Savitribai Phule Pune University

(Formerly University of Pune)

Syllabus for Ph.D. (PET) Entrance Exam : Engineering

Research Methodology

1. Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific methods, understanding the language of research, Concept, Construct, definition, Variable. Research Process

2. Problem Identification & Formulation, Research Question–Investigation Question Measurement Issues.
   Hypothesis–Qualities of a good Hypothesis-Null hypothesis & Alternative Hypothesis. Hypothesis Testing–Logic & Importance–Logic & Importance

3. Research Design: Concept and Importance in Research, Features of a good research Design: Exploratory Research Design, concept, types and uses, Descriptive Research Designs: concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

4. Qualitative and Quantitative Research: Qualitative research, Quantitative research, concept of measurement, causality, generalization, replication. Merging the two approaches. Types of data and data collection techniques

5. Measurement: Concept of measurement -what is measured? Problems in measurement in research –Validity and Reliability. Levels of measurement –Nominal, Ordinal, Interval, Ratio.

6. Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample –Practical considerations in sampling and sample size.

7. Data Analysis: Data Preparation –Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis –Cross tabulations and Chi square test including testing hypothesis of association, Analysis of Variance (ANOVA)

8. Interpretation of Data and Report writing: Types of publication, Paper Writing, Layout of a Research Paper, Journals in Science, Impact factor of Journals, When and where to publish ?
   Ethical issues related to publishing, Plagiarism and Self Plagiarism.

9. Use of Encyclopedias, Research Guides, Handbook etc. Academic Databases, Patent database, e-information

10. Research tools: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX /MS Office , Software for detection of Plagiarism

Subject Concerned Syllabus
Engineering

Computer Fundamentals

- Introduction to Computer System
- Basic Building blocks of Computer
- Use and applications of Computer.
- Definitions of-- Hardware, Software, Algorithm, flowchart, Program,
- Programming language
- System software
- Application software
- Operating system
- Complier and Interpreter.
- Basic of Internet,
- WWW, Browser & Search Engines.
- Introduction to Software & Tools required for UG & PG Engineering
- Programme of-- Computer & IT / Electronics & Electronics &Telecommunication / Electrical & Instrumentation/ Mechanical & Production/ Civil.

Engineering Mathematics

1.1 Statistics

1.1.1 Measures of central tendency – Mean, Median and Mode
1.1.2 Measures of dispersion - Mean deviation, Standard deviation
1.1.3 Moments, Skewness and Kurtosis
1.1.4 Correlation and Regression

1.2 Probability

1.2.1 Sample space, Classical definition of probability and Axiomatic approach of probability
1.2.2 Addition theorem on probability, Conditional probability, Multiplication theorem on probability and Baye's theorem
1.2.3 Binomial, Poisson and Normal distributions

1.3 Differential Equations

1.3.1 Definition and basic concepts such as order, degree of a differential equation
1.3.2 Ordinary differential equation of first order
1.3.3 Linear differential equation of nth order with constant coefficients
1.3.4 Cauchy's and Legendre's Homogeneous differential equations

1.4 Matrices

1.4.1 Definition of a matrix, types of matrices
1.4.2 Algebra of matrices
1.4.3 Inverse of a matrix by Adjoint method and by Elementary transformation
1.4.4 Rank of a matrix
1.4.5 Solution of system of Linear homogeneous and non-homogeneous equations
1.4.6 Eigen values, Eigen vectors
1.4.7 Cayley Hamilton theorem

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley India).
2. Statistical Methods by S. P. Gupta, (S. Chand Publication, Delhi).
3. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).