BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/ AGSR Division

SECOND SEMESTER 2020-21
COURSE HANDOUT

Date: 10.03.2021

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No : **BIO G643**
Course Title : **Plant Biotechnology**
Instructor-in-Charge : **JITENDRA PANWAR**
Instructor : **Mukul Joshi**
Practical Instructors : **Mukul Joshi, Swarnima, Shobham**

1. Course Description: Plant genetic systems and their implications for plant transformation and protein targeting, Cell and tissue culture, techniques for plant transformation; *Agrobacterium* mediated and biolistic methods, vectors for plant transformation, genetic manipulation of herbicide tolerance, pest resistance, disease resistance, stress tolerance, improvement of crop yield and quality, Public concerns of GM crops.

2. Scope and Objective of the Course:
This course will enable students to increase their knowledge in recent advances in plant cell and tissue culture techniques both theoretically and practically. It will provide an insight to the theory and practice of plant biotechnology with emphasis on the genetic engineering of plants to produce new products for medicine, industry and agriculture.

3. Text Books:
1. Narayanaswamy, S. Plant Cell and Tissue Culture, Tata McGraw Hill Publishing Company Limited, 1994 (Ninth Reprint 2008).
2. Adrian Slater, Nigel W. Scott, and Mark R. Fowler: Plant Biotechnology: The Genetic manipulation of plants (Second edition). Oxford University Press (2008).

4. Reference Books:
1. Bhojwani, S.S. and Razdan, M.K. Plant Tissue Culture: Theory and Practices, A Revised Edition, Elsevier, Reprint 2004.
2. Hammond, J. Mc Garvey, P. and Yusibov, Plant Biotechnology. Springer Verlag, Berlin, NY (1999), 2nd Printing 2000.
3. Recent research articles and reviews will be recommended regularly.

5. Course Plan:

Module No.	**Lecture Session**	**Reference**	**Learning outcomes**
1. Objective and scope of plant tissue culture	L 1-2. Historical introduction to plant tissue culture	Chap 1, TB-1 Chap 1, RB-1	Familiarization with plant tissue culture
2. Plant tissue culture laboratory	L 3-4. Lab organization (Lay out, requirements and general techniques)	Chap 2, TB-1 Chap 2, RB-1	Understanding basics of plant tissue culture laboratory
3. Requirements to grow plants *in vitro*	L 5-6. Culture media constituents, media selection and preparation	Chap 3, TB-1 Chap 3, RB-1	Knowledge about macro- & micro-nutrients and PGRs

4. *In vitro* techniques of clonal propagation	L 7-8. Micro propagation stages, factors affecting micropropagation, applications and limitations	Chap 7, TB-1 Chap 16, RB-1	Learning methods of micropropagation, its applications and limitations
5. Production of haploids	L9-10. Haploid production through anther culture and microspore culture, applications and limitations	Chap 10, TB-1 Chap 7, RB-1	Learning androgenesis and gynogenesis technique
6. Producing disease free plants	L 11-12. Meristem culture and virus free plants	Chap 6, TB-1 Chap 15, RB-1	Learning various methods for production of virus free plants
7. Creating variations *in vitro*	L 13-14. Somaclonal variations	Chap 9, RB-1	Understanding mechanisms & assessment of *in-vitro* variations
8. Somatic hybridization	L 15-16. Protoplast isolation and culture, somatic hybrids production	Chap 11, TB-1 Chap 12 & 13, RB-1	Learning techniques for protoplast isolation and somatic hybridization
9. Storing plant genetic resources	L 17-18. Cryopreservation	Chap 15, TB-1 Chap 18, RB-1	Knowledge about long-term storage of plant tissues
10. Introduction to plant genetic system and transformation	L 19-20. Plant genetic systems and their implications for plant transformation and protein targeting, heterologous promoters, *Arabidopsis* and new technologies	Chap 1, TB-2 Chap 1, RB-2	Understanding eukaryotic gene structure, its expression, regulation and promoter designing
11. Techniques for plant transformation	L 21-24. Agrobacterium mediated transfer and the Ti plasmid technology. Direct gene transfer methods: Particle bombardment.	Chap 3, TB-2; Chap 2 & 3, RB-2	Learning production of genetically modified plant.
12. Vectors for plant transformation	L 25-27. Desirable features of a vector, development of plant transformation vectors and optimization	Chap 4, TB-2; Chap 2 & 3, RB-2	Learning vector designing in order to produce high quality crops and plants.
13. Case studies	L 28-33. Genetic manipulation of pest resistance, Plant disease resistance, strategies for engineering stress tolerance, Strategies for improvement of crop yield and quality.	Chap 6, 7, 9, & 10, TB-2	Understanding transgenic plant production and their improvement
14. Molecular farming	L 34-37. Starch, polyfructans, bioplastics, The oleosin system, custom made antibodies, edible vaccines	Chap 11, TB-2; Chap 5, 6 and 8, RB-2	Knowledge on using plant systems for large scale production of pharmaceuticals and other important proteins

15. Science and society	L 38-40. Public concerns over GM crops and government regulations	Chap 12, TB-2 Chap 1, RB-2	Scientific awareness on the merits and demerits of transgenic plants

6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of component (Close Book/ Open Book)
Mid-Semester Test	90 Min.	30		Close Book
Comprehensive Examination	3 h	40	22/06 A/N	Partly Open Book
Lab assignment/ Quiz		20		Close Book
Seminar		10		

7. Chamber Consultation Hour: To be announced in the class.

8. Notices: Notices, if any regarding the course will be displayed on the Notice Board of Department of Biological Sciences.

9. Make-up Policy: Make-up decisions will be made on a case-by-case basis. Only genuine case as certified by Chief Medical Officer and/ or determined by the Departmental team will be considered. No make-up will be granted for Quizzes and Practical's.

Instructor-in-charge
BIO G643