Semester	**THREE**
Course	**Major**
Paper Code	**C2ST230321T**
Paper Title	**Sampling Distributions**
No. of Credits	**4**
Theory / Practical /Composite	**Theory**
Classes per week	**4**
Module	**1**

Course Outcomes

1. **Remember** the concepts of population, sample, parameter, statistic, sampling distribution, and standard error in the context of theoretical distributions.
2. **Understand** the derivation of distributions of functions of random variables and the properties of sampling distributions arising from normal populations.
3. **Apply** transformation techniques, moment generating functions, and distribution theory to obtain sampling distributions of statistics.
4. **Analyze** sampling distributions related to univariate and bivariate normal distributions, including distributions of sample mean, variance, correlation, and regression coefficients.
5. **Evaluate** the properties and applicability of χ^2, t, F, and non-central distributions in statistical inference problems.
6. **Create** sampling distributions and formulate statistical results involving order statistics and derived random variables for theoretical problem-solving.

Syllabus

Unit/Module	Content	No. of lectures	CO mapping	Cognitive levels
Unit 1	***Introduction*:** Concepts of population and sample, parameter and statistics in the context of theoretical distributions. Notion of sampling distribution of a statistic and its standard error.	5	CO1	K1
Unit 2	***Functions of random variables:*** Derivations of distributions of functions of random variables using distribution function, moment generating function and transformation of variables. Concept of Jacobian of transformation. Additive property of independent random variables. Orthogonal and polar transformations.	17	CO2 CO3	K2 K3
Unit 3	***Sampling distributions arising from univariate normal distribution***:			

	χ_2, t and F distributions and their properties. Distribution of sample mean and variance. ***Sampling distributions arising from bivariate normal distribution:*** Joint Distribution of sample means, variances, correlation coefficient (null case) and regression coefficients. ***Non Central distributions:*** Definitions of non-central χ_2, t and F. Simple properties related to non-central distributions (statements only).	15 6 3	CO4 CO5 CO5	K4 K5 K5
Unit 4	***Order statistics:*** Sample order statistics and their distributions. Distribution of sample range.	4	CO6	K6

Reading/Reference list

1. Goon, A.M. Gupta, M.K. and Dasgupta, B. (2003): An outline of Statistical Theory, Vol. 1, 4th Edn.World Press, Kolkata.
2. Rohatgi V.K. and Saleh, A. K. Md , E. (2009): An Introduction to Probability and Statistics, 3rd edition (Reprint), John Wiley and Sons.
3. Casella, G. & Berger, R.L. (2021): Statistical Inference. Cengage Learning.
4. Mood, A.M.; Graybill, F.A. & Boes, D.C.(1974): Introduction to the theory of Statistics, 3rd edition. McGraw- Hill series.
5. Freund, J.E.(2021): Mathematical Statistics with applications. 8th Edition. Pearson

Evaluation

Marks	Theory CIA: 30 Semester Exam: 70	Practical (Not applicable)
Paper Structure for Semester Exam	Short Questions (5 Marks Each)	Long Questions (15 Marks Each)
	5 out of 7	3 out of 5

CO	CO Description	Cognitive levels
CO1	**Remember** the concepts of population, sample, parameter, statistic, sampling distribution, and standard error in the context of theoretical distributions.	K1
CO2	**Understand** the derivation of distributions of functions of random variables and the properties of sampling distributions arising from normal populations.	K2

CO3	**Apply** transformation techniques, moment generating functions, and distribution theory to obtain sampling distributions of statistics.	K3
CO4	**Analyze** sampling distributions related to univariate and bivariate normal distributions, including distributions of sample mean, variance, correlation, and regression coefficients.	K4
CO5	**Evaluate** the properties and applicability of χ^2, t, F, and non-central distributions in statistical inference problems.	K5
CO6	**Create** sampling distributions and formulate statistical results involving order statistics and derived random variables for theoretical problem-solving.	K6