

Branch Name:	M.Sc. (Artificial Intelligence & Data Science)
Program Code:	ET214
Course Title:	Statistical Methods
Course Code:	1ET2140102
Pre-requisite Course:	Basic Probability & Mathematics

Course Objectives:

1. To understand random variables, probability distributions, and statistical foundations for AI and data analytics.
2. To apply discrete and continuous probability models for modeling real-world datasets.
3. To implement regression and curve fitting techniques for predictive data modeling.
4. To perform hypothesis testing using large and small sample statistical tests.
5. To develop statistical inference capabilities for data-driven AI decision-making systems.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	00	02	04	50	50	25	25	150

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Random Variable – Discrete and Continuous Random Variable – Distribution and Density Functions – Mathematical Expectation and Properties – Simple Problems	06	15
2	Discrete Probability Distributions: Binomial and Poisson Distributions – Mean & Variance – Recurrence Formula – Fitting of Binomial and Poisson Distributions – Simple Problems	10	25
3	Continuous Probability Distribution & Curve Fitting: Normal Distribution – Characteristics – Curve Fitting – Fitting of Straight Line and Second-Degree Parabola – Simple Problems	08	20
4	Test of Significance (Large Samples): Statistical Hypothesis – Simple & Composite Hypothesis – Null & Alternative Hypothesis – Critical Region – Type I & II Errors – Sampling Distribution & Standard Error – Large Sample Tests for Proportion, Difference of Proportions, Mean & Difference of Means	08	15
5	Test of Significance (Small Samples): t-test (mean, difference, paired), F-test – Chi-square test – Assumptions & Characteristics – Goodness of Fit and Independence of Attributes – Simple Problems	10	25

Text Books:

1. Gupta & Kapoor – Fundamentals of Mathematical Statistics, Sultan Chand.
2. Walpole, Myers, Myers, Ye – Probability and Statistics for Engineers and Scientists, Pearson.
3. Sheldon Ross – Introduction to Probability Models, Academic Press.

Reference Books:

1. Montgomery & Runger – *Applied Statistics and Probability for Engineers*, Wiley.
2. Devore – *Probability and Statistics for Engineering and the Sciences*, Cengage.
3. Larry Wasserman – *All of Statistics*, Springer.
4. Jay Devore – *Modern Mathematical Statistics with Applications*, Springer.

Suggested List of Experiments:

1. Computation of Mean, Variance, and Standard Deviation for Real Datasets.
2. Visualization of Discrete and Continuous Random Variables using Python Tools.
3. Simulation and Plotting of Probability Mass Functions (PMF) and Probability Density Functions (PDF).
4. Calculation of Mathematical Expectation and Variance for Given Probability Distributions.
5. Implementation of Binomial Distribution and Estimation of Parameters.
6. Implementation and Visualization of Poisson Distribution for Event Count Data.
7. Fitting of Binomial Distribution to Observed Frequency Data.
8. Fitting of Poisson Distribution to Real-world Event Data.
9. Analysis and Visualization of Normal Distribution using Real Dataset.
10. Curve Fitting using Least Squares Method (Straight Line Fitting).
11. Polynomial Curve Fitting (Second Degree Parabola) for Data Modeling.
12. Comparison of Actual and Predicted Values using Regression Models.
13. Hypothesis Testing for Population Mean using Z-Test (Large Sample Test).
14. Test for Difference of Means and Difference of Proportions (Large Samples).
15. Analysis of Type I and Type II Errors using Simulated Data.
16. Hypothesis Testing for Proportion using Real Survey Dataset.
17. One-Sample and Paired t-Test for Small Sample Data Analysis.
18. F-Test for Comparison of Variances between Two Samples.
19. Chi-Square Test for Goodness of Fit for Observed Data.
20. Chi-Square Test for Independence of Attributes using Contingency Tables.
21. Statistical Significance Testing for Machine Learning Model Results.
22. A/B Testing Experiment for Comparative Data Analysis.
23. Bayesian Inference Demonstration for Probabilistic Decision Making.
24. Mini Case Study: End-to-End Statistical Analysis of an AI Dataset (Distribution Fitting, Regression, and Hypothesis Testing).

Course Learning Outcomes (CLO):

CO	Course Learning Outcome	Bloom's Level
CO1	Understand random variables and probability distributions used in AI and analytics	L2 – Understand
CO2	Apply discrete and continuous probability models to analyze real-world datasets	L3 – Apply
CO3	Analyze regression, curve fitting, and statistical modeling techniques	L4 – Analyze
CO4	Evaluate hypotheses using large and small sample significance tests	L5 – Evaluate
CO5	Develop statistical inference solutions for AI and data-driven decision-making	L6 – Create

Mapping of CLO with PO and PSO

Course	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
Learning Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4
CLO1	H	M	–	–	M	–	–	–	–	L	–	M	M	L	H	L
CLO2	H	H	M	M	H	–	–	–	–	L	–	M	H	H	H	M
CLO3	M	H	M	H	M	–	–	–	–	M	–	M	H	M	H	M
CLO4	M	H	H	H	H	–	–	–	–	M	M	M	H	H	H	M
CLO5	M	H	H	H	H	M	L	M	M	H	H	H	H	H	H	H

H:High, M:Medium, L:Low