

III SEMESTER

HCT 3.1 AGRICULTURAL MICROBIOLOGY & PHYTOPATHOLOGY		
Course Code : HCT 3.1		Credit :4
Total Contact Hours : 60 T	Internal Assessment: 20 M	Examination: 80 M
Course outcome: After completion of course (Theory), students will be able to: ➤ Understand various plant microbe interactions and biofertilizer production. ➤ Appreciate role of microorganisms in sustainable agriculture. ➤ Comprehend the basic principles of phytopathology and plant pathogenesis. ➤ Analyze suitable disease management strategies of plant diseases.		
UNIT-I		
Agricultural Microbiology: Plant microbiome: Concept and scope, beneficial microorganisms, interactions of soil microorganisms with plants; rhizosphere and phylloplane microorganisms; modern concepts of microbial inoculants in agriculture. Microbial inoculants: Mass culturing and quality control of microbial inoculants-mother culture, shake culture and brief account of large-scale production of biofertilizers. Methods of application to seed, soil and nursery. Brief account of mass production and applications of Rhizobium, Azotobacter, Azospirillum, Cyanobacteria, Azolla and Frankia. Plant growth promoting rhizobacteria (PGPR/PGPB), phosphate solubilizers, siderophores, ammonia, HCN, phytohormones. Beneficial fungi in agriculture, Trichoderma, Metarhizium, Beauveria, Mycorrhizae - importance and applications.		15 hours
UNIT-II		
Fundamentals of Phytopathology Plant disease: Significance, parasitism and pathogenicity; types of plant diseases, plant disease diagnosis; disease cycle, infection cycle and plant disease triangle; Effects of pathogens on plant physiology – photosynthesis, nutrients uptake, respiration, membrane permeability, plant growth and reproduction. Plant pathogenesis: Process of pathogen attack; role of enzymes, toxins, growth regulators in plant disease. Plant disease epidemiology: Effect of environmental factors on disease development; Dissemination of plant pathogens; Disease forecasting and its significance.		15 hours
UNIT-III		
Plant defense mechanisms: Structural defense mechanisms: Pre-existing and induced structural defenses, cell wall, papillae, tyloses, anatomical barriers, Biochemical defense		15 hours

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mechanisms: Pre-existing and induced chemical defenses, elicitors, receptors and suppressors in disease development; phenols and phytoalexins, PR proteins, defense enzymes systemic acquired resistance. Genetics of plant disease: Variability in pathogens, stages of variation, types of plant resistance to pathogens; genetics of virulence in pathogens and resistance in plants, signaling in plant disease resistance, systemic acquired resistance.	
UNIT-IV	
Plant Diseases and their management: Diseases: Brief account of some important plant diseases-rots, damping-offs, downy mildews, white rust, powdery mildews, smuts, rusts, wilts, leaf spots, anthracnose, galls, ergots, bacterial, viral, phytoplasmal, nematodal, protozoal, viroid, non-parasitic diseases, seed-borne diseases and post-harvest diseases. Disease management: Quarantine regulations, cultural methods, physical methods, chemical control, biological control, cross protection, breeding for disease resistance, integrated disease management practices and transgenic plants for disease resistance Software for disease diagnosis and monitoring.	15 hours

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9. Steinhaus, E. A. (1963). Insect pathology: An advanced treatise (Vol I & II). Academic Press.
10. Subba Rao, N. S. (2019). Biofertilizers in agriculture and forestry (3rd ed.). CBS Publishers & Distributors.
11. Subba Rao, N. S. (2019). Recent advances in biological nitrogen fixation (2nd ed.). Cambridge University Press.
12. Swaminathan, M. S. (2016). Biotechnology in agriculture (2nd ed.). McMillan
13. Tronsmo, A.M., Collinge, D.B., Djurarie, A., Munk, L., Yuen, J., Trosno, A. 2020. Plant pathology and plant diseases. CABI, 461 pp
14. Waiters, D. 2020. Plant defense. Wiley-Blackwell publishers 256 pp.
15. Wani, S.H. 2019. Disease resistance in crop plants, Springer 307 pp.

HCT 3.2 IMMUNOLOGY		
Course Code : HCT 3.2	Credit :4	
Total Contact Hours : 60 T	Internal Assessment: 20 M	Examination: 80 M
Course outcome: After completion of course (Theory), students will be able to: ➤ Contrast and compare innate and adaptive immunity ➤ Understanding the development of humoral and cell mediated immunity ➤ Appreciate the mechanisms of autoimmunity, transplantation immunology ➤ Students should be equipped with features of antigen antibody reaction and diagnostic techniques.		
UNIT-I		
Overview of the immune system: Immunity - Types of Immunity, Innate and Acquired Immunity. Hematopoiesis, Cells of the Immune System- B & T Lymphocytes; Antigen Presenting Cells. Macrophages, Organs of the immune System: Primary lymphoid organs (Bone marrow and Thymus); Secondary lymphoid organs (lymph nodes, spleen and mucosal-associated lymphoid tissue). Antigens - Immunogenicity versus Antigenicity, Factors that influence immunogenicity, Epitopes - Properties of B-cell epitopes and T-cell epitopes, Haptens and the study of Antigenicity. Immunoglobulins; structure, classes and distribution of antibodies. B cell maturation, activation and differentiation. Antibody diversity, Generation of humoral immune response- primary and secondary. Complement system – alternate, classical and lectin pathways.		15 hours
UNIT-II		
Cell mediated Immunity: Major histocompatibility complex and antigen presentation: MHC- organization, inheritance, genes, molecules and peptide binding, expression, disease susceptibility, immune responsiveness, self MHC restriction, cytosolic and endocytic pathway for antigen processing. T-cell receptor, T-cell maturation, activation and differentiation: TCR- genetic organization and rearrangement of genes, TCR-complex, peptide binding, thymic selection, activation and differentiation of T cells. Cell mediated cytotoxicity: Effector T cells, cytotoxic T cells, NK cells, ADCC. Cytokines- properties and functions.		15 hours
UNIT-III		
Clinical immunology: Immunity to Infection: Bacteria, viral, fungal and parasitic infections (with examples from each group); Hypersensitivity - Type I-IV; Autoimmunity; Types		15 hours

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of autoimmune diseases; Mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity; Treatment of autoimmune diseases; Tumor immunology - Tumor antigens; Immune response to tumors and tumor evasion of the immune system, Cancer immunotherapy; Immunodeficiency - Primary immunodeficiencies, Acquired or secondary immunodeficiencies. Transplantation immunology: Types of grafts, Immunologic basis of graft rejection, immunosuppressive therapy, clinical transplantations, compatibility assessment. Apoptosis.	
UNIT-IV	
Antigen antibody reactions: Principles, Techniques and applications; Precipitation, agglutination and complement mediated immune reactions; Immunological techniques - ELISA, Western blotting, ELISPOT assay, Immunofluorescence, RIA, Flow cytometry and cell sorting, Immunoelectron Microscopy; tuberculin test, Chemiluminescent assays, Surface plasmon resonance, Biosensor assays for assessing ligand - receptor interactions. Antibody production: polyclonal and monoclonal antibodies; humanized antibodies, T-cells, therapeutic and diagnostic applications. Principle and strategies of vaccine production, types, significance and cytokines production.	15 hours

REFERENCES

1. Abul K. Abbas, Andrew H.L, Shiv Pillai (2021) "Cellular and Molecular Immunology" 10th Edition Saunders Publications
2. Anil Sharma (2019) Introduction to immunology text book Taylor and Francis
3. Doan T, Melvold R, Viselli S and Waltenbaugh, C Lippincott's illustrated Reviews Immunology (2012) 2nd ed., Wolters Kluwer India Pvt, Ltd, ISBN: 978-8184737639.
4. Hardeep K & Ravi T (2021) Textbook of immunology, Dreamtech press
5. Janeway's Immunobiology (2017) 9th ed., Murphy KM and Beaver C, WW Norton and Company, ISBN: 978-0815345510.
6. Kuby Immunology (2018) 8th ed., Punt J, Stranford S, Jones P and Owen JA, W.H Freeman and Company, ISBN: 978-1319114701.
7. Peter Parham Garland (2014) The Immune system-science, W W Norton & Company, 4th Edition.
8. Roitt, I.M, (2006). Essential of Immunology 12th edition, ELBS, Blackwell Scientific Publication
9. Roitt's Essential Immunology (2017) 13th ed., Delvis PJ, Martin SJ, Burton DR and Roitt, IM, Wiley-Blackwell, ISBN: 978-1118415771.14
10. Shivi B & Shukla A (2020) Fundamentals of Immunology

HCT 3.3 GENETIC ENGINEERING		
Course Code : HCT 3.3	Credit :4	
Total Contact Hours : 60 T	Internal Assessment: 20 M	Examination: 80 M
Course outcome: After completion of course (Theory), students will be able to: ➤ Have broad and balanced knowledge the scope and importance of genetic engineering. ➤ Understand the concept of genomic DNA library and chemical synthesis gene. ➤ Acquire the knowledge on the transformation, transfection and PCR techniques. ➤ Understand the broad application of genetic engineering.		
UNIT-I		
Tools of Genetic Engineering Introduction to Genetic Engineering: Scope and importance of Genetic engineering. Restriction endonucleases- nomenclature and types, recognition sequences and mechanism of action. DNA Modification enzymes (nucleases, kinases, Alkaline phosphatase, Klenow-Fragment polymerase, Lambda-Exonuclease and Exonuclease-III) and ligases- types and mechanism of action. A brief account of naturally occurring plasmids (Conjugative and Non-conjugative plasmids, Degradative plasmids, Resistance plasmids, Fertility plasmids, Col-Plasmids), artificial plasmids (pBR322, pUC vectors, Ti and Ri plasmids), Bacteriophages, Phagemids, Cosmids, Fosmids, Artificial chromosomes (BAC's, YAC's), Shuttle vectors, expression vectors, M13 derived vectors and Viral vectors (SV40 and Bovine Papilloma Virus).	15 hours	
UNIT-II		
Gene Libraries and Selection of Recombinants cDNA library: Isolation and purification of mRNA, Synthesis of cDNA, cloning of cDNA in to plasmids and phage vectors. Genomic DNA Library: Isolation and purification of Genomic and Plasmid DNA, preparation of DNA fragments for cloning, Construction of genomic DNA library with different vectors and screening techniques. Chemical synthesis of Genes: Methods (Phosphodiester, Phosphotriester and Phosphite ester methods principle and strategies). Oligonucleotide synthesis and application, synthesis of complete gene. Labeling and Detection Techniques: Labeling of DNA, RNA and Proteins (Radioactive and non-radioactive isotopes). DNA Sequencing (Chemical and Enzymatic method). Next generation sequencing (NGS).	15 hours	
UNIT-III		

Techniques in Genetic Engineering Transformation and Transfection techniques: Preparation of competent cells of bacteria, chemical methods- calcium phosphate precipitation method and liposome-mediated method. Physical methods-Electroporation and Gene gun method. Biological methods-Agrobacterium mediated transformation, Co-cultivation methods, Chloroplast transformation, method of DNA transfer to yeast, mammalian and plant cells. PCR: Methodology, types and applications. Gene Editing: CRISPR Cas-9, Blotting Techniques- Southern Blotting, Northern Blotting, Western Blotting and DOT Blot, Nucleic Acid hybridization (Colony Hybridization and Plaque Hybridization), Immunological methods and In vitro Translation. Chromosome walking. Gel Electrophoresis: Agarose gel Electrophoresis, PAGE and PFGE	15 hours
UNIT-IV	
Applications of Genetic Engineering Transgenic plants (disease resistant, weedicide resistant, frost resistant, halo-tolerant and pest resistant) production of growth hormones, interferon, insulin, recombinant vaccines, gene therapy, RNA; requirement of recombinant molecules in health, pharmaceuticals, agriculture and industrial sectors, research lab Antisense and Ribozyme technology: Molecular mechanism of antisense molecules, inhibition of splicing poly-adenylation and translation, disruption of RNA structure and capping Biochemistry of Ribozyme, hammer head, hairpin and other Ribozymes, strategies for designing Ribozymes, application of antisense and Ribozymes technologies.	15 hours

REFERENCES

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2. Channarayappa. (2006) Molecular Biotechnology, Principles and Practices. First Edition, University press (India) Pvt. Ltd, Hyderabad, India.
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SCT 3.1 FOOD & DAIRY TECHNOLOGY		
Course Code : SCT 3.1	Credit :4	
Total Contact Hours : 60 T	Internal Assessment: 20 M	Examination: 80 M
Course outcome: After completion of course (Theory), students will be able to: ➤ Know the details of food borne pathogens, fermented food products and role of microorganisms in dairy industry ➤ Understand concept and use of probiotics and illustrate the role of microorganisms in food safety ➤ Cultivate and enumerate microorganisms from various food samples ➤ Compare various physical and chemical methods used in the control of microorganisms		
UNIT-I		
Introduction: Origin, Concept, Scope and historical developments, Food as substrate for microorganisms: Hydrogen ion concentration (pH), Moisture requirement, Water activity, Oxidation-Reduction potential, Nutrient content, Inhibitory substances and biological structure. Food contamination: Contamination of foods from green plants, animals, sewage, soil, water, air and handling. Food spoilage: General principles of food spoilage, causes of food spoilage, Factors affecting kind and number of microorganisms. Chemical changes caused by microorganisms. Spoilage of Meat and Meat products, Egg and Egg products, Fish and Marine products, Cereal and Cereal products, Fruits and Vegetables. Food borne diseases and their control: Food Infection and Intoxication. Detection of food borne pathogens and their toxins by various methods		15 hours
UNIT-II		
Preservation of Foods: General principles involved in food preservation; low temperature preservation; lethal effects of chilling, freezing and thawing; high temperature preservation. Heat resistance of microorganism, heat penetration and thermal processing; Pasteurization, canning and dehydration; chemical preservation and its toxic effects; irradiations; Thermal inactivation of microbes- Concept, determination & importance of Thermal Death Time, F, Z & D values. Food hygiene and sanitation: Contamination during handling, processing of food and its control; Biochemical changes caused by microorganisms.		15 hours
UNIT-III		
Introduction and Genesis of Dairying, Milk properties, Nutritive components and microbiology of Milk: Milk definition, Composition and Variation, Factors		15 hours

effecting composition of milk, physiochemical properties of milk. Basics of milk processing and quality assurance: Enumeration of Microorganisms in assessment of milk-bacteria, yeast and molds. Bactofugation: Principles and thermal processing of milk. Thermization, Lactoperoxidase system, pasteurization (LTLT/ HTST concept).	
UNIT-IV	
Milk and milk products: Special Milks and fermented milk products: Toned, Double toned, Recombined milk, Preparation of buttermilk, Acidophilus milk, Yoghurt, Dahi, and Lassi. Fat Rich Dairy Products: Cream, Butter and Ghee. Condensed and Dried Milks: sweetened condensed skim milk, Evaporated milk, whole milk powder and skim milk powder. Cheese, Frozen Dairy Products: Methods of manufacture of Ice cream. Indigenous Milk Products/ Sweets: Khoa and khoa based sweets, paneer. Public health: Indicators microorganisms; Quality assurance: Microbiological quality standards of food: Government regulatory practices and policies- FDA, EPA, FSSAI, HACCP, ISI, and ISO9000 Series. Food testing laboratories.	15 hours

REFERENCES

1. Ananthakrishnan, C. P., & Gunasekaran, P. (2017). Dairy microbiology (2nd ed.). Sreelakshmi Publications.
2. Danwart, G. J. (2018). Basic food microbiology (2nd ed.). CBS Publishers & Distributors.
3. Doyle, M. P., Beuchat, L. R., & Montville, T. J. (2013). Food microbiology: Fundamentals and frontiers (4th ed.). ASM Press.
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SCT 3.2 GUT MICROBIOLOGY		
Course Code : SCT 3.2	Credit :4	
Total Contact Hours : 60 T	Internal Assessment: 20 M	Examination: 80 M
Course outcome: After completion of course (Theory), students will be able to: ➤ Know about the gut microbiota and detail about human gut structure and function ➤ Know about relation between the gut microbes and health ➤ Food habits and immunological response, properties and function ➤ Understand the role of the GI microbiota in health and concept of Probiotics		
UNIT-I		
Introduction to gut microbiota: Composition and structure of the human GI microbiota; Development of the human GI microbiota; Biogeography of the human microbiota in the GI tract; Factors shaping the GI microbiota. The Upper Gastrointestinal Tract: Esophagus and Stomach; Introduction; The esophageal microbiome; The microbiome in esophageal diseases; Microbial niches of the intestines		15 hours
UNIT-II		
Gut Microbiota: Gut microbiota through life span; Gut microbiota in health and disease; Genetic and environmental factor of gut microbiota; Impact of nutrition on gut microbiota; Therapeutic manipulation of gut microbiota; Application of microbiota and nutrition; Future of gut microbiota and nutrition. The Viruses of the Gut Microbiota: The eukaryotic virome, a component of the gut microbiome; Interplay between gut virome and immune system; Pathogenic viruses of the gut virome: enteropathogenic viruses associated with systemic infections; Gut as a major source of neurotropic viruses, when pathogenesis and shedding is favored by humoral immune deficiency ;An uncertain status for diet-derived animal viruses		15 hours
UNIT-III		
Food Substrates Important to the Microbiota: Dietary Fiber, Soluble and Insoluble, Carbohydrates, Fructose, and Lipids; The Benefits of Yogurt, Cultures, and Fermentation: General considerations about yogurt, fermented dairy products; Yogurt and digestive function. Immunologic Response in the Host: Intestinal epithelial cells; Toll-like receptors and intestinal epithelial cells; NOD receptors and intestinal epithelial cells; Immunoregulatory role of intestinal epithelial cells; Transcytosis of immunoglobulin A by intestinal epithelial cells; Antigen presentation in the gut; Role of dendritic cells; Innate lymphoid cells; T cells; Microbial modulation of immune function		15 hours

UNIT-IV	
Role of the GI microbiota in health; Bacterial Diarrheas; Enterotoxin-Mediated Diarrheal Diseases; Cholera; Enterotoxigenic E coli Diarrhea; Other Diarrhea-Causing Toxins; Gastrointestinal Disease Caused by Invasive Bacteria; Salmonella Enteritis; Shigella Dysentery; Fluid Production in Invasive Diarrhoeal Diseases; Viral Diarrhoea; Parasitic Diarrhoea. The Role of the Brain–Gut–Microbiome in Mental Health and Mental Disorders; Mood disorders. Probiotics: Probiotics: definition, types, properties, microbial group. Prebiotics: symbiotic and nutraceuticals, Taxonomy of Lactobacilli and Bifidobacteria, The Microecology of Lactobacilli in the Gastrointestinal Tract, Exopolysaccharide Production by Intestinal Lactobacilli	15 hours

REFERENCES

1. Antimicrobial Stewardship: Principles and Practice, CAB International, 2017. ProQuest Ebook Central
2. Arrona Cardoza P, Spillane MB, & Morales Marroquin E. (2021) Alzheimer's disease and gut microbiota: does trimethylamine N-oxide (TMAO) play a role? Nutr Rev. doi: 10.1093/nutrit/nuab022. PMID: 33942080.
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4. Fasano, Alessio, and Susie Flaherty. Gut Feelings: The Microbiome and Our Health, MIT Press, 2021. ProQuest Ebook Central
5. Health and the Gut: The Emerging Role of Intestinal Microbiota in Disease and Therapeutics, edited by William Olds, Apple Academic Press, Incorporated, 2014. ProQuest Ebook Central,
6. Luciana Princisval, Fernanda Rebelo, Brent L Williams, Anna Carolina Coimbra, Louise Crovesy, Ana Lorena Ferreira, Gilberto Kac, Association Between the Mode of Delivery and Infant Gut Microbiota Composition Up to 6 Months of Age: A Systematic Literature Review
7. Morales-Marroquin, E., Hanson, B., Greathouse, L., de la Cruz-Munoz, N., & Messiah, S. E. (2020). Comparison of methodological approaches to human gut microbiota changes in response to metabolic and bariatric surgery: A systematic review. Obes Rev, 21(8),
8. Tang, M. and Marroquin, E. Material Obesity Potentially Regulating Offspring's Obesity by Acting Through the Gut Microbiota. Accepted for publication in Frontiers in November, 2022

OET 3.1 MICROBES & ENVIRONMENT		
Course Code : SCT 3.1	Credit :2	
Total Contact Hours : 30 T	Internal Assessment: 10 M	Examination: 40 M
Course outcome: After completion of course (Theory), students will be able to: ➤ Learn about the four major components of the environment - atmosphere, lithosphere, hydrosphere, and biosphere. They be able to identify the position of microorganisms in the ecological niche. ➤ Explore the origin, evolution and biodiversity of the microorganisms. ➤ Explore cosmopolitan nature of microorganisms. ➤ Understand what greenhouse gases are and their sources. Explain how microorganisms can be used as indicators of water quality.		
UNIT-I		
Concept of environment: Atmosphere, lithosphere, hydrosphere and biosphere; Ecological niche - ecosystems, organization of ecosystems, food and energy triangles, position of microorganisms in the ecological niche. Origin and evolution of microorganisms: Origin and early evolution of microorganisms, relationship with the early stages of life on the earth, microbes as models for understanding how evolution works and the origin of all life on earth. Biodiversity of microorganisms: Richness and expanding microbial world, distribution of microorganisms in various environments, culturable and non-culturable bacteria.		15 hours
UNIT-II		
Cosmopolitan nature of microorganisms: Exobiology – does life exists elsewhere in the universe? X- files, news stories of 1996 – evidence for microbial life on Mars, debate, exploration for extraterrestrial life based on microbial life. Microbial Ecology: Use of microorganisms as clues to study complex ecosystems; Natural resources – renewable and non-renewable, microorganisms as renewable resources; Microbial community within a human being - humans are microbes' invention to move around. Microbial interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation. Microbe-Plant interaction: Symbiotic and non-symbiotic interactions. Biodegradation and bioremediation: Principles and degradation of common pesticides, organic (hydrocarbon oil spills), industrial wastes.		15 hours

REFERENCES

1. Agrios, G. N. (2005). Plant pathology. Academic Press.
2. American Public Health Association (APHA), American Water Works Association (AWWA), & Water Environment Federation (WEF). (2017). Standard methods for the examination of water and wastewater (23rd ed.). APHA.
3. Atlas, R., & Bartha, R. (2018). Microbial ecology: Fundamentals and applications. Benjamin/Cummings Science Publis.
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OET 3.2 DIAGNOSTICS MICROBIOLOGY		
Course Code : SCT 3.2		Credit :2
Total Contact Hours: 30 T	Internal Assessment: 10 M	Examination: 40 M
Course outcome: After completion of course (Theory), students will be able to: ➤ Understanding the process of sample handling for diagnostic purpose. ➤ Comprehend methods involved with special reference to important diseases. ➤ Understand the laboratory diagnosis of important bacterial, viral, fungal and protozoal infections ➤ Understand about different immunological techniques for the therapy.		
UNIT-I		
Introduction to diagnostic microbiology , significance of microbial diseases of humans. Laboratory safety measures and sample disposal Medical Specimens: collection procedure and transport of body fluid specimens' gastrointestinal specimens, genital specimens, respiratory specimens, urine specimens and wound specimens. specimen processing General methods, microscopy, culture methods and serology. Laboratory diagnosis of important bacterial, viral, fungal and protozoal infections (Mycobacterium, Staphylococcus, Treponema, Salmonella, HIV, Hepatitis, Corona, Aspergillus Candida, Plasmodium) Antimicrobial drug testing procedures.		15 hours
UNIT-II		
Diagnostic tools: Principles, Techniques and applications; Precipitation, agglutination and complement mediated immune reactions; Immunological techniques - ELISA, Western blotting, ELISPOT assay, Immunofluorescence, RIA, Flow cytometry and cell sorting, Immunoelectron Microscopy; tuberculin test, Chemiluminescent assays, Surface plasmon resonance, Biosensor assays for assessing ligand - receptor interactions.		15 hours

REFERENCES

1. Abul K. Abbas, Andrew H.L, Shiv Pillai (2021) "Cellular and Molecular Immunology" 10th Edition Saunders Publications
2. Anil Sharma (2019) Introduction to immunology text book Taylor and Francis
3. Hardeep K & Ravi T (2021) Textbook of immunology, Dreamtech press
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5. Kuby Immunology (2018) 8th ed., Punt J, Stranford S, Jones P and Owen JA, W.H Freeman and Company, ISBN: 978-1319114701.
6. Peter Parham Garland (2014) The Immune system–science, W W Norton & Company, 4th Edition.
7. Roitt, I.M, (2006). Essential of Immunology 12th edition, ELBS, Blackwell Scientific Publication
8. Roitt's Essential Immunology (2017) 13th ed., Delvis PJ, Martin SJ, Burton DR and Roitt, IM, Wiley-Blackwell, ISBN: 978-1118415771.14
9. Shivi B & Shukla A (2020) Fundamentals of Immunology



HCP 3.1 AGRICULTURAL MICROBIOLOGY & PHYTOPATHOLOGY

Course Code : HCP 3.1
Internal Assessment: 10 M

Credit :2
Examination: 40 M

Practicals:

1. Comparison of rhizosphere microorganisms from different crop plants.
2. Isolation of Rhizobium/ Azospirillum / Azotobacter
3. Isolation of phosphate solubilising microorganisms.
4. Seed health testing by dry seed examination.
5. Seed Health testing by seed wash method.
6. Detection of seed-borne fungi by blotter method.
7. Study of plant diseases caused by fungi, bacteria and viruses.
8. Testing of antimicrobial property of antagonist's culture filtrate.
9. Biological seed treatment with Trichoderma for the prevention of seed borne pathogens.
10. Isolation and mass culturing of Trichoderma using agricultural waste
11. Isolation of fluorescent pseudomonads.
12. Post harvest diseases.
13. Observation of diseased specimens, sections and slides.

HCT 3.2 IMMUNOLOGY

Course Code : HCP 3.2
Internal Assessment: 10 M

Credit :2
Examination: 40 M

Practicals:

1. Estimation of Haemoglobin content in blood.
2. Total RBC count.
3. Total WBC count.
4. Differential WBC count.
5. Radial Immunodiffusion test.
6. Ochterlony double diffusion test.
7. Separation of plasma and serum
8. Determination of antibody titre of the serum.
9. Separation of serum proteins by SDS-PAGE
10. Isolation of IgG from serum
11. Agglutination Tests.
 - a. VDRL test.

- b. Haemeagglutination test.
12. Detection of Salmonella by WIDAL test.
 13. Immunochromatography- HCG/HIV/HBSAg/ detection
 14. ELISA/ Western blot

HCT 3.3 GENETIC ENGINEERING

Course Code : HCP 3.3

Credit :2

Internal Assessment: 10 M

Examination: 40 M

Practicals:

1. Isolation and Electrophoretic separation of genomic DNA from Bacteria, Plant and Animal tissues.
2. Gel elution and purification of DNA fragment
3. Isolation and electrophoretic separation of RNA from Bacteria/Plant/Animal tissues.
4. Quantification and purity check of Isolated DNA using UV spectrophotometer.
5. Isolation, purification and electrophoretic separation of plasmid DNA from Bacteria.
6. Restriction Digestion of Genomic DNA and Plasmid DNA with Restriction Endonucleases and separation of digested products in Agarose gel.
7. DNA Ligation using T4 DNA Ligase and *E. coli* DNA ligase
8. Preparation of Competent cells using Calcium Chloride Method.
9. Transformation of Bacterial cells (blue white Selection).
10. Blotting techniques: Southern, Northern and Western Blotting
11. Amplification of DNA using Polymerase chain Reaction.

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SCP 3.1 FOOD & DAIRY TECHNOLOGY

Course Code : SCP 3.1

Credit :2

Internal Assessment: 10 M

Examination: 40 M

Practicals:

1. Microbiological Examination of Utensils.
2. Methylene blue reduction test
3. Enumeration of microorganisms from healthy and spoiled fruits and vegetables
4. Enumeration of microorganisms from cereals, spices and dry products
5. Enumeration study of spoilage of stored meat and fish
6. Study of microbiology of milk and milk products
7. Production of yoghurt, acidophilus milk, tempeh and cheese
8. Estimation of lactic acid in milk and curd
9. Estimation Fat in milk and milk products
10. Estimation of ascorbic acid from tomato, chilly and lemon
11. Mushroom cultivation (Oyster) and Spirulina, Agar-agar and single cell proteins
12. Mandatory visit to food research institutes/Industries

SCP 3.2 GUT MICROBIOLOGY

Course Code : SCP 3.2

Credit :2

Internal Assessment: 10 M

Examination: 40 M

Practicals:

1. Isolation of micro-organisms from oral samples
2. Isolation of micro-organisms from gut samples
3. Morphological and Microscopic Identification of oral and gut pathogens
4. Biochemical analysis of oral pathogens
5. Sugar Fermentation ability of oral and gut pathogens
6. Detection of *M.tuberculosis* by AFB staining technique
7. Estimation of endospore producing organisms by Endospore staining technique
8. Determination of thermal death temperature of oral and gut pathogens
9. Determination of thermal death time of oral and gut pathogens
10. Determination of phenolic co-efficient of oral and gut pathogens
11. Estimation of Antibiotic sensitivity test for oral and gut pathogens by Kirby bauer method