TRIBHUVAN UNIVERSITY

INSTITUTE OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICAL SCIENCES
Bachelor in Mathematical Sciences (B.Math.Sc.)

Course of Study

Code No.: MSST 251   *Full Mark*: 75
Paper: **Applied Probability Models**   *Pass Mark*: 30
Nature: Theory   *Credit*: 3

Course Description:

The main objective of the course is to teach students on sampling distribution, estimation, testing of hypothesis and statistical tests.

Learning Objectives:

The main objective of the course is to teach students on sampling distribution, estimation, testing of hypothesis and statistical tests.

Mode of Delivery:

The course will be taught by lecture (48 hrs), and problem solving and class discussion (24 hrs). The use of spreadsheet software for problem solving will be encouraged.

***Contents*:**

Unit 1 Sampling Distributions   **10 hrs**
Definition of a random sample, parameter and statistic, sampling distribution of a statistic, sampling distribution of the sample mean, proportion and sample variance (SRS with/ without replacement), standard errors of sample mean and proportion, independence of sample mean and sample variance, estimation of sample size. Exact sampling distributions: Definitions of central χ^2, t and F random variables, probability distributions of central χ^2, t and F and their properties, inter-relations between the distributions, applications of χ^2, t and F distribution in statistics.

Unit 2 Estimation, Estimators and Confidence Intervals   **10 hrs**
Point estimation: Estimation of parameters, characteristics and properties of a "Good" estimator: unbiasedness, consistency, efficiency and sufficiency and completeness; likelihood function and its properties, Methods of estimation: Maximum likelihood estimation of parameters of binomial, Poisson and normal distribution, properties of maximum likelihood estimator, methods of moments.
Interval estimation: Confidence interval and confidence limits, method for obtaining confidence limits, confidence intervals of mean, variance and difference between means from normally distributed population, confidence interval for proportion, large sample confidence intervals.

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Unit 3 Testing of Hypothesis **8 hrs**

    Testing of hypothesis: Statistical hypothesis, simple and composite hypotheses, test of statistical hypothesis: null and alternative hypotheses, type I and type II errors, level of significance, critical region, power of the test, one tailed and two tailed tests, p-value in testing of hypothesis, likelihood ratio test and its properties.

Unit 4 Statistical tests **10 hrs**

    One sample tests for mean of normal population (for known and unknown variance), test for proportion, test for difference between two means and two proportions, paired sample t-test, two independent sample tests for variances of normal populations, relationship between hypothesis testing and confidence interval, one way and two way ANOVA, tests of significance of simple correlation and regression coefficients, Chi-squared tests for independence of attributes and goodness of fit.

Unit 5 Bivariate distributions **10 hrs**

    Notion of bivariate random variable, bivariate distributions (discrete and continuous variables): Joint, marginal and conditional distributions, independence of random variables; Transformations of random variables: Jacobian of transformations, distributions of sum, product and ratio of random variables.

Reference Books:
1. Shrestha, H.B., *Statistical Inference*, Ekta Books
2. Rohatgi, V. K. (1984) *Statistical Inference*, Wiley, New York.
3. Hogg R.V and Criag, A.T (1978). *Introduction to mathematical statistics, 4th edition,* MacMillan Publishing Co., Inc., USA.
4. Kanji, G. K. (1999). 100 Statistical Tests, SAGE Publications Ltd., India.
5. Hogg, R. V., Tanis, E. A. & Rao, J. M. (2000) *Probability and Statistical Inference, 7th Edition,* Pearson Education Inc., India.

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