DESIGN SKILLS - 2024/5

Module code: ENG2125

Module Overview

This module extends from the design modules in the first year. The basic CAE skills generated in year 1 were primarily CAD and in this module these skills are extended to include FEA (finite element analysis). This provides a computer based stress analysis alternative to the analytical stress analysis skills developed in other parts of this programme. Project Management skills will prepare students for a group design activity enabling them to specify, plan and monitor their progress. Alongside formal lectures the students will work in small groups on several short duration design projects to promote team work and put theory into practice. This module will give students the skills and confidence to complete a larger group design project in a subsequent module.

Module provider

Mechanical Engineering Sciences

Module Leader

FOREMAN Charlotte (Mech Eng Sci)

Number of Credits: 15

ECTS Credits: 7.5

Framework: FHEQ Level 5

Module cap (Maximum number of students): N/A

Overall student workload

Independent Learning Hours: 82

Lecture Hours: 8

Tutorial Hours: 36

Guided Learning: 16

Captured Content: 8

Module Availability

Semester 1

Prerequisites / Co-requisites

N/A

Module content

Applications of computer based stress analysis in design (FEA)- 5 credits

An introduction to finite element analysis and the software package ANSYS; line area and solid elements, integration of CAD into the design process. Single parts and assemblies, modelling fibre-reinforced composite materials and a mini FEA modelling project.#

Project Management - 5 credits

Project definition: what constitutes a project, the project lifecycle and requirements capture. Concept selection Project management: UK/international standards, work breakdown structure, resources and costs, Gantt charts, risk management, monitor and control.

Group design exercises - 5 credits

Group work skills - Why group work is important for engineers, how to work effectively in a group, introduction to group dynamics, stages of group work, personality preferences, effective communication, short duration design tasks in groups.

Assessment pattern

Assessment type	Unit of assessment	Weighting
Coursework	Written assignment FEA	40
Online Scheduled Summative Class Test	Project Management class test (1 hour duration)	20
Coursework	Group Poster	40

Alternative Assessment

An alternative assessment to the group poster will be offered, consisting of an individual poster.

Assessment Strategy

The assessment strategy is designed to provide students with the opportunity to demonstrate their understanding of the 3 key complementary elements of this module: FEA, Project Management & Design tasks

FEA is computer based and a written assignment based on the FE analysis of a product is the most natural assessment method. This assessment will enhance students digital capabilities and will increase their employability by being able to add engineering software as a skill to their CV's.

Project Management (PM) is assessed in an online class test and applied during group activities.

The design tasks are undertaken in groups.

Thus, the summative assessment for this module consists of:

Written assignment (FEA) [Learning outcome 2]

Online Class test (Project Management) [Learning outcome 3]

Poster (group) [Learning outcomes 1 and 4]

Formative assessment

Formative assessment of project management knowledge and group working skills is given at the supervised group meetings.

Feedback

Feedback is given in tutorials and supervised group meetings. Feedback is provided on discussion forums and Teams group channels. Written feedback is given on the FEA coursework.

Module aims

- Develop further the understanding of the design process
- Allow students to understand the place of finite element analysis in the design process
- Enable students to explore the complete engineering product development process from requirements capture through to end-of-life
- Provide experience of team working, which will provide students with the opportunity to collaborate with peers, develop ideas and co-create required outputs

Learning outcomes

Ref		Attributes Developed	
001	Participate in an engineering design activity	KCP	
002	Apply the techniques of finite-element analysis using commercial software to the resolution of stress distributions in complex, loaded components	KCP	
003	Understand the nature and context of project management in various circumstances and apply appropriate project management and project planning techniques	KCP	
004	Demonstrate the ability to work effectively as part of a team (showing respect and empathy in support of team members), responding positively to any setbacks.	KC	C16

Attributes Developed

C - Cognitive/analytical

K - Subject knowledge

T - Transferable skills

P - Professional/Practical skills

Methods of Teaching / Learning

The learning and teaching strategy is designed to:

Equip students with the knowledge, skills and experience of FEA and project management tools and engineering design process through lectures, computer laboratory classes, tutorials and group exercises. This module is aimed at preparing students for a more complex design project undertaken as a group activity in semester 2 Design, Make, Evaluate module.

The learning and teaching methods include:

FEA practical workshop classes; to develop students use of this engineering software to solve engineering problems

Project Management lectures / tutorials: to equip students with the skills to manage a project.

Design Skills: Lectures and small group tasks to prepare students to work collaboratively. Working in groups, students will be tasked with several short duration group design tasks to complete. These will complement and reinforce the lecture topics, enable students to experience the process of engineering design and encourage efficient group working and team building.

Indicated Lecture Hours (which may also include seminars, tutorials, workshops and other contact time) are approximate and may include in-class tests where one or more of these are an assessment on the module. In-class tests are scheduled/organised separately to taught content and will be published on to student personal timetables, where they apply to taken modules, as soon as they are finalised by central administration. This will usually be after the initial publication of the teaching timetable for the relevant semester.

Reading list

https://readinglists.surrey.ac.uk
Upon accessing the reading list, please search for the module using the module code: ENG2125

Other information

The School of Mechanical Engineering Sciences is committed to developing graduates with strengths in Employability, Digital Capabilities, Global and Cultural Capabilities, Sustainability and Resourcefulness and Resilience. This module is designed to allow students to develop knowledge, skills and capabilities in the following areas;

Employability: This module provides students with working knowledge of key engineering software; FEA and project management software such as Gannt charts, software often used within engineering companies. Students will become familiar with different personality preferences, which is vital for effective group working, enabling them to recognize the strengths and weaknesses of the personality preferences. Students will actively assign roles and responsibilities in order to ensure tasks are planned well and targets are met. Students will engage in real world design problems and work collaboratively to develop solutions.

Digital capabilities: Students will be taught how to use Engineering software -FEA to visualize stresses and strains and apply to engineering problems. Students will further develop their skills from the L4 module in CAD by designing solutions using CAD software. Students will also use project management tools to help them monitor progress within their team. They will use Teams in order to work effectively in a group and to aid them with their collaborative work.

Global and Cultural Capabilities: Students work in groups randomly assigned. This will require students to engage effectively with people from different backgrounds in ways that respect the interests of cultural groups. Students will work together within these groups to perform decision making tasks. This provides an opportunity to interact, communicate and build relationships with people from different backgrounds. Peer assessment will encourage students to value and recognize the contribution of each team member. In group tutorials, students are encouraged to learn and share from each others personal and cultural knowledge and perspectives.

Sustainability: Students are given design briefs that ask them to consider ways in which engineering can be used to improve sustainability, and are asked to consider the environmental impact of their chosen materials / power sources as part of a conceptual design exercise.

Resourcefulness and resilience: Students will need to develop resourcefulness, be able to share ideas and experiences both individually and collectively, appreciate potential barriers and challenges faced by others and provide support and show empathy towards each other in working towards achieving successful outcomes and responding to problem-based task requirements.

Programmes this module appears in

Programme	Semester	Classification	Qualifying conditions
Aerospace Engineering BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module

Programme	Semester	Classification	Qualifying conditions
Aerospace Engineering MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Automotive Engineering (Dual degree with HIT) BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Automotive Engineering BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Automotive Engineering MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biomedical Engineering BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biomedical Engineering MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Mechanical Engineering BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Mechanical Engineering MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module