



**GOVT. COLLEGE FOR WOMEN PARADE
GROUND JAMMU (Autonomous)**
(*Erstwhile Maharani Mahila College*) Estd 1944
Affiliated to University of Jammu

SEMESTER V

Discipline Specific Elective (DSE)-I

Course Title: Plant Biotechnology and Genetic Engineering

Course Code: UBTTDSE-501

Course Credits: 04+02

Learning Outcomes

- This course is intended to introduce the student with the theoretical information and practical experience in plant tissue culture. Special emphasis is placed on setting up and operating a plant tissue culture laboratory.
- The course also familiarizes the students with the techniques employed in genetic engineering and Recombinant DNA technology.
- Focuses on the course work that prepares the student for immediate employment in plant tissue culture industry.

UNIT – I

Plant tissue culture, Micropropagation, stages of propagation, advantages and applications, culture media (White's and Murashige and Skoog's); Plant growth regulators (Auxins, Cytokinins and Gibberlins) and their use in plant tissue culture; Initiation and maintenance of callus, types of callus and suspension cultures, batch cultures and continuous cultures; Somatic embryogenesis, Virus free plants, shoot tip culture, meristem isolation and culture, thermotherapy, applications and limitations; vitrification.

UNIT – II

Haploid production by anther, pollen and ovule culture, embryo rescue, homozygous lines; Somatic cell hybridization; Protoplast isolation and culture, protoplast fusion and their applications, cybrids; Cryopreservation, types of cryoprotectants, freezing and storage, thawing and germplasm conservation, freeze preservation and slow growth cultures; Production of secondary metabolites.

UNIT – III

Analysis and characterization of DNA by spectrophotometry and agarose gel electrophoresis. Tools in genetic engineering; Restriction enzymes: types and properties; Polymerases, DNA pol I, Klenow fragment, Reverse Transcriptase, Taq polymerase, ligases T4 and E. coli DNA ligase, kinase, poly nucleotide kinases (PNK), phosphatases., Bacterial alkaline phosphatase (BAP) and calf intestinal alkaline phosphatase (CIAP), exonucleases, DNase, RNase and Proteinases; Cloning vectors; plasmids pUC18, cosmids Supercos and phages Lambda; Genomic DNA library



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construction in prokaryotes. Isolation and purification of mRNA, First and second strand synthesis to construct cDNA, construction of cDNA library.

UNIT – IV

Polymerase chain reaction, types and procedure, applications; restriction mapping, nucleic acid hybridization; DNA sequencing, DNA fingerprinting, molecular markers, RFLP, RAPD, AFLP, SSR, their applications; Introduction to Bioinformatics, Internet, search engines, biological databases, primary, secondary, nucleotide sequence database, Protein sequence databases, sequence analysis, multiple sequence alignment.

UNIT – V

Gene transfer in plants using *Agrobacterium tumefaciens*, vectorless gene transfer, selectable markers, scorable markers; Major genes transferred through genetic engineering; advantages and application of Genetic engineering, production of transgenic plants with resistance against herbicides and insects; Golden Rice, Bt cotton, Ethical considerations; edible vaccines.

Books recommended

1. Hammound, J., McGarvey, P. and Yusibov, V., Plant Biotechnology; Springer Verlag.
2. Fu, T-J. Singh, G. and Curitis, W.R., eds. Plant Cell and Tissue Culture for the Production of Food Ingredients, Kluwer Academic/ Plenum Press.
3. Gupta, P.K. Elements of Biotechnology, Rastogi and Co., Meerut, India.
4. Primrose, S.B. Molecular Biotechnology, 2nd edition, Blackwell Scientific Publishers. Oxford.
5. Berger, S.L and Kimmel, A.R. Methods in Enzymology, Guide to Molecular Cloning Techniques, vol. 152, Academic Press Inc., San Diego.
6. Bhojwani S.S. and Razdan M.K. Plant tissue culture: Theory and practice. Elsevier Science, New Delhi.

Practicals

1. Sterilization techniques for glassware/plasticware. Operational use of autoclave and laminar air flow.
2. Lab design and requirements of a standard plant tissue culture lab (It includes a visit to an established PTC lab).
3. Media preparation; making of cotton plugs, plugging and sealing of culture vessels.
4. To prepare different explants for culturing.
5. To demonstrate various steps of explant inoculation.
6. Genomic DNA isolation from plants.
7. Restriction digestion of DNA.
8. Demonstration of steps of Southern blotting.



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9. Demonstration of PCR amplification.
10. Demonstration of cloning.

Books recommended

1. Chawla, H.S. Biotechnology in Crop improvement. International Book Distribution Company.
2. Gupta, P.K. Elements of Biotechnology. Rastogi and Co., Meerut.
3. Henry, R.J. Practical Applications of Plant Molecular Biology. Chapman and Hall.
4. Razdan, M.K. Plant Tissue Culture, Elsevier.
5. Sambrook, J. Fritsch, E.F. and Maniatis, T. Molecular Cloning. A Laboratory Manual 2nd ed., Cold Spring Harbor Laboratory Press.



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Discipline Specific Elective (DSE)-II

Course Title: Biotechnology for Human Welfare

Course Code: UBTTDSE-502

Course Credits: (04+02)

Learning Outcomes

- Biotechnology for human welfare aims to provide introduction of various fields of biotechnology e.g. Agricultural, pharmaceutical and industrial biotechnology and their contribution for human welfare.
- It aims at gaining an understanding of current experimentation in biotechnology and genetic engineering.
- The course imparts knowledge regarding benefits of biotechnology in forensic science and crime detection by employing various molecular biology techniques.

UNIT-I

Biotechnology used in the field of Agriculture. GM crops, Herbicide resistant crops; insect resistant crops; disease resistant crops; stress tolerant crops; improvement of crop yield; seed nutritional quality improvement. Biopesticides and Biofertilizers.

UNIT-II

Animal husbandry and biotechnology. Production of transgenic mice, sheep, and fish; biotechnological approaches for the management of pests; mosquitoes and nematodes; diagnosis of shrimp and fish diseases caused by bacterial, fungal and viral pathogens using molecular methods; livestock improvement.

UNIT-III

Human health and medical biotechnology: Human health care products from recombinant DNA technology; disease diagnosis; Strategies of vaccine development. Gene therapy, Somatic and Germinal. Edible Vaccines.

UNIT-IV

Biotechnology in the field of industry. Types of fermentation process and Bioreactor design; microbial strain improvement techniques; Bioprocessing technology; downstream processing; production of single cell proteins; immobilization of enzymes and whole cells and their applications. Biosensors.



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UNIT-V

Benefits of biotechnology in forensic science and crime detection. DNA finger printing, Molecular Markers, Molecular polymorphism, RFLP, RAPD, STS, AFLP, SNP markers, Polymerase chain reaction (PCR). Construction of Genetic and Physical maps.

Practicals

1. To study the effect of pesticide and insecticide on plants.
2. Demonstration of PCR technique to evaluate transgenic animals.
3. Agarose gel electrophoresis as the separation technique for the analysis of amplified PCR products.
4. Performing ELISA a clinical analytical technique for disease diagnostics.
5. To compare the rate of fermentation of different fruit juices.
6. Molecular diversity analysis of different genotypes using molecular markers.
7. Demonstration of recombinant DNA technology used in Cloning experiments.
8. To study the colorimetric estimation of colored compound using spectrophotometer.
9. To study the enzyme activity of an industrially important enzyme using UV/Vis Spectrophotometer.
10. Demonstration of RFLP marker in diversity analysis of different varieties of plants.

Books Recommended:

1. Recombinant DNA technology by Watson *et. al.*, (Scientific American Books).
2. Principles of Gene Manipulation by Old and Primrose. (Blackwell).
3. Concepts in Biotechnology by Balasubramanian *et. al.*, (University press).
4. Microbiology by Prescott
5. H. S. Chawla. Introduction to plant Biotechnology



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Skill Enhancement Course (SEC)-III

Course Title: Intellectual Property Rights

Course Code: UBTTS-501

Course Credits: 02+02

Learning outcomes

- The Course will ensure that students understand the concept of Intellectual Property and the need to protect IP.
- Various Intellectual property rights and their applicability in different spheres including biology will make students aware of piracy related issues.
- The students will learn about various organizations which are authorized to grant IPR and various case studies.

Unit I:

- I.** Intellectual/Industrial property, Intellectual property rights: Meaning, Classification and Forms; Rationale for protection of IPRs - Importance of IPRs in the fields of science and technology.
- II.** Patents- Concepts and principles of patenting- Patentable subject matter. Procedure of obtaining patents, Infringement of patent rights.

Unit II:

- I.** Copyright: Introduction, Works protected under copyright law, Rights, Transfer of Copyright, Infringement; Trademarks: Objectives, Types, Rights, Infringement, Passing off, Defenses.
- II.** Industrial Designs: Objectives, Rights, Assignments, Infringements, Defenses of Design Infringement; Geographical Indications: Objectives, And International Position. Indian legislations for the protection of various types of IPs

Practicals

1. A Case study for copyright infringement in India.
2. To study the procedure for a Patent Application filling.
3. Procedural steps involved in the examination of Patent Application and assessment of Patent Infringement.
4. Identification and study of important geographical indicators (GIs) in the UT of J&K.
5. To understand the concept and legal framework, with procedural requirements relating to trade marks.
6. To study the steps involved in registration of new plant varieties under the Plant Varieties Protection and Farmers' Rights Act, 2001 (PVPFR).
7. To underline the rules and acts pertinent to Germplasm conservation and its registration.
8. A case study of the patentable inventions in biotechnology in India.



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9. Steps involved in the development and protection of the Industrial Designs associated with the companies.
10. Basmati rice and Turmeric: A Case study of traditional indigenous items of India.

Recommended Books:

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice", S. Viswanathan (Printers and Publishers) Pvt. Ltd.
2. Intellectual Property Rights: Critical Concepts in Law By D. Vaver Edition: illustrated Published by Taylor & Francis.
3. Intellectual Property: A Reference Handbook By Aaron Schwabach Published by ABC-CLIO.
4. N.K. Acharya: Textbook on intellectual property rights, Asia Law House.
5. Manjula Guru & M.B. Rao, Understanding Trips: Managing Knowledge in Developing Countries, Sage Publications.
6. Arthur Raphael Miller, Micheal H. Davis; Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, West Group Publishers.



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SEMESTER VI

Discipline Specific Elective (DSE)-III

Course Title: Immunology and Animal Biotechnology

Course Code: UBTTDSE-601

Course Credits: 04+02

Learning Objectives

- The Course aims to educate students on how the body defends itself from pathogenic invasions; the different strategies and players involved in body's response to various antigenic encounters.
- The students also get to know about animal tissue culture strategies and how animal cell culture is different from microbial and plant tissue culture.
- The students learn about various techniques of clinical and diagnostic significance and how these techniques are useful in diagnosing and identifying various conditions arising in the body.

UNIT – I

Introduction to the immune system – Innate and adaptive, Recognition of self and non self, Hematopoiesis and its regulation, Cells of immune system: Lymphoid cells, T cells, B cells, NK cells, Antigen Presenting Cells (dendritic cells and macrophages), Primary and Secondary lymphoid organs, Lymphatic system.

UNIT – II

Antigen-Antibody interaction, Affinity and avidity, Immunoglobulins – classes, basic structure and biological activity, B cell and T cell differentiation, activation and memory. T-cell subsets and surface markers, Recognition of antigen by T-cells and role of MHC, Structure of T and B cell receptors.

UNIT – III

Structure and organization of animal cell, Primary and established cell line cultures, mono-layer and suspension, Secondary culture, Established, transformed / continuous cell lines, commonly used cell lines. Basic techniques of cell culture in vitro; equipment and aseptic conditions, Disaggregation of tissue; cold and warm trypsinization; maintenance of cell culture; cell separation.



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UNIT – IV

Biology and characterization of cultured cells: Cell morphology, cell adhesion, cell proliferation, cell differentiation, energy metabolism. Measurement of growth and viability of cell in culture, Growth kinetics of cells in culture. Measurement of cytotoxicity. Scaling up of the animal cell culture. Organ and histotypic cultures. Cell transformation.

UNIT – V

Immuno-diffusion and Immuno-electrophoresis, Immuno-blot, ELISA and variants of ELISA, RIA, Monoclonal antibodies, Blood products, Vaccines and hormones, DNA transfer technology, Transgenic technology, production of useful products in transgenic animals.

Books recommended

1. Roitt, I.M., Brostoff, J. and Male, D.K. (2020), Immunology, 9th Edition. Gower Medical Publishing, New York.
2. Kuby, J. (2019), Immunology. 8th Edition. W.H. Freeman and company, New York.
3. Satyanarayana, U. (2020). Biotechnology. Books and Allied (P) Ltd, (Kolkatta) India.
4. Freshney, Ian R. (2010). Culture of Animal Cells 6th Edition. Wiley- Liss.
5. George Pinchuk. (2019). Schaum'S Outline of Immunology. 1st Edition. Mc Graw Hill

Practicals

1. Total and differential Leucocyte count.
2. Total RBC count.
3. Haemagglutination assay.
4. Separation of serum from blood.
5. Blood grouping.
6. Double immunodiffusion test using specific antibody and antigen.
7. Rocket immunoelectrophoresis.
8. Demonstration of ELISA
9. Demonstration of sterilization techniques.
10. Preparation of tissue culture medium.
11. Preparation single cell suspension from the animal tissue.
12. Trypsinization of tissue and establishment of a monolayer and subculturing.

Books recommended

1. Masters, John R.W. Animal Cell Culture – Practical approach, Oxford University Press, Oxford.
2. Freshney, Ian R. Culture of Animal Cells 6th Edition. Wiley- Liss.



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3. Kannan, N. Laboratory Manual in General Microbiology. Palani Paramount Publications, Palani, India.
 4. Talwar, G.P. and Gupta S.K. A Handbook of Practical and Clinical Immunology, CBS Publishers and Distributors, New Delhi.
 5. Clynes M. Animal Cell Culture Techniques, Springer.



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Skill Enhancement Course (SEC)-IV

Course Title: Clinical Biochemistry

Course Code: UBTTS-601

Course Credits: 02+02

Learning Objectives

- The Course aims to impart basic knowledge of clinical biochemistry involving techniques ranging from collection, handling and processing of clinical samples.
- The students will be demonstrated the importance of various different diagnostic tools and techniques useful in clinical diagnostics.

UNIT I

- I. Definition and scope of clinical biochemistry, normal values of important constituents of blood, CSF and urine, Safety measures in clinical laboratory. Basic techniques used in molecular diagnostics.
- II. Antigens. Blood group antigens (ABO & Rh factor). Blood group types and their inheritance. Immune system, basis of vaccination, Role of molecular diagnostics in present diagnostic era

UNIT II

- I. Diagnostic Enzymology: Factors affecting enzyme levels in blood. Principle, assay, and clinical significance of different enzymes.
- II. Toxicology: Biochemical basis of toxicity, Dose-response relationship, synergism and antagonism, determination of ED50 & LD50; Important Organ Function tests. Molecular diagnostics of HIV and Tuberculosis.

Practicals

1. To perform the blood grouping of the different samples provided.
2. Collection, preparation, preservation, and handling of clinical samples.
3. Estimation of hemoglobin in blood



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4. Separation of the serum from the blood.
 5. Estimation of the glucose concentration in the blood sample using glucometer.
 6. Examination of the urine sample for the presence of nitrogen as uric acid/ creatinine.
 7. To study the antigen-antibody interaction using ELISA test kit.
 8. Urine analysis for albumin, sugars and ketone bodies.
 9. Demonstration of RIA/ immunoelectrophoretic technique in antigen-antibody interaction.
 10. Estimation of alkaline phosphatase/acid phosphatase in blood sample.

Books Recommended:

1. Clinical biochemistry, metabolic and clinical aspects by William J. Marshall, Stephan K Elsevier science health.
2. Fundamentals of Clinical Biochemistry by Teiz, W.B-Saunders Company.
3. Clinical Biochemistry: An illustrated color text 3rd Ed. by Allan Gaw, Micheal Murphy, Robert Cowan, Denis O Reilly, Micheal Stewart and James Shepherd. Churchill Living tons.
4. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry By Trevor Palmer.
5. Devlin: Textbook of Biochemistry (with clinical correlation) (John Wiley and Sons Publishers).