

**UNIVERSITY OF MADRAS**  
**B.Sc. DEGREE PROGRAMME IN PLANT BIOLOGY**  
**AND PLANT BIOTECHNOLOGY**  
**SYLLABUS WITH EFFECT FROM 2023-2024**

**EC – 5 ELECTIVE I**  
**1. BIO-ANALYTICAL TECHNIQUES**

<b>Title of the Course</b>	<b>BIO-ANALYTICAL TECHNIQUES</b>						
<b>Paper Number</b>	Elective-I						
<b>Category</b>	Elective	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</b>	339E5A
		<b>Semester</b>	V				
<b>Instructional Hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>		
	3	1		-	4		
<b>Pre-requisite</b>	To impart expertise about analysis and research.						
<b>Learning Objectives</b>							
<b>C1</b>	To understand the principle, operation and maintenance of various tools/equipment in the laboratory.						
<b>C2</b>	Perform experiments using the laboratory instruments, formulate experiments for project work and evaluate critically the acquisition of data.						
<b>C3</b>	To equip students to collect, analyze and evaluate data generated by their own inquiries in a scientific manner.						
<b>C4</b>	To give an exposure to various forms of field research and data analysis techniques.						
<b>C5</b>	To provide an overview on modern equipments that they would help students gain confidences to instantly commence research careers and/or start entrepreneurial ventures.						
<b>Course outcomes:</b>  On completion of this course, the students will be able to: CO	<b>Programme Outcomes</b>						

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1. Relate to the various biological techniques and its importance.	K1
2. Explain the principles of Light microscopy, compound microscopy, Fluorescence microscopy and electron microscopy.	K2
3. Apply suitable strategies in data collections and disseminating research findings.	K3& K6
4. Compare and contrast the significance of different types of chromatography techniques.	K4
5. Develop methodologies for extraction and analysis of biochemical compounds.	K5
<b>UNIT</b>	<b>CONTENTS</b>
<b>I</b>	<b>I MICROSCOPY:</b> Principles of microscopy; Light microscopy; compound microscopy, bright field microscope, dark field microscope, phase-contrast microscope, Fluorescence microscopy; Transmission and Scanning electron microscopy. Microscopic measurements-micrometry, Microscopy drawing: Camera Lucida.
<b>II</b>	<b>CHROMATOGRAPHIC PRINCIPLES AND APPLICATIONS:</b> Principle, methodology and applications of Paper chromatography, Thin Layer Chromatography (TLC), Column chromatography, Gas chromatography – Mass spectrometry (GCMS), High Performance Liquid Chromatography (HPLC).

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<b>III</b>	<b>ELECTROPHORESIS AND PH METER:</b> Principle, methodology and applications of pH meter. Polyacrylamide gel electrophoresis (PAGE), Agarose Gel Electrophoresis.
<b>IV</b>	<b>IV SPECTROPHOTOMETRY AND CENTRIFUGATION TECHNIQUE:</b> Principle and law of absorption, construction, operation and uses of colorimeter and UV-Visible spectrophotometer, Principles, methods of centrifugation, types of centrifuge and applications.
<b>V</b>	<b>BIostatistics:</b> Data collection methods, population, samples, parameters; Representation of Data: Tabular, Graphical- Histogram – frequency curve – Bar diagram-measures of central tendency – Mean, Median and Mode; Standard deviation, Standard error, Chi-square test and goodness of fit –t-test.
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

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<b>Recommended Texts</b>	<ol style="list-style-type: none"> <li>1. Sharma, V.K. 1991. Techniques in microscopy and cell biology, Tata McGraw Hill, New Delhi.</li> <li>2. Sawhney, S.K and Randhir Singh. 2000. Introductory practical biochemistry, Narosa Publishing House.</li> <li>3. Asokan, P. 2001. Basics of analytical biochemistry. Chinna Publications.</li> <li>4. Bajpai, P.K. 2006. Biological instrumentation and methodology. S. Chand &amp; Company, New Delhi.</li> <li>5. Veerakumari, L. 2009. Bioinstrumentation. MJP Publications.</li> <li>6. Palanivelu, P. 2013. Analytical Biochemistry and Separation techniques, 20<sup>th</sup> century publications, Palkalai nagar, Madurai.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Rana, S.V.S. 2009. Biotechniques: Theory and Practice. Rastogi Publications.</li> <li>2. Zar, J.H. 2012. Biostatistical Analysis. 4th edition. Pearson Publication. U.S.A.</li> <li>3. Sundar Rao, P.S.S and Richard, J. 2011. Introduction to Biostatistics and research methods, PHI learning Private Ltd., New Delhi.</li> <li>4. Johansen, D.A. 1940. Plant Micro technique, TATA McGraw Hill Book Co., Ins., New Delhi.</li> <li>5. Peter Gray. 1964. Handbook of Basic Micro technique. McGraw hill publication, New York.</li> <li>6. Cooper, T.G. 1991. The Tools of Bio - chemistry, John Wiley &amp; sons, London.</li> <li>7. Dey, P.M and Harborne, J.B. 2000. Plant Biochemistry Harcourt Asia Pvt. Ltd.</li> <li>8. Plummer, D.T. 2003. An introduction to practical Biochemistry. 3rd Edn. Tata McGraw Hill Publishing Company Ltd. New Delhi.</li> <li>9. Zar, J.H. 1984. Biostatistics Analysis, Prentice Hall International, England Cliffs, New Jersey.</li> </ol>
<b>Web Resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.kobo.com/in/en/ebook/bioinstrumentation-1">https://www.kobo.com/in/en/ebook/bioinstrumentation-1</a></li> <li>2. <a href="https://www.worldcat.org/title/bioinstrumentation/oclc/74848857">https://www.worldcat.org/title/bioinstrumentation/oclc/74848857</a></li> <li>3. <a href="https://www.amazon.in/Bioinstrumentation-M-H-Fulekar-Bhawana-Pandey-ebook/dp/B01JP3M9TW">https://www.amazon.in/Bioinstrumentation-M-H-Fulekar-Bhawana-Pandey-ebook/dp/B01JP3M9TW</a></li> <li>4. <a href="https://www.amazon.in/Handbook-Biomedical-Instrumentation-R-S-Khandpur-ebook/dp/B0129ZDO9W?ref=kindlecontentin50-21&amp;tag=kindlecontentin50-21&amp;gclid=CjwKCAiAx_DwBRAfEiwA3vwZYkqkwRb_EGf73exaWpY8D9JNpJZsOcXQCQ4pZIRzTrYH2lopaVP1xxoCIPgQAvD_BwE">https://www.amazon.in/Handbook-Biomedical-Instrumentation-R-S-Khandpur-ebook/dp/B0129ZDO9W?ref=kindlecontentin50-21&amp;tag=kindlecontentin50-21&amp;gclid=CjwKCAiAx_DwBRAfEiwA3vwZYkqkwRb_EGf73exaWpY8D9JNpJZsOcXQCQ4pZIRzTrYH2lopaVP1xxoCIPgQAvD_BwE</a></li> <li>5. <a href="https://www.kobo.com/us/en/ebooks/biostatistics">https://www.kobo.com/us/en/ebooks/biostatistics</a></li> <li>6. <a href="https://www.amazon.in/Biostatistics-Veer-Bala-Rastogi-ebook/dp/B07LDCPXDG">https://www.amazon.in/Biostatistics-Veer-Bala-Rastogi-ebook/dp/B07LDCPXDG</a></li> </ol>

**Mapping with Programme Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	2	2	3	2	1	2	2	3	2

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<b>CO 2</b>	3	3	2	2	1	3	2	3	3	3
<b>CO 3</b>	2	2	3	2	1	2	1	3	2	2
<b>CO 4</b>	3	2	1	1	3	2	1	3	3	2
<b>CO 5</b>	3	2	1	3	2	2	3	3	3	2

**S-Strong (3)**

**M-Medium (2)**

**L-Low(1)**