STATISTICS (CODE NO. 08)

1. Probability (25 % weight)

Random Experiment, sample space, event, algebra of events, classical, Statistical and axiomatic definitions of probability . Basic theorems of probability and simple examples based there on, conditional probability of an event, independent events, Bayes' theorem and its applications. Discrete and continuous random variables and their distributions, expectation, moments, moment generating function. Joint distribution of two random variables, marginal and conditional distributions, independence of random varibles. Discrete Uniform, Binomial, Geometric,Negative-binomial,Hypergeometric,Poission, Uniform, beta, exponential , gamma, Cauchy, normal, and bivariate normal distributions, Chebyshev's inequality. weak law of large numbers and central limit theorem for independent and identically distributed random variables with finite variance and its simple applications.

2. Statistical Methods (25 % weight)

Concept of a statistical population and a sample, types of data, presentation and summarization of data, measures of central tendency, dispersion, skewness and kurtosis, measures of association and contingency, correlation, rank correlation, correlation ratio, simple and multiple linear regression, multiple and partial correlations (for three variables only) . Curve-fitting and principle of least squares, concepts of random sample, parameter and statistic. Z and χ^2 (Chi-square) , t and F statistics and their applications .

3. Statistical Inference (25 % weight)

Concept of statistic and its sampling distribution. Point estimate of a parameter. Concept of bias and standard error of an estimate . Standard errors of sample mean and sample proportion. Sampling distrubution (withoutproof) of mean of normal distribution. Independence of sample mean and variance in random sampling from a normal distribution (withoutproof).

Statistical Tests and interval Estimation : Null and alternative hypotheses. Types of errors, p-values. Statement of Chi-square, t, and F. statistics. Testing for the mean and variance of univariate normal distribution, testing of equality of two means and testing of equality of two variances of two independent univariate normal distributions. Related confidence intervals. Testing for the significance of sample

correlation coefficient in sampling from bivariate normal distibution and for the equality of means in sampling from bivariate normal distribution.

Large sample tests : Use of central limit theorem for testing and its applications to interval estimation of a single mean, a single proportion, difference of two means and two proportions. Fisher's Z-transformation and its uses. Pearson's Chi-square test for goodness of fit. Contingency table and test of independence in a contingency table

Non-parametric tests : Sign test for univariate and bivariate distrbutions, Wilcoxon-Mann-Whitney test, Run test, Median test, and Spearman's rank correlation coefficient test.

4. Sampling theory, Design of Experiments and Quality Control (25 % weight)

Sample Survery, Concepts of population and sample, need for sampling, Census and sample survey, basic concepts in sampling organizational aspects of survey sampling, Sample selection and sample size . Some basic sampling methods- simple random sampling (SRS) with and without replacement. Stratified random sampling. Systematic Sampling. Ratio and regression methods of estimation under SRS. Non sampling errors,

Analysis of varinace for one way and two-way classifications (with one observation per cell). Fundamental principles of design. Basic designs – CRD, RBD ,LSD and their analysis. Factorial designs - 2^n ($n \leq 4$) designs, Main effects and interaction effects and confounding in 2^3 design (complete confounding)

Concepts of quality and meaning of control. Different types of control charts ($\bar{X}$, R, p , np and c). Sampling inspection-single and double sampling plans for attributes. OC , ASN and ATI curves Concepts of producer's and consumer's risks .