# UNIVERSITY OF MADRAS

## M.Sc. DEGREE PROGRAMME IN BOTANY

SYLLABUS WITH EFFECT FROM 2023-2024

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|---|---|---|---|---|---|---|---|
| **Title of the Course** | **PLANT MOLECULAR BIOLOGY** | | | | | | |
| **Paper Number** | **CORE IX** | | | | | | |
| **Category** | Core | **Year** | II | **Credits** | 5 | **Course Code** | 523C3B |
| | | **Semester** | III | | | | |
| **Instructional Hours per week** | | **Lecture** | | **Tutorial** | **Lab Practice** | **Total** | |
| | | 5 | | 1 | - | 6 | |
| **Pre-requisite** | This course will help you comprehend key concepts and the use of application of numerous molecular techniques. | | | | | | |
| **Learning Objectives:** | | | | | | | |
| **C1** | To enlighten people of past molecular biology developments. | | | | | | |
| **C2** | To comprehend the molecular processes. | | | | | | |
| **C3** | A thorough examination of DNA structure, replication process, transcription process and translation processes.. | | | | | | |
| **C4** | To expose the students a fundamental of the various techniques used in molecular studies. | | | | | | |
| **C5** | A To introduce the constructs on the molecular information of the various plant cells enable them to decide the area of interest for further study. | | | | | | |

| UNIT | CONTENTS |
|---|---|
| I | **INTRODUCTION TO MOLECULAR BIOLOGY**<br><br>History of DNA. DNA as genetic material, Chemical structure of DNA and base composition, Watson-Crick model, structure of different types of nucleic acids, Types of DNA: A-, B-, Z-, DNA, denaturation and renaturation of DNA, melting temperature (Tm), UV absorption and hyperchromic effect. Structure of major types of RNA. |
| II | **ORGANIZATION OF NUCLEAR GENOME/ DNA REPLICATION**<br><br>DNA replication – Basic rule for replication of Nuclic acids–Replication of DNA in Prokaryotes and Eukaryotes. Enzymology of DNA replication in Prokaryotes and Eukaryotes. Types of DNA replication - Termination of DNA replication - DNA repair mechanism- DNA methylation. |
| III | **TRANSCRIPTION**<br><br>Central dogma. Transcription - Enzymology - RNA polymerase - classes of RNA molecules - transcription in Prokaryotes and Eukaryotes - splicing mechanisms. Inhibitors of nucleic acid biosynthesis. Significance of pribnow box, TATA box, CAAT box and enhancers in transcription initiation. Reverse transcription. |

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| **IV** | **UNIT IV TRANSLATION**<br><br>Protein synthesis and processing: Activation of amino acid, Attachment of activated amino acid with tRNA, Initiation of polypeptide chain, Elongation of polypeptide chain, Termination of polypeptide chain, Post translational processing. Features of Genetic code – codons and anticodons – Wobble hypothesis. |
| **V** | **UNIT V GENE REGULATION**<br><br>Gene regulation - Operon concept - Lac repressor-c-AMP, Catabolic repression-, *ara* - operon and *trp* operons - Gene expression in Eukaroytes - gal gene expression in Yeast. Role of chromatin in gene expression and gene silencing. |

| **Course outcomes: CO** | **On completion of this course, the students will be able to:** | **Programme outcomes** |
|---|---|---|
| CO1 | Recall a plant cell structure and explain its function. | K1 |
| CO2 | Understand the organization of nuclear genome. | K2 |
| CO3 | Apply the idea of transcription in plants. | K3 |
| CO4 | Analyze the expression of genes in plants. | K4 |
| CO5 | Evaluate expression of genes in plants and create idea to seek for suitable job in relevant industries. | K5 |

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| 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<br>(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. David, R and Hyde. 2010. Genetics and Molecular biology. Special Indian edition, Tata Mc Graw Hill P.Ltd. New Delhi.
2. Gerald Karp. 2010. Cell and Molecular Biology (6thedn). John Wiley and Sons Inc. ISBN – 13 978-0-470-48337-4.
3. Alberts, B., Bray, D., Lewis, J. Raff, M., Roberts, K. and Watson, J.D. 1989. Molecular Biology of the cell, Garland Publishing Inc. New York.
4. Veer Bala Rastogi. 2016. Principles of Molecular Biology, Medtech publishers, New Delhi.
5. Gupta, P.K. 2005. A textbook of Cell and Molecular Biology, Rastogi Publications, Meerut.

6. Watson J.D, Baker T.A., Bell S.P., Gann A., Levine M., Losick, R. 2014. Molecular Biology of the Gene (7th edition), Pearson Press.
7. Verma, P.S and Agarwal, V.K. 2009. Molecular Biology. S.Chand & Company Ltd. New Delhi.
8. Sheeler P and Bianchi D.E. 2006. Cell and Molecular Biology (3rd edition). Wiley India (P.) Ltd. New Delhi.
9. Allison L.A. 2007. Fundamental Molecular Biology. Blackwell Publishing. U.S.A.
10. Kumar, H.D. 1999. Molecular Biology. Vikas Publishing House Pvt. Ltd. New Delhi.
11. Walker, J.M and Rapley, R. 2006. Molecular biology and biotechnology (4th Edn) Panima publishing corporation, New Delhi.

**Reference Books:**

1. Richard, M., Twyman and Wisden, W. 1999. Advanced Molecular Biology, Viva Books Pvt. Ltd.
2. Turner, P.C., Mclenann, A.G., Bates, A.D. and White, M.R.H. 2001. Instant notes on molecular biology.
3. Watson, J.D, Baker T.A., Bell S.P., Gann A., Levine M., Losick R. 2014. Molecular Biology of the Gene (7th edition), Pearson Press.
4. Snustad Peter, D. Michael J. Simmons. 2015. Principles of Genetics, John Wiley Sons.
5. Clark, D. 2010. Molecular Biology. Academic Press Publication.
6. David Freifelder. 2008. Essentials of Molecular Biology. Narosa Publishing house. New Delhi.
7. Geoffrey M. Cooper and Robert E. Hausman. 2015. The Cell: A Molecular Approach. 7 thedn. Sinauer Associates is an imprint of Oxford University Press.
8. Gerald Karp, Janet Iwasa, Wallace Marshall. 2016. Karp's Cell and Molecular Biology. John Wiley& sons, UK.
9. Lodish, H., Berk, A., Chris A. Kaiser, Krieger, M., Bretscher, A., Kelsey C. Martin, Yaffe, M. Amon, A. 2020. Molecular cell biology. IX Ed. W H Freeman and Company.
10. Tropp, B.E. 2018. Molecular biology genes to proteins, 3rd Ed., Jones and Bartlette Publishers.
11. Bruce Alberts, 2008. Molecular Biology of the Cell (5thed.), Garland Science.
12. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments (6thed.). John Wiley & Sons. Inc. New York.
13. Malacinski, G.M, 2015, Freifelder Essentials of Molecular biology. (Paper back) (4th Edn.) Jones & Bartlet publisher.
14. Harvey lodish and Arnolod berk. 2016. Molecular cell biology. (7 thEdn). Publishers; Freeman, W.H & Company.
15. Grierson, D. and Covey, S.N. 1984. Plant Molecular Biology. Blackie and sons, London.
16. Karp.G. 2008. Cell and Molecular Biology. 5th Edn. John Wiley & sons, London.

**Web resources:**

1. https://www.youtube.com/watch?v=1LAKKvhVLms&list=PLKlDmF-iIyAlE_WaNGQU0wAnect COMvR1
2. https://www.youtube.com/watch?v=GsWo8dCivWs
3. https://www.youtube.com/watch?v=I4uaBXwaXXw
4. https://www.youtube.com/watch?v=47pkFey3CZ0

5. https://www.youtube.com/watch?v=XKboZQMCrB0
6. https://www.youtube.com/watch?v=BExZrIqlvWU
7. https://ocw.mit.edu/courses/biology/7-014-introductory-biology-spring-2005/

**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)**