UNIVERSITY OF MADRAS

M.Sc. DEGREE PROGRAMME IN BOTANY

SYLLABUS WITH EFFECT FROM 2023-2024

Title of the Course	**APPLIED BIOTECHNOLOGY**						
Paper Number	**ELECTIVE-VI**						
Category	Elective	**Year**	II	**Credits**	3	**Course Code**	523E4C
		Semester	IV				

Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**
	3	1	-	4

Pre-requisite	To empower students recognize and appreciate the basic principles that sustain biotechnology as an interdisciplinary domain of learning and research.
Learning Objectives:	
C1	To enable students understand and appreciate the fundamental principles that sustain biotechnology as an interdisciplinary field of study and research.
C2	To educate people about the development of Genetic Engineering.
C3	To expose the students on the fundaments of genetic transformation.
C4	To acquire hands-on experience and knowledge in handling molecular tools to manipulate plant genes.
C5	To understand various characteristics of genomes of plants that can be used for creating transgenic plants.

UNIT	**CONTENTS**
I	**GENE MANIPULATION** Recombinant DNA technology – Tools of recombinant DNA: cloning strategies – restriction endonucleases – modifying enzymes (ligases, phosphatases, and kinases), vectors; plasmid, bacteriophage and other viral vectors, cosmids, Ti plasmid, BAC and YAC Vectors - choice of vectors - Genomic cDNA libraries.
II	**MOLECULAR TOOLS AND TECHNIQUES** PCR techniques, DNA diagnostics (RFLP, RAPD, AFLP and SNP), gene chip, DNA fingerprinting. Novel introduction and expression. Antisense and sense gene suppression-biosynthetic pathways to produce/accumulate alternative products.
III	**GENETIC TRANSFORMATION** Methods of crop improvements- gene transfer - indirect method- *Agro bacterium* mediated gene transfer- Direct DNA gene transfer technology- liposome mediated gene transfer, biolistic Gun (Shot gun method)- Electroporation- silicon carbide method –microinjection.
IV	**BIOTECHNOLOGY AND TRANSGENICS** Biotechnology and transgenics- Herbicide resistance- resistance against glyphosate, resistance against pests and insects- *Bacillus thuringiensis* – Bt genes endotoxins.

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V	**TRANSGENIC BIOLOGICAL MONITORING OF HAZARDOUS WASTES:** Super bug, Transgenic plants as bioreactors, Transgenic plants as vaccine production systems. Regulation of genetically modified organism-Government rules for GMOS. Recombinant DNA guidelines, Status and development of GM food crops in India.

Course outcomes: CO	**On completion of this course, the students will be able to:**	**Programme outcomes**
CO1	Understand the concepts and methods in recombinant DNA technology and apply their idea of cloning vector and express the gene to microbes and plants.	K1
CO2	Analyze the gene expression to identify the molecular markers for selection of superior genotypes.	K2
CO3	Apply the skills on gene transfer technology.	K3
CO4	Evaluate expression of genes in plants.	K4
CO5	Create idea to seek for suitable job in relevant industries or to become a potential entrepreneur based on knowledge and hands-on trainings achieved during the course.	K5

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text:

1. Das, H.K. 2010. Textbook of Biotechnology (4th edition). Wiley India Pvt. Ltd. New Delhi
2. Gamborg, O.L and G.C. Phillips (eds). 1995. Plants, genes and agriculture. Jones and Bartlett Publishers.
3. Verma, P.S and Agarwal V.K. 2009. Genetic Engineering. S.Chand & Co. Ltd. New Delhi
4. Jones, H. 1996. Gene transfer to plants. Springer Lab Manual. Plant gene transfer and expression protocols. Methods in molecular biology. 49. Humana Press.
5. Kreuzer, H and A. Massey. 1996. Recombinant DNA and biotechnology. A guide for teachers. ASM Press.
6. Ramavat, K.G. 2006. Plant Biotechnology. S. Chand and Co. Ltd., New Delhi.
7. Trivedi, P.C. 2000. Plant Biotechnology-Recent Advances. Panima Publication Corporation, New Delhi.
8. Chawla, H.S. 2009. Introduction to Biotechnology. 2nd edn. Oxford IBH, ISBN: 978-81-204- 1732-8.
9. Ignacimuthu, S. 1998. Plant Biotechnology. Oxford and IBH publishers.
10. Halford, N. 2015. Plant Biotechnology: Current and Future Applications of Genetically Modified crops, John Wiley and Sons.

11. Kumar, Pradeep. 2018. Advances in Microbial Biotechnology: Current Trends and Future Prospects. 10.1201/9781351248914.
12. Thieman. 2014. Introduction to Biotechnology 3rd Edition. Pearson Education India.

Reference Books

1. Slater, A. Scott, N and Fowler, M. 2008. Plant Biotechnology: The Genetic Manipulation of Plants. Oxford University Press Inc.
2. Reynolds, P.H.S. 1999. Inducible Gene Expression in Plants. CABI Publishing, U.K.
3. Chawla, H.S. 2009. Introduction to Biotechnology, 2nd edn. Oxford IBH, ISBN:978-81-204-1732-8.
4. Halford, N. 2015. Plant Biotechnology: Current and Future Applications of Genetically Modified Crops, John Wiley and Sons.
5. Brown T.A. 2001. Gene Cloning and DNA Analysis- An Introduction (4th edition). Blackwell Science. Oxford.
6. Clark, D.P and Pazdernik, N.J. 2009. Biotechnology- Applying the Genetic Revolution. Elsevier Academic Press. USA.
7. Desmond S.T. Nicholl. 2010. An Introduction to Genetic Engineering. Cambridge University Press. New Delhi.
8. Glick B.R and J. J. Pasternak. 2009. Molecular Biotechnology, Panima Publication Co.
9. Harisha, S. 2007. Biotechnology Procedures and Experiments Handbook. Infinity Science Press Llc. Hingham. MA.
10. Mosier N.S and Ladisch M.R. 2009. Modern Biotechnology- Connecting Innovations in Microbiology and Biochemistry to Engineering Fundamentals. John Wiley & Sons Inc. New Jersey.
11. Primrose S., Twyman R. and Old B. 2001. Principles of Gene Manipulation (6th ed.). Blackwell Science. Oxford.

Web sources:

1. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/plant biotechnology
2. https://en.wikipedia.org/wiki/Biotechnology
3. https://www.isaaa.org/resources/publications/pocketk/2/default.asp
4. https://.britannica.com/technology/biotechnolog/
5. https://manavrachna.edu.in/blog/scope-of-biotechnology/

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	1	2	2	3	1
CO2	3	3	2	2	3	3	2	3	2	3
CO3	3	2	3	3	1	2	1	3	3	1
CO4	3	3	3	3	3	2	3	1	3	3
CO5	3	3	2	3	2	3	3	1	3	2

S-Strong (3) M-Medium (2) -Low(1)