MODULE DESCRIPTION FORM

16363 (16366 sem1/16367 sem2) Engineering Analysis III

Module Registrar: Prof D Mackenzie
d.mackenzie@strath.ac.uk

Taught To (Course): Cohorts for whom class is compulsory

Other Lecturers Involved: Dr B Keating, Dr E Minisci, Dr T Scanlon

Credit Weighting:
16363 = 20 (ECTS 10)
16366/16367 = 10

Semester: 1 and 2

Assumed Prerequisites: MM117 Mathematics 1M; ME103 Engineering Analysis and Applications 1; ME209 Mathematical Modelling and Analysis.

Compulsory class

Academic Level: 3

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Tutorial</th>
<th>Laboratory</th>
<th>Groupwork</th>
<th>External</th>
<th>Online</th>
<th>Project</th>
<th>Assignments</th>
<th>Private Study</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>4</td>
<td>8</td>
<td></td>
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<td></td>
<td>40</td>
<td>128</td>
<td>200</td>
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Educational Aim

This module aims to introduce the students to the theory and application of the two most widely used numerical methods in engineering analysis: the Finite Element Method and Computational Fluid Dynamics.

Learning Outcomes

On completion of the module the student is expected to be able to

LO1 understand the basic theory of the Finite Element Method and Computational Fluid Dynamics (CFD);

LO2 use FEM software ANSYS Workbench and CFD software FLUENT to solve various simplified practical engineering problems;

LO3 understand how mathematics, numerical analysis and computed technology are combined to model and simulate the behaviour of physical systems.

Syllabus

The module will teach the following:

1st Semester: Mathematical modelling of engineering systems using the Finite Element Method: Theory and practice. Introduction to the commercial finite element program ANSYS Workbench; structural analysis; stress analysis.

2nd Semester: Mathematical modelling of engineering systems using Computational Fluid Dynamics: Theory and Practice. Introduction of the commercial computational fluid dynamics program FLUENT; analysis of flow field; recirculation zones/stagnation points; boundary layers.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1
C1 understand energy method, displacement interpolation, element stiffness matrix, global stiffness matrix, boundary conditions, numerical solution procedure;
C2 understand control volume, differential method and higher order method, recirculation zones/stagnation points, boundary layers;
C3 understand procedure to solve structure and fluid problems numerically.

LO2
C1 be able to use FEM software ANSYS Workbench to solve solid and structure problems;
C2 be able to use CD software FLUENT to create models and solve different types of fluid problems;
C3 be able to obtain important results from ANSYS Workbench and FLUENT through post processing.

LO3
C1 understand how to simulate the behaviour of a physical system by transferring the practical problem into a mathematical model and using suitable numerical methods to solve the problem with a computer;
C2 be able to know the types of error in numerical analysis and how to improve the accuracy of numerical results.
The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

**12 Principles of Assessment and Feedback**

(on Learning & Teaching web pages: [www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/](http://www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/))

Written feedback on assignments will be provided to each student 4 weeks after the submission date. The questions raised by students will be collated and discussions / answers to the questions will be given through tutorials and lectures.

Each student will receive one-to-one advice in practical tutorial classes.

A special session may be organised to provide a summative feedback to all students and this will be done during the first two weeks of the following semester. The exact date, time and place of the session will be advised in advance.

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**Assessment Method(s) Including Percentage Breakdown and Duration of Exams**

- Attendance at project tutorials is compulsory and completion represents 20% of the overall mark.

<table>
<thead>
<tr>
<th>Examinations</th>
<th>Courseworks</th>
<th>Projects</th>
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<tbody>
<tr>
<td>Number</td>
<td>Month(s)</td>
<td>Duration</td>
</tr>
<tr>
<td>2</td>
<td>Jan/May</td>
<td>1hr each</td>
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<tr>
<td>LO1, LO2</td>
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Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

**Coursework / Submissions deadlines:**

**Resit Assessment Procedures:** 2hr examination in August.

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**PLEASE NOTE:**

Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of an exam.

**Recommended Reading**

- Simply for reference (do NOT purchase)

**Additional Student Feedback**

(Please specify details of when additional feedback will be provided)

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<th>Room No</th>
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Session: 2014/15

**Approved:**

**Course Director Signature:**  

**Date of Last Modifications:** 11 August 2014
# MODULE TIMETABLE

**Module Code:** 16363/366/367  
**Module Title:** Engineering Analysis 3

**Brief Description of Assessment:**
1\textsuperscript{st} Semester: 1 FEA modelling assignment: stress analysis.  
2\textsuperscript{nd} Semester: 1 CFD modelling assignment: 2D flow analysis.

## Assessment Timing:-
Indicate on the table below the start/submission dates for each assignment/project and the timing of each exam/assessment(s).

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<thead>
<tr>
<th>Semester One</th>
<th>WK1</th>
<th>WK2</th>
<th>WK3</th>
<th>WK4</th>
<th>WK5</th>
<th>WK6</th>
<th>WK7</th>
<th>WK8</th>
<th>WK9</th>
<th>WK10</th>
<th>WK11</th>
<th>WK12</th>
<th>Exam Period</th>
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<td>Start</td>
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<table>
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<th>Semester Two</th>
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<th>WK2</th>
<th>WK3</th>
<th>WK4</th>
<th>WK5</th>
<th>WK6</th>
<th>WK7</th>
<th>WK8</th>
<th>WK9</th>
<th>WK10</th>
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<td>1hr exam</td>
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