ELEN90054 Probability and Random Models

Credit Points:	12.50
Level:	9 (Graduate/Postgraduate)
Dates & Locations:	This subject is not offered in 2014.
Time Commitment:	Contact Hours: 36 hours of lectures, 12 hours of tutorials and 12 hours of workshops Total Time Commitment: 200 hours
Prerequisites:	**GRADUATE STUDENTS:** Admission into the MC-ENG Master of Engineering (Electrical, Biomedical or Mechatronics) **UNDERGRADUATE STUDENTS:** **One of:**

Subject	Study Period Commencement:	Credit Points:
MAST10006 Calculus 2	Semester 1, Semester 2	12.50
MAST10009 Accelerated Mathematics 2	Semester 2	12.50

AND one of:

Subject	Study Period Commencement:	Credit Points:
MAST10007 Linear Algebra	Summer Term, Semester 1, Semester 2	12.50
MAST10008 Accelerated Mathematics 1	Semester 1	12.50

Corequisites:	None
Recommended Background Knowledge:	Knowledge in one of the following subjects is recommended

Subject	Study Period Commencement:	Credit Points:
ELEN30012 Signals and Systems	Semester 2	12.50
BMEN30006 Fundamentals of Biosignals	Semester 1	12.50

Non Allowed Subjects: Anti-requisite for this subject is:

Subject	Study Period Commencement:	Credit Points:
ELEN30002 Stochastic Signals and Systems	Not offered 2014	12.50

Core Participation Requirements:	For the purposes of considering applications for Reasonable Adjustments under the Disability Standards for Education (Cwth 2005) and Students Experiencing Academic Disadvantage Policy, this subject requires all students to actively and safely participate in laboratory activities. Students who feel their disability may impact upon their participation are encouraged to discuss this with the Subject Coordinator and the Disability Liaison Unit. http://www.services.unimelb.edu.au/disability/
Contact:	Email: **gnair@unimelb.edu.au (mailto:gnair@unimelb.edu.au)**
Subject Overview:	**AIMS**

	This subject provides an introduction to probability theory, random variables, decision tests, and stochastic processes. Uncertainty is inevitable in real engineering systems, and the laws of probability offer a powerful way to evaluate uncertainty and make decisions according to well-defined, quantitative principles. The material covered is important in fields such as communications, data networks, signal processing and electronics. This subject is a core requirement in the Master of Engineering (Electrical, Mechanical, Mechatronics and Biomedical). **INDICATIVE CONTENT** Topics include: # Foundations – combinatorial analysis, axioms of probability, independence, conditional probability, Bayes' rule # Random variables (rv's)– definition; cumulative distribution, probability mass and probability density functions; expectation and variance; functions of an rv; important distributions and their properties and uses; # Multiple random variables – joint cumulative distribution, probability mass and probability density functions; independent rv's; correlation and covariance; conditional distributions and expectation; functions of several rv's; jointly Gaussian rv's; # Sums, inequalities and limit theorems – sums of rv's, moment generating function; Markov and Chebychev inequalities; weak and strong laws of large numbers; the Central Limit Theorem; # Decision testing - maximum likelihood, maximum a posterior, minimum cost and Neyman-Pearson rules; basic minimum mean-square error estimation. # Stochastic processes – mean and autocorrelation functions, strict and wide-sense stationarity; ergodicity; important processes and their properties and uses. This material is complemented by exposure to examples from electrical engineering and software tools (e.g. MATLAB) for computation and simulations.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILO)** Having completed this subject it is expected that the student be able to: 1 Demonstrate an understanding of combinatorics, the axioms of probability, independence, random variables, conditioning and Bayes' rule 2 Demonstrate an understanding of important distributions, stochastic processes and decision tests, and their significance 3 Formulate random models of signals and systems encountered in engineering 4 Calculate and interpret probabilities, probability densities, means, variances and covariances, from given information 5 Use the law of large numbers, the central limit theorem, and inequalities to find approximations and bounds 6 Simulate random models using software tools
Assessment:	One written examination, not exceeding three hours at the end of semester worth 60%; Continuous assessment of submitted project work, not exceeding 30 pages over the semester, worth 30%; A one-hour mid-semester test, worth 10%. Hurdle requirement: Students must pass the written exam to pass the subject. Intended Learning Outcomes (ILOs) 1 to 5 are assessed in the final written examination, the mid-semester test, and submitted reports for six computer-based workshops. ILO 6 is assessed through the six workshop reports.
Prescribed Texts:	Probabaility and Stochastic Processes, Yates and Goodman
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:	# Ability to apply knowledge of basic science and engineering fundamentals # In-depth technical competence in at least one engineering discipline # Ability to undertake problem identification, formulation and solution # Ability to utilise a systems approach to design and operational performance # Capacity for independent critical thought, rational inquiry and self-directed learning

	# Ability to communicate effectively, with the engineering team and with the community at large
Notes:	**LEARNING AND TEACHING METHODS** The subject is delivered through lectures, tutorials and workshop classes. **INDICATIVE KEY LEARNING RESOURCES** Students are provided with lecture slides, worked problem sets and reference text lists. **CAREERS / INDUSTRY LINKS** Exposure to simulation tools and teamwork through the six workshops.
Related Majors/Minors/ Specialisations:	B-ENG Electrical Engineering stream Master of Engineering (Biomedical) Master of Engineering (Electrical with Business) Master of Engineering (Electrical)