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 spectroscope. (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 Inflibnet. (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. Yeargers 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