

Paper 3a RESEARCH METHODOLOGY, INSTRUMENTATION AND BIOSTATISTICS

M. Sc. va (Candidates admitted from the academic year 2021-2022)

Course Code 212BO1M03

Total Hours 75

Credits 4

CORE THEORY

Learning Objective	To make students understand the basics of research, various biological techniques, instrumentation and interpretation of research findings and presentation of research work.
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CO No.	Course Outcome	PSO Addressed	CL
	Upon the completion of this course, students will be able to		
CO - 1	Understand the basics, various strategies and steps in carrying out a successful research.	PSO-6	U
CO - 2	Recognize the principle, working mechanism, types and application of microscopes; learn the various techniques pertaining to microscopy; Demonstrate the inevitable use of photographic techniques in biology.	PSO-6	Ap
CO - 3	Learn the various methods and techniques used in extraction and separation of bio-components.	PSO-6	U
CO - 4	Understand the principle, working mechanism, handling and maintenance of various analytical instruments.	PSO-6	An
CO - 5	Expose to the digital world of computers, different statistical methods, statistical packages/tools used in academics and scientific research.	PSO-6	Ap

UNIT I**HOURS 15**

Introduction to Research: Basic outline of research, Basic and Applied research and essential steps in research. Experimental design and analysis. Retrieval of abstracts and bibliographic data. Thesis and research writing. Ethics with respect to scientific research. Definition, introduction and importance. Scientific Misconduct of Publication Ethics. Falsification, Fabrication and Plagiarism (FFP). Selective Reporting and misrepresentation of data. Conflicts of interest, publication misconduct, complaints and appeals. Predatory publishers and journals.

UNIT II**15**

Microscopy: Light Microscopy, Optical principles, Magnification and Resolution. Dark-field, Phase Contrast, Polarized light, Differential Interference Contrast (Nomarski-DIC) and Fluorescence Microscopy. Electron Microscopy: Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM); Photomicrography and Photomacrography; Microtomy and Micrometry: Slide preparation, Fixatives and Staining technique. Preparation of Whole mounts. Tissue Printing.

UNIT III**15**

Extraction and Separation: Solvent extraction; Separation by Centrifugation; Purification by Dialysis, Sephadex Gel Filtration.; Thin Layer Chromatography (TLC); Column Chromatography; Gel Electrophoresis (SDS-PAGE).

UNIT IV	HOURS	15
Analytical Instruments: Detailed study of the Principle, Construction and Application of pH meter, Centrifuge, Spectrophotometer, High Performance Thin Layer Chromatography (HPTLC), Gas Chromatography and Mass Spectroscopy (GC - MS), Nuclear Magnetic Resonance Spectroscopy (NMR-spectroscopy), Atomic Absorption Spectroscopy (AAS), Flow Cytometer.		
UNIT V		15
Biostatistics: Frequency distribution, Measure of Central Tendency, Standard Deviation, Standard Error, Correlation and Regression. Test of significance, Analysis of variance (ANOVA) and Chi-square test. Packages used in Statistical analysis, RSM, Graph Pad Prism, SPSS.		

TEXT BOOKS

- GURUMANI, N. [2011] Research Methodology for Biological Sciences. MJP publishers, India.
- G W H POTTER. 1995. Analysis of biological molecules an introduction to principles, instrumentation and techniques. Chapman & Hall, London.
- CLIFFORD D. FERRIS. 1979. Introduction to Bioinstrumentation: With Biological, Environmental and Medical Applications (Contemporary Instrumentation and Analysis). Humana Press.
- WEBSTER, J. G. 2004. Bioinstrumentation, John Wiley & Sons, New York, 2004.
- ANANTA SWARGIARY. 2017. Biological Tools & Techniques (A textbook for UG/PG students of Life Sciences). Kalyani Publishers, New Delhi.
- TUAN VO-DINH. 2010. Protein Nanotechnology: Protocols, Instrumentation, and Applications. Edition II. Springer Science & Business Media.

SUGGESTED READING

- BERLYN, G.P. AND J.K. MIKSCH. 1976. Botanical Microtechnique and cytochemistry. Iowa State University Press. Iowa. USA.
- CLARK, G. 1981. Staining Procedures. Fourth Edition. Williams & Wilkins Co. MD.U.S.A.
- GAHAN, P.B. 1984. Plant Histochemistry and Cytochemistry - An Introduction. Academic Press. U.K.
- HOROBIN, R.W. 1988. Understanding Histochemistry: Selection, Evaluation and Design of Biological Stains. Ellis Horwood Ltd. U.K.

REFERENCES

- DELLY, J. 1988. Photography through the microscope. Ninth edition. Eastman Kodak Co. New York.
- GOMEZ, K.A. AND A. GOMEZ. 1976. Statistical Procedures for Agricultural Research with Emphasis on Rice. IRRI. Philippines.
- LACEY, A.J. 1989. Light microscopy in biology - a practical approach. IRL Press. Oxford University Press. U.K.
- PRASAD, S. 1992. Fundamentals of Biostatistics (Biometry). Emkay Pub. Delhi.
- REID, P.D., AND R.F. PONT-LEZICA (Eds.). 1992. Tissue Printing: tools for the study of anatomy, histochemistry, and gene expression. Academic Press. New York.
- ROBINSON, P.C. 1992. Qualitative polarized light microscopy. Royal Microscopical Society. Oxford University Press. U.K.