

# Mangalore University

Department of Studies in Biochemistry, Mangalore University

Jnanakaveri Campus, Chikka Aluvara, Kodagu District, Karnataka, 571 232

## PhD programme in Biochemistry

### Learning objectives

#### 1. Program outcomes (PO):

- Skilled human resource development
- Creativity/Innovative thinking, problem solving skills
- Employability and entrepreneurship

#### 2. Program specific outcomes (PSO):

##### The program enables the students in

- Acquire necessary knowledge and skills to undertake a career in research either in industry or in an academic set up.
- Apply the knowledge of experimental approaches to solve problems in the field of core biochemistry research.

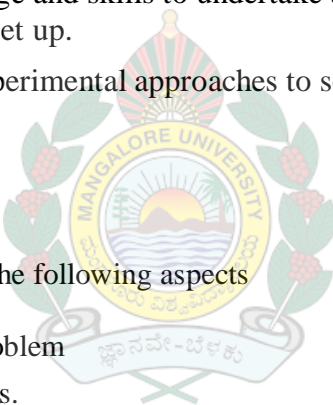
#### 3. Course outcome (CO):

##### PhD Syllabus

Students are trained and oriented in the following aspects

Paper 1: Research Methodology

- Identification of research problem
- Research design and methods.
- Data analysis and sampling
- Errors and analysis of research data
- Safety aspects and ethics in research
- Application of results and ethics
- Writing of research proposal and paper
- Collection and categorize the literature
- Knowledge of patents and dissertation



**MANGALORE UNIVERSITY**  
**DEPARTMENT OF BIOCHEMISTRY, CHIKKA ALUVARA**  
**Ph.D. COURSE WORK SYLLABUS**

**BC 601: RESEARCH METHODOLOGY**

**UNIT-I: Research Methodology**

**14 Hours**

**Research processes** - Scientific research, formation of the topic, hypothesis, Sources of information. Types and Methods of Research- Classification of Research- Pure and Applied Research- Exploring or Formulative Research-Descriptive Research-Diagnostic Research/Study-Evaluation research/Studies- Action Research - Experimental Research.

**Research design and methods** - Basic Principles, Need of research design, important concepts relating to research design – Observation and Facts, Development of Models - Developing a research plan - Exploration, Description, Diagnosis, and Experimentation.

**Writing methods-** Introduction, word processing and layout, writing and formatting with the computer, writing the first draft, revising the first draft on content and structure, revising the second draft on style, writing a thesis, writing review article and book reviews, preparing research proposals for grants. Collection and Citation of Literature: Acquisition of information, building up of own literature collection, anatomy of source description.

**Digital-** Web resources – e-Journal – Journal access – TOC alerts – Hot articles – Citation index – Impact factor – h-Index – e-Consortium – UGC infonet – e-Books – Internet discussion groups and communities – Blogs – Preprint server – Search engines, Scirus, Google Scholar, Chemical Industry, Wiki – Databases, ChemSpider, ScienceDirect, SciFinder, Scopus. Familiarity with ideas and concepts of investigation.

**UNIT-II: Data Analysis and Sampling**

**14 Hours**

**Data analysis-**Classification of errors-systematic errors-sources, Random errors -sources and distribution. Accuracy and precision-Determination of accuracy of methods, improving accuracy of analysis, significant figures, mean, standard deviation, Analysis of variance (ANOVA) – Correlation and Regression. Graphical methods- Linear regression line, correlation coefficient-Multiple linear regression (one variable with two other variables). Comparison of results: “t” test and “F” test rejection of results, gathering of data, analysis of data, revising of hypothesis, presentation of data and Conclusion.

**Sampling-** Introduction – definitions – theory of sampling – techniques of sampling – Representative sample, sample storage, sample pretreatment and sample preparation. Statistical criteria of good sampling and required size – stratified sampling v/s random sampling. Quality in analytical laboratories-quality control and quality assurance, accreditation system.

**UNIT- III: Safety Aspects and Ethics in Research**

**14 Hours**

**General safety and operational rules-** Safety equipments, personal protective equipments, compressed gas safety, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, in incineration and transportation of hazardous chemicals.

**Emergency response** - Chemical spills, radiation spills, biohazard spills, leaking compressed gas cylinders, fires, medical emergency accident reporting. Safety rules of laboratory acquaintance of experimental set up and instruments, intellectual property and intellectual property rights. Data management, importance of safety and security of data, evaluation of inventions. communication with patent council and publication of data, communication with investors, IP sales process.

**Application of results and ethics**- Environmental impacts - Ethical issues - ethical committees - Commercialization – Copy right – Royalty - Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

#### **UNIT-IV: Analytical Techniques**

**14 Hours**

**Protein and nucleic acid purification and characterization techniques**-Fractionation techniques (salt, solvent, pH and temperature), chromatographic techniques (ion exchange, gel filtration, affinity chromatography, HPLC and FPLC), Electrophoretic techniques (Native PAGE, SDS-PAGE, IEF, Agarose gel electrophoresis) spectroscopic techniques( UV-Visible spectroscopy, IR, NMR, ESR, CD, ORD, MALDI-TOF and LC-MS) and blotting techniques.



**Total: 56 Hours**

#### **Reference Books:**

1. C.R. Kothari, Research Methodology: Methods and Techniques. New Age International, 1990.
2. D.R. Kapoor & Pooja Saigal, Research Methodology Methods & Techniques, Regal Publications, 2013.
3. D. K. Bhattacharya, Research Methodology Pillappa; Third edition, 2013.
4. Suresh Chandra & Mohit K Sharma, Research Methodology, Alpha Science Intl Ltd; 1 edition, 2013.
5. R. Panneerselvam, Research Methodology, Phi Learning publication, 2009.
6. Nicholas Walliman, Research Methodology, 2010
7. P.M. Silverstein, F.X. Wester, Spectroscopic Identification of Organic Compounds, 6th Ed., Wiley 1998.
8. Douglas A. Skoog, Donald M. West, F. James Holler, Fundamentals of analytical Chemistry, Saunders College Pub., 1988.
9. S M Khopkar Basic Concepts Of Analytical Chemistry New Age International, 1998.
10. Gupta R. N. Chemical warfare and casualty Management 2011.
11. Vyas M N. Safety and hazards management in chemical industries 2013. Atlantic Publication
12. Dikshith T.S.S Safety evaluation of environmental chemicals. New Age International 1996.
13. Chemical Safety Matters-IUPAC –IPCS, Cambridge Univ. Press, 1992.
14. Fundamental of Research Methodology and Statistics, Yogesh Kumar Singh, New Age International Publishers, 2006.

15. Principles and Techniques of Biochemistry and Molecular Biology, 7<sup>th</sup> Edition, Keith Wilson and John Walker, Cambridge University Press, 2010.
16. Biophysical Chemistry (Principles and Techniques), Avinash Upadhyay, Kakoli Upadhyay, Nirmalendu Nath, Himalaya Publishers, 2009.
17. Molecular cloning-A laboratory manual, Joseph Sambrook, David W. Russell, 3<sup>rd</sup> Edition, Cold Spring Harbor laboratory press, Volume-1,2 and 3, 2001.
18. Principles and Reactions of Protein Extraction,Purification and Characterization, Hafiz Ahmed, CRC Press, 2004.
19. Gel Electrophoresis of Proteins:A Practical Approach, B D Hames and D Rickwood, 2<sup>nd</sup> Edition, IRL Press at Oxford University Press, 1990.

### **BC602 : Review of literature**

**This will be prepared by the student in consultation with his Research Supervisor. It should include state of the art research work analysis, related implementation issues and motivation for the stated research work.**

