Semester	**Six**
Course	**Minor**
Paper Code	**B3ST230611T**
Paper Title	**Probability Theory and Sampling Distribution**
No. of Credits	**4**
Theory/Composite/ Practical	**Theory**
Minimum No. of preparatory hours per week a student has to devote	**4**
Number of Modules	**1**
Syllabus	**UNIT 1:** Random experiments, sample space, events and algebra of events. Classical definition of probability, theorems regarding union and intersections of events, Boole's inequality and Bonferroni's inequality. Conditional probability and Bayes' Theorem. Independence of events. Frequency and Axiomatic definitions of probability. [18L] **UNIT 2:** Random variable and its probability distribution, cumulative distribution function, probability mass function, probability density function. Moment and quantile measures of central tendency, dispersion, skewness and kurtosis. Bivariate probability distribution. [13L] **UNIT 3:** Concept of theoretical distributions. Binomial, Poisson, Hypergeometric, Geometric, Rectangular, Normal, Exponential, Bivariate Normal Distribution – properties and applications. [13L] **UNIT 4**: Population and Sample. Random Sample. Parameter and Statistic. Sampling fluctuations, sampling distribution and standard error. Sampling distributions arising out of normal population – $\chi 2$, t, F (definition and statement of properties). Distribution of sample mean, sample variance and their independence in case of normal population (statement only). [8L]
Learning Outcomes	1. *Define* fundamental probability concepts, *explain* the different approaches, and *apply* probability theorems and inequalities to *analyze* event relationships. 2. *Describe* probability distributions and their functions, and *compute* moments and quantile-based measures to *interpret* data characteristics. 3. *Identify* key discrete and continuous probability distributions, *examine* their properties, and *apply* them to *solve* real-life statistical problems. 4. *Differentiate* between parameters and statistics, *explain* sampling fluctuations, and *apply* properties of χ^2, t, and F distributions to *evaluate* sample-based inferences.
Reading/ Reference list	1. A. M. Gun, M. K. Gupta and B. Dasgupta: ***Fundamentals of Statistics (Volume One)***, The World Press Private Limited; 2005. 2. Hogg RV, McKean JW, Craig AT. **Introduction to mathematical statistics**. Pearson Education India; 2013. 3. Ross SM. **A first course in probability**. Harlow, UK: Pearson; 2020.

Evaluation	CIA: 30 Semester Exam: 70	
Paper Structure for Semester Exam	**Short Questions (5 Marks Each)**	**Long Questions (15 Marks Each)**
	5 out of 7	3 out of 5