Semester II
(GMMB-201)
Paper 5 General Microbiology & Microbial Physiology
Course Objective:

At the end of this course the students will be able to describe: 1. What is microbiology, morphology and cell structure of major groups of microorganisms e.g., bacteria. 2. Cultivation and Maintenance of microorganisms. 3. Bacterial Reproduction: Transformation, Transduction and Conjugation. Endospores and sporulation in bacteria. 4. Control of Microorganisms: By physical, chemical and chemotherapeutic Agents. 5. Preservation of various types of foods. Fermented Foods. 6. Microbial physiology and metabolism provide information on sources of energy and its utilization by microorganisms. Microorganisms play important role in environment as producers, consumers and decomposers. 7. This diverse metabolic activity is generally not observed in any other group of living organisms."

Course Content

Unit I

Pioneers of Microbiology.

Microscopy - Principles, working and applications of bright field microscope, fluorescent microscope, Phase contrast microscope, electron microscope.

Microbial Cell Structure: Prokaryotic cell, Eukaryotic cell, Organization and function of cellular organelles. Bacterial endospore structure, biochemistry and genetics of sporulation

Unit II

Methods of sterilization and disinfection: Physical methods and chemical methods.

Microbiological media - Autotrophic media, defined synthetic mineral media, heterotrophic media. The concept of prototrophs and auxotrophs, prototrophic (minimal media) complex media (undefined media).

Cultivation of Bacteria, Fungi and Algae : Routine and special culture methods.

Isolation of pure cultures. Preservation and Maintenance of Microbial Cultures: Routine methods and Liquid nitrogen preservation, freeze-drying (lyophilization), etc.

Unit III

Identification methods and classification of bacteria: -

Microscopic identification characteristics, staining methods. Ecological identification methods, Nutritional (cultural) identification characters, biochemical identification methods, immunological characteristics, Molecular and genetic characteristics identification (16s rRNA).

Principles of bacterial taxonomy and classification: - Numerical taxonomy, Bergy's manual and its importance, general properties of bacterial groups.

Microbial nutrition and metabolism: autotrophy – Photoautotrophy and bacterial photosynthesis, Chemoautotrophy and heterotrophic metabolism.

Unit IV

Microbial growth: The concept of growth and definition, formation of protoplasm, building of macromolecules from elemental nutrients, supramolecules, orgnelles of cell and cellular components. Cell cycle in microbes and generation time.

Growth phases of bacteria – Lag phase, exponential (logarithmic) phase, stationary (ideo) phase, decline and survival of microbial cells. Importance of each growth phase.

Synchronous cultures – Methods of synchronous culturing, Continuous culturing methods, factors affecting growth. Methods of growth measurement.

BOOKS RECOMMENDED:

1. Text book of Microbiology by Pleczar and Reid (Mc Graw Hill).
2. Microbiology by Tortora, Funk & Case.
3. Microbiology by Prescott.
4. Principles of Genetics by Sinnet et.al, (Mc Graw Hill).
5. Principles of Heridity by Robert Tumarin.
6. Genetics by M.W.Strick Berger (Mac Millan).
7. Cell and Molecular Biology by E,D.P. De Roberties (International edition).

Paper 6 Immunology (GMMB-202)
Course Objective:

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 background, Innate and adaptive immunity; Cells and organs involved in immune system; Antigens and Antibodies- Properties and types; Haptens and Adjuvants. Antibody as B cell receptor, antigenic determinants on antibodies (isotype, allotype and idiotype).Genesis of antibody variability. Generation of immune response: B-cell maturation in bone marrow, humoral immune response; T cell maturation in thymus, thymic selection, Generationof cell-mediated immune response; Concept of tolerance, immunopotentiation and immunosuppression.

Unit II

Immunological principles of various reactions and techniques: Affinity and avidity, cross reactivity, precipitation, agglutination, immunodiffusion, immunoelectrophoresis, ELISA, western blotting, immunofluorescence, RIST, RAST, MLR, flow cytometry and fluorescence, and immunoelectron microscopy; Hybridoma technology, monoclonal antibodies and abzymes; Antibody engineering.

Unit III

Organization of Major histocompatibility complex (mice and humans).Structure and cellular distribution of HLA antigens, antigen processing and presentation, cytosolic and endocytic pathways. Complement system: Components of the complement activation , classical, alternative and lectin pathways; Complement activation

Unit IV

Types and mechanism of hypersensitive reactions; Autoimmunity - theories, mechanism and diseases with their diagnosis; tumor immunology - tumor specific antigens, Immune response to tumors, immunodiagnosis of tumors - detection of tumor markers – □ foetal proteins, carcinoembryonic antigen etc Immunodeficiency disorders: Animal models of primary immunodeficiency (nude mouse and SCID mouse). Specific impaired functions in lymphoid lineage (SCID, DiGeorge syndrome), myeloid lineage (CGD and Chediak, Higashi Syndrome).

Recommended Books:

1. Immunology: An Introductionby I.R. Tizard, Saunders College Publishing, Philadelphia.
2. Kuby Immunology (2012)by J. Owen, J. Punt and S. Stranford, W.H. Freeman and Co., USA.
3. Goldsby RA, Kindt TJ and Osborne BA (2000) Immunology, 4th Edition, WH Freeman and Company, NY
4. Janeway C, Travers P, Capra JD, Walport MJ (1999) Immunobiology: The Immune System in Health and Disease, Garland Pub., USA
5. Roitt IM, Brostoff J, Male DK (2001) Immunology, Mosby Inc, UK 4. Janeway CA, Trevors P, Walport M, Schlomchick M (2001)
6. Immunobiology, The Immune System in Health and Disease, 5th Edition, Garland Publicatons, USA

Paper 7 Research methodology & Techniques (GMMB-203)

Course Objectives:

"Research methods are the strategies, processes or techniques utilized in the collection of data or evidence for analysis in order to uncover new information or create better understanding of a topic. There are different types of research methods which use different tools for data collection."

Course Contents

Unit I

Optical methods: colourimetry and spectrophotometry, fluorimetry, optical rotation

Circular dichroism, NMR, ESR spectroscopy, x-ray diffraction, types of mass spectrometry. Electrophoretic techniques and application, counter current distribution.

Unit II

Separation methods: Chromatographic techniques – HPLC, FPLC paper, thin layer, ion exchange, gel filtration and affinity chromatography.

Diffusion, dialysis, cell disruption methods, centrifugation techniques, cell free extracts and their use in metabolic studies.

Radio isotopes – detection and measurement of radioactivity – scintillation counters,

autoradiography, stable isotopes and their use. Safety precautions. General method of study of intermediary metabolism in microbes. Uses of mutants in study of metabolism.

Unit III

Population, samples and sampling procedures, variables, variations and frequency distributions, measures of central tendency and dispersion, element of probability, gausian or normal distribution, binomial distribution, poisson distribution, 't' distribution, 'F' distribution and Chisquare distribution, correlation and linear regression. Normal curve test, 't' test, 'F' test, ANOVA, analysis of covariance, Chi-square test, and confidence intervals. DMRT and its use in biological experiments. Experimental designs using statistical tools.

Unit IV

Introduction to Computers

Introduction to disk operating systems (DOS): Sample commands, DIR-CD-RD-DEL-COPYMOVE-REN-TYPE-EDIT (Editor) CE-DATE and TIME.

Introduction to Windows: Word Processing: Electronic Spread Sheet

Data collection, Data representation, Manuscript preparation, Plagiarism, Research ethics, QA, QC, GLP, GMP, Patents & IPR

1. Gordon.M.H. and Macrae.M. instrumental analysis in biological sciences., Blackie and sons Ltd. London 1998
2. Principles of physical biochemistry. Vanholdem.W.C and Johnson, P.S. Printice Hall, 1998.
3. Principles and techniques in practical biochemistry.Wilson.K and Walker.J.M. Foundation books, New Delhi, 1994.
4. Alberts. B., Bray, D., Lewis, J., Raff, M., Roberts, K and Watson, J.D. (1994). Molecular Biology of the cell. Garland Publisher Inc., New York
5. Bishop J.A. (1982). Retroviruses and cancer genes. Advances in cancer research.
6. Brachet J. (1985). Molecular Cytology. Academic Press New York
7. Celis J E (Eds): Cell Biology: A Laboratory Hand Book. Vol I & II Academic Press.
8. Introduction to Bioinformatics by Arthur M.Lesk, Oxford.
9. Biostatistics – Daniel. (Wiley).
10. Statistics by S.C. Gupta.
11. Statistical Methods by G.W.Snedecor & W.G.Cochran.
12. Fundamentals of Biostatistics – Khan & Khanum.
13. Entrepreneurship: New Venture Creation : David H. Holt
14. Patterns of Entrepreneurship : Jack M. Kaplan
15. Entrepreneurship and Small Business Management: C.B. Gupta, S.S. Khanka, Sultan Chand &Sons.

Paper 8 Virology (GMMB-204)

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 I

Brief outline on discovery of viruses, nomenclature and classification of viruses; Viral genome, their types and structures; virus related agents; Viral cultivation, assay and diagnosis; primary & secondary cell cultures; Assay of viruses, physical and chemical methods (protein, nucleic acid, radioactivity tracers, electron microscopy), Infectivity assay (plaque method, end point method) – Infectivity assay of plant viruses. Haemagglutination& HAI; complement fixation; immunofluorescence methods, ELISA and Radioimmunoassays.

Unit II

Bacterial Viruses- Classification and nomenclature, Bacteriophage structural organization; life cycle: lytic and lysogenic cycle, application of bacteriophages; briefdetails on M13,Mu,T3,T4, and Lamda P1. Viruses of cyanabacteria, algae, fungi.

Unit III

Plant Viruses- Classification and nomenclature; Structureand life cycle of plant viruses. Propagation, purification, characterization, identification and genomics of plant viruses like TMV, Cauliflower MosaicVirus ,Gemini virus and Potato Virus X Symptoms of plant virus diseases, Transmission of plant viruses,Viral diseases and their control. Some common viral diseases of plants. Viral and Viriod diseases: Papaya ring spot, rice tungro, tomato yellow leaf curl, Potato spindle tuber, coconut cadangcadang.

Unit IV

Animal Viruses-Classification and nomenclature; Structure and lifecycle of animal viruses. Replicative strategies employed by DNA and RNA viruses. Epidemiology, pathogenicity, diagnosis, prevention and treatment of Picorna,Orthomyxo, Paramyxo, Toga, Rhabdo,Rota, Pox, Herpes, Adeno, Hepatitis, HIV and other Oncogenic viruses; viral vaccines (conventional vaccines, genetic recombinant vaccines used in national immunisationprogrammes with examples, newergeneration vaccines including DNA Vaccines with examples) interferons, and antiviral drugs.

List of practical based on theory papers (Semester-II)
GMMB LAB-201

1. Preparation of liquid and solid media for growth of microorganisms.
2. Slants and Stab cultures, Isolation and maintenance of microorganisms by plating, streaking and serial dilution methods.
3. Biochemical characterization of selected microbes.
4. Simple staining and Grams staining.
5. Acid fast and spore staining.
6. Microscopic examination of bacteria, yeast and molds.
7. Selection of animals, Preparation of antigens, Immunization and methods of bleeding, Serum separation, Storage.
8. Antibody titre by ELISA method.
9. Double diffusion, Immuno-electrophoresis and Radial Immuno diffusion.
10. Complement fixation test.
11. Isolation and purification of IgG from serum or IgY from chicken egg.
12. SDS-PAGE, Immunoblotting, Dot blot assays
13. Blood smear identification of leucocytes by Giemsa stain
14. Separation of leucocytes by dextran method
15. Demonstration of Phagocytosis of latex beads
16. Separation of mononuclear cells by Ficoll-Hypaque
17. Flowcytometry, identification of T cells and their subsets
18. Lymphoproliferation by mitogen / antigen induced
19. Lympnode Immunohistochemistry (direct and indirect peroxidase assay)
20. Hybridoma technology and monoclonal antibody production.
21. Immunodiagnostics using commercial kits

List of practical based on theory papers (Semester-II)
GMMB LAB-202

1. Use of simple techniques in laboratory(Colorimetry, Centrifugation; Electrophoresis and GLC);
2. Determination of viable and total number of cells, Measurement of cell size, Growth – types of growth (synchronous,diauxic, batch),
3. Study factors affecting growth, Sporulation and spore germination inbacteria.
4. Induction and repression of enzymes; Study of bacterial growth under aerobic,micro, aerophilic and anaerobic conditions.
5. Morphological, Physiological and Biochemical tests of selected bacterial cultures.
6. Production of amino acids and vitamins by microorganisms.
7. To study agarose gel electrophoresis of genomic DNA.
8. Growth of a microorganism and growth curve.
9. Analysis of water for portability and determination of MPN.
10. Microbiological examination of milk.
11. Searching Data from NCBI Database.
12. Working on EMBL.
13. Searching structural data from PDB.
14. Genome Map viewer from NCBI.
15. Database search using BLAST.
16. Sequence alignments.
17. Sequence and structure visualization
18. TLC of lipids and identification of different lipids.
19. Separation of Sugars by TLC.
20. Separation of amino acids by TLC.