



Subject: Probability and Statistics (BET2XX13217)

Type of course: Major (Core)

Prerequisite: Basic knowledge of Mathematics, Algebra, and introductory Probability concepts studied at higher secondary or first-year engineering level.

Rationale: This course provides fundamental and applied knowledge of probability and statistics required in engineering, scientific analysis, and decision-making. It develops analytical skills in probability distributions, statistical data analysis, correlation, curve fitting, and hypothesis testing. The course enables students to interpret data, solve engineering problems involving uncertainty, and apply statistical methods in research and industrial applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
4	0	0	4	100	50	150

Course Content:

Sr. No	Course Content	Hrs.	% Weightage													
1	Chapter 1: Foundations of Probability - Fundamentals of Probability - Random Experiments, Sample Space, and Events - Counting principle - Permutation and Combination - Probability - Compound Events - Conditional Probability and Multiplicative Rule - Independent Events - Bayes' Rule and Total Probability Theorem	12	20%													
	<table><tr><th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr><tr><td>1</td><td>Probability Proficiency Test: Conducted through an individual timed test comprising theoretical and problem-solving questions on probability concepts.</td><td>20</td><td></td></tr><tr><td>2</td><td>ALA: The System Solver Clinic</td><td></td><td>10</td></tr><tr><td></td><td>Total:</td><td>20</td><td>10</td></tr></table>			Sr No.	Evaluation Methods	SEE	CCE	1	Probability Proficiency Test: Conducted through an individual timed test comprising theoretical and problem-solving questions on probability concepts.	20		2	ALA: The System Solver Clinic		10	
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2	ALA: The System Solver Clinic		10													
	Total:	20	10													

	Description of ALA: The activity includes solving real-life probability problems using counting principles and probability laws.																		
2	Chapter 2: Special Probability and Curve fitting • Random Variables (Discrete & Continuous) • Binomial distribution • Bernoulli distribution • Poisson distribution • Normal distribution • Method of least square • Fitting of straight lines • Fitting of Second degree parabola • Fitting of data to linear form [Exponential to linear] <table border="1"> <thead> <tr> <th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td>Numerical problems solving on probability distributions and curve fitting methods.</td><td>20</td><td></td></tr> <tr> <td>2</td><td>ALA: Graphical Interpretation of data</td><td></td><td>10</td></tr> <tr> <td></td><td>Total:</td><td>20</td><td>10</td></tr> </tbody> </table> Description of ALA: Data analysis and plotting for fitting straight lines and parabolic curves.	Sr No.	Evaluation Methods	SEE	CCE	1	Numerical problems solving on probability distributions and curve fitting methods.	20		2	ALA: Graphical Interpretation of data		10		Total:	20	10	12	20%
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3	Chapter 3: Descriptive Statistics • Measures of Central Tendency- Group and Ungroup data • Range • Mean- A.M and H.R • Median, Mode • Quartiles, Deciles and Percentiles • Quartile Deviation • Mean Deviation • Standard Deviation and Variance <table border="1"> <thead> <tr> <th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td>Decode the Data: Solve objective questions based on statistical calculations</td><td>20</td><td></td></tr> <tr> <td>2</td><td>Viva Voce</td><td></td><td>10</td></tr> <tr> <td></td><td>Total:</td><td>20</td><td>10</td></tr> </tbody> </table>	Sr No.	Evaluation Methods	SEE	CCE	1	Decode the Data: Solve objective questions based on statistical calculations	20		2	Viva Voce		10		Total:	20	10	12	20%
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4	Chapter 4: Advanced Measures in Statistics: Moments and Correlation • Moments (Raw and Central) • Moment about Arbitrary point • Moment about origin • Moment about mean • Skewness • Kurtosis • Karl Pearson's Coefficient of Correlation • Spearman's Rank Correlation Coefficient- Repeated and Non-Repeated <table border="1"> <thead> <tr> <th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td>Engineering Data Analytics: Apply statistical techniques to examine and interpret engineering datasets.</td><td>10</td><td></td></tr> <tr> <td>2</td><td>ALA: Data Detective Activity</td><td></td><td>10</td></tr> <tr> <td></td><td>Total:</td><td>20</td><td>10</td></tr> </tbody> </table> Description of ALA: Students analyze a real-world dataset to identify skewness, kurtosis, and correlation, then interpret the results.	Sr No.	Evaluation Methods	SEE	CCE	1	Engineering Data Analytics: Apply statistical techniques to examine and interpret engineering datasets.	10		2	ALA: Data Detective Activity		10		Total:	20	10	12	20%
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5	Chapter 5: Applied Statistics & Hypothesis Testing • Sampling and Hypothesis Formation • Population and Sample concepts • Null and Alternative Hypotheses • Levels of Significance and Type I/II Errors • Large Sample Tests (Z-Tests) • Test for Single Proportion and Difference of Proportions • Test for Single Mean and Difference of Means • Test for Difference of Standard Deviations • Small Sample Tests (Exact Sampling) • t-Test: Single mean, difference of means, and correlation coefficients <table border="1"> <thead> <tr> <th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td>Statistical Computing: Perform statistical calculations using sampling and hypothesis testing methods.</td><td>20</td><td></td></tr> <tr> <td>2</td><td>ALA: Compare & Conclude</td><td></td><td>10</td></tr> <tr> <td></td><td>Total:</td><td>20</td><td>10</td></tr> </tbody> </table> Description of ALA: Students compare two datasets using mean, proportion, or variance tests and present findings.	Sr No.	Evaluation Methods	SEE	CCE	1	Statistical Computing: Perform statistical calculations using sampling and hypothesis testing methods.	20		2	ALA: Compare & Conclude		10		Total:	20	10	12	20%
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Suggested Specification table with Marks:

Distribution of Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	10%	15%	30%	25%	10%	10%

Course Outcomes:

After learning the course, the students should be able to:	
CO1	Apply fundamental probability concepts, counting techniques, conditional probability, and Bayes' theorem to solve engineering and real-life problems.
CO2	Analyze random variables and probability distributions, and apply curve fitting techniques using the method of least squares for data modeling.
CO3	Compute and interpret measures of central tendency, dispersion, and positional measures for grouped and ungrouped data.
CO4	Evaluate statistical characteristics of datasets using moments, skewness, kurtosis, and correlation analysis techniques.
CO5	Perform hypothesis testing using large and small sample tests to make statistical inferences and support engineering decision-making.

Instructional Method:

- Interactive lectures with numerical problem-solving
- Demonstration of statistical techniques using real-life datasets
- Activity-based learning and group discussions
- Case studies and application-oriented examples
- Practice sessions on probability and hypothesis testing problems
- Data interpretation and analytical exercises
- Use of statistical tools/software for computations and visualization
- Tutorials, quizzes, and assignments for concept reinforcement

Reference Books:

1. Higher Engineering Mathematics – Khanna Publishers.
2. Fundamentals of Mathematical Statistics – Sultan Chand & Sons.
3. Probability and Statistics for Engineers – Pearson Education.
4. Introduction to Probability and Statistics – Cengage Learning.
5. Applied Statistics and Probability for Engineers – Wiley.
6. Engineering Mathematics – Tata McGraw-Hill.
7. Introduction to Mathematical Statistics – Pearson Education.
8. Schaum's Outline of Probability and Statistics – McGraw-Hill.



Suggestive Rubrics:

Suggestive Assessment Guidelines:

Module 1:

ALA: The System Solver Clinic (10 Marks)

- 10 Marks: Accurate application of probability laws, correct counting methods, and clear interpretation of results.
08 Marks: Correct solutions with minor calculation or notation errors.
05 Marks: Basic probability concepts understood, but mistakes in conditional probability or event analysis.
02 Marks: Partial attempt with major logical or computational errors.
00 Marks: Not submitted.

SEE: Probability Proficiency Test (20 Marks)

- 20 Marks: Excellent understanding of probability concepts with accurate and complete problem-solving.
16 Marks: Good conceptual clarity with minor computational errors.
10 Marks: Basic understanding demonstrated, but incomplete or partially correct solutions.
05 Marks: Significant errors in probability formulation and interpretation.
00 Marks: Incomplete or off-topic.

Module 2:

ALA: Graphical Interpretation of Data (10 Marks)

- 10 Marks: Accurate plotting, correct curve fitting, and clear graphical interpretation of data trends.
08 Marks: Correct fitting with minor plotting or presentation errors.
05 Marks: Basic understanding of distributions and fitting methods shown, but interpretation is limited.
02 Marks: Incomplete graphical representation with major errors.
00 Marks: Not submitted.

SEE: Numerical Problem Solving on Probability Distributions and Curve Fitting (20 Marks)

- 20 Marks: Accurate distribution analysis and flawless curve fitting computations with proper interpretation.
16 Marks: Correct methods used with minor algebraic or plotting errors.
10 Marks: Basic concepts correct but incomplete execution of numerical procedures.
05 Marks: Major confusion in distribution selection or fitting technique.
00 Marks: Incomplete or off-topic.

Module 3:

Viva Voce (10 Marks)

- 10 Marks: Confident explanation of statistical concepts with accurate interpretation of measures.
08 Marks: Good conceptual understanding with minor communication gaps.
05 Marks: Basic knowledge demonstrated but lacks clarity in explanation.



02 Marks: Limited understanding and weak responses.
00 Marks: Not attended.

SEE: Decode the Data (20 Marks)

20 Marks: Accurate computation and interpretation of all descriptive statistical measures.
16 Marks: Mostly correct calculations with minor arithmetic errors.
10 Marks: Basic statistical methods understood but incomplete interpretation.
05 Marks: Significant mistakes in computation or data analysis.
00 Marks: Incomplete or off-topic.

Module 4:

ALA: Data Detective Activity (10 Marks)

10 Marks: Excellent dataset analysis with accurate identification of skewness, kurtosis, and correlation.
08 Marks: Good analytical approach with minor interpretation errors.
05 Marks: Basic understanding shown, but analysis lacks depth or clarity.
02 Marks: Poor interpretation and limited participation.
00 Marks: Not submitted.

SEE: Engineering Data Analytics (20 Marks)

20 Marks: Accurate computation of moments and correlation with clear analytical interpretation.
16 Marks: Correct methodology with minor calculation or notation errors.
10 Marks: Basic concepts correct but incomplete analytical reasoning.
05 Marks: Significant confusion in statistical analysis methods.
00 Marks: Incomplete or off-topic.

Module 5:

ALA: Compare & Conclude (10 Marks)

10 Marks: Correct hypothesis formulation, accurate testing procedure, and logical conclusion presentation.
08 Marks: Proper statistical testing with minor computational or interpretation errors.
05 Marks: Basic hypothesis testing concepts understood, but conclusion lacks clarity.
02 Marks: Partial attempt with incorrect test selection or weak analysis.
00 Marks: Not submitted.

SEE: Statistical Computing (20 Marks)

20 Marks: Accurate hypothesis testing, correct selection of statistical tests, and proper interpretation of results.
16 Marks: Good understanding with minor calculation or notation errors.
10 Marks: Basic testing methods understood but incomplete execution.
05 Marks: Major errors in hypothesis formulation or statistical calculations.
00 Marks: Incomplete or off-topic.

