Definitive Module Document (DMD)

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Module Code:MAAD0023

Title of Module
Full Title: Computer Aided Engineering
Short Title: CAE

MODULE

MAAD0023 (A 05/6)

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Version: 1

Credit Points: 15

Level / ECTS Level: M

First Offered: 26/9/2005 00-00-00

6. Home Department:
AAD

7. Departments(s) contributing to teaching:

9. Module Aims:
- develop knowledge and skills in the key Computer Aided Engineering (CAE)methods ; Computer Aided Design (CAD), Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD)

- provide CAD, FEA and CFD based solutions to typical mechanical engineering problems,

- analyse mechanical engineering problems in order to optimise computer based model

- assess validity of simulation results.

10a. Learning Outcomes: Knowledge and Understanding:
- understand the underlying physical principles and numerical methods of CAD, FEA and CFD techniques,

- demonstrate an understanding of the required modelling methodology for a given application,

- appreciate critical evaluations of simulation results

10b. Learning Outcomes: Skills and Attributes:
- generate required CAD models, transfer model to CFD/ FEA packages, generate required meshes and solver settings for basic mechanical engineering problems,

- employ appropriate material properties, physical properties and boundary conditions for CAE models,

- select solution methods and parameters with convergence criteria and monitor simulations,

- carry out correlation of simulation and test results.

11. Module Content
11a Module Content:
This module aims to enable students to

(i) construct computer simulation models for requirements found in mechanical engineering using

CAD surface and solid information,

(ii) examine the effect of mesh density, domain size, boundary conditions, material properties

and appropriate numerical schemes on the accuracy of results, using an appropriate FEA

package,

(iii) validate and correlate the results against benchmark solutions.

Part of the module covers the numerical foundation of CFD and FEA methods, dynamic analysis and fluid flow/ heat transfer. Both rationale and dexterity in the use of the software packages are introduced. Convergence and monitoring of solutions is considered together with post-processing issues.

The students will also consider a range of modelling techniques in solving fundamental problems in mechanical engineering.

11b. Further details on how the learning outcomes of the module will be achieved:
The intended learning outcomes are facilitated through a combination of approaches to learning and teaching, typically this will include lectures, workshops, tutorials, individual and group assignments, and seminars. The students would be expected to use a variety of methods to numerically represent engineering problems, through the use of both generic and industry specific software packages.

Both CFD and FEA reply upon numerical method, consequently there will be materials to familiarize students with numerical methods. FEA in the module is based upon linear approaches and CFD is based largely upon non-linear method. To aid with learning students will carry out simulations with various meshing density for both CFD and FEA. Following on from studies of mesh sensitivity and quality there will be an introduction to mixed element meshes and additional meshing techniques which are being increasingly used by industry.

The fundamental continuum mechanics will be treated in some details emphasizing differences and similarities between solid and fluid mechanics. Typical topics cover introduction to governing equations, solution procedures and assessment and validation of simulation results. Both components will start with the numerical methods in parallel with case studies. These case studies will reflect the application and need of the methods, and should also lay the foundation of case studies. The advanced CAD and CAE software packages will be introduced so that students will learn a number of standard simulation tools used in industry. Typical simulation tools are Ideas, ANSYS, Phoenics and Star CD. Workshops and tutorials will focus on the calculation and understanding of relevant solution parameters and the specification and on the calculation of boundary conditions from basic data to be expected in industry. Minor student projects will be introduced after the case studies to enhance the students' skills in using the industry standard simulation packages as well as translating a technical task into a realistic simulation model. The projects will be formulated in a manner that will encourage the students to explore effects of numerical and physical parameters as well as model detail and extent of domain. The use of seminars at the end of the project will enhance the students' presentation performance, but more importantly it will expose all students to a wide range of issues in mechanical engineering through attending the presentations of their peers.

Finally the examination addresses all issues.

12. Language of Delivery:
English

13. Language of Assessment:
English

14. Assessment Details (Academic):
Coursework: 40

Exam: 60

Other: The examination (60%) is an end-of-module 3 hours individual examination to assess learning outcomes 1-3, 5-6.

In-course assessments will typically consist of-

- One CFD assignment to assess learning outcomes 4-7 (15%)

- One FEA assignment to assess learning outcomes 4-7 (15%)

- One CFD phase test to assess learning outcomes 1-3, 5 (5%)

- One FEA phase test to assess learning outcomes 1-3, 5 (5%)

Each Assessment satisfies a selection of the learning outcomes.

Assessment Notes:
The successful candidates are required to pass an examination and overall.

15. Locations(s):
UH HATFIELD

16. Pre and Co-Requisite:
Pre-Requisite

Co-Req

Prohibited

17. Subject Board of Examiner/s:

18. Comments