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RME001 - RESEARCH METHODOLOGY (Science & Technology)

Unit-I: Research Preparation and Planning *8 hours*

Objectives of research – Understanding research and its goals. Critical thinking. Techniques for generating research topics. Topic selection and justification. Techniques involved in designing a questionnaire – Methods of scientific enquiry – formulation of hypotheses and testing of the same – Development of a research proposal – Theoretical and Experimental Processes.

Unit-II: Research Resources *8 hours*

Sources of information. Literature search. World Wide Web, Online data bases – search tools. Citation indices - Principles underlying impact factor – literature review – Case studies, review articles and Meta analysis – record of research review -- Role of the librarian. Ethical and Moral Issues in Research, Plagiarism, tools to avoid plagiarism – Intellectual Property Rights – Copy right laws – Patent rights.

Unit-III: Academic Writing & Presentation *9 hours*

Proposal submission for funding agencies, Elements of Style. Organization of proposals, Basic knowledge of funding agencies, Research report writing, Communication skills, Tailoring the presentation to the target audience – Oral presentations, Poster preparations, Submission of research articles for Publication to Reputed journals, Thesis writing, and Research report writing. Elements of excellent presentation: Preparation, Visual and Delivery. Oral Communication skills and Oral defence.

Unit-IV: Data Collection, Analysis and Inference *11 hours*

Basic Statistical Distributions and their applications: Binomial, Poisson, Normal, Exponential, Weibull and Geometric Distributions.

Sample size determination & sampling techniques: Random sampling, stratified sampling, systematic sampling and cluster sampling.

Large Sample Tests and Small Sample Tests: Student–t-test, F-test and χ^2 test and their applications in research studies.

Correlation and Regression Analysis-Time series analysis: Forecasting methods.

Factor analysis, Cluster Analysis and Discriminant Analysis (Basic ideas only).

Principles of Experimentation, Basic Experimental Designs: Completely Randomized Design Randomized Block Design and Latin Square Design. Factorial Designs: 2^2, 2^3 and 2^4 – Accuracy, Precision and error analysis.

Unit-V: Mathematical Modelling *9 hours*

Basic concepts of modeling of Engineering systems – static and dynamic model – Model for prediction and its limitations.

System simulation -- validation.

Use of optimization techniques – Genetic Algorithm, Simulated Annealing, Particle Swarm Optimization.

References

1. Ganesan R, Research Methodology for Engineers , MJP Publishers, Chennai. 2011
2. Walpole R.A., Myers R.H., Myers S.L. and Ye, King: Probability & Statistics for Engineers and Scientists, Pearson Prentice Hall, Pearson Education, Inc. 2007.
3. Anderson B.H., Dursaton, and Poole M.: Thesis and assignment writing, Wiley Eastern 1997.
4. Bijorn Gustavii: How to write and illustrate scientific papers? Cambridge University Press.
5. Bordens K.S. and Abbott, B.b.: Research Design and Methods, Mc Graw Hill, 2008.
6. Graves N, Varma V: Working for a doctorate Toutledge 1997.
7. Graziano, A., M., and Raulin, M.,L.: Research Methods – A Process of Inquiry, Sixth Edition, Pearson, 2007.
8. Leedy., P., D.: Practical Research – Planning and Design, Eighth Edition, Pearson., 2005.
9. Kothari C.K., Research Methodology- Methods and Techniques (New Age International, New Delhi), 2004.