

**SEMESTER II**  
**PCZOD20 - RESEARCH METHODOLOGY**

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	II	PCZOD20	Research Methodology	Theory	Core	6	4	100

**Objectives:**

- To enable the students to understand the principles and methods of various instruments used in biology and to prepare them to use these techniques in their own research.
- To understand the Research methods and the preparation of research manuscripts and the role of Journals and e-journals in research.

**Course Outcomes:**

**On completion of the course the student will be able to...**

**CO1:** Describe the principle and working mechanisms of various instruments.

**CO2:** Interpret theoretical knowledge of various biological instruments useful for research.

**CO3:** Demonstrate critical thinking in designing research problem and find the solution to scientific research problem.

**CO4:** Discuss research based acquaintance in designing the experiments and interpretation of data with research tools.

**CO5:** Explain scientific ideas in both written and oral formats.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	M	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	M	H	H	H

**Unit 1:**

**(18 Hours)**

1.1: Principles and biological uses of phase contrast, fluorescence. (K1, K2, K3, K4, K5)

1.2: Scanning and transmission electron microscopes. (K1, K2, K3, K4, K5)

1.3: Spectroscopic techniques- Absorption and Emission principles - UV, visible spectroscopy. (K1, K2, K3, K4, K5)

1.4: Fluorescence and Raman spectroscopy. (K1, K2, K3, K4, K5)

1.5: X-ray crystallography. (K1, K2, K3, K4, K5)

1.6: NMR. (K1, K2, K3, K4, K5, K6)

**Unit 2:(18 Hours)**

- 2.1: Principle and application of - Chromatography - Gel, Ion, column, Affinity, HPLC & GLC. (K1, K2, K3, K4, K5)
- 2.2: Electrophoresis – Agarose, SDS - PAGE, Immunoelectrophoresis. (K1, K2, K3, K4, K5)
- 2.3: Centrifugation - Principle, Ultra centrifugation. (K1, K2, K3, K4, K5)
- 2.4: Applications of Radioactive Isotopes in biology. (K1, K2, K3, K4, K5, K6)
- 2.5: Counting methods - GM counters, Scintillation counters. (K1, K2, K3, K4, K5)
- 2.6: PEG. Autoradiography. (K1, K2, K3, K4, K5)

**Unit 3:(18 Hours)**

- 3.1: Scientific Method and its goals. (K1, K2, K3, K4, K5)
- 3.2: Research process. (K1, K2, K3, K4, K5)
- 3.3: Criteria of good research – research problem. (K1, K2, K3, K4, K5)
- 3.4: Criteria for selecting the problem. (K1, K2, K3, K4, K5)
- 3.5: Necessity of defining the problem – hypothesis. (K1, K2, K3, K4, K5)
- 3.6: Types of hypothesis - testing of hypothesis and their limitations. (K1, K2, K3, K4, K5)

**Unit 4:(18 Hours)**

- 4.1: Research Design - Meaning and needs of research design. (K1, K2, K3, K4, K5)
- 4.2: Important concepts relating to research design - different research design. (K1, K2, K3, K4, K5)
- 4.3: Sampling design - Steps in sampling design - Characteristics of good sampling design. (K1, K2, K3, K4, K5)
- 4.4: Different types of sample design. (K1, K2, K3, K4, K5)
- 4.5: Research methods – Survey - experimental, exploratory - case study. (K1, K2, K3, K4, K5)
- 4.6: Selection of tools - criteria for selection of tools – different types of tools - criteria of good research tool. (K1, K2, K3, K4, K5)

**Unit 5:****(18 Hours)**

- 5.1: Reference work and preparation of dissertation. (K1, K2, K3, K4, K5, K6)
- 5.2: Pubmed, Google Scholar, and Infilbnet. (K1, K2, K3, K4, K5)
- 5.3: Computer aided techniques for data analysis, SPSS software. (K1, K2, K3, K4, K5, K6)
- 5.4: Data presentation and power point presentation. (K1, K2, K3, K4, K5)
- 5.5: Reference collection – preparation of thesis. (K1, K2, K3, K4, K5)
- 5.6: Preparation of scientific paper for publication in a Journal. (K1, K2, K3, K4, K5)

**Books for Study and Reference:****Textbooks:**

1. Anderson Durston, Polle 1970 - Thesis and Assignment Writing - Wiley Eastern Ltd., New Delhi.
2. Comir and Peter Wood Ford 1979 - Writing Scientific Papers in English - Pitman Medical Publishing Co., London.

**Reference Books:**

3. Day R.A. 1994 - How to Write and Publish a Scientific Paper - Cambridge University Press, London.
4. Palanichamy S. and Shanmugavelu M. 1997 - Research Methods in Biological Sciences –Palani Paramount Publications, Tamil Nadu, India.

5. Milton J.S.,1992-Statistical Methods in Biological and Health Sciences-McGrawHill Inc., York.
6. Gurumani N. 2006 - Research Methodology for Biological Sciences - MJP Publishers, Chennai.
7. Kothari C.R. 2010- Research Methodology- New Age International Publishers.
8. Sybesma C., 1989, Biophysics-An Introduction, Kluwer Academic Publisher.
9. Thomas F. Weiss, 1995, Cellular Biophysics I and II, MIT press.
10. Yeagers E.K, 1992, Basic Biophysics for Biology, CRC press.
11. Narayanan P. 2000- Essentials of Biophysics- New Age International Publishers.

**E-Resources:**

<https://research-methodology.net>

<https://study.com/academy>

<https://ncu.libguides.com>