## STATISTICS—CODE NO. (17)

**Probability :**

Random experiment, sample space, event, algebra of events, probability on a discrete sample space, basic theorems of probability and simple examples based thereon, conditional probability of an event, independent events, Bayes' theorem and its application, discrete and continuous random variables and their distributions, expectation, moments, moment generating function, joint distribution of two or more random variables, marginal and conditional distributions, independence of random variables, covariance, correlation, co-efficient, distribution of function of random variables. Bernoulli, binomial, geometric, negative binomial, hypergeometric, Poisson, multinomial, uniform, beta, exponential, gamma, Cauchy, normal, lognormal and bivariate normal distributions, real-life situations where these distributions provide appropriate models, Chebyshev's inequality, weak law of large numbers and central limit theorem for independent and identically distributed random variables with finite variance and their simple applications.

**Statistical Methods :**

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, intraclass correlation, correlation ratio, simple and multiple linear regression, multiple and partial correlations (involving three variables only), curve-fitting and principle of least squares, concepts of random sample, parameter and statistic, Z, $X^2$, t and F statistics and their properties and applications, distributions of sample range and median (for continuous distributions only), censored sampling (concept and illustrations).

**Statistical Inference :**

Unbiasedness, consistency, efficiency, sufficiency, Completeness, minimum variance unbiased estimation, Rao-Blackwell theorem, Lehmann-Scheffe theorem, Cramer-Rao inequality and minimum variance bound estimator, moments, maximum likelihood, least squares and minimum chisquare methods of estimation, properties of maximum likelihood and other estimators, idea of a random interval, confidence intervals for the Parameters of standard distributions, shortest confidence intervals, large-sample confidence intervals.

Simple and composite hypotheses, two kinds of errors, level of significance, size and power of a test, desirable properties of a good test, most powerful test, Neyman-Pearson lemma and its use in simple examples, uniformly most powerful test, likelihood ratio test and its properties and applications.

Chi-square test, sign test, Wald-Wolfowitz runs test, run test for randomness, median test, Wilcoxon test and Wilcoxon-Mann-Whitney test.

Wald's sequential probability ratio test, OC and ASN functions, application to binomial and normal distributions.

Loss function, risk function, minimax and Bayes rules.

**Sampling Theory and Design of Experiments :**

Complete enumeration *vs.* sampling, need for sampling, basic concepts in sampling, designing large-scale sample surveys, sampling and non-sampling errors, simple random sampling, properties of a good estimator, estimation of sample size, stratified random sampling, systematic sampling, cluster sampling, ratio and regression methods of estimation under simple and stratified random sampling, double sampling for ratio and regression methods of estimation, two-stage sampling with equal-size first-stage units.

Analysis of variance with equal number of observations per cell in one, two and three-way classifications, analysis of covariance in one and two-way classifications, basic priniciples of experimental designs, completely randomized design, randomized block design, latin square design, missing plot technique, $2^2$ factorial design, total and partial confounding, $3^2$ factorial experiments, split-plot design and balanced incomplete block design.