

## **STAT-801 Probability Theory (3 Credit Hours)**

### **1. Objectives**

This course aims to introduce students the advanced Probability theory and related applications.

### **2. Course Contents**

Introduction to probability. Random variables and distribution function. Probability mass and density functions, independence, indicators and matching. Dependence, conditional distributions, conditional expectation and sums of random variables. The multivariate normal distribution, distributions arising from the normal distribution and distribution based sampling. Coupling and Poisson approximation and geometrical probability. Generating functions with some applications. Characteristic functions with some applications. Inversion, continuity, limit and large deviation theorems. Markov processes, classification of states and chains, and stationary distributions. Martingales convergence theorem, its prediction and conditional expectation. Uniform integrability.

### **3. Recommended Books**

- i. Grimmett and Stirzaker. Probability and Random Processes, 3rd Edition, Oxford Science Publications, (2001)
- ii. Berger, Marc, An introduction to probability and stochastic processes, Springer-Verlag (1993).
- iii. Robert, B.A., Basic Probability Theory. Dover Publication. (2008).
- iv. Stirzaker, D., Probability and Random Variables, 3rd Edition. Cambridge University Press, Cambridge. (2001).
- v. Hogg R. V. and Craig A. T., Introduction to Mathematical Statistics, 7th Edition. Prentice-Hall Int. Inc. New Jersey. (2013).

### **4. Outcomes**

On successful completion of this course, students will be able to understand and evaluate dependent, independent random variables' distributions, generating functions, characteristic functions, and their applications including Markov chain, martingales and uniform integrability.