Semester II

PAPER 5 Microbiology (GMBT-201)

Course Objectives

"(i) The student will be able to understand the basic techniques in microbiology to improve yield of the microbes etc. (ii) The student will understand the application of microbial agents in agrochemical industries. (iii) The student will learn the advancement in genetic engineering techniques in agriculture. (iv) At the end of this course, the student will learn the use of biofertilizers and ethical aspects in agriculture and animal farming."

Course Contents

UNIT-1: Methods in Microbiology

Sterilization Methods, Pure culture technique, Enrichment techniques, Preservation & Maintenance of culture, Staining & fixation, Bacterial morphology, Growth curve of bacteria, Measurement of microbial growth, The influence of environmental, factors in growth, Synchronous growth, Continuous growth, Sporulation, Spore germination, Common Nutrient Requirements, Types of media for growth of microorganisms.

UNIT-2: Medical Microbiology and epidemiology

Pathogenicity and virulence, Virulence factors of microorganism, Epidemiology

UNIT-3: Bacterial Genetics

Recombination of bacterial genes, gene targeting, Gene transfer method- Transformation, Conjugation & Transduction, Mutation:- Types , causes & effects of mutation

UNIT-4: Viruses & Prions

General Characteristics of viruses, Viruses of Bacteria Lytic & Lysogeny cycle (General features, RNA & DNA viruses), Viruses of Plants:- Different types of plant, viruses , mechanism of infection, Animal viruses:- General features of retroviruses, overview of Animal viruses, HIV and AIDS, Prions & Molecular basis of their pathogenecity

UNIT-5: Antimicrobial agents

Types of antimicrobial agents, Classes of antibiotics (β-lactams, tetracyclins, aminoglycosides, macrolids, Polypeptides antibiotics & their mode of action), Antiviral, antifungal, antiprotozoan antibiotics, Development of resistance to antibiotics, Microbial spoilage and its impact.

BOOKS RECOMMENDED:

1. Atlas R.M. (1998) Microbiology : Fundamental and application (IIeds) Mac millan Publishing company
2. Bruijin et al., (1998). Bacterial genomes, Chapman and Hill
3. Chauhan, K.A., Varma, A. and kharwad,h. (2007). Microbes for Human life. I.K.International Pvt. Ltd., New Delhi.
4. Dale J.W. (1994). Molecular genetics and Bacteria. John Wiley and sons
5. Hayes W. (1970). The genetics of Bacteria and their viruses. The English Book society of Blackwell Scientific Publication, Oxford
6. Hunderson et al., (1999). Cellular Microbiology Wiley
7. Kavanagh, K. (2007). Medical Mycology. John wiley & sons ltd., England.
8. Lewin B (2002). Genes VIII, Oxford
9. Maheshwari, K.D., Dubey, R.C. and Kang, S.C. (2006). Biotechnological Application of Microorganisms. I.K.International Pvt. Ltd., New Delhi.
10. Mims, C., Dockrell, M.H.and Goering, V.R. (2004). Medical Microbiology.3rd edition. Mosby year book, Europe.
11. Prescot L.M., Hanley, J.P. and Klein, D.A. (1999). Microbiology, WCB Mc Graw Hill , Con MY
12. Presscott,L.M., Hanley,J.P. and Klein,D.A.(1999). Microbiology, Mc Graw Hill, New York.

PAPER 6 Immunology (GMBT-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. 4. What is Compliment system. Primary and Secondary Immune Response; Generation of Humoral and Cell Mediated Immune Response."

Course Contents

UNIT-1: Molecular cells & organs of Immune system

Historical perspective, Innate Immunity:- Skin, Mucosal Surface, Physiological barrier, Inflammation, Adaptive Immunity

Molecules of innate & Acquired immune system:- Complement, Interferon, other molecules, Cells of Innate & Acquired Immune system. Organs of the immune system:- Primary Lymphoid organs, Secondary Lymphoid organs, Lymphatic etc.

UNIT-2: Antigens, Antibody & Ag-Ab Interaction

Antigens: - Immunogenicity vs Antigenicity, Factors influencing Immunogenicity, Adjuvant,, Epitopes & Haptens, super antigens, auto antigens

Antibody:- Structure, classes & functions, Allotypes & Idiotypes, Basic principles of Antigen-Antibody Interaction, Immunological techniques: Principles & Applications: Precipitation & agglutination, Radio, Immunoassay, Enzyme linked Immunosorbent Assay etc.

UNIT-3: Mechanism of Immune response

Generation of Immunological diversity, Antigen recognition, Lymphocyte development &activation, Lymphocyte interaction, cytokines & lymphoid system

UNIT-4: MHC & Transplantation Immunology

MHC:- General organization, MHC molecules & genes, Cell recognition of self & nonself, MHC restriction, Tolerance:- Central Peripheral & acquired tolerance, HLA typing methods using serological and molecular techniques.

UNIT-5: The Immune system in Health & Disease

AIDS & other Immunodeficiencies, Autoimmunity & autoimmune diseases, Hypersensitivity, Vaccines:- Principle & types of vaccines, Recent advances in vaccination, Monoclonal & Recombinant antibodies

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 Cell Biology & Analytical Techniques (GMBT-203)

Course Objectives

"At the end of course, students will be able to describe following methods: - 1. Regarding cell division, Mitosis, meiosis, Comparison. 2. Regarding Movement across membranes- Passive transport: simple diffusion, facilitated diffusion-transporters (uniporters and co-transporters) and channel proteins. Active transport. 3. What is cell cycle, programmed cell death, Carcinogenesis, types and therapy, Chromosomal Organization, alteration in chromosome number, polyploidy etc. 4. Simple microscopy, phase contrast microscopy, florescence and electron microscopy (TEM and SEM), pH meter, absorption and emission spectroscopy. 5. Paper chromatography, thin layer chromatography, column chromatography: silica and gel filtration.6. HPLC, SDS-PAGE, electrophoresis, Western blotting"

Course Contents

UNIT-1:

Cell Organelles, Structure of plasma membrane, various models of plasma membrane structure, Mitochondria, chloroplast, Golgi Bodies, ribosomes, ER, peroxisomes, Cellular transport, active, passive and facilitated transport mechanisms.

UNIT-2:

Cell cycle, Cell signalling & Apoptosis: Overview of cell cycle & It's control, Various stages of Mitosis & Meiosis, Components of Cell Cycle control systems, Role of Protein kinase in cell cycle & check points, Signaling through G-Proteins linked cell surface receptors, Signaling through Enzyme linked cell surface receptors

UNIT-3:

Cytoskeleton: Microtubules, cilia, flagella & centrioles, roles of microtubule dynamics in cell division, Microfilaments & cell motility, Intermediate filaments, Actin & Myosin, Functional role of actins filaments and motor proteins, The cytoskeleton & cell behaviour

UNIT-4:

Molecular Biology of Cancer: Characteristics of cancer cells, Proto-oncogenes & its regulation, Viral oncogenes (Viruses & Cancer), Techniques used in cancer research, Cancer treatment present & future

UNIT-5:

General microscopy, phase contrast microscopy, florescence and electron microscopy (TEM andSEM), pH meter, absorption and emission spectroscopy, colorimetry, spectrophotometry (visible, UV, infrared),centrifugation, cell fractionation techniques, isolation of sub-cellular organelles andparticles.

Chromatography techniques, principle and applications, principle of electrophoresis. Starch-gel, polyacrylamide gel (native and SDS-PAGE),agarose-gel electrophoresis, pulse field gel electrophoresis, immuno- electrophoresis, isoelectric focusing

Recommended Books:

1. 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
2. Bishop J.A. (1982). Retroviruses and cancer genes. Advances in cancer research.
3. Brachet J. (1985). Molecular Cytology. Academic Press New York
4. Celis J E (Eds): Cell Biology: A Laboratory Hand Book. Vol I & II Academic Press.
5. Dale,W.J. and Park,F.S. (2004). Molecular Genectics of Bacteria. John wiley & sons ltd., England.
6. Elliot and Elliot. (2001). Biochemistry and Molecular Biology. Oxford University Press. 7. Gerald Karp. (1996). Cell and Molecular Biology. John Wiley and Sons. Inc
7. Halli,k.B. and Halligrimsson,B. (2008). Evolution. 4 th edition. Jones and Bartlett Publishers, Canada.
8. J.Daneil H and Lodish D. (1995). Molecular cell Biology. Baltimore Scientific American Book
9. The Principles and practice of electron microscopy. Watt IM, Cambridge Unive, press, London, 1989.
10. Gordon.M.H. and Macrae.M. instrumental analysis in biological sciences., Blackie and sons Ltd. London 1998
11. Principles of physical biochemistry. Vanholdem.W.C and Johnson, P.S. Printice Hall, 1998.
12. Principles and techniques in practical biochemistry.Wilson.K and Walker.J.M. Foundation books, New Delhi, 1994.

PAPER 8 Plant Biotechnology (GMBT-204)

Course Objective:

"At the end of course, students will be able to describe following:1. Organogenic differentiation, Types of culture, Protoplast culture. 2. In vitro haploid production. 3. Protoplast Isolation and fusion, Soma clonal variation. 4. Plant Growth Promoting bacteria. 5. Nitrogen fixation, Nitrogenase, Hydrogenase, Nodulation. 6. Biocontrol of pathogens"

Course Contents

UNIT-I

Culture media: - constituents and concepts of sterilization, Preparation, isolation and selection of explant, Concepts of totipotency. Suspension cell culture, Callus culture, Protoplast Isolation, culture & fusion. Anther & pollen culture for production, Somatic embryogenesis, Synthetic seeds. Germplasm Conservation: Improvement, exploitation and conservation of plant genetic resources, Somatic Hybridization and somaclonal variations

UNIT-II

Plant Genetic engineering: Gene cloning techniques, Techniques for gene transfer into plants. Mechanism of gene transfer by TI and RI plasmids as vectors. Reporter genes, transient gene assays and identification of transgenic plants. Molecular markers and their significance. RFLP, AFLP and QTL in plants. RAPD for molecular mapping and crop improvement.

UNIT-II

Agricultural Biotechnology: Engineering of herbicide tolerance in plants, production of disease resistant plants by gene transfer; Development of insect resistant plants. Biotechnological strategies for engineering stress tolerance.

Algal Biotechnology: Laboratory culture of micro algae. Large scale biomass production. Marine micro algae/sea weeds and their products, Biofertilizers

UNIT-IV

Altering protein and oil quality traits in seeds. Chloroplast transformation – advantages in tobacco and potato, plants for expression of bacterial, viral and eukaryotic genes. Edible vaccines and plantibodies. The genetic manipulation of crop yield by enhancement of photosynthesis.

UNIT-V

Mycorrhizal biofertilizers, bacterial fertilizers.Biopesticides in agricultural production.

RECOMMENDED BOOKS:

1. Altman, A (1997), Agricultural Biotechnology
2. Bhojwani SS, MK Razdan (1983), Advanced immunology.
3. Blitterswiji, V.C. (2008). Tissue Engineering. Academic press, USA. Plant Tissue Culture: Theory and Practice, - elsevier.com
4. Clark,P.D. and Pazdernik, J.N. (2009). Biotechnology. Elsevier Academic press, London.
5. Freshney RI, JRW Masters, J Masters (2000),

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

1. Sterilization, disinfection, safety in microbiological laboratory.
2. Preparation of media for growth of various microorganisms.
3. Identification and culturing of various microorganisms.
4. Staining and enumeration of microorganisms.
5. Growth curve, measure of bacterial population by turbidometry and studying the effect of temperature, pH, carbon and nitrogen.
6. Assay of antibiotics production and demonstration of antibiotic resistance.
7. Isolation and screening of industrially important microorganisms.
8. Determination of thermal death point and thermal death time of microorganisms.
9. Selection of animals, Preparation of antigens, Immunization and methods of bleeding, Serum separation, Storage.
10. Antibody titre by ELISA method.
11. Double diffusion, Immuno-electrophoresis and Radial Immuno diffusion.
12. Complement fixation test.
13. Isolation and purification of IgG from serum or IgY from chicken egg.
14. SDS-PAGE, Immunoblotting, Dot blot assays
15. Blood smear identification of leucocytes by Giemsa stain
16. Separation of leucocytes by dextran method
17. Demonstration of Phagocytosis of latex beads
18. Separation of mononuclear cells by Ficoll-Hypaque
19. Flowcytometry, identification of T cells and their subsets
20. Lymphoproliferation by mitogen / antigen induced
21. Lympnode Immunohistochemistry (direct and indirect peroxidase assay)
22. Hybridoma technology and monoclonal antibody production.
23. Immunodiagnostics using commercial kits

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

1. Study of different cell types
2. Study of meiotic chromosomes in grasshopper.
3. Study of meiotic anomalies
4. Study of meiotic chromosomes in mouse
5. Extraction of lipids-Plant and animal sources.
6. Qualitative estimation of lipids-using standard curve, emulsion test, solubility and saponification test, acid value test.
7. Determination of Iodine Number of different lipids.
8. Salicylic acid chromatography of Lipids
9. TLC of lipids and identification of different lipids.
10. Separation of Sugars by TLC.
11. Separation of amino acids by TLC.
12. In vitro morphogenetic studies on any one plant system (Seed culture, multiplication of shoots, rooting and hardening)
13. Isolation of explants, establishment, subculture and maintenance of callus.
14. Morphology of callus cells (callus smear preparation) and histological aspects (microtomy).

15. Embryogenesis in culture cells/tissues
16. Anther culture for haploid production.
17. Embryo culture.
18. Preparation of synthetic seeds.
19. Isolation of Protoplasts
20. Secondary Metabolite production by single cell culture