

Department of Mathematics & Statistics
St. Xavier's College, Ranchi

Research Methodology & Data Analysis Using SPSS

Duration: 30 Hours (Theory: 15 hrs | Practical: 15 hrs)

Target Group: UG/PG Students

Course Level: Introductory to Applied

Course Fee: Rs. 3000/-

Course Code: ADC03/25-26/02

Course Rationale

Undergraduate science students often conduct experiments, field surveys, and laboratory studies but lack structured training in research methodology. This course introduces students to **scientific research design, data handling, statistical analysis, and interpretation**, with hands-on experience using SPSS.

Course Objectives

After completing the course, students will be able to:

- Understand the fundamentals of scientific research
- Formulate research problems and objectives
- Choose appropriate study designs and sampling methods
- Collect, manage, and analyze research data
- Apply basic statistical tests using SPSS
- Interpret results and prepare research reports

Course Outcomes

Students will be able to:

- Design small-scale research studies
- Perform data entry and analysis in SPSS
- Apply suitable statistical tools for biological and geological data
- Interpret statistical outputs correctly
- Write structured research reports and project proposals

Course Structure

UNIT I: Introduction to Research Methodology

- Meaning and objectives of research
- Scientific method and research process
- Types of research:
 - Basic vs Applied
 - Experimental vs Observational
 - Laboratory vs Field studies
- Research examples from life sciences and geology

UNIT II: Research Problem, Literature Review, and Ethics

- Identification of research problems
- Formulation of research questions and hypotheses
- Review of literature:
 - Sources of scientific literature
 - Use of Google Scholar, PubMed
- Research ethics:
 - Plagiarism
 - Authorship
 - Ethical approval (overview)

UNIT III: Research Design and Sampling

- Research design:
 - Experimental design
 - Case-control
 - Cross-sectional studies
- Variables and controls
- Sampling techniques:
 - Random sampling
 - Stratified sampling
 - Systematic sampling
- Sample size concept (introductory)
- Sources of bias and error

UNIT IV: Data Collection and Data Management

- Types of data in biological and geological research
- Data collection tools:
 - Laboratory experiments
 - Field surveys
 - Questionnaires
- Data coding and data entry
- Data cleaning and validation

SPSS Practical: Data entry and variable definition

UNIT V: Basic Statistical Analysis Using SPSS

- Descriptive statistics:
 - Mean, Median, Mode
 - Standard deviation and variance
- Data visualization:
 - Bar charts
 - Histograms
 - Box plots
- Interpretation of results

Hands-on: Biological and environmental datasets

UNIT VI: Hypothesis Testing and Inferential Statistics

- Concept of hypothesis testing
- Level of significance and p-value
- Parametric tests:
 - t-test
 - One-way ANOVA
- Non-parametric tests:
 - Chi-square test
- Application in life science experiments

SPSS Practical: Running and interpreting tests

UNIT VII: Correlation, Regression, and Interpretation

- Correlation analysis (Pearson, Spearman)
- Simple linear regression
- Interpretation of coefficients and R^2
- Applications in ecological and biochemical studies

SPSS Practical: Correlation and regression analysis

UNIT VIII: Research Report Writing and Presentation

- Structure of a research paper:
 - Title
 - Abstract
 - Introduction
 - Methodology
 - Results
 - Discussion
 - References
- Presentation of tables and figures
- Basics of referencing styles
- Common mistakes in reporting results