DEPARTMENT OF STATISTICS

Syllabus for Ph.D. course work

Research Methodology (including Computer Application)

Research Methodology

No. of classes: 40

1. Introduction 4

Meaning of Research, Objectives of Research, Motivation in Research ,Types of Research , Research Approaches ,Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India

2. Defining the Research Problem 2

What is a Research Problem? Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem .

3. Research Design 2

Meaning of Research Design, Need for Research Design ,Features of a Good Design ,Important Concepts Relating to Research Design ,Different Research Designs, Basic Principles of Experimental Designs.

4. Methods of Data collection and Sampling Techniques 4

Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, How to Select a Random Sample? Random Sample from an Infinite Universe, Complex Random Sampling Designs Conclusion

5. Analysis and Interpretation of Data 4

Measurement in Research, Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques.

6. Processing and Analysis of Data 4

Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation.

7. Testing of Hypotheses-I 8

What is a Hypothesis? Basic Concepts Concerning Testing of Hypotheses, Procedure for Hypothesis Testing Flow Diagram for Hypothesis Testing, Measuring the Power of a Hypothesis Test, Tests of Hypotheses, Important Parametric Tests, Hypothesis Testing of Means, Hypothesis Testing for Differences between Means, Hypothesis Testing for Comparing Two Related Samples, Hypothesis Testing of proportions, Hypothesis Testing for Difference between Proportions, Hypothesis Testing for Comparing a Variance to Some Hypothesized Population Variance, Testing the Equality of Variances of Two Normal Populations, Hypothesis Testing of Correlation Coefficients, Limitations of the Tests of Hypotheses.

8. Analysis of Variance and Covariance 4

Analysis of Variance (ANOVA) ,What is ANOVA? The Basic Principle of ANOVA ,ANOVA Technique, Setting up Analysis of Variance Table, Short-cut Method for One-way ANOVA, Coding Method, Two-way ANOVA ,ANOVA in Latin-Square Design, Analysis of Co-variance (ANOCOVA), ANOCOVA Technique, Assumptions in ANOCOVA.

9. Testing of Hypotheses-II (Nonparametric or Distribution-free Tests) 2

Important Nonparametric or Distribution-free Test.

Relationship between Spearman's *r* and Kendall's *W*.

Characteristics of Distribution-free or Non-parametric Tests.

10. Multivariate Analysis Techniques 2

Growth of Multivariate Techniques.

Characteristics and Applications.

Classification of Multivariate Techniques.

Variables in Multivariate Analysis.

11. Interpretation and Report Writing 4

Meaning of Interpretation.

Why Interpretation?

Technique of Interpretation.

Precaution in Interpretation.

Significance of Report Writing.

Different Steps in Writing Report .

Layout of the Research Report .

Types of Reports.

Oral Presentation.

Mechanics of Writing a Research Report.

Precautions for Writing Research Reports .

Reference: Kothari- Research Methodology.

R programming No. of classes: 48

Session 1: Basics of R programming; numerical arithmetic, simple manipulation of vectors, descriptive statistics on univariate data.

Session 2: Bivariate data, factors, descriptive statistics.

Session 3: Arrays and matrices, matrix operations.

Session 4: Lists and dataframes, *attach, detach, read.table,* accessing datasets from other R packages.

Sessions 5 to 7: Probability distributions, sampling with and without replacement, different aspects of a probability distribution in R.

Sessions 7 to 9: *Q-Q plots*, standard statistical tests.

Sessions 10 to 12: Grouped expressions, conditional statements, loops, *for, while*. Functions in R: built-in functions and user-defined functions.

Sessions 13 & 14: Vectorized calculations; *apply, tapply* etc.

Sessions 14 to 18: Statistical models in R; formulae for statistical models, linear models, generic functions for extracting model information, ANOVA, updating fitted models, GLM, NLS, maximum likelihood models.

Sessions 19 & 20: Graphical procedures, high level and low level plotting commands, graphical parameters.

Sessions 21 & 24: Standard packages from R; some nonstandard statistical models.

Session = 2 class periods

References:

1. An Introduction to R; manual from www.r-project.org
2. W.N. Venables & B.D.Ripley: Modern Applied Statistics with S plus.
3. Kajal Dihidar: A beginner's guide to R-programming. Lecture notes, Indian Statistical Institute.