## 3.4.1 Additional Information: Research Methodology Syllabus for the PhD Course work

| Sl. No. | Department |
|---|---|
| 1 | Biotechnology |
| 2 | Chemistry |
| 3 | English |

**Biotechnology**

## PAPER 1 - RESEARCH METHODOLOGY

60 hr (15 hr/unit

**Unit 1: Research prerequisites**

a) Testing hypothesis – null and alternate hypothesis refinement of experiment
b) Field/Lab techniques- design, study/experimental design, negative and positive controls, Methodology; sample size
c) Collection, compilation, analysis, interpretation of data and drawing conclusions
d) Literature retrieval, citation methods and bibliography. Journal indexing, impact factor, h-index, journal ranking
e) Format of writing research paper/dissertation. Plagiarism, Shodhganga, IPR and patenting
f) Types of research/study (e.g. Cohort study)
g) Design of questionnaire
h) Good laboratory practices (GLP). Safety standards, safety measures, safety regulations: Institutional Biosafety Committee (IBSC). Guidelines and ethics in animal experimentation, animal breeding and maintenance: CPCSEA; Institutional Animal Ethics Committee (IAEC). Institutional Ethics Committee (IEC)
i) Model organisms in life science research – *Neurospora crassa, Drosophila melanogaster, Caenorhabditis elegans, Arabidopsis thaliana, Danio rerio* (Zebra fish), *Mus musculus, Rattus norvegicus*.

**Unit 2: Principles of instrumental analysis**

a) Photomicrography; Tissue preparation for microscopic analysis
b) Light microscopy, Fluorescent microscopy, Transmission and scanning electron microscopic techniques (TEM and SEM) - Preparation of samples and their applications; confocal microscopy and atomic force microscopy
c) Autoradiography and Scintillation counting
d) X-ray diffraction techniques, IR-analysis,
e) Gel documentation
f) NMR, HPLC, FPLC, GCMS, MALDI
g) ELISA, RIA
h) PCR

**Unit 3: Analytical techniques**

a) Ultra centrifugation (tissue fractionation)
b) Chromatographic techniques
c) Electrophoresis and Spectrophotometry
d) Photometry and related techniques, Luminometer
e) Staining techniques – cytological and histochemical, fluorescent – FISH
f) Lyophilization
g) Blotting techniques – Western, Southern, Northern

**Unit 4: Biostatistical methods**

a) Standard deviation standard error of the mean
b) Sampling - Design, concepts, types, techniques and scaling, choosing sample size and z-score
c) Theory of probability normal distribution, parametric and non-parametric tests, independent/repeated measures design
d) Design of experiments (e.g. Random block design and Latin square design), Analysis of variance (ANOVA, ANCOVA, MANOVA)
e) Graphical representation
f) Databases, Statistical packages
g) Hardy-Weinberg equilibrium
h) Techniques of remote sensing in bioresource mapping

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**Chemistry**

## Research Methodology in Chemistry

**Foundation of Research:** What is research? Objectives of Research, Scientific Research, Research & Theory-conceptual and theoretical model-importance of research methodology in scientific research, research design, basic principles-need of research design, features of good design, important concepts relating to research design. Types and methods of research, classification of research, pure and applied research, exploring or formulative research, descriptive research, diagnostic research/study, Evaluation of research/study, action research, experimental research-problem selection.

**Literature survey:** Sources of information, need for reviewing literature, primary-secondary-tertiary sources, journals, journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text books, current contents, Introduction to chemical abstracts and Beilstein, subject index, substance index, author index, formula index and other indices with examples.

**Digital:** Web resources, E-journals, journal access, TOC alerts. Hot articles: Citation index, UGC infonet, E-books, Search engines- Google scholar, chemical industry, Wiki-databases, chemSpider, ScienceDirect, SciFinder, Scopus. Field studies, planning of research-The planning process-selection of a problem for research, formulation of the selected problems, hypothesis formation, measurement, research design/plan.

**Research problem:** Identification, statement of research problem, objectives, design and execution of experiments, collection and interpretation of experimental data, arriving at conclusions, reporting the results of research-style and format, title, abstract and the text, references, tables, figures, elucidations, quotations and footnote. Writing of monographs, review articles and dissertations.

**Basic knowledge of computer systems:** Softwares-system software and application software, programming languages-machine language, assembly language and high level languages. Interpreter and compiler, flow charts and algorithms, general awareness of software packages and other scientific applications. Application and uses of common softwares in chemistry-origin, chemsketch, chemdraw, basic ideas on the use of internet in chemistry education.

**Concepts of chemical safety:** Chemical safety and ethical handling of chemicals, safe working procedure and protective environment, emergency procedure and first aid, laboratory ventilation, safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmosphere, safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals.

**Advanced techniques of analysis and ethics of research:** Applications of UV-Visible, IR, NMR, Mass, ESR, XRD for the structural elucidation of compounds, Thermal analysis and electro-chemical principles (polarography, cyclic voltammetry).

Ethical issues, copy right, royalty, intellectual property rights, citation and acknowledgement. Reproducibility.

Safety rules of laboratory acquaintance of experimental set up, importance of safety and security of data.

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2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques, New Age International. .
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4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing.
5. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
9. Ramesh Kumari, Computers and their applications to Chemistry, 2nd Ed., Alpha Sci.
11. Chemical Safety Matters-IUPAC –IPCS, Cambridge Univ. Press, 1992.

English

DEPARTMENT OF ENGLISH
MANGLORE UNIVERSITY

SYLLABUS FOR COURSE WORK FOR PH.D IN ENGLISH
BOS (PG) 18.04.2015

PAPER I - RESEARCH METHODOLOGY

Hours of Instructions in a Week: 4
Assessment:

| | |
|---|---|
| End-semester Examination: | 70 Marks (of 3 Hours) |
| One Term Paper: | 15 Marks |
| One seminar: | 15 Marks |

I. Concepts

1. Research proposal, Dissertation
2. Thesis, Hypothesis, Thesis Statement, the paragraph
3. Structure of a Ph.D dissertation
4. Style Sheets: MLA, Cambridge and Oxford
5. Using Word Processors: Page Setting and setting up styles
6. Using online Library Sources (such as Jstor and Project Muse)
7. Plagiarism and intellectual copy rights.

II. Processes

1. Preparing the Research Proposal: Selecting a topic, review of literature, Working bibliography
2. Documentation: using the Library, accessing the internet, inter-library loan
3. Argumentative strategies: outlining, types of argument
4. Mechanics of writing: MLA style Manual and MLA Handbook; use of quotations; endnotes, footnotes, list of works cited, bibliography

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Gibaldi, Joseph. MLA Style Manual and Guide to Scholarly Publishing 1985. 2nd edn. New York: MLA, 1998.

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Wolfreys, Julian. Introducing Literary Theories: A Guide and a Glossary. 2001. New Delhi: Atlantic, 2005.