



L	T	P/S	SW/ FW	TOTAL CREDIT UNITS
3	0	0	2	4

## Programme – Ph.D. (Biosciences and Biotechnology)

**Course Title: Research Methodology in Biosciences and Biotechnology**

**Course Code: GCMB909**

**Credit Units: 04**

**Course Objectives:** The course develops skills based on scientific learning, biochemical, analytical and computational techniques that embrace the fundamental as well as applied knowledge to probe intricate patterns in latest biological research.

**Prerequisite:** Graduate in Biosciences, Life Sciences

**Student Learning Outcomes:** On the completion of the course

- The student will be able to resume the core vital concepts presented in biosciences and biotechnology and make rational perception about research in biological sciences and allied fields.
- Evaluate and interpret current literature and research explorations in the relevant biological research.
- Correlate and employ channelized biological and molecular concepts learned through research methodology evaluations.

### Course Contents/Syllabus:

	Weightage (%)
<b>Module I</b>	20
<b>Descriptors/Topics: Research Design and Methodology</b> Definition and objectives of Research – Types of research, Various Steps in Research process, Research Design, Developing a research question-Choice of a problem; Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research	
<b>Module II</b>	20

<p><b>Descriptors/Topics: Scientific Writing</b>  Scientific Writing: An Insight into Research: Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing.  a. Definition and basic concepts, objectives, significance and techniques of research, finding research materials – literature survey, compiling records.  b. Definition and kinds of scientific documents – research paper, review paper, book reviews, thesis, conference and project reports (for the scientific community and for funding agencies).  c. Components of a research paper – title, authors and addresses, abstract, acknowledgements, references, tables and illustrations, Impact Factor and publication.  d. Dealing with publishers – submission of manuscript, ordering reprints.  e. Oral and poster presentation of research papers in conferences/symposia.  f. Preparation and submission of research project proposals to funding agencies  g. IPR - Different types of IP, IPR and Biotechnology; PPP and Technology Transfer</p>	
<p><b>Module III</b></p>	<p><b>10</b></p>
<p><b>Descriptors/Topics: Biology Experiment Design</b>  Research Designs and Formulation of Research Designs  Basis of classification of various types of designs</p>	
<p><b>Module IV</b></p>	<p><b>50</b></p>
<p><b>Descriptors/Topics: Biostatistics</b>  Introduction to Biostatistics &amp; Describing data: frequency distributions &amp; descriptive statistics (Graphs)  Quantitative Techniques: Levels of significance, Use of Statistics in Biosciences, Statistical Modeling and Analysis, Time Series Analysis  Measures of Central tendency and Dispersion. Probability distribution: Binomial, Poisson and Normal.  Sampling &amp; Experimental design  Elements of probability theory &amp; Probability distributions (Normal &amp; Binomial)  Hypothesis Testing - Comparing two sample means; Type I &amp; II errors  Comparing paired samples; Statistical power, Paired t tests, Student t test, Chi Square test; Significance of a Test  Statistical power &amp; errors in hypothesis testing  Conditions for test validity &amp; assessing data normality; Transformations  Non-parametric alternatives: Analysis of Variance (ANOVA); Multiple comparisons  Introduction to bivariate analysis - Correlation &amp; regression  Linear regression  Introduction to inference; Sampling Distributions; Confidence intervals and Experimental Designs  Analysis of categorical data: Goodness-of-fit &amp; Contingency tables  Tabular and graphical description of data: Tables and graphs of frequency data of variables,  Relation between frequency distributions and other graphs, preparing data for analysis</p>	

**Pedagogy for Course Delivery:**

Lectures – 34

Internal Assessment – 2

Total – 36 hours

**Assessment/ Examination Scheme:**

Theory Assessment (L&T)				
Continuous Assessment/Internal Assessment			End Term Examination	
Components (Drop down)	Class Test	Viva	Assignment	
Weightage (%)	15	5	10	70

SW Assessment					
Continuous Assessment/Internal Assessment		End Term Examination			
Components (Drop down)	Assignment	Presentation	Concept Map	Report	Viva
Weightage (%)	15	15	10	30	30

**Text & References:**

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, Vishwa Prakashan, 2006
2. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, ISBN:81-315-0047-0,2006
3. Biostatistics: A foundation for Analysis in the Health Sciences, E Wayne W. Daniel, Wiley Series in Probability and Statistics.
4. Introductory Statistics. Fifth Edition. (2004) Prem S. Mann. John Wiley and Sons (ASIA) Pvt. Ltd.