SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
COLLEGE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MATHEMATICS
LESSON PLAN
21MAB204T/ Probability and Queueing Theory
Course offered to School of Computing

Unit I			
Lecture Hour		**Description**	**Reference**
S-1	**SLO-1**	Probability-Basic concepts and axioms	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 1.1-1.19
	SLO-2	Conditional probability, Multiplication theorem	
S-2	**SLO-1**	Discrete Random Variable	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 2.1 – 2.16
	SLO-2	Probability Mass Function (PMF), Cumulative Distribution Function (CDF) - Applications	
S-3	**SLO-1**	Continuous Random Variable	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 2.1 – 2.16
	SLO-2	Probability Distribution Function (PDF) and Cumulative Distribution Function (CDF)- Applications	
S-4	**SLO-1**	**Problem-solving using tutorial sheet 1**	
	SLO-2		
S-5	**SLO-1**	Moments - Central and raw moments	S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9th ed.,, Sultan Chand & Sons, 1999 Page No. 5.11 – 5.12; 6.1 - 6.20
	SLO-2	Applications of moments	
S-6	**SLO-1**	Expectation and Variance - Properties	S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9th ed.,, Sultan Chand & Sons, 1999 Page No. 5.11 – 5.12; 6.1 - 6.20
	SLO-2	Applications	
S-7	**SLO-1**	Moment Generating Function (MGF) - Properties	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 4.49, 4.52 - 4.53
	SLO-2	MGF-Applications	
S-8	**SLO-1**	**Problem-solving using tutorial sheet 2**	
	SLO-2		
S-9	**SLO-1**	Introduction to Tchebycheff's inequality	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 4.63 – 4.70
	SLO-2	Applications of Tchebycheff's inequality	
S-10	**SLO-1**	Applications of Tchebycheff's inequality using distributions	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 4.71 – 4.72
	SLO-2	Applications of Tchebycheff's inequality using distributions	
S-11	**SLO-1**	Function of a Random Variable	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 3.1 – 3.2, 3.7 – 3.14
	SLO-2	Applications of the function of a Random Variable	
S-12	**SLO-1**	**Problem-solving using tutorial sheet 3**	
	SLO-2		

Unit II			
Lecture Hour		**Description**	**Reference**
	SLO-1	Discrete probability distribution	

S-1	**SLO-2**	Introduction to the binomial distribution	S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9th ed.,, Sultan Chand & Sons, 1999 Page No. 8.4 – 8. 11
S-2	**SLO-1**	MGF, Mean, Variance of binomial distribution	S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9th ed.,, Sultan Chand & Sons, 1999 Page No. 8.4 – 8. 11
	SLO-2	Applications of binomial distribution	
S-3	**SLO-1**	Theoretical frequencies of binomial distribution.	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 5.18 – 5.19
	SLO-2	Applications	
S-4	**SLO-1**	**Problem-solving using tutorial sheet 4**	
	SLO-2		
S-5	**SLO-1**	Introduction to Poisson distribution - MGF, Mean and Variance.	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 5.4 – 5.6, 5.19 – 5.22
	SLO-2	Applications of Poisson distribution	
S-6	**SLO-1**	Theoretical frequencies of Poisson distribution - Applications	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 5.23 – 5.24; 5. 38 – 5.39.
	SLO-2	Introduction to Exponential distribution - MGF, Mean, Variance	
S-7	**SLO-1**	Applications of Exponential distribution	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 5.39; 5.58 - 5.60, 5.80
	SLO-2	Memoryless property of Exponential distribution -Applications	
S-8	**SLO-1**	**Problem-solving using tutorial sheet 5**	
	SLO-2		
S-9	**SLO-1**	Introduction to Normal distribution, Standard normal distribution - Characteristics	S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9th ed.,, Sultan Chand & Sons, 1999 Page No. 9.3 – 9.5
	SLO-2	MGF, Mean, Variance of normal, and standard normal distribution	
S-10	**SLO-1**	Applications of normal distribution	S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9th ed.,, Sultan Chand & Sons, 1999 Page No. 9.3 – 9.5**,** 9.15-9.24
	SLO-2	Applications of normal distribution	
S-11	**SLO-1**	Applications of normal distribution	S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9th ed.,, Sultan Chand & Sons, 1999 Page No. 9.15 – 9.24
	SLO-2	Applications of normal distribution	
S-12	**SLO-1**	**Problem-solving using tutorial sheet 6**	
	SLO-2		

Unit III			
Lecture Hour		**Description**	**Reference**
S-1	**SLO-1**	Joint distributions - Discrete probability distribution Marginal and conditional probability distributions	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 2.23 – 2.33, 2.43-2.44
	SLO-2	Cumulative distribution function, Applications of discrete probability distribution	
	SLO-1	Applications of discrete joint probability distribution	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing

S-2	**SLO-2**	Continuous probability distribution - Marginal and conditional probability distributions, CDF	Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 2.24 – 2.26, 2.28 – 2.33
S-3	**SLO-1**	Applications of bivariate continuous probability distribution	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 2.34 -2.39; 2.45 – 2.46
	SLO-2	Applications of bivariate continuous probability distribution	
S-4	**SLO-1**	**Problem-solving using tutorial sheet 7**	
	SLO-2		
S-5	**SLO-1**	Covariance – Properties	S.C. Gupta, V.K.Kapoor, Fundamentals of Mathematical Statistics, 9th ed.,, Sultan Chand & Sons, 1999 Page No. 6.10, 6.29 – 6.41
	SLO-2	Applications of covariance in discrete and continuous two-dimensional random variables.	
S-6	**SLO-1**	Correlation	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 4.18 – 4.20, 4.29
	SLO-2	Applications of correlation in two-dimensional random variables	
S-7	**SLO-1**	Linear regression-properties	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 4.35 – 4.37, 4.43, 4.48
	SLO-2	Applications of linear regression in two-dimensional random variables	
S-8	**SLO-1**	**Problem-solving using tutorial sheet 8**	
	SLO-2		
S-9	**SLO-1**	Central Limit Theorem (CLT - for independent and identically distributed random variables)	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 4.73 -4.76
	SLO-2	Applications of the Central Limit Theorem	
S-10	**SLO-1**	Applications of the Central Limit Theorem	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 4.75, 4.78
	SLO-2	Applications of CLT using Poisson distribution	
S-11	**SLO-1**	Applications of CLT using exponential distribution	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 4.78
	SLO-2	Applications of CLT using exponential distribution	
S-12	**SLO-1**	**Problem-solving using tutorial sheet 9**	
	SLO-2		

Unit IV			
Lecture Hour		**Description**	**Reference**
S-1	**SLO-1**	Introduction to queueing theory – Characteristics, Kendall notation	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 8.1 – 8.5
	SLO-2	P_0 and P_n of Poisson queues	
S-2	**SLO-1**	Introduction to (M /M /1): (∞ / FIFO) model	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 8.5 – 8.10
	SLO-2	Characteristics - Ls, Lq, Ws, Wq etc., Little's formula	
S-3	**SLO-1**	(M /M /1) : (∞ / FIFO) - Applications	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 8.22 – 8.31
	SLO-2	(M /M /1) : (∞ / FIFO) - Applications	
S-4	**SLO-1**	**Problem-solving using tutorial sheet 10**	
	SLO-2		

S-5	**SLO-1**	Introduction to (M / M /s) : (∞ / FIFO) model	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 8.10 – 8.14
	SLO-2	Characteristics - Ls, Lq, Ws, Wq etc.,	
S-6	**SLO-1**	(M / M / s): (∞ / FIFO) - Applications	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 8.31 – 8.39
	SLO-2	(M / M / s): (∞ / FIFO) - Applications	
S-7	**SLO-1**	(M / M / s): (∞ / FIFO) - Applications	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 8.56 – 8.57
	SLO-2	(M / M / s): (∞ / FIFO) - Applications	
S-8	**SLO-1**	**Problem-solving using tutorial sheet 11**	
	SLO-2		
S-9	**SLO-1**	Introduction to (M / M / 1): (K / FIFO) model	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 8.15 – 8.18
	SLO-2	Effective arrival rate	
S-10	**SLO-1**	Applications of Model (M / M / 1): (K / FIFO)	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 8.39 – 8.44
	SLO-2	Applications of Model (M / M /1): (K / FIFO)	
S-11	**SLO-1**	Applications of Model (M / M / 1): (K / FIFO)	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 8.57 – 8.58
	SLO-2	Applications of Model (M / M / 1): (K / FIFO)	
S-12	**SLO-1**	**Problem-solving using tutorial sheet 12**	
	SLO-2		

Unit V			
Lecture Hour		**Description**	**Reference**
S-1	**SLO-1**	Introduction to the Markov process aAnd Markov chain	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 7.45 – 7.47
	SLO-2	One-step transition probability, n-step transition probability	
S-2	**SLO-1**	One-step transition probability matrix	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 7.47 – 7.49
	SLO-2	Chapman-Kolmogorov theorem - Definition	
S-3	**SLO-1**	Formation of one-step transition probability matrix- Applications	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 7.59 – 7.66
	SLO-2	Formation of one-step transition probability matrix- Applications	
S-4	**SLO-1**	**Problem-solving using tutorial sheet 13**	
	SLO-2		
S-5	**SLO-1**	One-step transition probability matrix- Applications of Chapman Kolmogorov theorem	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 7.59 - 7.50
	SLO-2	One-step transition probability matrix- Applications of Chapman Kolmogorov theorem	
S-6	**SLO-1**	Steady-state or limiting probability distribution	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing

	SLO-2	Steady-state or limiting probability distribution-Applications	Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 7.62 – 7.67
S-7	SLO-1	Applications of limiting state probability distribution of a Markov chain	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 7.71
	SLO-2	Applications of limiting state probability distribution of a Markov chain	
S-8	SLO-1	**Problem-solving using tutorial sheet 14**	
	SLO-2		
S-9	SLO-1	Classification of states of a Markov chain	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 7.49, 7.66 - 7.68
	SLO-2	Irreducible, non-irreducible, periodic, persistent, non-null persistent states	
S-10	SLO-1	Applications of classification of states of a Markov chain	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 7.69 – 7.72
	SLO-2	Persistent and transient states of a Markov chain -Applications	
S-11	SLO-1	Ergodic and non-ergodic Markov chain	Veerarajan T, Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks, Tata Mc Graw Hill, 1st Reprint 2015 Page No. 7.69 – 7.72
	SLO-2	Applications of ergodic and non-ergodic Markov chain	
S-12	SLO-1	**Problem-solving using tutorial sheet 15**	
	SLO-2		

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