

# UNIVERSITY OF MADRAS

## B.Sc. DEGREE PROGRAMME IN MATHEMATICS

SYLLABUS WITH EFFECT FROM 2023-2024

<b>Title of the Course</b>		<b>MATHEMATICAL STATISTICS THEORY AND PRACTICAL</b>					
<b>Paper Number</b>							
<b>Category</b>	Elective	<b>Year</b>	II	<b>Credits</b>	3	<b>Course Code</b>	234E3A
		<b>Semester</b>	III				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		3		1		--	4
<b>Pre-requisite</b>		12 <sup>th</sup> Standard Mathematics					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Students gain knowledge about Random Variables, Generating Functions, Correlation and Regression. <b>Elective for B.Sc Mathematics</b></li> <li>• They also learn the basic concepts of Standard Distributions, estimation theory and finding the method of estimators.</li> <li>• Also, they learn some concepts in testing of hypothesis.</li> </ul>					
<b>Course Outline</b>		<b>UNIT – I:</b> Random variables (discrete and continuous), Distribution function - expected values and Moments – Moment generating function- Characteristic function – Uniqueness Theorem (Statement Only) Chebychev’s inequality – Simple problems <b>Hours: 12</b>					
		<b>UNIT-II:</b> Concepts of bivariate distributions – Correlation & Regression – Rank Correlation Coefficient – Simple Problems <b>Hours: 12</b>					
		<b>UNIT-III:</b> Standard Distributions Normal - Uniform distributions – Sampling Theory – Sampling Distributions – Concept of Standard error – Sampling Distribution based on Normal, t, Chi-Square and F distributions. <b>Hours: 12</b>					
		<b>UNIT-IV:</b> Estimation - Introduction – Concept of Unbiasedness – Consistency, Efficiency And Sufficiency – Cramer Rao Inequality – Method of Estimation – Maximum likelihood Function. <b>Hours 12</b>					
		<b>UNIT-V:</b> Test of Significance – Tests of Hypothesis – Type I and Type II Errors – Large Sample Test – Exact test based on Normal, t, Chi-Square and F distributions with respect to Population Mean and Variance - Test of Independence of Attributes based on contingency tables – Goodness of fit based on Chi-Square – Simple Problems. <b>Hours 12</b>					
		<b>Total Hours: 60</b>					
<b>Extended Professional Component (is apart of internal component only, Not to be included in the External Examination question paper)</b>				Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved  (To be discussed during the Tutorial hour)			

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<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Recommended Text</b>	Elements of Mathematical Statistics by S.C.Gupta & V.K Kapoor – S.Chand & Co
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Fundamentals of Mathematical by Statistics, S.C.Gupta &amp; V.K Kapoor –S. Chand &amp; Co</li> <li>2. Introduction to Mathematical Statistics,Hogg, R.V Craig A.T(1988) ; McMillan</li> <li>3. Introduction to theory of Statistics, Mood A.M &amp; Graybill F.A &amp; Boes D.G(1974) McGraw Hill.</li> <li>4. Statistical Methods, Snedecor G.W &amp; Cochran W.G(1967) ; Oxford and IBH.</li> <li>5. Mathematical Statistics by P. R. Vittal, Margham Publications</li> </ol>
<b>Website and e-Learning Source</b>	<a href="https://nptel.ac.in">https://nptel.ac.in</a> <a href="https://www.mathhelp.com/">https://www.mathhelp.com/</a>

### Mathematical Statistics Practical

1. Curve Fitting by the method of least squares (a)  $y = ax + b$ , (b)  $y = ae^{bx}$ ,
2. Computation of Correlation Coefficients and Regression for the given data – Rank Correlation Coefficient
3. Test of significance with regard to population mean based on large samples
4. Conducting hypothesis test for a sample mean with unknown population variance using t test – Small samples
5. Conducting hypothesis test for the difference between two means of paired samples
6. Test of independence of attributes based on contingency table
7. Conducting a hypothesis test for the difference between two variance using F distribution

#### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO 1:** Able to understand identify random variables and distribution functions.

**CLO 2:** Able to identify bivariate distribution characteristic, generating functions.

**CLO 3:** Able to understand sampling distributions

**CLO 4:** Able to understand estimators

**CLO 5:** Able to understand the testing of hypothesis.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO 1	3	1	3	--	--	--	3	2	1
CLO 2	2	1	3	1	--	--	3	2	1
CLO 3	3	1	3	1	--	--	3	2	1
CLO 4	3	1	3	--	--	--	3	2	1
CLO 5	3	1	3	--	--	--	3	2	1