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		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning			Program Learning Outcomes (PLO)														
CLR-1 :	Apply and evaluating probability using random variables	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Gain the knowledge and acquire the application of distribution to find the probability using Theoretical distributions	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design,	Modern Tool Usage	Society & Culture	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-3 :	To Assess the appropriate model and apply and soling any realistic problem situation to determine the probability																		
CLR-4 :	To interpret the decision using Markov queueing applications																		
CLR-5 :	To construct chain of decisions from the past situations using Monrovians																		
CLR-6 :	Interpret random variables and Queuing theory in engineering problems.																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	Solving problems on Discrete and Continuous Random variables	3	85	80	M	H	L	-	-	-	-	-	M	-	-	H	-	-	-
CLO-2 :	Identifying Distribution and solving the problems in Discrete and Continuous Distribution	3	85	80	M	H		M	M	-	-	-	M	L	-	H	-	-	-
CLO-3 :	Decision Models using sampling techniques in Large and Small samples	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-
CLO-4 :	Solving Queuing problems using Kendall's notation	3	85	80	M	H	-	-	-	-	-	-	M	L	-	H	-	-	-
CLO-5 :	To Evaluate the probability in uncertain situations using Markov chain rule	3	85	80	M	H	L	M	-	-	-	-	M	-	-	H	-	-	-
CLO-6 :	Solving and analyzing the problems in random variables and Queuing theory.	3	85	80	M	H	-	-	-	-	-	-	M	-	-	H	-	-	-

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 Independent-Attributes with standard distributions	Initial Probability distribution problems 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 chebychevs 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 chebychevs 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* ***chebychevs 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 Markovchains*
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	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
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