431-622 Applied Queueing Theory

Credit Points:	12.50
Level:	9 (Graduate/Postgraduate)
Dates & Locations:	2009, This subject commences in the following study period/s: Semester 1, - Taught on campus.
Time Commitment:	Contact Hours: 3 hours per week; Non-contact time commitment: 84 hours Total Time Commitment: Not available
Prerequisites:	Knowledge of probability and basic programming at undergraduate engineering level
Corequisites:	None
Recommended Background Knowledge:	None
Non Allowed Subjects:	None
Core Participation Requirements:	For the purposes of considering request for Reasonable Adjustments under the Disability Standards for Education (Cwth 2005), and Student Support and Engagement Policy, academic requirements for this subject are articulated in the Subject Overview, Learning Outcomes, Assessment and Generic Skills sections of this entry. It is University policy to take all reasonable steps to minimise the impact of disability upon academic study, and reasonable adjustments will be made to enhance a student's participation in the University's programs. Students who feel their disability may impact on meeting the requirements of this subject are encouraged to discuss this matter with a Faculty Student Adviser and Student Equity and Disability Support: http://services.unimelb.edu.au/disability
Coordinator:	Prof Moshe Zukerman
Subject Overview:	This subject covers queuing models and their analyses, simulation and numerical algorithms. Attention is given to modelling of practical traffic/network cases. It will benefit students wishing to continue for further academic degrees/research as well as to practitioners. It includes: Deterministic queuing models: D/D/..., Single server Markov chain models such as M/M/1, M/M/k, M/M/k/k, finite buffer, finite source, state dependent and Markov modulated models; M/G/1, G/G/1 and priority queuing models; Internet traffic models, queuing networks, and telecommunication applications (mobile and fixed).
Objectives:	On completion of this subject, the students should have developed the skills and knowledge to understand the theoretical fundamentals of queueing theory and to apply them to practical telecommunications applications. Specifically, they should have a solid understanding of all the mathematical derivations, techniques and logic leading to the following queueing theory results: • Little's Formula; • queueing performance of M/M/1, M/M/k, M/M/infinity, M/M/k/k; finite buffer, finite source, state dependent and Markov modulated and discrete-time queueing models; • recursions of Erlang B and Engset Formulae, and iterative fixed point solution of Engset formula; • Pollaczek-Khinchin formula using the residual service and Kendall's recursion approaches; • M/G/1 mean busy period and mean queue size and delay of M/D/1 and M/M/1 as special cases of M/G/1; • mean queue size of each priority class for M/G/1 with priorities nonpreemptive and preemptive resume; • Reich's formula for a G/G/1 queue; • relationship between overflow probability of G/GI/1 queue and loss probability of its G/GI/1/k equivalent; • Jackson networks performance analysis; • Erlang Fixed-point approximation. The students should understand certain practical and theoretical implications of modelling traffic using Poisson process, MMPP, Gaussian process, EAR(1), PPBP. They should also be able

	to program computer simulations for any of the above mentioned queueing models fed by the above describe traffic models. They should be able to interpret performance results and explain those using physical meaning arguments. Furthermore, they should be able to dimension a link fed by circuit-switching of packet switching traffic, to evaluate the performance of a circuit switching, packet switching and cellular mobile networks.
Assessment:	• Formally supervised written examination - 3 hours 50% (end of semester). This final exam is a hurdle. A student must pass the exam to pass the subject. • Written class test - 1 hour 20% (mid semester); • A project or homework assignments (1500 – 3000 word limit) 30% (end of semester).
Prescribed Texts:	Textbook: • Moshe Zukerman, “Introduction to Queueing Theory and Stochastic Teletraffic Models”, (Classnotes) Additional Reading: • D. Bertsekas and R. Gallager, Data networks, Prentice Hall, Englewood Cliff, New Jersey 1992. • S. K. Bose, An Introduction to queueing systems, Kluver Academic/Plenum Publisher, New York 2002. • H. Akimaru and K. Kawashima, Teletraffic - theory and application, ISBN 3-540-19805-9, 2nd ed., Springer, London 1999. • R. B. Cooper, Introduction to Queueing Theory, North Holland 1981. • L. Kleinrock, Queueing Systems, Volume 1 - Theory, John Wiley and Sons 1975. • L. Kleinrock, Queueing Systems, Volume 2 - Computer Applications, John Wiley and Sons 1976.
Breadth Options:	This subject is not available as a breadth subject.
Fees Information:	Subject EFTSL, Level, Discipline & Census Date, http://enrolment.unimelb.edu.au/fees
Generic Skills:	On completion of this subject, the students should have developed: • analytical, critical and creative thinking, with an aptitude for continued self-directed learning; • sense of intellectual curiosity; • ability to interpret data and research results; • sense of intellectual integrity and ethics of scholarship; • writing, problem-solving and communication skills; • ability to learn in a range of ways, including through information and communication technologies; • capacity to confront unfamiliar problems; • ability to evaluate and synthesise the research and professional literature; • ability to develop models of practical applications and evaluate their performance by rigorous analytical means and by programming computer simulations; • capacity to manage competing demands on time, including self-directed project work.
Related Course(s):	Master of Telecommunications Engineering