Module Specification

Stress & Dynamics

Version: 2023-24, v6.0, 10 Jul 2023

Contents

Part 1: Information

Module title: Stress & Dynamics

Module code: UFMFH3-30-1

Level: Level 4

For implementation from: 2023-24

UWE credit rating: 30

ECTS credit rating: 15

College: College of Arts, Technology and Environment

School: CATE School of Engineering

Partner institutions: None

Field: Engineering, Design and Mathematics

Module type: Module

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: Two of the key disciplines that underpin many areas of engineering are introduced in this module and supported by practical laboratory exercises. This foundation of knowledge presented here will be used to extend specialist knowledge in future years.

Features: Not applicable

Educational aims: See Learning Outcomes

Outline syllabus: Stress Analysis (Semester 1):

Introduction to statics, 3 equations of static equilibrium, reactions at supports, UDL case.

Pin-jointed framework, forces experienced by the joints due to members in compression and tension. Method of Joints,

Method of Joints; Method of sections

Properties of materials, stress, strain, Young’s Modulus,

Shear Force and Bending Moment Theory

Introduce stresses in beams and Second Moment of Area

Second moment of area – Parallel axis theorem

Combined bending and end load; Bi –axial bending. Thermal Strain and Intro to 2D and 3D theory

Introduction to thin pressure vessels derivation of formula; Change in volume

Torsion, derivation of the engineering torsion formula,

Composite Shafts, connected in series and parallel

Dynamics (Semester 2):

Displacement, velocity and acceleration: revision of constant acceleration formulae for linear and angular motion

Scalars and vectors: vector notation, addition and multiplication (revision). Relevance to dynamics. Relative and absolute quantities (displacement, velocity etc.).

Newton’s laws: Newton’s three laws of motion, drawing Free-body and kinetic diagrams for particles and applying Newton’s second law to solve problems.

Non-uniform acceleration: using a graphical/numerical method to solve non-uniform acceleration problems, and using integration to solve non-uniform acceleration problems if the function of the acceleration is known.

Work and Energy: derivation of equations for work for various forcing functions, relationship between work and kinetic energy, and derivation of gravitation potential energy and elastic potential energy. Conservation of energy and the energy balance equation.

Momentum and Force Impulse: Definition of momentum, conservation of momentum, elastic and inelastic collisions, impulse of a constant and varying force.

Rotational energy and angular momentum: Rotational kinetic energy and moment of inertia determination. Angular momentum definition and the particular case of a disk.

Torque and Centrifugal Force: definition of torque. Newton’s second law for rotating bodies (rigid bodies). Torque impulse, work done by a torque and power transmitted by a torque leads on to equivalents between linear and angular quantities.

Rigid Body Dynamics: Equations of motion for a rigid body, drawing free-body and kinetic diagrams for rigid bodies, applying Newton’s laws for rigid body problems.

Springs and Mechanical Oscillation: Natural vibrations, simple harmonic motion. Stiffness of springs, combined stiffness, oscillation of a spring. Oscillation of a pendulum, and introduction to damping and resonance.

Part 3: Teaching and learning methods

Teaching and learning methods: Stress delivered in semester 1 (component A); Dynamics delivered in semester 2 (component B).

Contact: 72 hours

Assimilation and skill development: 126 hours

Coursework: 34 hours

Exam preparation: 68 hours

Total: 300 hours

Large group lecture supported by small group tutorial sessions. Study time outside of contact hours will be spent on going through exercises and example problems.

Lab sessions (small groups) will provide experience of empirical methods and will require further non-contact time or assignment preparation.

Scheduled learning includes lectures, tutorials\lab sessions.

Independent learning includes hours engaged with essential reading, assignment preparation and completion etc.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Show a detailed knowledge and understanding of key principles and results in stress analysis

MO2 Show a detailed knowledge and understanding of key principles and results in dynamics

MO3 Develop an knowledge and understanding of subject specific skills with respect to modelling and solving numerical problems in stress analysis and dynamics, based on knowledge of the relevant engineering principles

MO4 Demonstrate the ability to apply knowledge of theoretical and practical experience to solve problems in the analysis and solution of problems of stress analysis.

MO5 Apply knowledge and experience to investigate and solve problems in the subject area of dynamics

MO6 Show cognitive skills with respect to modelling and simplifying real problems, and applying mathematical methods of analysis, and understanding the capabilities of computer based modelling

MO7 Demonstrate key transferable skills in problem formulation and decision making, interpreting experimental results

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Face-to-face learning = 72 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/modules/ufmfh3-30-1.html

Part 4: Assessment

Assessment strategy: This assessment profile involves three tasks.

Stress Analysis–
The assessment strategy for each task involves a series of tests (regular short online e-assessment that provide regular feedback and points of engagement) and a final end of semester assessment task that assess application knowledge to extended problems.

Dynamics

The assessment strategy for each task involves a series of tests (regular short online e-assessment that provide regular feedback and points of engagement) and a final end of semester assessment that assess application knowledge to extended problems.

Resit same as first sit.

Assessment tasks:

Examination (First Sit)
Description: Examination (3 hours)
Weighting: 70 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO4, MO6

Portfolio (First Sit)
Description: Portfolio of online assessments.
Weighting: 10 %
Final assessment: No
Group work: No
Learning outcomes tested: MO2, MO3, MO5, MO6

Laboratory Report (First Sit)
Description: Short Laboratory Report prepared during the scheduled session. Max 1500 words.
Weighting: 20 %
Final assessment: No
Group work: No
Learning outcomes tested: MO3, MO4, MO5, MO7

Examination (Resit)
Description: Examination (3 hours).
Weighting: 70 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2, MO4, MO6

Portfolio (Resit)

Description: Portfolio of online assessments.

Weighting: 10 %

Final assessment: No

Group work: No

Learning outcomes tested: MO2, MO3, MO5, MO6

Laboratory Report (Resit)

Description: Short Laboratory Report prepared during the scheduled session. Max 1500 words.

Weighting: 20 %

Final assessment: No

Group work: No

Learning outcomes tested: MO3, MO4, MO5, MO7

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mechanical Engineering and Technology (Vehicle Technology) {Foundation} [GCET] BEng (Hons) 2022-23

Mechanical Engineering and Technology (Mechatronics) {Foundation} [GCET] BEng (Hons) 2022-23

Mechanical Engineering and Technology {Foundation} [GCET] BEng (Hons) 2022-23

Mechanical Engineering and Technology (Manufacturing) {Foundation} [GCET] BEng (Hons) 2022-23

Mechatronics [UCS] FdSc 2022-23

Mechatronics [GlosColl] FdSc 2022-23