

  
**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                             | -                             | -     | -      | 150        | 8         |
|         | Review Report        |                                |                               |       |        | 50         | 2         |
|         | Viva                 |                                |                               |       |        |            |           |
|         |                      | <b>Total</b>                   |                               |       |        | <b>300</b> | <b>14</b> |

\* 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 Guidelined 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) 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:

- 1) Bailly and Ollis. 1986 Biochemical Engineering Fundamentals 2/e. McGraw-Hill, Michigan
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- 3) Buerges, M.J. 1942. X-Ray Crystallography, John Wiley, New York.

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- 6) Cooper IP 1982, Biotechnology and Law – IPR Vol.1&2, C Broadman & Co.
- 7) Da Skooge Holt 1985. Principles of Instrumental Analysis. Saunders.
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- 10) Gurumani, N. 2006. Research Methodology for Biological Sciences, MJP Publishers, Chennai.
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- 12) Ian Freshney, R. 2000. Culture of Animal Cells: A Manual of Basic Technique. IV Edition, Wiley-Liss.
- 13) Jan A Pechenik, 1987. A Short Guide to Writing about Biology Little, Brown and Company, Boston, Toronto.
- 14) Janathan Anderson, Berry H. Durston and Millicent Poole, 1987. Thesis and Assignment Writing, Wiley Eastern Limited, Wiley Eastern University Edition.
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- 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,

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- 25) Tandon, PN., K.Muralidhar and Y K Gupta. 2012. Use of Animals in Scientific Research and Education, INSA publication.
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- 27) <http://shodhganga.inflibnet.ac.in>

## **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):

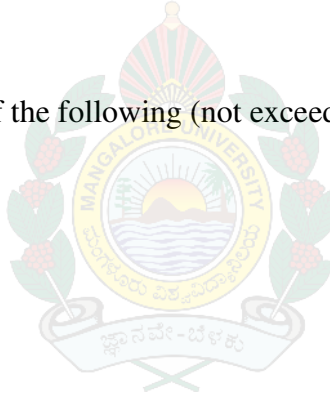
4X4=16

- 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.