

**PAPER NO-8: PROBABILITY AND STATISTICAL METHODS - IV**

1. Sampling Distribution
  - 1.1 Definitions of random sample, parameter and statistic
  - 1.2 Concept of Sampling distribution of a statistic, sample mean and standard error
  - 1.3 Standard error of sample mean and sample proportion
2. Test of Significance and Large Sample Theory
  - 2.1 Null and alternative hypotheses
  - 2.2 Level of significance and probabilities of Type I and Type II errors
  - 2.3 Critical region and p-value
  - 2.4 Large sample tests
  - 2.5 Use of C.L.T. for testing single proportion, difference of proportions, single mean, difference of means, standard deviation and difference of standard deviations
3. Chi-Square ( $\chi^2$ ) Distribution
  - 3.1 Sampling Distribution of  $\chi^2$
  - 3.2 Moment generating functions of  $\chi^2$
  - 3.3 Theorems based on  $\chi^2$  distribution
  - 3.4 Applications of  $\chi^2$
4. t Distribution and F Distribution
  - 4.1 p.d.f. of t-distribution and its properties
  - 4.2 p.d.f. of F-distribution and its properties
  - 4.3 Distribution of sample Correlation coefficient r when  $\rho = 0$
  - 4.4 Tests of significance based on t and F Distributions
5. Order Statistics
  - 5.1 Distribution of  $r^{\text{th}}$  order statistics and its p.d.f.
  - 5.2 Distribution of smallest and largest order statistics
  - 5.3 Joint distribution of  $r^{\text{th}}$  and  $s^{\text{th}}$  order statistics
  - 5.4 Distribution of sample median and sample range

**WEEK-WISE DETAILS**

**Week 1-2: Sampling distribution.**

- Mood, A.M., Graybill, F.A. and Boes, D.C. (2007): *Introduction to the Theory of Statistics*, 3<sup>rd</sup> Edition (Reprint), Tata McGraw-Hill Pub. Co. Ltd. pp. 222-230
- Hogg, R.V. and Tanis, E.A. (2009): *A Brief Course in Mathematical Statistics*, Pearson Education. pp.14.4-14.6, 14.23-14.25

**Week 3-4: Test of significance and large sample theory**

- Freund, R.J and William J. Wilson (2003): *Statistical Methods*, 2<sup>nd</sup> Edition, Academic Press. pp. 117-130
- Walpole, Ronald E., Myers, Raymond H., Myers, Sharon L. and Ye, Keying (2011): *Probability and Statistics for Engineers and Scientists*, 9th Edition, Prentice Hall, pp. 321-340
- Hogg, R.V. and Tanis, E.A. (2009): *A Brief Course in Mathematical Statistics*. Pearson Education, pp. 14.8-14.25, 14.25-14.36

**Week 5-7: Chi-Square ( $\chi^2$ ) distribution**

- Rohatgi, V. K. (1975): *Introduction to Probability theory and Mathematical Statistics*, Wiley Eastern Limited, pp.311-315
- Hogg, R.V. and Tanis, E.A. (2009): *A Brief Course in Mathematical Statistics*, Pearson

Education, pp. 15.24-15.41

### **Week 8-10: t and F Distributions**

- Hogg, R.V. and Tanis, E.A. (2009): *A Brief Course in Mathematical Statistics*. Pearson Education, pp.16.2-16.10,16.12-16.25, 16.26-16.28, 16.29-16.36,16.36-16.40

### **Week 11-12: Order Statistics**

- David, H.A. and Nagaraja, H.N. (2003): *Order statistics*, 3<sup>rd</sup> Edition, John Wiley and Sons. pp. 2-14

## **Practical/ Lab work**

### **LIST OF PRACTICALS**

1. Large Sample Tests (Based on normal distribution)
  - a. Testing of significance for single proportion and the associated consideration of confidence interval
  - b. Testing of significance for difference of two proportions and the associated construction of confidence interval
  - c. Testing of significance for single mean and the associated construction of confidence interval
  - d. Testing of significance for difference of two means and the associated construction of confidence interval
  - e. Testing of significance for difference of two standard deviations
2. Small Sample Tests (Based on Chi-Square Distribution)
  - a. Testing if the population variance has a specific value
  - b. Testing of goodness of fit
  - c. Testing of independence of attributes based on 2 X 2 contingency table without and with Yates' corrections
  - d. Based on 2 X k contingency table using Brandt and Snedecor formula
  - e. Testing of the homogeneity of several population variance
  - f. Pooling of various probabilities obtained from independent tests of significance to give a single test of significance of the aggregate of these tests
  - g. Testing of the homogeneity of the population correlation coefficients
3. Small Sample Tests (Based on t and F – Distribution)
  - a. Testing if the sample means differs significantly from the hypothetical value of the population mean and the associated construction of confidence interval
  - b. Testing of the significance of the difference between two means and the associated construction of confidence interval
  - c. Applying the paired t-test for difference of means
  - d. Testing of the significance of an observed sample correlation coefficient
  - e. Testing of the significance of an observed regression coefficient
  - f. Testing of the significance of an observed partial correlation coefficient
  - g. Testing if the sample means differs significantly from the hypothetical value of the population mean and the associated construction of confidence interval
  - h. Testing of equality of two population variances