MANGALORE UNIVERSITY
Department of Biosciences

Ph.D. Course Work in Biosciences

Courses	Particulars	Hours of Instructions per week	Duration of Examination (Hrs)	Marks			Credits
				IA	Theory	Total	
Course I	Research Methodology	4	3	30	70	100	4
Course II	Research and Publication Ethics	2	3	30	70	100	2
Course III	Review of Literature Review Report Viva	14	-	-	-	 150 50	 6 2
		Total				**400**	**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)

PO 1 Research Know-how: Develop the knowledge and wherewithal to independently carry out research on diverse basic or applied aspects of biological sciences.

PO 2 Biosafety measures: Develop practices in biosafety measures used in laboratories at different levels

PO 3 Research Investigation: Apply standard methods, including testing hypothesis, field/lab techniques, data collection, design of experiments, framing questionnaire, analysis and interpretation of results in order to draw valid conclusions.

PO 4 Operation of Instruments: Handle and trouble shoot various advanced instruments for analyses of biological samples.

PO 5 Problem Analysis: Apply suitable statistical and mathematical methods to analyse the lab and/or field-based data for interpretation of the results.

PO 6 State-of-the-art Skills: Learn advanced techniques and their applications including bioinformatics, statistical packages, databases, and remote sensing techniques.

PO 7 Research Ethics: Identify the ethical issues associated with experimentation using animal models and human samples, with the aid of national and international guidelines.

Programme Specific Outcomes (PSO)

PSO 1 Gain the knowledge and expertise to carry out studies by understanding the basic principles and methodologies of research in science.

PSO 2 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.

PSO 3 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.

PSO 4 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.

PSO 5 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.

COURSE I –RESEARCH METHODOLOGY

60 hrs (15 hrs/unit)

Course Outcomes:

Upon successful completion of the course, students will:

CO 1. Get acquainted with a good knowledge of research methodologies including how to select a problem based on types and significance of scientific research, testing hypothesis.

CO 2. Be able to build the knowledge of field and lab techniques, setting experimental designs, sample collection, analysing and interpretation of the data.

CO 3. Gain the knowledge on how to write the review of literature, citations, research article

CO 4. Develop good laboratory practices, including how to get the ethical clearance for animal experimentation, to handle animals, and how to design questionnaires.

CO 5. Know about different model organisms available for research in biological sciences and to select an ideal model based on research problem.

CO 6. Upgrade the knowledge and skill of operation and applications of different types (from basic to advanced level) of microscope and other laboratory instruments.

CO 7. Develop the skill on tissue (plant/animal) preparations and different staining techniques for cytological and histological studies.

CO 8. Understand the principles and applications of various analytical techniques such as ultracentrifugation, chromatography, electrophoresis, spectrophotometer, lyophilisation, blotting, PCR, and rDNA technology.

CO 9. Be able to evaluate data using statistical methods / tools, how to represent the data graphically, and uses of statistical packages.

CO 10. 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).

CO 11. 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.
f) Formats for writing research paper/dissertation. Shodhganga, IPR and patenting
g) Laboratory and personnel safety measures: good laboratory practices; guidelines and ethics in animal experimentation: CPCSEA Guidelines 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, Arabidopsis thaliana*, *C. elegans*, *Drosophila melanogaster*, *Danio rerio, 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- Agaorse 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) Students 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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2) Banwell, C.N. 1972. Fundamentals of Molecular Spectroscopy. McGraw Hill, London.
3) Buerges, M.J. 1942. X-Ray Crystallography, John Wiley, New York.
4) Carr and Casherine, E. 1982. Cell Structure: An Introduction to Biomedical Electron Microscopy. Churchill, Edinburgh.
5) Chaplin, M.F. and Bucke. 1990 Enzyme Technology. Cambridge University Press.
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7) Da Skooge Holt 1985. Principles of Instrumental Analysis. Saunders.
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11) Hayet, M.A. 1978. Principles and Techniques of Electron Microscopy. Van Nostrand Reinhold, New York.
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16) John W. Best, 1983. Research in Education, Fourth Edition, Prentice Hall of India Pvt. Ltd. New Delhi.
17) Joseph Gibaldi and Walter S. Achtert, MLA. 1989. Handbook for Writers of Research Papers, Third Edition, Wiley Eastern Limited, New Delhi
18) Karp, G. 1999. Cell and Molecular Biology – Concepts and Experiments. (Ed. John Harris, D),Wiley & Sons, New York.
19) Khan and Irfan 1994. Fundamentals of Biostatistics, Ukaae Publication, Hyderabad.
20) Khopkar, S.N. 1988. Basic Concepts of Analytical Chemistry. II Edition, New Age Publishers.
21) Newbury Dale, E. 1988. Advanced Electron Microscopy and x-Ray Microanalysis. Plenum Publishers, New York.
22) Rastogi, V.B. 2006. Fundamentals of Biostatistics. Ane Book India, New Delhi,
23) Robert A. Day, 1983. How to Write and Publish a Scientific Paper, First Indian Edition, 1983, Vikas Publishing House Pvt. Ltd., New Delhi
24) Satguru Prasad, 1995. Fundamentals of Biostatistics (Biometry), EMKAY Publications, New Delhi, University Press, New York.
25) Tandon, PN., K. Muralidhar and Y K Gupta. 2012. Use of Animals in Scientific Research and Education, INSA publication.
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COURSE II – RESEARCH AND PUBLICATION ETHICS (RPE)

Course Outcomes:

Students will be able to:

CO 1. Be aware about the publication ethics and publication misconducts

CO 2. Understand the philosophy of science and ethics and research integrity

CO 3. Develop hands-on skills to identify research misconduct and predatory publications.

CO 4. Differentiate indexing and citation databases, open access publication and research metrics

CO 5. Use plagiarism tools

Theory

Philosophy and Ethics (3 hrs.)

a) Introduction to philosophy: definition, nature and scope, concept, branches
b) Ethics: definition, moral philosophy, nature of moral judgement and reactions

Scientific Conduct (5hrs.)

a) Ethics with respect to science and research
b) Intellectual honesty and research integrity
c) Scientific misconducts: falsification, fabrication, and plagiarism (FFP)
d) Redundant publications: duplicate and overlapping publications, salami slicing
e) Selective reporting and misrepresentation of data

Publication ethics (7hrs.)

a) Publication ethics: definition, introduction and importance
b) Best practices/ standards setting initiatives and guidelines: COPE, WAME. etc.
c) Conflicts of interest
d) Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types
e) Violation of publication ethics, authorship and contributorship
f) Identification of publication misconduct, complaints and appeals
g) Predatory publishers and journals

Practice

Open access publishing (4hrs.)

a) Open access publications and initiatives
b) SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
c) Software tool to identify predatory publications developed by SPPU
d) Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Publication misconduct (4hrs.)

A. Group discussions (2 hrs.)

a) Subject specific ethical issues, FFP, authorship
b) Conflicts of interest
c) Complaints and appeals: examples and fraud from India and abroad

B. Software tools (2 hrs.)

Use of plagiarism software like Turnitin, Uukund and other Open Source software tools

Databases and research metrics (7 hrs.)

A. Databases (4 hrs.)

a) Indexing databases
b) Citation databases: Web of Science, Scopus, etc.

B. **Research metrics (3 hrs.)**

a) Impact factor of journal as per journal citation report, SNIP, SJR, IPP, Cite score
b) Metrics: h-index, g index, i10 index, altametrics

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7. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN:978-81-939482-1-7. https://www.insaindia.res.in/pdf/Ethics_Book.pdf

COURSE III – REVIEW OF LITERATURE

Course Outcomes (CO)

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

CO 1. Understand what literature review is and how to write it with a scientific approach, focusing on the specialization / research problem.

CO 2. 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.

CO 3. Acquainted with a thorough knowledge and confidence to initiate the research on the topics/problem of thrust areas.

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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.