UNIVERSITY OF MADRAS

M.Sc. DEGREE PROGRAMME IN BOTANY

SYLLABUS WITH EFFECT FROM 2023-2024

Title of the Course	**CELL BIOLOGY, GENETICS AND PLANT BREEDING**						
Paper Number	**CORE VIII**						
Category	Core	**Year**	II	**Credits**	5	**Course Code**	523C3A
		Semester	III				

Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**
	5	1	-	6

Pre-requisite	To acquire knowledge on cell, genetic traits and plant breeding techniques for crop improvement.
Learning Objectives:	
C1	Enable to learn various cell structures and functions of prokaryotes and eukaryotes and understand the salient features and functions of cellular organelles.
C2	To understand the cell division and it molecular mechanism so as to appreciate and manipulate normal and abnormal cell and tissue growth.
C3	Understanding of laws of inheritance, genetic basis of loci and alleles and their linkage.
C4	Knowledge on the structure, function and modifications of genetic materials in relation to diverse gene types and mutation.
C5	Gain knowledge of the various plant breeding principles and how molecular genetics techniques are used to improve crops.

UNIT	**CONTENTS**
I	Cell and the Cell theory – Cell structure in prokaryotes and eukaryotes, Ultra structure of cell wall. Plasma membrane – Ultra structure, properties and functions. Chemistry and functions of intracellular organelles, nucleus, mitochondria, chloroplast, golgi bodies, lysosomes, endoplasmic reticulum and peroxisomes.
II	Cell division and cell cycle: Mitosis and meiosis and their significance. Biology of cancer cells; Oncogenes. Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle. Chromosomes - morphology, fine structure - telomere-types; lamp brush, polytene, isochromosomes - heterochromatin and euchromatin, transposons, chromosome identification - banding techniques. Cell signaling: Hormones and their receptors, cell surface receptor, signalling through G Protein coupled receptors, signal transduction pathways, second messengers, light signalling in plants, bacterial quorum sensing. Microbial Genetics: Methods of Genetic transfers – transformation, conjugation, transduction and sex-duction.
	MENDELIAN PRINCIPLES

III	Mendelian principles: Dominance, segregation, independent assortment. Concept of Gene: Allele, multiple alleles, pseudoallele, Non-Mendelian inheritance: Co-dominance, incomplete dominance, gene interactions, Linkage and crossing over, sex linkage and sex influenced characters. Gene mapping methods: tetrad analysis, mapping with molecular markers.
IV	**MUTATION AND EXTRA CHROMOSOMAL INHERITANCE** Extra chromosomal inheritance involving chloroplast and mitochondrial genes. Human genetics: Pedigree analysis, Karyotypes, genetic disorders. Mutation: Types - insertion, deletion, frame shift, point mutation, Causes of mutation and mutant types - lethal, conditional, biochemical. Structural aberrations of chromosomes: Deletion, duplication, inversion, translocation. Recombination: Homologous, non-homologous and transposition.
V	**PLANT BREEDING:** Objectives of plant breeding, Genetic basis of breeding self and cross – pollinated crops. pure line selection and mass selection, clonal selection methods. Hybridization, Genetics and physiological basis of heterosis.

Course outcomes: CO	**On completion of this course, the students will be able to:**	**Programme outcomes**
CO1	Recognize the general features and organization of ultra structure of cell wall and cell organelles in prokaryotes and eukaryotes	K1
CO2	Infer and interpret events like cell division and it molecular mechanism so as to appreciate and manipulate normal and abnormal cell and tissue growth.	K2
CO3	Analyze the various factors determining the heredity from one generation to another.	K3
CO4	Acquire combined knowledge with special emphasis on extra chromosomal inheritance	K4
CO5	Crete the innovative techniques in plant breeding.	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. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.

2. Sharma, A.K and Sharma, A. 1980. Chromosome Techniques. Theory and Practice, Butterworth.
3. Roy, S.C and Kumar, K.D.C. 1977. Cell Biology, New Central Book Agency, Calcutta.
4. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments.6th edition. John Wiley & Sons.
5. Stansfield, W.D. 1969. Theory and problems of Genetics. McGraw-Hill
6. Sinnott, E.W.Dunn, L.E and Dobzhansky, T. 1973. Principles of Genetics. McGraw-Hill.New York.
7. Chaudhari, H.K.1984. Elementary Principles of Plant Breeding. Oxford & IBH Publishing Company.
8. Sukhla R.M. 2012. Molecular Genetics, Published by Wisdom Press.
9. Brown, T.A. 1992. Genetics a Molecular Approach, 2nd Ed. Chapman and Hall.
10. Chahal, G.S and Gosal, S.S. 2018. Principles and Procedures of Plant Breeding Biotechnological and Conventional Approaches, Narosa Publishing House, New Delhi.
11. Darbeshwar Roy. 2000. Plant Breeding: Analysis and Exploitation of variation, Narosa Publishing House, New Delhi.
12. Singh, B.D. 2013. Plant Breeding: Principles and Methods, Kalyani Publishers, New Delhi
13. Singh, P. 2017. Fundamentals of Plant Breeding, Kalyani Publishers.
14. Chaudhary, R.C. 2017. Introductory principles of plant breeding, Oxford IBH Publishers, New Delhi.
15. Stoskf, N.C., Tomes, D.T and Christie B.R. 2019. Plant Breeding- Theory and Practice (First Indian Print), Scientific Publishers, India.
16. Becker, W.M., L.J. Kleinsmith and J. Hardin, 2011. The world of the cell. Dorling Kindersley (India) Pvt. Ltd., New Delhi.
17. Aminul, I. 2011. Text Book of Cell Biology. Books and Allied (P) Ltd, Kolkata, India.
18. Geoffrey M. Cooper. 2019. The Cell: A Molecular Approach, Oxford University Press.
19. Janet Iwasa, Gerald Karp, Wallace, F. Marshall. 2018. Karp's Cell Biology, Global Edition.
20. Gupta, P.K. 2009. Genetics. Rastogi publications, Meerut, New Delhi.

Reference Books

1. De Robertis, E.M.F. 2011. Cell and Molecular Biology, Lippincott Williams & Wilkins, New York.
2. Krebs, J.E., Goldstein, E.S and Kilpatrick, S.T. 2017. Lewin’s Genes XII Jones and Sybenga, J. 1975. Meiotic configurations. Springer Verlag, Berlin Heidel Berg.
3. Russel, P.J. 1998. Genetics (5 th edition), The Benjamin / Cummings Publishing Company, Inc., USA.
4. Stebbins, J.L. 1971. Chromosomal Evolution in Higher Plants, Edward Arnold Publ., London.
5. Wolfe, S.L. 1993. Molecular and Cellular Biology, Wordsworth Publ. Co., California, USA.
6. Simmonds, N.W. 1979. Principles of Crop improvement. Longman, London.
7. Lewin, B. 2000. Genes VII, Oxford University Press, USA.
8. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
9. Allard, R.W. 2010. Principles of Plant Breeding. 2 nd ed. John Wiley and Sons, Inc. New Jersey, US.

10. Gerald Karp. 2013. Cell Biology. 7th edition. John Wiley & Sons.
11. Gardner, E.J. 2019. Principles of Genetics, 8th ed. Johan Wiley, New York.
12. Hardin, J and Bertoni, G.P. 2018. Becker's World of cell. 9th ed. Pearson publications.
13. Klug, W.S and Cummings, M.R. 2018. Concepts of Genetics. 12th ed. Pearson Education Pvt. Ltd., Singapore.
14. Cooper, G.M and Hausma, R.E. 2015. The Cell: Molecular Approach. 7th ed. Oxford University Press, UK.
15. Lewis Cantley, Tony Hunter, Richard Sever, Jeremy Thorner. 2014. Signal Transduction: Principles, Pathways, and Processes. Cold Spring Harbor Laboratory.
16. Hartl, D.L and Jones E.W. 2017. Genetic analysis of Genes and Genomes. 2nd ed. Jones and Bartlett Pub, Boston.
17. Baluska, F and Vaidurya Pratap Sahi. 2018. Concepts in Cell Biology - History and Evolution. Botanical Institute, Karlsruhe Institute of Technology, Karlsruhe, German.
18. Gerald Karp, Janet Iwasa, Wallace Marshall. 2020. Karp's Cell Biology, IX Ed., Wiley.
19. Swaminathan, M.S.Gupta, P.K and Singa, U.1974. Cytogenetic to crop plants, Macmillan Ltd New Delhi.

Reading List

1. https://www.britannica.com/science/cell-biology
2. https://medlineplus.gov/genetocs/understanding/basics/cell/
3. http://www.mendelweb.org/
4. http://www.sci.sdsu.edu/~smaloy/MicrobialGenetics/problems/
5. http://www.ornl.gov/TechResources/Human_Genome/genetics.html
6. https://www.videezy.com/free-video/genetic
7. https://www.mysciencework.com/publication/download/lecture-notes-cellbiology
8. https://www.youtube.com/watch?v=1WuwwYcDHMg
9. https://www.slideshare.net/earshadshinichi/cell-biology-the-cell-its-structureand history
10. https://www.youtube.com/watch?v=OIN4keY8q3k
11. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118313718

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	3	2	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)