X. Suggested Reading

- Gerald CF and Wheatley PO. 2003. *Applied Numerical Analysis*, Pearson, 7th Edition.
- Jain MK, Iyengar SRK and Jain RK. 2012. *Numerical Methods for Scientific and Engineering Computation*, New Age International Publishers, 6th edition.
- Chappra SC. 2014. *Numerical Methods for Engineers*, McGraw-Hill Higher Education; 7th edition.
- Mathew JH. 1992. *Numerical Methods for Mathematics*, Science and Engineering, Prentice Hall, 2nd edition,
- Burden RL and Faires JD. 2004. *Numerical Analysis*, Brooks Cole, 8th edition.
- Atkinson K and Han W. 2004. *Elementary Numerical Analysis*, John Willey & Sons, 3rd Edition.

I. Course Title : Statistical Methods for Research Workers

II. Course Code : STAT 501

III. Credit Hours : 2+1

IV. Aim of the course

To expose students to various statistical techniques for analysis of data and interpretation of results.

V. Theory

Unit I

Probability and probability distributions. Principle of least squares. Linear and non-linear regression. Multiple regression. Correlation analysis. Selection of variables. Validation of models. Sampling techniques. Determination of sample size. Sampling distribution of mean and proportion.

Unit II

Hypothesis testing. Concept of p-value. Student's t-test. Large sample tests. Confidence intervals. ANOVA and testing of hypothesis in regression analysis. Analysis of variance for one way and two way classification (with equal cell frequency).Transformation ofdata.

Unit III

Advantages and disadvantages of nonparametric statistical tests. Scales of measurements. Run-test. Sign test. Median test. Wilcoxon-Mann Whitney test. Chi-square test. Kruskal-Walli's one way and Friedman's two way ANOVA by ranks. Kendall's Coefficient of concordance.

VI. Practical

Fitting of distributions. Sample and sampling distributions. Correlation analysis. Regression analysis (Multivariate, quadratic, exponential, power function, selection of variables, validation of models, ANOVA and testing of hypothesis). Tests of significance (Z-test, t-test, F-test and Chi-square test). Analysis of variance. Non-parametric tests.

VII. Learning outcome

The students will be able to understand different techniques for analyzing the data of their research work.

VIII. Lecture Schedule

S.No.	Topics	No. of Lectures
1.	Elementary statistics	
2.	Probability theory	2
3.	Probability distributions (Binomial, Poisson and Normal)	3
4.	Sampling techniques, Determination of sample size	2
5.	Sampling distribution of mean and Proportion	1
6.	Hypothesis testing concept of p-value	1
7.	Large sample (mean, proportion)	1
8.	Student's t-test (Single mean, Difference of mean for independent samples and paired observations) and F-test	3
9.	Analysis of variance (one way and two way), Transformation of data	2
10.	Correlation analysis and testing (Bivariate, Rank, Intra-class, Partial, Fisher's Z-transformation)	2
11.	Multiple linear regression and model validation	2
12.	Testing of coefficient of determination and regression coefficient	2
13.	Selection of variables in regression (forward substitution method and step-wise regression)	1
14.	Non-Linear regression (Quadratic, exponential and Power)	2
15.	Introduction to Non-parametric and scales of measurements	1
16.	Chi-square test (Goodness of fit, Independence of attributes, homogeneity of variances)	2
17.	One Sample test (Sign test, Median test, Run rest,)	2
18.	Two sample test (Wilcoxon Sign test, Mann Whitney test, Chi square test for two independent samples)	1
19.	K-Sample (Kruskal-Walli's test and Friedman's two way ANOVA)	2
20.	Kendall's coefficient of concordance	1
	Total	**33**

IX. List of Practicals

S.No.	Topics	No. of Practicals
1.	Elementary statistics	1
2.	Probability distributions (Binomial, Poisson and Normal)	1
3.	Sampling techniques, Determination of sample size, Sampling distribution of mean and Proportion	1
4.	Large sample (mean, proportion)	1
5.	Student's t-test (Single mean, Difference of mean for independent samples and paired observations) and F-test	1
6.	Analysis of variance (one way and two way), Transformation of data	2
7.	Correlation analysis and testing (Bivariate, Rank, Intra-class, Partial, Fisher's Z-transformation)	1
8.	Multiple linear regression and model validation	1
9.	Testing of coefficient of determination and regression coefficient	
10.	Selection of variables in regression (Forward substitution method and step-wise regression)	1
11.	Non-Linear regression (Quadratic, exponential and Power)	2
12.	Introduction to Non-parametric and scales of measurements	
13.	Chi-square test (Goodness of fit, Independence of attributes, homogeneity of variances)	2
14.	One Sample test:Sign test, Median test, Run rest, Two sample test: Wilcoxon Sign test, Mann Whitney test, X^2 test for two independent samples	1

S.No.	Topic	No. of Practicals
15.	K-Sample: Kruskal-Walli's test and Friedman's two way ANOVA, Kendall's coefficient of concordance	1
	Total	**16**

X. Suggested Reading

- Anderson T W 1958. *An Introduction to Multivariate Statistical Analysis*. John Wiley.
- Dillon W R and Goldstein M. 1984. *Multivariate Analysis - Methods and Applications*. John Wiley.
- Electronic Statistics Text Book: http://www.statsoft.com/textbook/stathome.html
- Goon A M, Gupta M K and Dasgupta B. 1977. *An Outline of Statistical Theory*. Vol. I. The World Press.
- Goon A M, Gupta M K and Dasgupta B. 1983. *Fundamentals of Statistics*. Vol. I. The World Press.
- Hoel P G. 1971. *Introduction to Mathematical Statistics*. John Wiley.
- Hogg R V and Craig T T. 1978. *Introduction to Mathematical Statistics*. Macmillan.
- Montgomery and Runger 2014. *Applied Statistics and Probability for Engineers*. John Wiley
- Morrison D F. 1976. *Multivariate Statistical Methods*. McGraw Hill.
- Siegel S, Johan N and Casellan Jr. 1956. *Non-parametric Tests for Behavior Sciences*. John Wiley.

I. Course Title : Experimental Designs

II. Course Code : Stat 502

III. Credit Hours : 1+1

IV. Aim of the course

To acquaint and equip the students with the basic principles of theory of designs and analysis of experiments.

V. Theory

Unit I

Basic principles of experimental designs. Uniformity trials. Completely randomized design, randomized block design and latin square designs. Multiple comparison tests.

Unit II

Missing plot techniques. Analysis of covariance. Factorial experiments:2^2, $2^3$and 3^2. Split plot design. Strip plot design. Factorial in split plot design.

Unit III

Crossover designs. Balanced incomplete block design. Response surface designs. Groups of experiments.

VI. Practical

Uniformity trials. Completely randomized design. Randomized block and latin square designs. Missing plot and analysis of covariance Split plot designs. Factorial in split plot design. Strip plot designs. Cross over and balanced incomplete block designs. Groups of experiments.

VII. Learning outcome

The students will be able to plan and design the experiments for their research.