Semester	**4**
Course	**Minor [Economics +Computer Science]**
Paper Code	**B2MT230421T**
Paper Title	**Probability theory and Calculus-2**
No. of Credits	**4**
Theory / Practical / Composite	**Theory**
Minimum No. of preparatory hours per week a student has to devote	**4**
Number of Modules	**Nil**
Syllabus	**Probability Theory [40]:** Experiments: Deterministic and Non-deterministic; Sample space connected to different random experiments, examples [finite, countably infinite and uncountable]. [1] Events: Elementary and compound events, examples. Formation of new events through different algebraicoperations on them [union, intersection, complement].[1] Definitions of sure event ; impossible event, mutually exclusive events along with examples.[1] Idea of pair-wise disjoint /mutually exclusive, mutually exhaustive events for a class of events, examples.[1]. Introduction to the idea of probability: different interpretations: Frequency interpretation; Classical interpretation [criticism or shortcomings of this approach, problems] [1] Kolmogorov's Axiomatic approach[Kolmogorov's probability axioms].[1] Properties of probability function.[2] Boole's and Bonferroni's inequality [1] Conditional Probability. definition, examples,.[2] multiplication ruleof probability, Bayes' theorem, related problems. [2] Independence of two events. extension to a finite/ countably infinite collection of events, pairwise and mutual independence, problems. Trials. Independent trials [Bernoulli][1] Introduction to random variables: Distribution function. Properties.[3] Classification of random variables: discrete and absolutely continuous random variables. Probability mass function and probability density function and properties[3]Transformation of one dimensional random variable (discrete and absolutely continuous) and related problems.[2] Examples of Discrete and Absolutely Continuous random variables: Binomial, Poission , Uniform, Normal .[2]Moments for univariate distributions. Raw and central. Properties , Expectation

	and variance and related problems [4]. Two-dimensional random variable: definition and examples [1], joint distribution function. Properties; marginal distributions; joint probability mass function and joint probability density function definition.[4]; transformation for two dimensional random variables and related problems [3] Conditional distribution functions for discrete and continuous random variables; Conditional Moments; Correlation Co-efficient and its properties [4] **Calculus-2 [12]:** Functions of two variables[12]: Partial derivative: knowledge and use of chain rule. Exact differentials: definition and examples (emphasis on problem solving only)(4). Successive partial derivatives: statement of Schwarz's theorem on commutativity of mixed partial derivatives(3)Unconstrained optimization of functions of two variables, Lagrange's method of constrained optimization—problems only(5).
Learning Outcomes	Upon successful completion of the course a student will be able to do the following. • Understand the concept of randomness through introduction to random experiments and probability theory. • Understanding conditional probability, Bayes theorem and its applications. • Getting introduced to random variables and probability distribution function. • Understanding transformation applied to univariate distributions and its applications. • Learning bivariate random variables and their distributions, understanding conditional expectation and applying it to regression. • Getting introduced to partial derivatives and chain rule. • Understanding optimization of functions of two variables: unconstrained and constrained.
Reading/Reference Lists	• Mathematical Probability: Banerjee, De, Sen. • Introduction to Probability Theory: Sheldon Ross. • Basic Probability Theory: Robert B Ash. • Mathematical Analysis: Malik & Arora. • Real Analysis: S.K.Mapa. • Differential Calculus: An Introduction to Analysis: Maity & Ghosh.
Evaluation	End Sem:70 CIA:30
Paper Structure for Theory Semester Exam	7 questions each carrying 10 marks out of 13/14 questions.