ST.JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER **BIOTECHNOLOGY**  TIME: 4 HRS/WEEK BTH 4703(3) **GENETIC ENGINEERING PLANT & ANIMAL BIOTECHNOLOGY** MAX.MARKS: 100

w.e.f 2020-21(AH) **SYLLABUS**

**OBJECTIVES:** To enable the students to –

* Learn enzymes used in recombinant DNA technology & cloning vectors
* Know various gene transfer techniques in r-DNA technology
* Acquire knowledge about Plant tissue culture its uses and techniques involved in tissue culture
* Study Animal biotechnology which includes Artificial insemination, invitro fertilization and embryo transfer.
* Acquire knowledge about ethics, bio-safety and patent rights

**COURSE OUTCOMES: Students will**

* **CO1:** Accustomed with the tools and techniques of genetic engineering molecular cloning and expression vectors.
* **CO2:**Capable to identify the economized protocols for both the classical & hybrid varieties, with the available tissue culture concepts..
  + - **CO3:**Able to evaluate animal culture media constituents and their role to manufacture the desired products
    - **CO4:**Be abundant in producing transgenic plants.
* **CO5:**Be proficient on health care products. Also be familiarized in generation and protection of patents, copyrights and trademarks.

**UNIT-I: TOOLS AND TECHNIQUES OF RDNA TECHNOLOGY :**

1. Introduction to rDNA technology, steps involved in cloning.
2. Tools of genetic engineering: Cloning vectors &Enzymes – restriction endonucleases and DNA Ligase, Hosts – bacteria and yeast).
3. Principles and application of PCR.
4. Southern, Northern and Western Blotting.
5. DNA sequencing methods: Maxam-Gilbert, Sanger and Site-directed Mutagenesis.
6. cDNA library&construction
7. Methods of gene transfer methods
8. Isolation and screening of recombinant clones.
9. Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (disease diagnosis and DNA fingerprinting).

**UNIT – II: PLANT TISSUE CULTURE TECHNIQUES & SECONDARY METABOLITES PRODUCTION :**

1. Plant tissue culture: totipotency, media preparation – nutrients and plant growth regulators
2. Sterilization techniques.

BTH 4703(3) ::2::

1. Establishment of cultures – callus culture, cell suspension culture, protoplast culture and anther culture.
2. Applications of tissue culture-micro propagation, somatic hybridization, Somatic embryogenesis; synthetic seed production. Cryopreservation.
3. Plant secondary metabolites- concept and their importance.
4. Plant transformation technology-- *Agrobacterium* mediated Gene transfer (Ti plasmid), hairy root features of Ri-plasmid.
5. Transgenic plants as bioreactors. Herbicide resistance – glyphosphate, Insect resistance- Bt-cotton.
6. Molecular markers -RAPD, RFLP and DNA fingerprinting-principles and applications.

**UNIT – III: ANIMAL TISSUE CULTURE TECHNIQUES :**

1. Animal cell culture: cell culture media and composition.
2. Culture of mammalian cells, tissues and organs; primary culture, secondary culture, cell lines,stem cell cultures; Tests: cell viability and cytotoxicity.
3. Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications.

**UNIT – IV: TRANSGENIC ANIMALS & GENE THERAPY :**

1. Production of vaccines, diagnostics, hormones and other recombinant DNA products in medicine (insulin,somatostatin, vaccines),
2. IVF (*In-vitro* Fertilization)
3. Concept of Gene therapy, Concept of transgenic animals – Merits and demerits -ethical issues in animal biotechnology

**UNIT V: BIOETHICS, BIO-SAFETY AND IPR :**

1. Bioethics in cloning and stem cell research, Human and animal experimentation, animal rights/welfare.
2. Bio-safety-introduction to biological safety cabinets; primary containment for biohazards; bio-safety levels; GLP, GMP.
3. Introduction to IP-Types of IP: patents, trademarks & copyright

**REFERENCES :**

1. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
2. Molecular Biotechnology - 4th edition, 2010, G.R. Click and J.J. Pasternak, Publ: Panima
3. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
4. Plant Tissue Culture, kalyan Kumar De,199 M7,New Central Book Agency
5. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan,1998
6. Biotechnology – By U. Satyanarayana ;1997
7. Introduction to Plant Tissue Culture,M. K. Razdan, 2003,Science Publishers
8. A Textbook of Biotechnology,R C Dubey,S. 2014,Chand Publishing
9. Elements of Biotechnology,P. K. Gupta, 1994,Rastogi Publications
10. R. Ian Freshney, “Culture of animal cells – A manual of basic techniques” 4th edition, John Wiley & Sons, 2000 ,Inc, publication, New York

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ST.JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER **BIOTECHNOLOGY** TIME: 2 HRS/WEEK BTH 4753 (2) **GENETIC ENGINEERING PLANT & ANIMAL BIOTECHNOLOGY**MAX. MARKS: 50

w.e.f 2020-21 (AH) **PRACTICAL**

**OBJCECTIVE:**To enable the students to

* To enable the students to learn the techniques of Genetic engineering
* Acquire the techniques and inoculation methods in plant tissue culture

**COURSE OUTCOMES: Students will**

* **CO1:** Be expertise in formulating the concentrations of tissue culture media

constituents

* **CO2:** Capable to identify the economized protocols for both the classical &

hybrid varieties, with the available tissue culture concepts.

* **CO3:** Able to breed the haploid cultivars and enhance vegetative propagation,

virus free stocks, flexible to current agriculture practice

**COURSE:**

1. Isolation of plasmid DNA (alkaline lysis method)
2. Analysis of plasmid DNA by Agarose gel electrophoresis
3. Southern blotting (theory exercise)
4. PCR Amplification (theory exercise)
5. Preparation of plant tissue culture media (Composition of MS media)
6. Raising of aseptic seedlings
7. Induction of callus from different explants
8. Micropropagation(shoot tip and Nodal culture)
9. Establishing a plant cell culture (both in solid and liquid media)
10. cell suspension culture

**REFERENCES:**

1. Plant Tissue Culture: Theory and Practice by S.S. Bhojwani and A. Razdan,1998
2. Dr.Anurudh K. Singh, Santhosh K. Tiwari &Dr. J. P. Yadav (2017), Practical Manual, Plant Genetic Engineering. <https://www.researchgate.net/publication/322152584>
3. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rdedition. Cold Spring Harbor Laboratory Press.
4. Vennison, S. John (2009), Laboratory manual for Genetic Engineering, Prentice Hall India Learning Private Limited.
5. Dr.SandhyaMitra, (2015) Genetic Engineering: Principles and Practice, 2nd Edition, McGraw Hill Education (India) Private Limited, New Delhi.
6. Dr.Anurudh K. Singh, Santhosh K. Tiwari &Dr. J. P. Yadav (2017), Practical Manual, Plant Genetic Engineering. <https://www.researchgate.net/publication/322152584>
7. P. N. Arora & P. K. Malhan. 2012, Biostatistics: Himalaya Publishing House (January 2012), ISBN-10, 8183186912.

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