KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY (KIIT)
(Deemed to be University) **DEPARTMENT OF**
MATHEMATICS SCHOOL OF APPLIED
SCIENCES AUTUMN SEMESTER 2023-24
COURSE HANDOUT

Date: 09.08.2023

1. **Course Title: PROBABILITY AND STATISTICS**
2. **Course Code: MA 21001**
3. **L-T-P Structure: 3-1-0**
4. **Course Coordinator: Dr. Prasanta Kumar Das**
5. **Associate Course Coordinator: Dr. Arjit Patra**

6. COURSE OBJECTIVE

The objective of this course is to familiarize the students with the foundation of probability and statistics and to use it in solving the problems arises in engineering and real life applications.

7. COURSE OUTCOMES

At the end of the course, the students will be expected to: CO1:

understand basic probability and its applications
CO2: study probability distributions and can use it in real life data analysis
CO3: have a knowledge on univariate and bivariate distributions and their properties
CO4: measure the central tendency and dispersion of a data set to draw conclusion from the data and interpret the data with the appropriate pictorial representation.
CO5: have good understanding of the Central Limit Theorem and its applications CO6:
analyze the statistical inference

8.COURSE DETAILS Probability and

random variables:

Basic concepts of sample space, events(with example), Axiom of Probability, Conditional Probability, Bayes' Theorem and its applications.Discrete random variable, probability mass function, cumulative distribution function and Moment Generating function for discrete random variable, some special distributions like Uniform distribution, Geometric distribution, Binomial distribution, Negative Binomial distribution, Poisson distribution, Hypergeometric distribution, mean and variance.Continuous random variable, density function, cumulative distribution function and Moment Generating function. Uniform distribution, normal distribution, mean, variance, percentile and critical value of normal distribution,normal approximation of the binomial distributionand exponential distribution.

Joint probability and distributions:

Joint probability mass function and marginal probability mass function, joint probability density function and marginal probability density function, concept of independent random variable(joint probability), conditional probability mass function and conditional probability density function. Expected value, covariance and correlation for jointly distributed random variable(both continuous and discrete). Sum of two independent random variables, and weak law of large number.

Descriptive Statistics:

Frequency distribution, pictorial and tabular representation of data, stem and leaf display, dot plots, histogram, box plots and comparative box plots. Basic concepts on mean, median and mode, Skewness, Kurtosis, Correlation, Coefficient of Correlation, rank correlation, Regression Analysis (Least square method).

Inferential statistics:

Population, sample, random sample, sampling distribution, distribution of sample mean, central limit theorem, point estimator, point estimation of parameter using method of maximum likelihood estimation, confidence interval, confidence interval for the mean of a normal population with known and unknown variance, confidence interval for the variance of a normal population, hypothesis testing, one sided and two sided alternatives, Tests for mean of the normal distribution with known variance, Tests for mean of the normal distribution with unknown variance, tests for variance of the normal distribution.

Text books:

T1. Probability and Statistics for Engineers and Sciences by J. L. Devore, CENGAGE Learning, 9th Edition.
T2. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, 10th Edition.

Reference Books:

R1. Introduction to Probability and Statistics for Engineers and Scientists by S.M. Ross, Elsevier/AP, 6th Edition.
R2. Introduction to Probability and Statistics by J.S. Milton & J.C. Arnold, McGraw Hill, 4th Edition.
R3. Introduction to Probability Theory and Statistical Inference by H.J. Larson, John Wiley & Sons Inc, 3rd Edition.
R4. Fundamental of Mathematical Statistics by S.C. Gupta & V.K.Kapoor, S. Chand, 12th Edition.

9. LESSON PLAN AND ACTIVITIES

Unit Name	Lect. No.	Learning Topics to be covered	Article No./ Text Book	CO Mapping
		Unit - I (Probability; Discrete random variables and Probability Distributions)		
Basics on Probability	1.	Sample spaces, Events (with examples)	**2.1, 2.2 (T1)**	**CO1**
	2.	Axiom of Probability, Conditional Probability, Bayes' Theorem and its applications.	**2.4 (T1)**	**CO1**
	3.	Independent events	**2.5 (T1)**	**CO1**
	4.	Tutorial (Problem Solving)		
Discrete Random variables and Probability Distributions	5.	Discrete random variable, probability mass function, cumulative distribution function	**3.1, 3.2 (T1)**	**CO2**

	6.	Expected values, Moments, Central moments	**3.3 (T1)**	**CO2**
	7.	Moment Generating function	**24.5 (T2)**	**CO2**
	8.	Tutorial (Problem Solving)		**CO2**
	9.	some special distributions like Uniform distribution, Binomial distribution	**3.3, 3.4 (T1)**	**CO2**
	10.	Hypergeometric distribution	**3.5 (T1)**	**CO2**
	11.	Geometric distribution, Negative Binomial distribution	**3.5 (T1)**	**CO2**
	12.	Poisson distribution	**3.6 (T1)**	**CO2**
	13.	Tutorial (Problem solving)		
		Doubt Clearing		
		Quiz Test-1		
		Assignment-I		
Continuous random variables and Probability distributions	14.	Continuous random variable, density function, cumulative distribution function, density function of the function of random variable	**4.1(T1)**	**CO2**
	15.	Uniform distribution, Mean, variance and median	**4.2(T1)**	**CO2**
	16.	normal distribution, mean, variance, percentile and critical value of normal distribution,	**4.3(T1)**	**CO2**
	17.	normal approximation of the binomial distribution, Applications	**4.3(T1)**	**CO2**
	18.	exponential distribution, Mean, variance and median	**4.4(T1)**	**CO2**
	19.	Tutorial (Problem solving)		
Joint probability and distributions	20.	Joint probability mass function and marginal probability mass functions	**5.1(T1)**	**CO3**
	21.	Mean and variance of Joint probability mass function and marginal probability mass functions	**5.1(T1)**	**CO3**
	22.	Joint probability density function and marginal probability density function	**5.1(T1)**	**CO3**
	23.	Mean and variance of Joint probability density function and marginal probability density functions	**5.2(T1)**	**CO3**
	24.	Tutorial (Problem solving)		**CO3**
	25.	Independent random variables (joint probability), conditional	**5.2(T1)**	**CO3**

		probability mass function and conditional probability density function.		
	26.	Expected value, covariance and Correlation coefficient for jointly distributed joint discrete random variable	**5.3(T1)**	**CO3**
	27.	Expected value, covariance and Correlation coefficient for jointly distributed joint continuous random variable	**5.3(T1)**	**CO3**
	28.	Linear Combination of random variables, Mean Random variable, mean and variance of mean random variable of the identically independent random variables	**5.4(T1)**	**CO3**
	29.	Tutorial (Problem solving)		
	30.	**Doubt Clearing**		
		Quiz Test-II		
		Assignment-II		
Descriptive Statistics	31.	Frequency distribution, pictorial and tabular representation of data	**1.2(T1)**	**CO4**
	32.	stem and leaf display, dot plots,	**1.2(T1)**	**CO4**
	33.	histogram, box plots and comparative box plots.	**1.2, 1.4(T1)**	**CO4**
	34.	Tutorial (Problem solving)		
	35.	Basic concepts on mean, median and mode	**1.3(T1)**	**CO4**
	36.	Skewness, Kurtosis Correlation	**24.6 (T2)**	**CO4**
	37.	Coefficient of Correlation, rank correlation	**25.9 (T2)**	**CO4**
	38.	Tutorial (Problem solving)		
	39.	Regression Analysis: Least square method	**20.5 (T2)**	**CO4**
	40.	Linear regression	**20.5 (T2)**	**CO4**
	41.	Problems solving on Linear regression	**20.5 (T2)**	**CO4**
	42.	Regression: Fitting straight line using correlation coefficient of the data	**25.9 (T2)**	**CO4**
	43.	Tutorial (Problem solving)		
Inferential statistics	44.	Population, sample, random sample,	**25.1(T2)**	**CO5**
	45.	sampling distribution, distribution of sample mean	**25.1(T2)**	**CO5**
	46.	Central limit theorem	**25.1(T1)**	**CO5**
	47.	Tutorial (Problem solving)		

	48.	Point estimator, point estimation of parameter using method of maximum likelihood estimation	**25.2(T2)**	**CO5**
	49.	estimation of parameter of binomial, geometric, poison, exponential, normal distribution		**CO5**
	50.	confidence interval, confidence interval for the mean of a normal population with known variance,	**25.3 (T2)**	**CO6**
	51.	t-distribution, confidence interval for the mean of a normal population with unknown variance,	**25.3(T2)**	**CO6**
	52.	Tutorial (Problem solving)		
	53.	chi squared distribution, confidence interval for the variance of a normal population,	**25.3(T2)**	**CO6**
	54.	hypothesis testing, one sided and two sided alternatives,	**25.4(T2)**	**CO6**
	55.	Tests for mean of the normal distribution with known variance,	**25.4(T2)**	**CO6**
	56.	Tests for mean of the normal distribution with unknown variance	**25.4(T2)**	**CO6**
	57.	tests for variance of the normal distribution		**CO6**
	58.	Tutorial (Problem solving)		
	59.	**Doubt Clearing**		
		Quiz Test-III		
		Assignment-III (Critical Q. Sets)		
	60 - 62	**Previous Year's question & answer discussion**		

Sl. No.	Assessment Component	Duration	Weightage / Marks	Nature of the Component
1	Mid Semester Examination	90 min	20	Closed Book
2	End Semester Examination	3 Hours	50	Closed Book
3	Problem Solving (Assignment)	1 week	10	Open Book
4	Quiz Test	20 min	15	Closed Book
5	Critical Thinking	15 days	05	Open Book

11. ACTIVITIES CALENDAR

Sl. No.	Type of Activity/ Nature of the Component	Marks	Schedule for Activities	Duration For Submission	Publication of result	Mapping with COs
1	Assignment-I (Open Book)	5	3rd week of August	1 week	1st week of September	CO1 & CO2
2	Quiz -I (Closed Book)	5	3rd week of August	30min	3rd week of August	CO1 & CO2
3	Assignment-II (Open Book)	5	2nd week of September	1 week	4th week of September	CO3 & CO4
4	Quiz -II (Closed Book)	5	2nd week of September	30min	2nd week of September	CO3 & CO4
5	Critical Thinking (Open Book)	5	2nd week of November	15 days	4th week of November	CO1, CO2, CO3, CO4, CO5 & CO6
6	Quiz -III (Closed Book)	5	4th week of November	30min	4th week of November	CO5 & CO6