and control, ASM Press, Washington DC
3. Plant Virology by REF Matthews
4. Dimmock N. J., Primrose S. B. 1994 Introduction to modern Virology, 4th edition, Blackwell scientific Publications, Oxford.
5. Morag C and Embury M. C. 1994, Medical Virology 10th edition, Churchill Livingstone, London.

Lab Course I (based on papers GBMB301, 302, 303)

1. Study of microflora of soil.
2. Isolation of bacteria from soil
3. Isolation of nitrogen fixing organism (Azotobacter from soil and Rhizobium from root nodule of legumes.
4. Quantification of serum proteins
5. Determination of A/G ratio in serum
6. DNA isolation from given biological material.
7. Demonstration of Transformation
8. RNA isolation from baker's yeast.
9. DNA estimation
10. RNA estimation
11. Extraction and estimation of DNA from plant samples.
12. Extraction and estimation of DNA from microbial cultures.
13. Extraction and estimation of plasmids.
14. Agarose Gel Electrophoresis.
15. Competent Cell formation.
16. Transformation of given microbial cells.

GBMB-304 BOTANY III

(Gymnosperms, Angiosperms and Embryology)

Course Objectives:

After the completion of this course, the students understand in advanced level of the diversity in plant life can be understood from the following topics of diversity: Diversity on The Basis of Habitat, plants classified into following groups students understand the geographical understanding respectfully: Hydrophytes: These plants may be: Hygrophytes: Halophytes: Mesophytes: Xerophytes: Geological time scale, theories of fossil formation, types of fossils, fossil gymnosperms. Life histories of *Cycas* & *Pinus*"

Course Contents:

Unit-1

1. Salient features of Gymnosperms.
2. Comparative study of the structure and life history of *Cycas* and *Pinus*.
3. Fossils: Process of fossilization and types of fossils, Living fossils.
4. Economic importance of the Gymnosperms

Unit-2

1. Elementary knowledge of centres of origin, classification as proposed by Linnaeus, Bentham and Hooker.
2. Nomenclature: International Code of Botanical Nomenclature (ICBN), history, scientific naming of plants, priority, types and validity.
3. Collection and preservation techniques of specimens for herbarium and museum, Botanical gardens, Herbaria and Botanical Survey of India (BSI).

Unit-3

1. General taxonomy and economic importance of the following families:
 - (a) Malvaceae, Fabaceae,
 - (b) Solanaceae.
 - (c) Cruciferae
 - (d). Monocotyledonae: Poaceae.

Unit-4

1. Structure of anther, micro-sporogenesis and development of male gametophytes in angiosperms.
2. Structure of ovule, mega sporogenesis and development of the female gametophytes.

3. Pollination, fertilization and life history of a typical angiosperm.

Unit - 5

1. Endosperm and embryo development.
2. Polyembryony and apomixis.
3. Seed germination and dormancy, elementary plant movements.

Practical

1. Demonstration of permanent slides of Gymnosperms.
2. Demonstration of permanent slides of angiosperms.
3. Preparation of a standard herbarium using suitable tools and techniques.
4. Study of the floral description of the family-
5. Study of the floral description of the family-Malvaceae
6. Study of the floral description of the plant- *Daturastramonium-Family*;
7. Study of the floral description of the family- Cucurbitaceae
8. Study of the floral description of the family- Rubiaceae
9. Study of the floral description of the family-Lamiaceae
10. Study of the floral description of the family-Euphorbiaceae
11. Study of the floral description of the family-Poaceae
12. Preparation of Transverse section of anther to observe the structure of microsporangium.
13. Slide preparation to study the structure of ovule and mechanism of megasporogenesis.
14. T.S. of monocot root and description (Maize)
15. T.S. of dicot root and description (*A. hypogea*)
16. T.S. of monocot stem and description (Maize)
17. T.S. of dicot stem and description (*A. hypogea*)

Books recommended:

1. Sharma OP, An Introduction to Gymnosperm PragatiPrakashan, Meerut.
2. Bhojwani SS and SP Bhatnagar. Embryology of Angiosperms
3. Maheshwari P. An Introduction to Embryology of Angiosperms
4. Gupta RK Text book of Systematic Botany, Atma Ram and Sons, New Delhi
5. Pandey BP A Textbook of Angiosperms. S Chand & Co. New Delhi
6. Singh V and Jain DK. Taxonomy of Angiosperm.

GBMB-305 ZOOLOGY III

(Vertebrate Zoology)

Course Objectives:

"At the end of this course the students will be able to: 1. Describe unique feature of diverse appearance of animals, this course will enhance the students to get the knowledge about the anatomy of different systems of higher chordates. 2. On completion of this course, the students will gain in-depth knowledge related to excretory system, nervous system and structures of Brain, Eye and Ear."

Course Contents:

Unit I: Origin & General Characteristics of Chordates

Chordate characters, origin and evolution of chordate groups, scheme of Chordate classification. General characteristics of primitive chordates, structure and affinities of *Balanoglossus*, and *Herdmania*.

Unit II: Cyclostomes and Pisces

General characteristics of Cyclostome and of Pisces, migration. Accessory respiratory organs in fishes. Common edible fishes of India. Pisciculture – Status and scope of Fisheries in India. Species of fishes suitable for culture in India. Different types of breeding, hypophysation.

Unit III: Amphibia and Reptiles

Origin, general characteristics & classification up to orders, Parental care General characteristics & classification up to order, Identification of poisonous and non-poisonous snakes, Biting mechanism, Venom and anti-venom, Extinct reptiles.

Units IV: Ayes and Mammals

General characteristics, Flight adaptation and migration in birds, Origin and of bird, General characteristics of Prototheria, Metatheria&Eutheria Evolution of horse and Man. Tissue types and histology of liver, kidney, pancreas, stomach, intestine, thyroid gland, testes and ovary.

Practical

1. Chordates: Study of *Balanoglossus*, *Herdmania*, *Salpa*, *Amphioxus*.
2. Cyclostomes: *Petromyzon*, *Myxine*.
3. Chondrichthyes: *Scoliodon*, *Sphyrna*, *Pristis*, *Torpedo*, *Chimaera*.
4. Osteichthyes: *Acipenser*, *Exocoetus*, *Wallago*, *Protopeternus*, *Anguilla*, *Labeorohita*, *Channa*.
5. Amphibians: *Urotyphlus*, *Bufo*, *Hyla*, *Necturus*, *Siren*, *Axolotl* larva.
6. Study of local amphibian fauna.
7. Reptilians: Turtle, Crocodile, Krait, Viper, *Hydrophis*, *Chamelion*, *Calotesversicolor*.
8. Study of local reptilian fauna.
9. Aves: Study of *Psittacula* (parrot), *Eudynamys* (koel), *Tytoalba*(owl), *Passer* (sparrow), *Columba* (pigeon).
10. Study of local avian fauna.
11. Mammals: Study of Mole, Mongoose, Bat, Squirrel, Loris.
12. Study of local mammalian fauna.
13. Preparation of temporary mounts of placoid scales.
14. Dissection of *Heteropneustesfossilis* to study secondary accessory organs.
15. Dissection of *Scoliodon* to study cranial nerves and digestive system.
16. Dissection of Rohu to study Weberianossicles.

Recommended Books

1. Green N.P.O. et al., 1995, Biological Sciences, Second Edition, Cambridge University Press.
2. Kotpal R.L., 2001, Modern Text Book of Zoology, Vertabrates, Rastogi Publication, Meerut, India.
3. Parker T.J. and Haswell W.A., 1990, A Text Book of Zoology, Vol. II Revised by A.J. Marshall.
4. Sinha, A.K., Adhikari, S., and Ganguli, B.B., 2001, Biology of Animals (Vol.-II & III), New Central Book Agency, Calcutta.
5. Subramoniam, T., 2002, Developmental Biology, Narosa Publishing House Pvt. Ltd., New Delhi.
6. Parker, T.J. and Haswell, 1995, A Text Book of Zoology (Vol. I & II), 7 th Edition, Low Price Publication, Delhi.
7. Leeson&Leeson, 1984, Histology, WB Saunders - IgakuShoin Publication Philadelphia & Tokyo.
8. R.C. Kotpal. Modern text book of Zoology-Vertebrates.

GBMB-306 CHEMISTRY III

Course Objective:

"(i) After the completion of this course, the student will understand the modern view of atomic structure, and learn to fill configuration of elements (ii) The student will learn the general concepts regulating organic chemistry reaction mechanism and their examples with real world applications. (iii) The students will learn different types of organic reaction mechanisms and their examples. (iv) The students will learn the physical chemistry concepts in gaseous states and its applications."

Course Content:

1. **Acids and Bases** : Arrhenius, Brönsted-Lowry, Solvent System and Lewis concepts of acids and bases. Factors affecting strengths of Lewis acids and bases.
2. **Non-aqueous Solvents** :Physical properties of a solvent for functioning as an effective reaction medium. Types of solvents and their general characteristics.Reactions in liquid ammonia and liquid sulfur dioxide.
3. **Solution and Colligative properties**: Types of solution, ideal solution, non ideal solution, partial and immiscible liquids, lowering of vapour pressure, elevation of boiling points, depression of freezing point, osmosis and osmotic pressure, relationship between different colligative properties, abnormal colligative properties of solution.

4. Stereochemistry :Fischer, saw-horse and Newman projection formulae. Chirality-optical activity, enantiomerism and diastereoisomerism involving one and two chiral centers, configuration, geometrical isomerism, D/L, R/S and E/Z nomenclatures.

5. Aromaticity: Structure, stability and reaction of benzene, Huckel rule, Electrophilic aromatic substitution reactions, mechanism of nitration, mechanism of sulphonation, mechanism of halogenation, mechanism of protonation, Alkyl benzene, mechanism of friedel craft alkylation, reaction of alkyl benzene, electrophilic aromatic substitution in alkyl benzene, halogenation of alkyl benzene, side chain halogenation of alkyl benzene, alkenylbenzene, alkynylbenzene.

6. Phenols, Aromatic Aldehydes and Ketones :: Preparation, reaction and acidity of phenols. Rearrangement of hydroperoxides, Fries rearrangement, Ring substitution, Kolbe reaction, Reimer-Tiemann reaction.Preparation and important reactions of benzaldehyde and acetophenone.

7. Transition Metals :Characteristic properties of 3d elements – ionic radii, oxidation states, complexation tendency, magnetic behaviour and electronic spectral properties. Spectrophotometric estimation of metal ions.

Books Recommended

1. *"A New Concise Inorganic Chemistry"*, **J. D. Lee**, 5th Edition (1996), Chapman & Hall, London.
2. *"Modern Inorganic Chemistry"*, **R. C. Aggarwal**, 1st Edition (1987), KitabMahal, Allahabad.
3. *"Basic Inorganic Chemistry"*, **F. A. Cotton, G. Wilkinson, and Paul L. Gaus**, 3rd Edition (1995), John Wiley & Sons, New York.
4. *"Organic Chemistry"*, **R. T. Morrison and R. N. Boyd**, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
5. *"Organic Chemistry"*, **S. M. Mukherjee, S. P. Singh, and R. P. Kapoor**, 1st Edition (1985), New Age International (P) Ltd. Publishers, New Delhi.
6. *"Organic Chemistry – Structure and Reactivity"*, **Seyhan N. Ege**, 3rd Edition (1998), AITBS Publishers and Distributors, Delhi.
7. *"Organic Chemistry"*, **Paula Y. Bruice**, 2nd Edition , Prentice-Hall InternattionalInc, New Jersey, International Edition (1998).
8. *"Physical Chemistry"*, **P. C. Rakshit**, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
9. *"Principles of Physical Chemistry"*, **B. R. Puri, L. R. Sharma, and M. S. Pathania**, 37th Edition (1998), ShobanLalNagin Chand & Co., Jalandhar.
10. *"Physical Chemistry"*, **K. J. Laidler and J. M. Meiser**, 3rd Edition, Houghton Mifflin Comp., New York, International Edition(1999).
11. *"Principle of Nanoscience and Nanotechnology"*, (2010), **M. A. Shah and Tokeer Ahmad**, Narosa Publishing House, New Delhi.