ELEN90003 Network Design and Optimisation

Credit Points:	12.5
Level:	9 (Graduate/Postgraduate)
Dates & Locations:	2016, Parkville This subject commences in the following study period/s: Semester 2, Parkville - Taught on campus.
Time Commitment:	Contact Hours: 1 x 3 hour lecture per week Total Time Commitment: 200 hours
Prerequisites:	4-year Electrical Engineering degree or equivalent.
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 Students Experiencing Academic Disadvantage Policy, academic requirements for this subject are articulated in the Subject Description, Subject Objectives, Generic Skills and Assessment Requirements of this entry. The University is dedicated to provide support to those with special requirements. Further details on the disability support scheme can be found at the Disability Liaison Unit website: http://www.services.unimelb.edu.au/disability/
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Subject Overview:	**AIMS** This subject provides knowledge and skills necessary for analysis, design modelling and optimization of telecommunication network. **INDICATIVE CONTENT** This subject is a collection of analytical, numerical and optimisation techniques relating to network modelling and optimisation. Topics in this subject can be generically applied to wired or wireless networks and are not limited to any specific type or tier. More specifically, the subject will include: # Topological modelling of telecommunication network # Capacity planning and design; problems involving flow # Content and data delivery; supply and demand in telecommunication networks # Network cost optimization with flow considerations # Collision detection; spanning trees, ethernet and its application, # Routing protocols; shortest path problems # Application of evolutionary computation in network design and optimization (will be presented subject to time availability) # Quality of service and class of service (core network); Multiprotocole Label Switching (will be presented subject to time availability) # Designing for performance, consideration of service level agreements in network design # Survivability, reliability and availability in network design; Designing fault tolerant network; Self healing design techniques; Fault detection mechanisms # Packet loss, delay and buffer size consideration in network design; Application of relevant queuing models

Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILO's)** On completion of the subject, students will be equipped with a strong background in application of modelling and analytical techniques to design and optimise networking problems. Specifically, it is expected that students acquire the following set of skills and knowledge: 1 Linear programming formulation of network design and optimization problem; Simplex algorithm 2 Maximum flow problem; Path augmentation and labelling methods Transportation problem; Minimum cost and penalty cost method for finding feasible solution; Modified distribution method for finding minimum cost supply-demand solution 3 Minimum cost flow problem; Network simplex method 4 Prim's and Kruskal's algorithm for minimum spanning trees 5 Shortest math problem; Dijkstra algorithm 6 Travelling sales man problem; application of branch and bound 7 Application of Genetic algorithm, Tabu search and hill climbing in network design and optimization (including cost optimization) - (subject to time availability) 8 Modelling network redundancies; cost consideration of adding redundancies (as a multiobjective optimization example) 9 Obtaining availability and reliability figures; application of mean time to failure and mean time to repair and the relevant formulations 10 Little's formula, Deterministic queuing models; Birth-Death process Queue models such as M/M/k, M/M/k/k, finite buffer, finite source, state dependent models; queuing networks, and telecommunication applications; Recursion of Erlang B formula
Assessment:	Continuous assessment of submitted project work completed in small groups (2-4 students), not exceeding 30 pages in total, due in week 12 (approximately 55-60 hours of work per student), 40% (Adressing ILO's 1-10) One written examination, not exceeding three hours at the end of semester 60% (Adressing ILO's 1-10). Hurdle requirement: Students must pass the written exam to pass the subject.
Prescribed Texts:	None
Recommended Texts:	Additional Reading: As this subject is a collection of several analytical, numerical and optimisation topics, the best source of information is the lecture material on the Learning Management System (LMS). Sources will be recommended on the subject website.
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 the following skills: # Problem solving and analytical skills; # Critical and creative thinking, with an aptitude for continued self-directed learning; # Sense of intellectual curiosity; # Ability to interpret data and research results; # 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.
Notes:	**LEARNING AND TEACHING METHODS** The subject is delivered through sessions that combine lecture presentation, discussion, and mini-tutorials. Private study is also required, in addition to the weekly sessions. Learning is also enhanced by active participation in the online Discussion Board. **INDICATIVE KEY LEARNING RESOURCES**

	Students are provided with lecture slides and tutorial problems. Extensive reference material is uploaded or linked on the subject website. **CAREERS / INDUSTRY LINKS** Student teams are encouraged to interact with industry professionals as part of their assignment. Specific industry interactions may be organised according to interest and opportunities.
Related Course(s):	Master of Telecommunications Engineering