

BT-Core Theory paper-8: Industrial and Environmental Biotechnology-50 Hrs

Part A: Industrial Biotechnology

Unit 1: Bioprocess/fermentation technology- (10Hrs)

Introduction, conventional bioreactor, media (substrates), SSF, strategies of strain improvement - types of fermentation-batch, fed-batch, continuous, fermentation process, control of parameters, scale up, overview of downstream processing.

Unit 2: Fermentation process (10Hrs)

With respect to microorganism involved, inoculum preparation, and media used, fermentation process, and recovery.

Organic solvent - ethanol, Enzyme-protease, organic acid - citric acid, antibiotic-penicillin, vitamin-B12, alcoholic beverages-wine, beer, brief account on fermented foods-cheese, yoghurt.

Unit3: Enzyme technology and Biotransformation's (05Hrs)

Production of recombinant enzymes, immobilization of enzymes and cells, adsorption, entrapment, covalent binding, crosslinking and applications, brief account on biosensors. Biotransformation concept, types, biotransformation of steroids and antibiotics.

Part B-Environmental Biotechnology

Unit 4: Waste treatment (10Hrs)

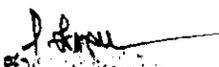
Brief account on water purification systems, waste water treatment-primary, secondary-activated sludge, lagoons ,trickling filters, packed bed reactors , tertiary treatment and water recycling .waste water treatment of dairy and distillery.

Solid waste management-sources of solid waste, composting method, vermicomposting, landfilling.

Unit 5: Bioremediation and Bioleaching (15Hrs)

Concept and definitions, insitu and exsitu method, bioremediation of soil, phytoremediation and applications. Xenobiotics and recalcitrancy, properties of xenobiotics, biodegradation of pesticides and herbicide, role of G.E.M. in biodegradation, metabolism of xenobiotics. Biological recovery for oil spills (super bug).

Bioleaching: Concept, types of leaching, microorganisms used, bioleaching of uranium, copper and gold and its significance.


ಕವಿ/ಕವಿತೆ,
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಶಿವಗೋಡಿ, ದಾವಣಗೆರೆ-577 002.

BT-Core practical paper-7: Plant and Agriculture Biotechnology

1. Preparation of plant tissue culture medium's. (Stock solutions)
2. Explant preparation and sterilization
3. Initiation and maintenance of callus
4. Induction of rhizogenesis and caulogenesis
5. Auxiliary and terminal bud culture
6. Preparation of synthetic seeds
7. Protoplast isolation
8. Staining of rhizobium from root nodules
9. Isolation of rhizobium on YEMA media
10. VAM staining
11. Study of azolla, anabena, spirulina.
12. Survey of Biotechnology based agriproducts in the market.
13. Biofertilizers- commercial available
14. *Azolla* and *Anabaena*


ಕುಲಸಚಿವರು,
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಶಿವಮೊಗ್ಗೋತ್ಪತ್ತಿ, ದಾವಣಗೆರೆ-577 002.

BT-Core Theory paper-7: Plant and Agriculture Biotechnology-50 Hrs

Part A: Plant Biotechnology

Unit: 1 Introduction to Plant tissue culture (05Hrs)

Introduction, brief history, terminology-explant, callus, totipotency, differentiation, dedifferentiation and redifferentiation, types of cultures, basic technique of plant tissue culture, applications of plant tissue culture.

Unit: 2 Culture media and callus culture (05Hrs)

Culture media, types (MS, B5), role of various agents in culture media, growth regulators preparation of explant, surface sterilization, callus culture and suspension culture.

Unit3: Protoplast culture and somatic hybridization (10Hrs)

Introduction, isolation of protoplast -physical and chemical methods, culture and regeneration of protoplast. Somatic hybridization-definition, technique of production of somatic hybrid-fusion by fusogens-PEG, electrofusion, heterokaryon, selection of fused cells. Applications of hybrids, cybrids. Somaclonal variations, isolation and importance of soma clones.

Unit4: Miropagation and somatic embryogenesis (10Hrs)

Introduction, stages, factors affecting Miropagation, applications, organogenesis-direct, indirect, somatic embryogenesis, embryo culture and importance. Brief account on germplasm conservation, Synthetic seed.

Part B: Agriculture Biotechnology

Unit5: Biofertilizers and Biopesticides (20Hrs) Brief account on nitrogen fixation, siderophores, phytohormones, Brief account on types and production of biofertilizers, phosphate solubilizers. Microbial insecticides *Bacillus thuringensis* mode of action, genetic engineering of Bt.strains, and its importance. Baculoviruses as biocontrol agent.

Genetic engineering of plants *Agrobacterium-tumefecians* and biolistic methods for transgenic plants, reporter genes for transformation, herbicide resistance, antisense RNA approach-flavr-savr tomato, golden rice. Brief account on transgenic plants as bioreactors-plantibodies, edible vaccines, therapeutic proteins in plants. Brief account on molecular marker assisted plant breeding RFLP, AFLP, STS, microsatellites, QTL.

References:

1. H. S. Chawla- Plant Biotechnology.
2. H. S. Razdan- Plant tissue culture
3. U. Satyanarayana- Biotechnology
4. P. K. Gupta - elements of Biotechnology

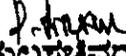

ಕುಲಸಚಿವರು,
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಶಿವನಗೋಟ್ರೆ, ದಾವಣಗೆರೆ-577 002.

References:

1. Kuby Immunology
2. Fahim Halim Khan Elements of Immunology .
3. Abul K Abbas- Cellular and molecular Immunology
4. B. D. Singh - Biotechnology
5. Ian Freshney- Culture of Animal cells
6. Peter Lydyard, Alex Whelan & Michael Fanger, Instant notes on Immunology

BT-Core Practical paper-6(B): Immunotechnology and medical Biotechnology

- 1) Determination of blood group.
- 2) Determination of Rh factor.
- 3) Estimation of Haemoglobin content in blood by Sahli's method.
- 4) Erythrocyte sedimentation rate.
- 5) Packed cell volume.
- 6) Enumeration of RBC by Hemocytometer.
- 7) Enumeration of WBC by Hemocytometer.
- 8) Observation of different types of blood cells by smear technique.
- 9) Study of Precipitation reaction (Pregnancy test/ Radial immunodiffusion/ Ouchterlony double diffusion).
- 10) Study of Rocket Immunoelectrophoresis.
- 11) ELISA
- 12) Animal cell culture techniques- Plasma clot, Single Slide method, Grid method, hanging drop method.
- 13) Extraction of plasma and serum.
- 14) Study of pregnancy kit.
- 15) Preparation of Hank's and Earl's BSS.


ಕುಲಸಚಿವರು,
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಶಿವಮೊಗ್ಗೋತ್ಥಿ, ದಾವಣಗೆರೆ-577 002.

BT-Core Theory paper-6(B): Immunotechnology and Medical Biotechnology-50 Hrs.

Part A: IMMUNOTECHNOLOGY

Unit:1. Introduction to immune system: **(10Hrs)**
Historical perspectives, early vaccination, innate immunity and acquired immunity
humoral and cell mediated immunity.

Cells of Immune System:

Hematopoiesis, Lymphoid cells B & T lymphocytes. N. K. cells, phagocyte, mast cells,
dendritic cells.

Organs of the Immune system:

Primary lymphoid organs: Thymus, Bone marrow, secondary lymphoid organs: lymph
nodes, spleen, and mucosa associated lymphoid tissue.

Unit:2. Antigen and antibodies **(15Hrs)**

Antigens: Nature and Properties of antigens: foreignes, molecular size - epitopes: Immune
response to Ag, adjuvants.

Antibodies: Structure of antibodies; classes of Immuno globulins, Isotype, allotype and
idotypic determinants, immunoglobulin superfamily.

Antigen- Antibody interactions: Affinity avidity, measure of Ag-Ab binding, cross reactivity:
application of Ag-Ab interactions: agglutination reaction: blood grouping, immune
precipitation(RID, ODD), RIA and ELISA, Western blotting

Hypersensitivity: brief account on types.

Part-B: Medical Biotechnology

Unit:3. Monoclonal antibodies and vaccines: **(12Hrs)**

Active and passive immunization, vaccine designs recombinant vector vaccines, therapeutic
proteins, and molecular diagnostics

Gene therapy

background, types of gene therapy (ex vivo & in vivo), choosing targets for gene therapy,
vectors in gene therapy, retroviruses, adenoviruses, adeno-associated viruses, types of
gene delivery, Weismann barrier (soma-to-germ line barrier).

Unit:4. Xenotransplantation - **(13Hrs)**

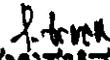
Terminology, mechanisms of transplantation, organ donors, social & ethical issues.

Tissue Engineering, Skin, Liver, Pancreas.

Cell Adhesion- based therapy integrin's, inflammation, cancer & metastasis.

Drug delivery- conventional & new approaches to drug delivery.

Detection of genetic diseases, Hemophilia, Thalassemia, sickle cell anemia


ಕುಲಸಚಿವರು,
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಶಿವಮೊಗ್ಗ, ದಾವಣಗೆರೆ ಜಿಲ್ಲೆ, ಕರ್ನಾಟಕ.

Unit 5. Cell transformation, cell cloning and transgenic animals (10Hrs)

Characters of transformed cells, dilution cell cloning and suspension cell cloning, Organ and histotypic culture and tissue engineering, Technique of organ culture, histotypic culture, spheroids, MCTS, and it's applications (somatic nuclear transfer) and production of clones (Dolly). Tissue engineering- basic aspect of tissue engineering, brief account on tissue engineered skin. **Transgenic animals**-Introduction, Principle, technique of production, transgenic mice and its applications, trans genesis in large animals-as bioreactors. Human genome project; importance and methodology.

References:

1. Kuby Immunology
2. Fahim Halim Khan- Elements of Immunology .
3. Abul K Abbas- Cellular and molecular Immunology.
4. B. D. Singh - Biotechnology
5. Ian Freshney - Culture of Animal cells
6. Peter Lydyard, Alex Whelan & Michael Fanger- Instant notes on Immunology

BT-Core Practical paper-6: Immunology and Animal Biotechnology

- 1) Determination of blood group.
- 2) Determination of Rh factor.
- 3) Estimation of Haemoglobin content in blood by Sahli's method.
- 4) Erythrocyte sedimentation rate.
- 5) Packed cell volume.
- 6) Enumeration of RBC by Hemocytometer.
- 7) Enumeration of WBC by Hemocytometer.
- 8) Differential WBC Count.
- 9) Study of antigen antibody reaction (Pregnancy test/ Radial immunodiffusion/ Ouchterlony double diffusion).
- 10) ELISA
- 11) Animal cell culture techniques- Plasma clot, Single Slide method, Grid method, hanging drop method.
- 12) Extraction of plasma and serum.
- 13) Mounting of chick embryo.
- 14) Preparation of Hank's and Earl's BSS.
- 15) Purification of IgG from serum.
- 16) Purification of IgY from egg.


ಕುಲಸಚಿವರು,
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಬೆಂಗಳೂರು, ದಾವಣಗೆರೆ-577 002.

BT-Core Theory paper-6(A): Immunology and Animal Biotechnology-50 Hrs.

PART A: IMMUNOLOGY

Unit 1: Overview of immune system (10hrs)

Introduction, history, properties of immune system, hematopoiesis.

Innate and adaptive immune system

Innate immune system- Cells (phagocytes, NK, mast cells, basophils, dendritic cells) and molecules of the innate immune system-cytokines, interferons, antimicrobial peptides, The complement system. Innate immunity and inflammation. Physical, chemical and biological barriers.

Adaptive immune system- Lymphocytes, primary and secondary lymphoid organs. Antigen / haptens, antigen processing and presentation.

Unit 2: Antibody, immune complexes and Immune response (10hrs)

Antibody - structure, classes, properties and functions of immunoglobulins, monoclonal and polyclonal antibodies, production of McAbs, **Antibodies and assays**-Agglutination, Precipitation assay, opsonization, effects of combination of antigen and antibody, Immunoassay- ELISA, Radio-immuno assay, Immunofluorescence and flow cytometry. Role of antibodies in complement activation.

Primary and secondary immune response.

Unit 3: Immunity to infections, vaccination and autoimmune diseases (5hrs)

Immune response to bacterial (tuberculosis), parasite (malaria), virus (HIV) infections. Active and passive immunization, types of vaccines. Immunodeficiency (congenital, acquired), autoimmune diseases, factors and mechanisms of development. Brief account on transplantation, immunology and hypersensitivity.

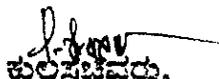
Part B: Animal Biotechnology

Unit 4: Introduction to animal cell culture: (15Hrs)

History, fundamentals, facilities and applications, culture media for animal cells- natural and artificial, properties of culture media, BSS, complete culture media, importance of serum and growth factors, serum free media- EMEM, DMEM, RPMI-1640, it's uses.

Cell characterization, scale up and Cell viability

Brief account on characterization of cultured cells, technique of primary cell culture, trypsinization, concept of cell lines, nomenclature and commonly used cell lines, large scale culture of cells (monolayer, suspension and immobilized cell), cell viability and toxicity- assay based on-Dye exclusion, based on apoptosis and MTT assay.


ಕುಲಸಚಿವರು,
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಶಿವಗಂಗೋತ್ರಿ, ದಾವಣಗೆರೆ-577 002.

BT-Core Practical paper-5: Molecular Biology and Recombinant DNA technology

- 1) Isolation of DNA from Spleen
- 2) Isolation of DNA from Sheep liver.
- 3) Isolation of DNA from plant source (Coconut endosperm & onion).
- 4) Isolation of genomic DNA from plant tissue (Cauliflower).
- 5) Isolation of RNA from Baker's yeast.
- 6) Estimation of DNA by Diphenylamine method.
- 7) Estimation of RNA by Orcinol method.
- 8) Determination of T_m curve for isolated DNA.
- 9) Separation of DNA by agarose gel electrophoresis.
- 10) Small scale preparation of E.coli plasmid.
- 11) Separation of proteins by SDS- PAGE.
- 12) Demonstration of Restriction digestion.
- 13) Demonstration of Ligation.
- 14) Study by charts- Gene cloning, PCR, screening of recombinants- replica, blue-white screening, Northern, Southern and western blotting, DNA fingerprinting, DNA sequencing.

P. Anur
ಪ್ರಾಚಾರ್ಯರು,
ಜಯವಂತಿ ಪ್ರಾಚಾರ್ಯರ ಕಛೇರಿ
ಶಿವಮೊಗ್ಗ, ಜಯವಂತಿ-577 002.

Unit 4: Techniques in Genetic engineering (10Hrs)

Cloning from genomic DNA or RNA, construction of chimeric DNA, construction of chimeric vector into host cell, selection of transformed cells. Creating a gene library, complementary gene library, screening by nucleic acid probes, colony hybridization and manipulation of gene expression in prokaryotes-*E.coli*, Eukaryotes-yeast, and mammalian cell expression system.

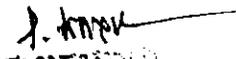
Nucleic acid blotting techniques-Southern, northern and western blotting techniques, DNA sequencing-Maxam and Gilbert, Sangers method, DNA profiling, DNA microarrays. PCR, applications of PCR, agarose gel electrophoresis.

Unit 5: Applications and regulations of genetic engineering (05Hrs)

DNA fingerprinting and its applications, Pharmaceutical products by genetic engineering - insulin, interferons, recombinant vaccines, brief account on gene therapy. Transgenic organisms (GMOs) Regulating and patenting biotechnological inventions, biosafety and bioethics.

References:

1. B. Alberts- Molecular biology of cell.
2. David Freifelder- **Molecular biology**.
3. Lodish H.,Berk A. Baltimore, D and Darnell- Molecular biology W. H. Freeman and company (New York)
4. Lehninger- Principles of Biochemistry, Fourth Edition by David L. Nelson ,Michael M. Cox
5. T.A.Brown- Introduction to Gene cloning.
6. U Satyanarayana,Biotechnology.
7. B.D.Singh,Biotechnology.
8. Glick B. R. & Pasternick J. J. Molecular Biotechnology, Principle and applications of Recombinant DNA.
9. Nicholl D. S. T. Introduction to Genetic engineering
10. Old R W and Primrose S. B. Principles of Gene Manipulation , An introduction to Genetic Engineering
11. Satheesh M. K. Bioethics and Biosafety.


ಕುಲಸಚಿವರು,
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಕುಲಸಚಿವರು, ದಾವಣಗೆರೆ - 577 002.

BT-Core Theory paper-5: Molecular Biology and Recombinant DNA technology

50 Hrs

Part A: Molecular Biology

Unit 1. DNA-Replication, Recombination, Damage and Repair (10Hrs)

DNA as a genetic material, Griffith, Avery, McLeod and McCarty, and Hershey and Chase Experiments.

DNA Replication- Mode of DNA replication- semi-conservative replication, Mechanism of DNA replication in prokaryotes and eukaryotes, cell cycle and DNA replication, inhibitors of replication, telomeres and telomerase. Recombination-homologous and non-homologous, Damage and repair of DNA. Types of DNA damages, mutations, mutagens-physical and chemical, types of mutations-point, frameshift, Repair of DNA, defects in DNA repair.

Unit 2: Transcription and Translation and Regulation of Gene expression - (15Hrs)

Central dogma, Concept of Gene, structure of gene in prokaryotes and eukaryotes, process of transcription in prokaryotes, transcriptional factors, post transcriptional modifications of RNA, inhibitors of transcription, **Genetic code-** salient feature of genetic code, wobble hypothesis, Ribosomes. **Translation-** Initiation, elongation and termination in prokaryotes and eukaryotes, post translational modifications of proteins, chaperones and their importance, Inhibitors of protein synthesis in prokaryotes.

General idea of gene regulation, structure of operon- operator, repressor, promoter and regulator site, gene regulation- positive and negative (Lac and Trp operons). Brief account of gene expression in eukaryotes-Enhancers and tissue specific gene expression of proteins.

Part B: Recombinant DNA technology

Unit 3. Introduction to Genetic engineering (10Hrs)

Brief history, outline of genetic engineering, principles of DNA isolation, molecular tools of genetic engineering, restriction endonucleases, ligases, alkaline phosphatases, DNA modifying enzymes, **method of gene manipulation**-host cells-*E.coli*, *Bacillus*, yeast, *Pichia*, mammalian cells. Vectors-plasmids pBR322, bacteriophage lambda, cosmids, YAC, retroviruses as vectors. Methods of gene transfer -physical and chemical methods.

ಶಿ.ಶಿ.ಎಂ.
ಕುಲಸಚಿವರು,
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಶಿವನಗೇರಿ, ದಾವಣಗೆರೆ-577 002.