

MANGALORE UNIVERSITY
Department of Biosciences

Ph.D. course work in Biosciences

Scheme of Assessment and Examination

Papers	Particulars	Hours of Instructions per week	Duration of Examination (Hrs)	Marks			Credits
				IA	Theory	Total	
Paper 1	Research Methodology	4	3	30	70	100	4
Paper 2	Review of Literature	16	-	-	-		
	Review Report					150	8
	Viva					50	2
	Total					300	14

* Internal Assessment (30 marks) will be based on assignment/seminar.

*Review report should contain state of the art research works analysis, related implementation issues and motivation for the stated research work.

Programme Outcomes (PO)

PO1. Research Knowledge: Utilize the knowledge of research methodology to carry out innovative studies on basic or applied science of Biology.

PO2. Safety skill: Expertize in safety measures of laboratories useful to work in any advanced industries of biomedical fields.

PO3. Investigations of research problems: Apply the methodological knowledge, including testing hypothesis, field/lab techniques, data collection, design of experiments, framing questionnaire, analysis and interpretation of results, to draw valid conclusions.

PO4. Operation of Instruments: Handle, trouble shoot various advanced instruments for analyses of biological samples.

PO5. Problem Analysis: Apply suitable statistical and mathematical methods to analyse the lab and/or field based data for interpretation of the results.

PO6. Usage of Modern Tools: Utilize the computer for various biological applications, including bioinformatics, statistical packages and databases, and remote sensing techniques.

PO7. Ethics: Identify the ethical issues associated with experimentations using animal models and human samples, with the aid of national and international guidelines.

PO8: Self Confidence: Gain the confidence to carry out studies independently not only for Ph.D, but also for future professional life in teaching, research and industrial fields.

Programme Specific Outcomes (PSO)

PSO1. Gain the knowledge and confidence to carry out studies by understanding the basic principles and methodologies of research in science.

PSO2. Capable of creating a research problem and designing a research study paving the way to come out with new concepts either in basic or applied field of biological sciences.

PSO3. Become familiar with how to write a good synopsis, research proposal and project report, helpful to bring out an excellent thesis, publication of research articles in high impact journals and attracting the grant from financial agencies.

PO4. Gain the knowledge of various laboratory experiments and instruments from basic to advanced that will be useful to carry out scholarly scientific research in biomedical field.

PO5. Build the confidence of solving the biological problems by applying statistics / using statistical packages, databases and remote sensing for a good analysis and interpretation of data to draw valid conclusions.

PAPER I –RESEARCH METHODOLOGY

60 hrs (15 hrs/unit)

Course Outcomes (CO)

Upon successful completion of the course, students will be able to:

- Acquainted with a good knowledge of research methodologies including how to select a problem based on types and significance of scientific research, testing hypothesis.
- Build the knowledge of field and lab techniques, setting experimental designs, sample collection, analysing and interpretation of the data.
- Gain the knowledge on how to write the review of literature, citations, journal indexing, research article, and know what is peer reviewed journal, impact factor and h-index.
- Develop a good laboratory practice, including how to get the ethical clearance for animal experimentation, to handle animals, and how to design questionnaires.
- Know about different model organisms available for research in biological sciences and to select an ideal model based on research problem.
- Upgrade the knowledge and skill of operation and applications of different types (from basic to advanced level) of microscope and other laboratory instruments.
- Develop the skill on tissue (plant/animal) preparations and different staining techniques for cytological and histological studies.
- Understand the principles and applications of various analytical techniques such as ultracentrifugation, chromatography, electrophoresis, spectrophotometer, lyophilisation, blotting, PCR, and rDNA technology.
- Become expert how to evaluate the data using statistical methods / tools, how to represent the data graphically, and uses of statistical packages.
- Understand the basics of bioinformatics and know how to retrieve the databases and make use of search engines, internet tools and World Wide Web (WWW).
- Appreciate the wide applications of remote sensing techniques for biological research with special reference biodiversity and landscape analysis.

Unit 1: Understanding basic research concepts

- a) Scientific research, types and significance.
- b) Testing hypothesis – null and alternate hypothesis, refinement of experiment
- c) Field/Lab techniques, study/experimental design, negative and positive controls, Methodology
- d) Collection, compilation, analysis, interpretation of data and drawing conclusions
- e) Literature retrieval, citation methods and bibliography. Journal indexing, impact factor, h-index, journal ranking
- f) Formats for writing research paper/dissertation. Plagiarism, Shodhganga, IPR and patenting

- g) Laboratory and personnel safety measures: good laboratory practices; guidelines and ethics in animal experimentation: CPCSEA Guideline and IAEC – Rules and regulations for breeding and maintenance of small laboratory animals; Human ethical Committee.
- h) Design of questionnaire
- i) Model organisms in life science research – *Neurospora crassa*, *Drosophila melanogaster*, *C. elegans*, *Arabidopsis thaliana*, Zebra finch, *Mus musculus*, *Rattus norvegicus*.

Unit 2: Principles of instrumental analysis

- a) Tissue preparation for cytological and histological analysis
- b) Staining techniques – Cytological, Histochemical, Fluorescent – FISH
- c) Light, compound and stereo -microscopy
- d) Dark field, phase contrast, polarization, fluorescent and confocal microscopy
- e) Principles and applications of Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM),
- f) Sample preparation for Electron Microscopy
- g) Autoradiography and X-ray diffraction techniques
- h) IR-analysis

Unit 3: Analytical techniques

- a) Ultracentrifugation (tissue fractionation) – Isolation of cellular and sub-cellular components
- b) Chromatographic techniques, HPLC, NMR, GC-MS
- c) Electrophoresis- Agarose and PAGE, 2D PAGE and Gel documentation.
- d) Spectrophotometry- Flame photometry, AAS
- e) Lyophilization-Principle and method
- f) Blotting techniques – Western, Southern and Northern
- g) Polymerase Chain Reaction-Types and applications, ELISA and RIA applications
- h) Transgenic technology (r-DNA technology)

Unit 4: Bio-statistical and mathematical methods

- a) Graphical representation
- b) Mean, Standard deviation, standard error
- c) Theory of probability, normal distribution, parametric and non-parametric tests, independent/repeated measures design
- d) Student's t-test
- e) Analysis of variance (ANOVA, ANCOVA, MANOVA)
- f) Computer and its applications in biological sciences – Bioinformatics, Statistical packages, Databases
- g) Remote sensing techniques.

References:

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PAPER II : REVIEW OF LITERATURE

Course Outcomes (CO)

Upon successful completion of the course, students will be able to:

- Understand what literature review is and how to write it with a scientific approach, focusing on the specialization / research problem.
- Gain the knowledge how to write scholarly research article, including the current knowledge with recent findings, theoretical and methodological contributions to a particular topic, based on the secondary sources.
- Acquainted with a thorough knowledge and confidence to initiate the research on the topics/problem of thrust areas.

Ph. D Course Work in Biosciences

Model Question Paper

Time: 3 hrs.

Max. Marks: 70

1. Write short notes on any **Four** of the following (not exceeding 2 pages each):

4X4=16

- a.
- b.
- c.
- d.
- e.
- f.

Write brief answers on any **Four** of the following (not exceeding 4 pages each):

4X7=28

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.



Answer any **Two** of the following (not exceeding 8 pages each):

2X13=26

- 8.
- 9.
- 10.