THE UNIVERSITY OF WESTERN AUSTRALIA

GENG2140 MODELLING AND COMPUTER ANALYSIS FOR ENGINEERS – SEMESTER TWO 2009

UNIT COORDINATOR(S)

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LECTURER(S)

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Further information about this unit (including a copy of this unit outline) may be obtained from:
http://undergraduate.csse.uwa.edu.au/units/GENG2140/

INTRODUCTION

This unit guides students through problem description, physical modelling, mathematical modelling, computer simulation and critical analysis of results. An introduction is given to computational methods in the solution of engineering problems including iterations, numerical and automatic symbolic integration, search methods, relaxation, approximation, root finding for non-linear functions, solution of systems of linear algebraic and non-linear differential equations as well as with computational errors associated with these methods. Students are expected to learn Matlab programming language and use spreadsheets in Excel.

GENERIC LEARNING OUTCOMES

Outcome	**Assessment Activity**
Students who successfully complete this unit should *further* develop: • The ability to apply knowledge of basic science and engineering fundamentals to complete assigned tasks • Technical competence • The ability to think and reason logically and creatively • The ability to undertake problem identification, formulation and solution • The ability to develop appropriate frameworks, numerical models and validity assessment to problems	Assignments Final examination

SPECIFIC LEARNING OUTCOMES

Outcome	Assessment Activity
Students who successfully complete this unit should be able to: • Create mathematical and numerical models of simple but realistic engineering systems • Solve numerical and statistical models using a computer and critically assess results; understand when an engineering system may be treated as linear and when non-linear treatment is necessary as well as when the system can be considered probabilistic and when statistical methods are required • Use mathematical software packages (which use procedural programming as well as notebook-type and spreadsheet-type environments) to efficiently analyse and solve problems in engineering • Apply the knowledge of basic science and engineering fundamentals	6 assignments Final examination

ASSESSMENT MECHANISM STATEMENT

Assessment consists of 6 compulsory assignments and a final examination. Final grading of the unit is based on semester two only. No supplementary assessment will be available for the unit. Final unit marks may be modified in accordance with Faculty policy (see http://www.ecm.uwa.edu.au/for/students/assess)

	Assessment	Contribution
1	Assignments Tutorial sheets will be handed out 10 days before the deadline indicated in the assignment sheet. Assignments should be placed in the marked assignment boxes on the first floor North wing of the Civil Engineering Building. Penalty for late submission: 15% (10% for Assignment 1) of the mark for the first day of late submission and then 4% of the mark per working day late submission	50%
2	3-hour final examination at the end of semester two	50%

RECOMMENDED READING

- Nakamura, S. *Numerical Analysis and Graphic Visualisation with MATLAB,* Prentice Hall (1996)

IMPORTANT INFORMATION

- Students should be aware of the University guidelines on Academic Misconduct (see http://www.ecm.uwa.edu.au/for/students/plagiarism)
- Students should be aware of the Faculty Policy for Appeals (see http://www.ecm.uwa.edu.au/for/students/exams)
- Students should be aware of the Charter of Student Rights (see http://www.secretariat.uwa.edu.au/home/policies/charter)

LECTURE LIST

For details of times and venues of all teaching sessions consult the university timetable at http://www.timetable.uwa.edu.au/

Lecture(s)	**Content (Note: The order and/or number of lectures may vary)**
1, 2	Introduction to modelling and computer analysis
3-5	Introduction to Excel and Matlab
6	Computer arithmetic and truncation errors. Numerical differentiation
7-8	Matrices, operations, application to stress analysis
9, 10	Gauss method, Ill-conditioned matrices
11-15	Sensitivity analysis, Statistical simulations, Monte-Carlo method
16	Revision 1
17-19	Curve fitting
20-22	Numerical methods of solving non-linear algebraic equations
23-25	Numerical methods of minimisation
26, 27	Numerical integration
28	Revision 2
29, 30	Gauss integration
31-34	Numerical solution of ordinary differential equations – initial value problem
35, 36	Numerical solution of ordinary differential equations – boundary value problem
37, 38	Method of finite differences
39	Final revision

COMPUTER LAB LIST

Lab	**Content (Note: The order and/or number of tutorials may vary)**
1-3	Excel and Matlab
4-6	Numerical errors and numerical differentiation
7-9	Matrices and stresses
10-12	Ill-conditioned matrices

13-18	Sensitivity analysis and statistical simulations
19-21	Curve fitting
22-24	Numerical methods of solving non-linear algebraic equations
25-27	Numerical methods of minimisation
28-32	Numerical integration
33-35	Numerical solution of ordinary differential equations – initial value problem
36, 37	Numerical solution of ordinary differential equations – boundary value problem
38,39	Method of finite differences