ENEN90032 Environmental Analysis Tools

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: 48 hours (Lectures: 2 hours per week; Tutorials: 2 hours per week) Total Time Commitment: 200 hours
Prerequisites:	Admission to MC-ENG Master of Engineering **OR** Admission to the 206EC Master of Environmental Engineering **OR**

Subject	Study Period Commencement:	Credit Points:
MAST20029 Engineering Mathematics	Summer Term, Semester 1, Semester 2	12.50

Corequisites:	None
Recommended Background Knowledge:	Completion of the following subjects will assist in learning:

Subject	Study Period Commencement:	Credit Points:
CVEN30008 Engineering Risk Analysis	Semester 1	12.50
CVEN30010 Systems Modelling and Design	Semester 2	12.50

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:	Dr Dongryeol Ryu
Contact:	Dr Dongryeol Ryu **dryu@unimelb.edu.au (mailto:dryu@unimelb.edu.au)**
Subject Overview:	**AIMS** The aim of this subject is to help students develop capability to effectively summarise environmental variables met in the course of research and design, to select appropriate statistical models describing the data structure, and to conduct statistical inference on underlying processes. Students will apply a variety of models from a conventional or Bayesian approach to solve the problems at hand and derive deterministic or stochastic inferences from them. The subject is composed of four wide-ranging topics from exploratory data analysis to spatial modelling. At the beginning of each topic, students are provided with a set of data from environmental research, and a number of analysis tools are conveyed in the lectures. The mathematical aspects of the subject build on concepts developed in fundamental engineering

	mathematics and statistics courses from undergraduate courses. It supports student learning in the capstone design and research projects where data analysis skills are assumed. The subject provides a fundamental skill for a career in environmental engineering where the ability to analyse and communicate the meaning of time series and spatial data sets are expected. **INDICATIVE CONTENT** Specific topics include: 1. Exploratory Data Analysis # Summary statistics and probability models # Analysis of variability and hypothesis test # Linear regression and verification/validation. 2. Time Series Analysis # Introduction to multivariate analysis # Principle component analysis # Stochastic forecast and verification. 3. Methods for Multivariate Data # Multivariate linear regression # Principle component analysis. 4. Analysis of Spatial Data # Simple spatial interpolations # Analysis of spatial variability # Spatial models and Kriging.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILO)** On completion of this subject the student is expected to: 1 Effectively summarise their analysis and design outputs 2 Use stochastic approach to make statistical inference about random environmental variables 3 Define and evaluate objective functions for their design target 4 Quantitatively test their hypothesis 5 Select the most appropriate statistical model describing the data at hand 6 Generate both deterministic and stochastic realisations of environmental variables.
Assessment:	Two 2500-word reports (90%) due mid-semester and week 12, each assignment will require approximately 55 hours of work. Intended Learning Outcomes (ILOs) 1 to 6 are addressed in these reports Four 20-minute quizzes (10%) held every three weeks throughout the semester. ILOs 1 to 6 are addressed in the quizzes
Prescribed Texts:	None
Recommended Texts:	Chris Chatfield (2004). *The Analysis of Time Series: An Introduction*. Chapman & Hall. Boca Raton, FL Wilks, D.S. (2011). *Statistical Methods in the Atmospheric Sciences*. Elsevier, Amsterdam, The Netherlands. Kitanidis, P.K. (1997). *Introduction to Geostatistics: Applications to Hydrogeology*. Cambridge University Press, Cambridge; New York Ramsey, Fred L. & Daniel W. Schafer. (2013). *The Statistical Sleuth: A Course in Methods of Data Analysis*. Brooks/Cole Cengage Learning, Boston, MA
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 science and engineering fundamentals # Ability to undertake problem identification, formulation, and solution # Proficiency in engineering design

	# Ability to conduct an engineering project.
Notes:	**LEARNING AND TEACHING METHODS** Key analysis methods are introduced in lectures, which are then followed up in tutorial and computer based exercises. The tutorial use problem based learning techniques. The computer based exercises use MatLab as the main software tool, which is used throughout the course. **INDICATIVE KEY LEARNING RESOURCES** Chris Chatfield (2004). *The Analysis of Time Series: An Introduction*. Chapman & Hall. Boca Raton, FL Wilks, D.S., (2011). *Statistical Methods in the Atmospheric Sciences.* Elsevier, Amsterdam, The Netherlands. Kitanidis, P.K. (1997). *Introduction to Geostatistics: Applications to Hydrogeology*. Cambridge University Press, Cambridge; New York Ramsey, Fred L. & Daniel W. Schafer (2013). *The Statistical Sleuth: A Course in Methods of Data Analysis*. Brooks/Cole Cengage Learning, Boston, MA Anon (n.d.) Learn Matlab. **http://aaee-scholar.pbworks.com/w/page/1177071/Learn%20MATLAB (http://aaee-scholar.pbworks.com/w/page/1177071/Learn%20MATLAB)** **CAREERS / INDUSTRY LINKS** Real data sets from industry and research partners form the basis of the assignments and learning activities. Industry standard computation software (MatLab) is used for assignments.
Related Course(s):	Doctor of Philosophy - Engineering Master of Environmental Engineering Master of Information Technology Master of Philosophy - Engineering
Related Majors/Minors/ Specialisations:	Energy Efficiency Modelling and Implementation Energy Efficiency Modelling and Implementation Energy Studies Energy Studies Integrated Water Catchment Management Integrated Water Catchment Management MIT Spatial Specialisation Master of Engineering (Environmental) Tailored Specialisation Tailored Specialisation Waste Management Waste Management