# UNIVERSITY OF MADRAS

## M.Sc. DEGREE PROGRAMME IN BOTANY

SYLLABUS WITH EFFECT FROM 2023-2024

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|---|---|---|---|---|---|---|---|
| **Title of the Course** | | **RESEARCH METHODOLOGY** | | | | | |
| **Paper Number** | | **ELECTIVE-III** | | | | | |
| **Category** | ELECTIVE | **Year** | I | **Credits** | 2 | **Course Code** | 423E2C |
| | | **Semester** | II | | | | |
| **Instructional Hours per week** | | **Lecture** | | **Tutorial** | | **Lab Practice** | **Total** |
| | | 3 | | 1 | | - | 4 |
| **Pre-requisite** | | To impart expertise about analysis and research. | | | | | |

**Learning Objectives:**

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| **C1** | To equip students to collect, analyze and evaluate data generated by their own inquiries in a scientific manner. |
| **C2** | To provide an overview on modern equipments that they would help students gain confidence to instantly commence research careers and/or start entrepreneurial ventures. |
| **C3** | To help students understand the value of research in learning. |
| **C4** | To provide an overview on modern equipments that they would help students gain confidence to instantly commence research careers and/or start entrepreneurial ventures. |
| **C5** | To understand the value of research, its general concept, and the craft of thesis and paper writing and publication. |

| **UNIT** | **CONTENTS** |
|---|---|
| **I** | **UNIT I ADVANCED MICROSCOPIC TECHNIQUES**<br>Principles, working procedure and applications of<br>i. Transmission electron microscope (TEM),<br>ii. Scanning electron microscope (SEM)<br>iii. Atomic Force microscope (AFM) |
| **II** | **UNIT II ANALYTICAL TECHNIQUES**<br>Principles, working procedure and applications of<br>i. UV Spectrophotometer<br>ii. FTIR<br>iii. GCMS<br>iv. NMR |
| **III** | **UNIT III SEPARATION TECHNIQUES**<br>Principles, working procedure and applications of<br>i. Centrifuge<br>ii. HPLC<br>iii. Agarose gel electrophoresis<br>iv. SDS Polyacrylamide gel electrophoresi |
| **IV** | **UNIT IV DETECTION OF MOLECULES**<br>Detection of molecules using<br>i. ELISA<br>ii. Southern blotting<br>iii. Western blotting<br>iv. Northern blotting |

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| **V** | **UNIT V RESEARCH DESIGN AND VALIDATION**<br>Components of manuscript writing- Title, authors and addresses, abstract, keywords, introduction, materials and methods, results and discussion, summary, acknowledgements, references. |

| **Course outcomes: CO** | **On completion of this course, the students will be able to:** | **Programme outcomes** |
|---|---|---|
| CO1 | Understand general laboratory procedures and maintenance of research equipments, microscopy. | K1 & K2 |
| CO2 | Realize the need of centrifuges and chromatography and their uses in research. | K2 & K3 |
| CO3 | Learn the principles and applications of electrophoresis. | K5 |
| CO4 | Realize the importance of biosafety guidelines. | K3 & K4 |
| CO5 | Understand the methods of writing scientific paper and components of research paper. | K4 & 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. Anderson, J.B.H. 1970. Durston and M. Poole, Thesis and Assignment Writing, Wiley Eastern Private Limited, New Delhi.
2. Day, R.A. 1988. How to write and publish a scientific paper, 3rd edition, Oryx Press, Phoenix, Anzona.
3. Veerakumari, L. 2017. Bioinstrumentation. MJP Publisher, India. p578.
4. Sree Ramulu, V.S.1988. Thesis Writing, Oxford& IBH Pub. New Delhi.
5. Jayaraman, J. 2000. Laboratory manual of Biochemistry, Wiley Eastern Limited, New Delhi 110 002.
6. Ray, K. 2004. And the dispute goes on Deccan Herald, Tuesday, January 13, DH News Service, and New Delhi.
7. Sharma, K.R. 2002. Research methodology .National publishing house, Jaipur and New Delhi.
8. Kothari, C.R. 2014. Research Methodology-Methods & Techniques. Wishwa Prakashan.
9. Palanivelu, P. 2013. Analytical Biochemistry and Separation techniques, 20th century publications, Palkalai nagar, Madurai.
10. Mishra Shanthi Bhusan. 2015. Handbook of Research Methodology - A Compendium for Scholars & Researchers, Ebooks2go Inc.

11. Gurumani, N. 2019. Research Methodology: For Biological Sciences, MP. Publishers.
12. Narayana, P.S.D. Varalakshmi, T. Pullaiah. 2016. Research Methodology in Plant Science, Scientific Publishers, Jaipur, Rajasthan.

**Reference Books**

1. Sharma, V.K. 1991. Techniques in microscopy and cell biology, Tata McGraw Hill, New Delhi.
2. Asokan, P. 2001. Basics of analytical biochemistry. Chinna Publications.
3. Bajpai, P.K. 2006. Biological instrumentation and methodology. S. Chand & Company, New Delhi.
4. Biju Dharmapalan. 2012. Scientific Research Methodology. Narosa Publising House, New Delhi.
5. Rana, S.V.S. 2009. Biotechniques: Theory and Practice. Rastogi Publications.
6. Habib, M.M., Pathik, B.B and Maryam, H. 2014. Research methodology-contemporary practices: guidelines for academic researchers. Cambridge Scholars Publishing. ISBN 1443864617.
7. Dey, P.M and Harborne, J.B. 2000. Plant Biochemistry Harcourt Asia Pvt. Ltd.
8. Plummer, D.T. 2003. An introduction to practical Biochemistry. 3rd Edn. Tata McGraw Hill Publishing Company Ltd. New Delhi.
9. Jayaraman, J. 2011. Laboratory Manual of Biochemistry, New Age International Private Limited.
10. Harborne. 1998. Phytochemical methods, Springer Netherlands.
11. Pyrczak, F and Bruce, R. 2017. Writing Empirical Research Reports: A Basic Guide for Students of the Social and Behavioral Sciences. (8th Edition), Routlage Publishers, USA.
12. Marimuthu R. 2011. Microscopy and Microtechnique. MJP publishers Chennai.

**Web resources:**

1. https://www.kobo.com/in/en/ebook/bioinstrumentation-1
2. https://www.worldcat.org/title/bioinstrumentation/oclc/74848857
3. https://www.amazon.in/Bioinstrumentation-M-H-Fulekar-Bhawana-Pandey-ebook/dp/B01JP3M9TW
4. https://en.wikipdia.org/wiki/bioinstrumentation
5. https://www.britannica.com/science/chromatography
6. https://en.wikipedia.org/wiki/electrophoresis
7. https://microbenotes.com/centritugation.principal-types-and application

**Mapping with Programme Outcomes:**

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

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