UNIVERSITY OF MADRAS

M.Sc. DEGREE PROGRAMME IN BOTANY

SYLLABUS WITH EFFECT FROM 2023-2024

Title of the Course	**LABORATORY COURSE- III (Covering Core Papers VIII, IX AND X)**						
Paper Number	**CORE XI**						
Category	Core	**Year**	II	**Credits**	4	**Course Code**	523C3D
		Semester	III				
Instructional Hours per week		**Lecture**		**Tutorial**	**Lab Practice**	**Total**	
		4		-	4	8	
Pre-requisite	Practicals pertaining to above subjects is important to get knowledge on overall cell structure, cellular organelles and staining procedures and fundamental principles of genetics and plant breeding.						

Learning Objectives:

C1	Observe the different stages of mitosis and chromosome behaviour and organization during various stages and to learn staining techniques of various plant tissues.
C2	Explain the principles of linkage, crossing over and the hereditary mechanisms.
C3	Expose the students to gain recent advances in molecular biology.
C4	Understand the principles of plant breeding to apply crop improvement programmes
C5	Understand the principles of plant tissue culture in order to produce labour suitable for the demands of the industry.

UNIT	**EXPERIMENTS**
I	**CELL BIOLOGY** 1. Squash preparation of *Allium cepa* root tips and observation of stages of mitosis – Haematoxylin staining. 2. Calculate the mitotic index of onion root tip cells. 3. Study of meiosis – *Tradescantia* /*Allium cepa* flower bud for chromosomal examination – acetocarmine staining - smear techniques. 4. Study of induced aberrations in onion root tips employing chemicals (or) latex. 5. Study of sub cellular organelles from electron micrographs. 6. Acetocarmine and Hematoxylin staining. 7. Study of cells and chromosome morphology. 8. Banding pattern of chromosomes 9. Specialized chromosomes
II	**GENETICS** 1. Verification of Mendel's laws 2. Mendelian principles: Problems related to Monohybrid, dihybrid, test and back cross. 3. Gene mapping 4. Gene interactions – Completmentary genes (9:7)

	Spotters: 1. Incomplete dominance (1:2:1) 2. Dihybrid cross (12:3:1) 3. Dominant Epistatis (12:3:1) 4. Recessive Epistatis (9:3:4) 5. Duplicate factors (15:1) 6. Pedigree analysis 7. Calculation of variation pattern in fruits/leaves/seeds – mean, standard deviation standard error, co-efficient variation – Based on the data given.
III	**PLANT BREEDING** 1. Charts on plant breeding techniques. 2. Hybridization techniques in self and cross pollinated plants (anthesis, emasculation, bagging). (Demonstration). 3. Induction of polyploidy in plants by colchicines (Demonstration).
IV	**PLANT MOLECULAR BIOLOGY** 1. Isolation of Genomic DNA from plant tissue. 2. Isolation of RNA. 3. Electrophoresis of nucleic acids – Agarose. 4. Preparation of competent *E.coli* cells. 5. Isolation of plasmid DNA. 6. PCR techniques. **Demonstration experiments:** 1. Southern blotting 2. Northern blotting 3. Western blotting **Spotters:** 1. DNA melting curve 2. Tertiary structure of protein 3. tRNA 4. Ethidium bromide 5. Lac Operon 6. SDS-PAGE 7. Solving problems based on the theory syllabus
V	**APPLIED PLANT CELL AND TISSUE CULTURE** 1. Different types of sterilization techniques used in tissue culture. 2. Media –Preparation of MS medium. 3. Aseptic techniques used towards the initiation and establishment of cultures. 4. Callus Culture. 5. Shoot tip culture.

	6. Synthetic seed preparation. 7. Solving the problems with reference to the growth hormones concentration.

Course outcomes: CO	**On completion of this course, the students will be able to:**	**Programme outcomes**
CO1	Recall or remember the various aspects of cell biology, genetics, molecular biology, plant breeding and tissue culture.	K1
CO2	Understand various concepts of cell biology, genetics, plant breeding and tissue culture.	K2
CO3	Apply the theory knowledge gained into practical mode in order to acquire applied knowledge by day-to-day hands-on experiences.	K3
CO4	Analyze or interpret the results achieved in practical session in the context of existing theory and knowledge.	K4
CO5	Evaluate the theory and practical skills gained 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. George M Malacinski. 2015. Freifelders Essentials of Molecular Biology (4th ed.). Jones & Bartlett.
2. Gupta P.K. 2017. Cell and Molecular Biology (5th ed.), Rastogi Publications, Meerut.
3. Gupta, P.K. 2018. Cytogenetics, Rastogi Publications, Meerut.
4. Kumar, H.D. 2007. Molecular Biology and Biotechnology, Vikas Publishing House, New Delhi.
5. Bharadwaj, D.N. 2012. Breeding of field crops (pp. 1-23). Agrobios (India).
6. Singh, R.J. 2016. Plant Cytogenetics. CRC press, US.
7. Jackson, S.A., Kianian, S.F., Hossain, K.G and Walling, J.G. 2012. Practical laboratory exercises for plant molecular cytogenetics. In Plant Cytogenetics (pp. 323-333). Springer, New York.
8. Shivakumar, S. 2002. Molecular analysis: Laboratory Manual. University press, Palkalai nagar, Madurai, India.

Reference Books:

1. Gardener, J, Simmons, H.J and Snustad, D.P. 2006. Principle of Genetics, John Wiley &

Sons, New York.
2. De Robertis E.D.P. and De Robertis E.M.P. 2017. Cell and Molecular Biology (8thed.) (South Asian Edition), Lea and Febiger, Philadelphia, USA.
3. Jackson, S.A., Kianian, S.F., Hossain, K.G., and Walling, J. G. 2012. Practical laboratory exercises for plant molecular cytogenetics. In Plant Cytogenetics (pp. 323-333). Springer, New York, NY.
4. Glick, B.R and J.E. Thompson. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida.
5. Gunning, B.E.S and M. W. Steer. 1996. Plant Cell Biology: Structure and function. Jones and Bartlett Publishers, Boston, Massachusetts.
6. Hackett, P.B. and J.A. Fuchs, J.W. Messing. 1988. An Introduction to Recombinant DNA Techniques: Basic Experiments in Gene Manipulation. The Benjamin/ Cummings Publishing Co., Inc Menlo Park, California. 8. Hall, RD. (Ed).1999. Plant Cell Culture Protocols. Humana Press, New Jersey.
7. Harris, N and K.J. Oparka. 1994. Plant cell Biology: A Practical Approach. IRL Press, At Oxford University Press, Oxford, UK.
8. Gelvin, S.B., Schilperoort, R.A. (Eds.). 2000. Plant Molecualr Biology Manual.
9. Henry, RJ. 1997. Practical applications of plant molecular biology, Chapman & Hall, London.
10. Krebs, J.E., Goldstein E.S. and Kilpatrick S.T. 2017. Lewin's GENES XII (12thed.). Jones & Bartlett Learning.

Web sources:

1. https://www.madrasshoppe.com/cell-biology-practical-manual-dr-renu-gupta-9788193651223-200674.html
2. https://www.bjcancer.org/Sites_OldFiles/_Library/UserFiles/pdf/Cell_Biology_Laboratory_Manual.pdf
3. https://www.kopykitab.com/Genetics-With-Practicals-by-Prof-S-S-Patole-Dr-V-R-Borane-Dr-R-K-Petare
4. https://www.kopykitab.com/Practical-Plant-Breeding-by-Gupta-S-k
5. https://www.kopykitab.com/Cell-And-Molecular-Biology-A-Lab-Manual-by-K-V-Chaitanya
6. https://www.amazon.in/Plant-Tissue-Culture-Theory-Practicals/dp/9386347350

Mapping with Programme Outcomes:

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

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