Description: Computational Mechanics in Design

<table>
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<th>Subject</th>
<th>Cat-Nbr</th>
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<th>Term</th>
<th>Mode</th>
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<td>MEC</td>
<td>3302</td>
<td>20590</td>
<td>1, 2003</td>
<td>EXT</td>
<td>1.00</td>
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Academic Group: FOENS
Academic Org: FOES02
HECS Band: 2
ASCED Code: 030701

STAFFING
Examiner: Chris Snook
Moderator: Selvan Pather

PRE-REQUISITES
Pre-requisite: MEC2401 and MEC2402

OTHER-REQUISITES
Prerequisites 70350+70370

SYNOPSIS
This course will provide students with an understanding of the operation and limitations of computer aided engineering (CAE) systems, and provide opportunities to develop the basic skills required to operate such systems. Material presented will include the architecture of CAE systems, numerical methods, finite element methods, computer graphics, engineering methods of CAE, optimisation, solid feature based parametric modelling, and technical information management systems. The advantage of a CAE process is demonstrated by several engineering assignments that students must complete on a CAE facility throughout the semester. Considerable emphasis is placed on the appropriate use of the finite element method in the design process.

OBJECTIVES
On completion of this course, students should be able to:

- describe the basic features of CAD/CAE facilities, including computer hardware, graphical display and input devices, operating system and software capability, hardcopy devices and operator training and support requirements;
explain the concepts and demonstrate the principles used in the geometric description of lines, edges, surfaces and volumes to construct 2D, wire frame, surface and solid models;
• demonstrate proficiency in the use of a "parametric feature based" CAD system;
• demonstrate proficiency in developing a solid model of an engineering artefact, exporting that model to an engineering analysis package and carrying out that analysis;
• explain the concepts and principles used in the formulation and application of the finite element method (focussed on stress analysis of common mechanical devices);
• demonstrate an ability to formulate, implement, and document solutions to solve simple engineering problems using the finite element method;
• choose appropriate software packages to assist in the solution of a range of common engineering problems;
• undertake a systematic approach to the design of an engineering system using computer aided engineering software;
• evaluate the performance of an existing design using computer aided engineering software, in particular, to evaluate the validity of the model and solution in relation to the original problem specification;
• demonstrate an awareness of the potential areas of application of CAE tools, and to explain the advantages and disadvantages of such systems.

TOPICS

<table>
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<tr>
<th>Description</th>
<th>Weighting (%)</th>
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<tbody>
<tr>
<td>1. Overview of CAE systems</td>
<td>5.00</td>
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<tr>
<td>2. Computer Graphics</td>
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<tr>
<td>3. CAD and Solid Modelling Systems</td>
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<tr>
<td>4. Finite Element Method - Basic Analysis</td>
<td>30.00</td>
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<tr>
<td>5. Finite Element Method - Applications</td>
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<tr>
<td>6. Case Studies and Future Directions</td>
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TEXT and MATERIALS required to be PURCHASED or ACCESSED:

Books can be ordered by fax or telephone. For costs and further details use the 'Book Search' facility at http://bookshop.usq.edu.au by entering the author or title of the text.

Adams, V. & Askenazi, A. 1999, Building Better Products with Finite Element Analysis, Onword Press, Santa Fe, NM.

REFERENCE MATERIALS

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

1994, A Finite Element Primer, NAFEMS, Glasgow.
Knight, C. E. 1993, The Finite Element Method in Mechanical Design, PWS- Kent,
Moaveni, A. 1999, Finite Element Analysis: Theory and Application with ANSYS, Prentice Hall,

STUDENT WORKLOAD REQUIREMENTS

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>HOURS</th>
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<tr>
<td>Directed Study</td>
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<td>Examinations</td>
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<td>Private Study</td>
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<td>Project Work</td>
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ASSESSMENT DETAILS

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<th>Marks Out of</th>
<th>Wtg(%)</th>
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<th>Due Date</th>
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<tr>
<td>ASSIGNMENT 1</td>
<td>200.00</td>
<td>20.00</td>
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<td>09 Apr 2003</td>
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<td>ASSIGNMENT 2</td>
<td>200.00</td>
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<td>MAJOR DESIGN ASSIGNMENT</td>
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<tr>
<td>2 HOUR OPEN EXAMINATION</td>
<td>300.00</td>
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NOTES:

- Student Administration will advise students of the dates of their examinations during the semester.

IMPORTANT ASSESSMENT INFORMATION

1 Attendance requirements:
   There are no attendance requirements for this course. However, it is the students' responsibility to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.

2 Requirements for students to complete each assessment item satisfactorily:
   To complete each of the assessment items satisfactorily, students must obtain at least 50% of the marks available (or at least a grade of C-) for each assessment item.

3 Penalties for late submission of required work:
If students submit assignments after the due date without prior approval then a penalty of 10% of the total marks gained by the student for the assignment will apply for each working day late.

4 Requirements for student to be awarded a passing grade in the course:
To be assured of receiving a passing grade a student must achieve at least 40% in each of the summative assessments and at least 50% of the available weighted marks for the summative assessment items.

5 Method used to combine assessment results to attain final grade:
The final grades for students will be assigned on the basis of the weighted aggregate of the marks (or grades) obtained for each of the summative assessment items in the course.

6 Examination information:
In an Open Examination, candidates may have access to any material during the examination except the following: electronic communication devices, bulky materials, devices requiring mains power and material likely to disturb other students.

7 Examination period when Deferred/Supplementary examinations will be held:
Any Deferred or Supplementary examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.

8 University Regulations:
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL: http://www.usq.edu.au/SECARIAT/calendar/Part5/ or in the printed version of the current USQ Handbook.

ASSESSMENT NOTES

1 The due date for an assignment is the date by which a student must despatch the assignment to the USQ. The onus is on the student to provide proof of the despatch date, if requested by the Examiner.

2 Students must retain a copy of each item submitted for assessment. This must be produced within five days if required by the Examiner.

3 In accordance with University's Assignment Extension Policy (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an assignment in extenuating circumstances.

4 The Faculty will normally only accept assessments that have been written, typed or printed on paper-based media.

5 The Faculty will NOT accept submission of assignments by facsimile.

6 Students who do not have regular access to postal services or who are otherwise disadvantaged by these regulations may be given special consideration. They should contact the examiner of the course to negotiate such special arrangements.

7 In the event that a due date for an assignment falls on a local public holiday in their area, such as a Show holiday, the due date for the assignment will be the next day. Students are to note on the assignment cover the date of the public holiday for the Examiner's convenience.
8 Students who have undertaken all of the required assessments in a course but who have failed to meet some of the specified objectives of a course within the normally prescribed time may be awarded the temporary grade: IM (Incomplete - Make up). An IM grade will only be awarded when, in the opinion of the examiner, a student will be able to achieve the remaining objectives of the course after a period of non-directed personal study.

9 Students who, for medical, family/personal, or employment-related reasons, are unable to complete an assignment or to sit for an examination at the scheduled time may apply to defer an assessment in a course. Such a request must be accompanied by appropriate supporting documentation. One of the following temporary grades may be awarded IDS (Incomplete - Deferred Examination; IDM (Incomplete Deferred Make-up); IDB (Incomplete - Both Deferred Examination and Deferred Make-up).

10 The Faculty of Engineering and Surveying does not offer supplementary examinations.