



**MANGALORE UNIVERSITY**  
**MSc Medical Physics**

**MPS 555: Research methodology & Communication**

**Teaching hours: Each Unit – 12 h**

**Objectives:**

To familiarise and to introduce the students for carrying out the research work in a systematic and organised way and acquainting with methodologies of conducting research. Also to equip the students in selecting the research topic, literature survey, writing the proposal and designing and writing research papers and dissertation.

**Outcomes:**

- Students will understand the concept of research and the processes involved in conducting the research and will be aware of various kinds of research methodologies.
- They will be able to conduct literature survey related to their area of research, preparing the research proposal and designing it.
- They will understand the techniques of data collection and their interpretation.
- They will be able to solve the problems encountered in conducting the research.
- Students will be able to communicate their research outcome to the scientific journals and publishing.
- They will be able to prepare the research dissertation.

**Unit I. Introduction to Research: General.**

Definition, need, process. Research objectives, Research approaches, Significance of research & importance of knowing how research is done-Criteria of good research; Types of Research: Pure, Applied and Action Research, Kinds of Research: Diagnostic, Descriptive, Exploratory, Explanatory, Research Ethics – Animal ethics; Human ethics; Bio-safety in research: microorganisms studies Scientific methods, components of scientific methods, Research process, Problem encountered by researchers in India; Personal attributes- Research and scholarship; difference between undergraduate and research education: skills habits and attitudes for research; status of research in India; Psychological phases of PhD process; stress point; aims of supervisors; mismatches and problems; Managing self; empathy; managing relations with your supervisor, colleagues, and supporting staff, listening; assertiveness; teamwork; sense of humour; Duration and stages of a PhD Process; long term and short goals; time tabling and deadlines; Profession; integrity, objectivity, fairness and consistency; loyalty; plagiarism and research ethics; safely. Problem finding and literature survey.

## **Unit II. Literature survey, Proposal writing and Research Design.**

Types of Literature search – use of library, books & journals – Medlines, internet, getting patents and article reprints as a source of literature survey; Review of Literature – Formulation of Hypothesis, Identification and selection of research problems, preparation of research proposal, synopsis. Need for research design, Important concepts relating to design, Features of good design; Research designs ; Basic principles of experimental design - Pre-experimental, CRD and Quasi-Experimental designs; Types of research design: Historical design, Descriptive design, case control, cohort, cross sectional, longitudinal; Experimental and modelling skills-Introduction, selection of variables, design matrix, 2-level factorial design, 3-level factorial design, fractional factorial design, analysis of variance, Taguchi methods – orthogonal arrays, signal to noise ratio; Response Surface Methodology, Latest trends in experimental designs.

## **Unit III. Data Collection Techniques and Interpretation.**

Collection of Data: Primary Data, Meaning of Secondary data, Meaning, Relevance, limitations and cautions. Data Collection methods: Interview; Observation; Questionnaire Scope of survey based research, Types of surveys – specific, periodic and transaction driven, Identification of research problem, analysis of research problem, customer identification, categorization and sampling, planning a survey project – resources, budget and schedule, preparation of questionnaire – elements of questionnaire, sequencing questions, question formats; methods of conducting survey, data collection, analysis, and compilation of survey report, Developing tools – Validity (internal & external), Reliability of the tools. Meaning of Interpretations; Techniques of Interpretation, Precautions in Interpretations, Data Processing ; Coding, tabulations, classifications.

## **Unit IV Problem Solving and Creativity.**

Thinking processes problem solving and creativity Level and styles of thinking; common-sense and scientific thinking; examples. Problem solving strategies reformulation or rephrasing. Techniques of representation, Logical thinking, division into sub-problems, verbalization. awareness of scale; importance of graphical representation; Creativity - Some definitions, illustrations from day to day life; gift or skill; creative process; requirement of creativity- role of motivation and open v/s closed minds; multiple approaches to a problem analytical vs analogical reasoning, puzzle solving; example; prepared mind, Creative problem solving using Triz Prescriptions for developing creativity and problem solving; Communication Skills: Reading Skill :Reading tactics and strategies, Reading purpose and meaning, Reading outcomes, structure of meaning; Writing Skill: Guidelines for effective writing, Writing styles for application with personal resume, Business letter and memo including requests, complains, Technical report writing, Development of paragraph,

Development of story. Listening Skill: Barriers to listening, Effective listening skills, Attending telephone calls, Note-taking; Speaking and discussion Skill: Component of effective talk / presentation, Effective speaking skills, Discussion skills.

#### **Unit V. Research Reporting and Scientific Writing.**

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). Publication – role of author, guide, co-authors. Components of a research paper – the IMRAD system, title, authors and addresses, abstract, acknowledgements, references, tables and illustrations. Structure, style and contents; Style manuals (Chicago, Harvard, Vancouver, APA, MLA); Citation styles: Footnotes, references; Evaluation of research, Dealing with publishers – submission of manuscript, ordering reprints. Current trends in scientific research (Advanced countries, Less-Advanced countries and Global); Report writing- Significance of Report writing; Different steps in Report writing; Mechanics and precautions of writing research reports; Layout of the Research project; Types of reports and Oral presentation, Oral and poster presentation of research papers in conferences/symposia; Preparation of abstracts. Preparation and submission of research project proposals to funding agencies. Structure of Thesis and Content – Preparing Abstracts; Collaborators & Funding - Classification of Institutes, Collaborations and collaborators, Funding for research, Computers in research.

#### **Reference Books**

1. How to Write and Publish a Scientific Paper ?; Robert A. Day, Barbara Gastel ; 6th edition; Cambridge : Cambridge University ; 2006.
2. Research Methodology Methods and Techniques ; C.R. Kothari; 2nd edition; New Age International; 1990 (e-published in 2009).
3. Research Methodology Methods and Statistical Techniques ; Santosh Gupta; New Delhi: Deep & Deep Publications ; 2000.
4. Research Methodology ; Indrayan
5. E.M. Phillips and D.S. Pugh, || How to get a Ph.D-a handbook for Ph.D students and their supervisors||, Viva books Pvt. Ltd for all scholars irrespective of their disciplines.
6. Hand book of Science Communication, compiled by Antony Wilson. Jane Gregory,
7. Steve Miller, Shirely Earl. Overseas Press India Pvt. Ltd, New Delhi. First edition 2005

8. G.L Squires,|| Practical physics||, Cambridge University Press, for all scholars except those from Humanities and management Sciences.
9. Peter b Medewar,|| Advice to a Young Scientist||, Pan Books. LONDON. 1979.
- 10.D C Montgomery, Design and Analysis of Experiments