INTRODUCTION TO QUEUEING THEORY

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PRE-REQUISITES : Calculus-based Probability Theory

INTENDED AUDIENCE : Students at advanced undergraduate and postgraduate level in Mathematics, Statistics, Computer Science & Engg, Communications Engg., Industrial Engineering, Operations Research, Management Science and allied areas interested in this field.

INDUSTRIES APPLICABLE TO : Software/Manufacturing/Scheduling companies that employ advanced tools in their design and analysis of systems and networks.

COURSE OUTLINE :

This course gives a detailed introduction into queueing theory along with the stochastic processes techniques useful for modelling queueing systems. A queue is a waiting line, and a queueing system is a system which provides service to some jobs (customers, clients) that arrive with time and wait to get served (Examples: - a telecommunication system that processes requests for communication; - a hospital facing randomly occurring demand for hospital beds; - central processing unit that handles arriving jobs)

ABOUT INSTRUCTOR :

Prof. Selvaraju has more than eighteen years of teaching experience (in addition to research experience) in the areas of applied probability and stochastic modelling, especially in queueing theory and financial mathematics, and has offered several courses to the B.Tech. (CSE as well as Mathematics and Computing) and M.Sc. (Mathematics and Computing) students at IIT Guwahati.

COURSE PLAN :

Week 1 : Introduction to queues, measures of system performance, characteristics of queueing systems, Little's law and other general results; Transforms and generating functions

Week 2 : Stochastic processes overview, discrete-time Markov chains, classification and long-term behaviour

Week 3 : Continuous-time Markov chain, birth-death processes, Poisson process and exponential distribution

Week 4 : Birth-death queueing systems: Single-server queues, multiserver queues, finite-capacity queues

Week 5 : Birth-death queueing systems: Loss systems, infinite-server queues, finite-source queues, state-dependent queues, queues with impatience, overview of transient analysis and busy period analysis

Week 6 : Non-birth-death Markovian queueing systems: Bulk input queues, bulk service queues, Erlangian models

Week 7 : Priority queues, retrial queues, discrete-time queues

Week 8 : Queueing networks: Series, open Jackson networks

Week 9 : Queueing networks: Closed Jackson networks, cyclic queues, extensions of Jackson networks

Week 10 : Renewal and semi-Markov processes; Semi-Markovian queues

Week 11 : Semi-Markovian queues: Single server and multiserver general service and general input models

Week 12 : General queueing models, queues with vacations