Plant Biotechnology Syllabus (2 credit)

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1. **Plant transformation (4 lectures):** Mechanism of Agrobacterium mediated transformation, binary vectors; other methods, particle bombardment, protoplast transformation, plastid transformation, detection of transgene, identification of integration site, determination of copy number, inheritance of transgene.
2. **Expression systems (3 lectures):** Constitutive and inducible expression systems, transctivation systems of plants, mGAL4-UAS/VP16-system, GVG/dex system, tTA/Top10/pTAx /Tet-ON/OFF systems.
3. **Mutagenesis in plants (2 lectures):** T-DNA/transposon mutagenesis, selection of mutants from random library, promoter/enhancer trap, gene-trap constructs.
4. **Hybrid seed production (2 lectures):** Negative selection markers,male sterile and restorer lines, self-incompatibility, hybrid vigor, RILs.
5. **Genome editing (2 lectures):** Zinc finger nuclease, TALEN, CRISPR technology, selection and application.
6. **Molecular markers (3 lectures):**SSR/SSLP, CAPS/deCAPS, application of markers in forward genetics, breeding, genome editing, and mutagenesis
7. **Somatic embryogenesis, clonal multiplication and shoot tip culture (3 lectures):** Methods, A model for early development in higher plants, Gene expression programme during somatic embryogenesis, somaclonal variations, organogenesis vs embryogenesis.
8. **Pro-embryo and Embryo culture (2 lectures)**: Artificial seeds, androgenic switch
9. **Haploids and polyploids (1 lecture)**: Development and applications
10. **Secondary plant products (1 lecture):** Production secondary plant products from cultured cells and their industrial application
11. **Cryopreservation of germplasm(1 lecture)**: Methods, applications
12. **Transgenic plants (5lectures):** Introduction,genetic modification of plants against environmental abuses: virus resistance, fungal resistance, herbicide resistance, tolerance towards stresses such as salinity, drought and high temperature
13. **Towards improved crop yield and nutritional quality (2lectures):** delayed fruit ripening, improved protein composition, genetic manipulation of crop yield by enhancement of photosynthesis
14. **Molecular pharming and molecular farming (1 lecture):** carbohydrates, lipids and proteins, bioplastic
15. **GM crops (1 lecture):** safety and societal concerns

Books Suggested:

I. Genetic transformation of plants (2005) by Kirsi Marja Oksman Caldentey
II. Plant Biotechnology: the Genetic Manipulation of plants (2003) by AdrianSlater
III. Plant Biotechnology (2004) by W G Hopkins

IV. Plant cell culture basics (2003) by C Evans
V. Plant Biotechnology: current and future applications of genetically modified crops (2006) by N G Halford
VI. Handbook of plant cell culture3 vols (2009) by Evans
VII. Agribiotechnology and plant tissue culture (2003) by Bhojwani
VIII. Plant cell culture (2005) by G Dixons
IX. Recent advances in plant biotechnology and its applicatuions (2006) by AKumar and S K Sopory