Course Code	18MAB204T	Course Name	PROBABILITY AND QUEUEING THEORY	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	Nil	Progressive Courses	Nil

Course Offering Department	Mathematics	Data Book / Codes/Standards	Statistical tables

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Describe probability concepts and characteristic of random variables.
CLR-2:	Gain the knowledge on discrete and continuous distributions.
CLR-3:	Understand how to develop null and alternate hypothesis and apply to large and small sample tests.
CLR-4:	Interpret from F test, Chi square test in sampling distributions and gain knowledge using Markov queueing models
CLR-5:	Construct Markov chains and analyse stationary state distributions.
CLR-6:	Interpret random variables and Queuing theory in engineering problems.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)											
		Learning Blooms Level (1-6)	1 Engineering Knowledge	2 Problem Analysis	3 Design & Development	4 Analysis, Design, Research	5 Modern Tool Usage	6 Society & Culture	7 Environment & Sustainability	8 Ethics	9 Individual & Team Work	10 Communication	11 Project Mgt. & Finance	12 Life Long Learning
CO-1:	Apply the concepts of probability and random variables in engineering problems.	4	3	3	-	-	-	-	-	-		-	-	-
CO-2:	Identify random variables and model them using various distributions.	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-3:	Infer results by using hypothesis testing on large and small samples.	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-4:	Examine F test, Chi Square test in sampling techniques and analyse the performance measures of queuing models.	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-5:	Determine the transition probabilities and classify the states of Markov chain.	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-6:	Apply probability techniques and implement them in the study on sampling distributions, queueing models and Markov chain.	4	3	3	-	-	-	-	-	-	-	-	-	-

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Probability Basic concepts and Axioms	Discrete Probability distribution	Sampling distribution, Null Hypothesis, Alternate Hypothesis	Introduction to F-test	Markov Process and Introduction of a Markov Chain
	SLO-2	Conditional probability, Multiplication theorem	Introduction to Binomial distribution	One tailed test, two tailed test	Problems on F-test	Past and Future - Step and State
S-2	SLO-1	Discrete and continuous Random variables	MGF, Mean, Variance of Binomial distribution	Level of significance, Critical region	Chi square test - Goodness of fit	One step Transition Probability N step transition Probability
	SLO-2	Probability mass function, cdf	Applications of Binomial distribution	Large samples test	Problems on Chi square test -Goodness of fit	Chapman-Kolmogorov theorem definition
S-3	SLO-1	Continuous Random variables	Fit a Binomial distribution.	Student - t test Single Proportion	Problems on Chi-square test Independent-Attributes	Initial Probability distribution problems Using Markov Chain
	SLO-2	pdf and cdf applications	Introduction to Poisson Distribution	Two Sample proportions	Problems on Chi-square test	Initial Probability distribution problems

					Independent-Attributes with standard distributions	Using Markov Chain
S-4	SLO-1	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
	SLO-2					
S-5	SLO-1	Expectation and Variance	MGF , Mean , Variance of Poisson distribution	Large sample test-Single Mean	Introduction to Queueing Theory and Applications. Kendall, notation	Classification of States of a Markov Chain
	SLO-2	Problems on Expectation and Variance	Applications of Poisson Distribution	Difference of Means	Introduction to M/M/1 : infinity/ FIFO	Irreducible, Non irreducible, a period, Persistent, Non null Persistent
S-6	SLO-1	Moment Generating Function	Fit a Poisson Distribution	Problems on difference of Means	Ls, Lq, Ws,Wq	Problems on Classification of a Markov Chain
	SLO-2	Problems on MGF	Introduction , MGF Mean, Variance of Geometric distribution	Applications of Difference of Means	M/M/1 :Infinity /FIFO problems	Problem on Classification of a Markov Chain
S-7	SLO-1	Functions of Random variables	Applications of Geometric Distribution, problems on Memory less property	Introduction to small samples	M/M/1 :Infinity /FIFO problems	Classification of states of a Markov Chain
	SLO-2	Problems on Functions of Random variable	Introduction , MGF, Mean, Variance of Uniform Distribution	Introduction to small Samples	M/M/1 :Infinity /FIFO problems	Stationary and steady state
S-8	SLO-1	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 8	Problem solving using tutorial sheet 11	Problem solving using tutorial sheet 14
	SLO-2					
S-9	SLO-1	Tchebycheffs inequality	Applications of Uniform Distribution problems	Problems on single mean -small samples	Single Server Model with Finite System Capacity, Characteristics of the Model (M/M/1) : (K/FIFO)	Problems on Classification-State-stationary using Markov Chain
	SLO-2	Introduction to theoretical distribution	Introduction , MGF, Mean, Variance of Exponential distribution	Problems on single mean -small samples	Effective arrival rate	Problems on Stationary and steady state
S-10	SLO-1	Formula and application of Tchebycheffs inequality	Applications of Exponential distribution problems	Problems on difference of mean-small samples	Problems on Model (M/M/1) : (K/FIFO)	Problems on Ergodicity using Markov Chain
	SLO-2	Applications of Tchebychevs inequality	Introduction to Normal distribution	Problems on difference of mean-small samples	Problems on Model (M/M/1) : (K/FIFO)	Problems on Ergodicity using Markov Chain
S-11	SLO-1	Applications of Tchebychevs inequality using distribution	Applications of Normal distribution problems	Applications of paired - t test	Problems on Model (M/M/1) : (K/FIFO)	Problems on Ergodicity
	SLO-2	Problems practice using Tchebychevs inequality	Practical applications of Normal distribution	Problems of paired - t test.	Problems on Model (M/M/1) : (K/FIFO)	Problems on Ergodic and Non Ergodic Using Markov chains

S-12	SLO-1	Problem solving using tutorial sheet 3	Problem solving using tutorial sheet 6	Problem solving using tutorial sheet 9	Problem solving using tutorial sheet 12	Problem solving using tutorial sheet 15
	SLO-2	Applications of random variables in engineering	Applications of distribution to find the probability using Theoretical distributions	Applications of solving any realistic problem situation to determine the probability	Applications of Queueing decision models	Applications of constructing chain of decisions from the past situations using Monrovians

Learning Resources	1. Veerarajan T, Probability , Statistics and Random Processes, Tata Mc.Graw Hill, 1st Reprint 2004 2. S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9th ed.,, Sultan Chand & Sons, 1999 3. Gross. D and Harri.C.M. Fundamentals of Queuing theory, John Wiley and Sons, 1985	4. Trivedi K S, Probability and Statistics with reliability, Queueing and Computer Science Applications, prentice Hall of India, New Delhi, 1984 5. Allen .A.O. , Probability Statistics and Queueing theory, Academic Press

Learning Assessment

Bloom's Level of Thinking		Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20 %	-	20 %	-	20 %	-	20 %	-	20 %	-
Level 2	Understand	20 %	-	20 %	-	20 %	-	20 %	-	20 %	-
Level 3	Apply	30 %	-	30 %	-	30 %	-	30 %	-	30 %	-
Level 4	Analyze	30 %	-	30 %	-	30 %	-	30 %	-	30 %	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

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