Course Objective	To develop the modeling and mathematical skills to analytically determine computer systems and analytically determine computer systems and communication network performance. Students should be able to read and understand the current performance analysis and queueing theory literature upon completion of the course. Understand strengths and weaknesses of Queueing Models
Course Outcome(s)	Construct models in discrete and continuous time based on Markov Chains, describe and explain the theory of Markov Chains, describe and motivate Little's formula and its applications, describe and analyze basic Markov queuing models and situations to which they may be applied apply Markov models for selected applications.

Syllabus:

Probability and random variable, discrete and continuous, univariate and multivariate distributions, moments, law of large numbers and central limit theorem (without proof). Poisson process, birth and death process, infinite and finite queueing models M/M/1, M/M/C, M/G/1, M/M/1/N, M/E/1, E/M/1, M/G/1/N, GI/M/1, and more complex non-Markovian queueing models - GI/G/1 queues, Multiserver Queues: M/M/c, M/G/c, GI/M/c modles, Erlang's loss system, Queues with finite populations: M/M/1/N/K, M/G/1/N/K etc. models and Engset formula, Concept bulk queues: M[X]/M/1, M/M[Y]/1, M/M(a, b)/1, M[X]/G/1, GI[X]/M/1, M/G(a, b)/1, GI/M(a, b)/1 etc. queueing models. Priority queueing models, Vacation queueing models, Network of queues, finite processor sharing models, central server model of multiprogramming, performance evaluation of systems using queueing models. Concepts of bottleneck and system saturation point. Introduction to discrete time queues and its applications.

Text books:

1. Gross D. and Harris C. M., Fundamentals of Queueing Theory, Wiley, 2012.

References:

1. Kleinrock L., Queueing Systems Volume 1 : Theory, Wiley, 2013 .
2. Kleinrock L., Computer Applications, Volume 2, Queueing Systems, Wiley, 2013.

Code:MAT5020: Stochastic Models and Applications Prerequisites: Basic Probability	L	T	P	Credit
	3	2	0	4

Course Category	Elective
Course Type	Theory
Course Objective	Upon completion of this course, students will: · understand the need for system models that capture random behavior to assess the risk of undesirable outcomes. · be able to model a number of important industrial and service systems and analyze those models to improve system performance. · be able to construct algorithmic solution strategies to explore system models that have been developed.
Course Outcome(s)	Students would acquire a rigorous understanding of basic concepts in probability theory. They would learn some important concepts concerning multiple random variables such as Bayes rule for random variables, conditional expectation and its uses etc. They would also learn stochastic processes, including Markov Chains and Poisson Processes. The course would provide the background needed to study topics such as Machine Learning, Adaptive Signal Processing, Estimation Theory etc

Syllabus:

Probability spaces, conditional probability, independence, random variables, distribution functions, multiple random variables and joint distributions, functions of random variables, moments, characteristic functions and moment generating functions, conditional expectation, sequence of random variables and convergence concepts, laws of large numbers, central limit theorem, stochastic processes, Markov chains, Poisson process.

Text books:

1. Ross S. M, Introduction to Probability Models, 10th Edition, Academic Press, 2012.

References:

1. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, 1971.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, 1972.

Code:MAT5021: Topological Dynamics	L	T	P	Credit