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SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Year: B. Tech. II (Semester III) (CO, EC)

Subject Name: Probability and Statistics for Engineering **Subject Code:** BTAS11302
Type of course: Basic Science Course (BSC)
Prerequisite: Probability basics

Rationale: Systematic study of uncertainty (randomness) by probability - statistics and curve fitting by numerical methods.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Total Hours	% Weightage
1.	**Basic Probability:** Experiments, Definition of Probability, Conditional probability, Independent events, Mutually exclusive events, Multiplication law, Bayes' Theorem, Discrete random variable, Continuous random variable, Probability mass function, Probability density function, and Cumulative distribution function. Entropy and its computation.	10	20
2.	**Applications of Probability Distributions**: **Discrete probability distributions-** Bernoulli trials, Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution, Using table values of Binomial probabilities and Poisson probabilities. Fitting of Binomial distribution. **Continuous probability distributions-**Normal curve, Standard normal probability distribution, Normal approximation to the Binomial distribution, Computing probabilities using tables of	10	25

	Normal distributions.		
3.	**Basic Statistics:** Measures of central tendency- Mean, median, mode, quartiles, percentiles. Measures of dispersion-Range, Interquartile range, variance, standard deviation, coefficient of variation. Measures of association-Covariance, Correlation coefficient, Rank correlation coefficient. Simple linear regression, Multiple Regression, Fitting of trend by Moving Average method.	10	20
4.	**Applied Statistics:** Formation of hypothesis- Developing Null and Alternative hypothesis, Type I and Type II errors. Testing the hypothesis-One-tailed test, Two-tailed test, Decision making-Using p-value approach, critical value approach, confidence interval approach Test of significance-Single population mean when population standard deviation is known and unknown, Single population variance, Chi-square test for goodness of fit.	10	25
5.	**Curve Fitting by the Numerical Method:** The method of least squares, Fitting of straight line, fitting of second degree polynomial.	05	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
00	18	12	12	18	0

Legends: R: Remembrance, U: Understanding; A: Application, N: Analyze, E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr No	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Introduction to Probability Theory	P. G. Hoel, S. C. Port and C. J. Stone	Universal Book Stall.	1971	Latest

2.	A First Course in Probability	S. Ross	Pearson Education India	2010	8th
3.	An Introduction to Probability Theory and its Applications	W. Feller	Wiley	Jan. 1991	Vol. 1
4.	Applied Statistics and Probability for Engineers	D.C. Montgomery and G. C. Runger	John Wiley & Sons, Inc.	2003	3rd
5.	Probability and Statistics for Engineering and the Sciences	J. L. Devore	Cengage Learning	2012	8th
6.	Miller and Freund's Probability and Statistics for Engineers	Richard A. Johnson	PHI	2003	6th

Course Outcome:

Sr. No.	CO Statement	Weightage in %
CO-1	Apply the terminologies of basic probability, two types of random variables and their probability functions.	20
CO-2	Explain the behavior of various discrete and continuous probability distributions.	25
CO-3	Evaluate the central tendency, correlation and correlation coefficient and regression.	20
CO-4	Apply the statistics for testing the significance of the given large and small sample data by using t- test, F- test and Chi-square test.	25
CO-5	Apply the fitting of various curves by method of least square.	10

Mapping with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	3	1	1	-	-	-	-	-	-	-	1
CO-2	3	3	2	2	2	1	1	-	-	-	-	2

CO-3	3	3	2	2	1	-	-	-	-	-	-	2
CO-4	3	3	2	3	2	1	1	-	-	-	-	2
CO-5	3	3	1	1	-	-	-	-	-	-	-	1

List of Open Source learning website: MIT Open courseware, NPTEL

List of Practical:

Sr. No	Practical
1	Simulate a fair coin tossing experiment. Using 1000 repetitions of the experiment, count the number of times 3 heads occur. What is the simulated probability of obtaining three heads in four coin tosses?
2	Write a program to estimate the PDF of a random variable: $X = \sum Ui - 1/2$, i varies from 1 to 12 Where, *Ui* is a uniform random variable. Compare this PDF to the Gaussian PDF
3	A large circular dart-board is set up with a bulls eye at the centre of the circle, which is at coordinate (0,0). A dart is thrown at the center but lands at (X, Y) where X and Y are two different Gaussian Random variables. Write a program to find the average distance of the dart from the bulls eye.
4	A defective batch of 1000 micro-chips contains 940 good chips and 60 bad chips. If we choose a sample of 100 chips, find the probability that there will be 95 or more good chips by using computer simulation. Assume sampling with replacement using Binomial Law, for the simulation and theoretical probability.
5	Probability Distributions: Observe and realize various probability distributions using the Probability Distribution function tool in MATLAB. Various distributions include: (a) Normal, (b) Beta, (c) Binomial, (d) Gamma, (e) Lognormal, (f) Geometric Also observe PDF and CDF of various distributions
6	Polynomial Models: To Model data with a polynomial, measure a quantity y at several values of time t. Use the polyfit function to find the polynomial coefficients. • Evaluate the polynomial at uniformly spaced times, t2. Then, plot the original data and the model on the same plot. • Evaluate model at the data time vector • Calculate the residuals. Plot the residuals.

7	Programmatic Fitting: • Load the sample data and Calculate Correlation Coefficients • Fit a Polynomial to the Data • Plot and Calculate Confidence Bounds
8	Moving Average Method: To estimate long-term trend using a symmetric moving average function.
9	Linear Regression: To fit the model to the given data. • Import the data into a dataset array. • Create a fitted model. • Locate and remove outliers. • Simplify the model. • Predict responses to new data. • Share the model.
10	1. Gamma Distribution PDF: Compute the pdf of a gamma distribution with parameters A = 100 and B = 10. For comparison, also compute the pdf of a normal distribution with parameters mu = 1000 and sigma = 100.
11	Functions of Binomial Distribution: • Plot Standard Normal Distribution CDF • Plot Gamma Distribution CDF • Compute the median of the fitted distribution. • Plot the pdf of a Standard Normal Distribution • Find the mean of Fitted Distribution and Skewed Distribution • Find Standard Deviation of a Fitted Distribution • Find Variance of a Fitted Distribution and Skewed Distribution
10	Hypothesis Testing: • To determine the number of samples or observations needed to carry out a statistical test. • Test a Normal Mean with Known Standard Deviation • Test a Normal Mean with Unknown Standard Deviation • Test the Correlation