# MODULE SPECIFICATION

| Part 1: Information | | | |
|---|---|---|---|
| Module Title | Stress & Dynamics | | |
| Module Code | UFMFH3-30-1 | Level | Level 4 |
| For implementation from | 2020-21 | | |
| UWE Credit Rating | 30 | ECTS Credit Rating | 15 |
| Faculty | Faculty of Environment & Technology | Field | Engineering, Design and Mathematics |
| Department | FET Dept of Engin Design & Mathematics | | |
| Module type: | Standard | | |
| Pre-requisites | None | | |
| Excluded Combinations | None | | |
| Co- requisites | None | | |
| Module Entry 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.

**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.

**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.

**Part 3: Assessment**

Component A: Stress Analysis–
Assessed via end of semester Exam to assess the students understanding of concepts and techniques and an online assessment on practical work carrying a modest weighting to encourage engagement and focus on formative feedback.

Component B: Dynamics
Assessed via end of semester Exam to assess the students understanding of concepts and techniques and an online assessment on practical work carrying a modest weighting to encourage engagement and focus on formative feedback.

| First Sit Components | **Final Assessment** | **Element weighting** | **Description** |
|---|---|---|---|
| Examination (Online) - Component A | | 45 % | End of semester 1 online exam |
| Online Assignment - Component A | | 5 % | Online tests |
| Online Assignment - Component B | ✓ | 5 % | Online tests |
| Examination (Online) - Component B | | 45 % | End of semester 2 online exam |
| Resit Components | **Final Assessment** | **Element weighting** | **Description** |
| Examination (Online) - Component A | | 50 % | Online Exam |
| Examination (Online) - Component B | ✓ | 50 % | Online Exam |

**Part 4: Teaching and Learning Methods**

Learning Outcomes

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

| Module Learning Outcomes | Reference |
|---|---|
| Show a detailed knowledge and understanding of key principles and results in stress analysis | MO1 |
| Show a detailed knowledge and understanding of key principles and results in dynamics | MO2 |
| 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 | MO3 |
| Demonstrate the ability to apply knowledge of theoretical and practical experience to solve problems in the analysis and solution of problems of stress analysis. | MO4 |
| Apply knowledge and experience to investigate and solve problems in the subject area of dynamics | MO5 |
| 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 | MO6 |
| Demonstrate key transferable skills in problem formulation and decision making, interpreting experimental results | MO7 |

Contact Hours

| | |
|---|---|
| **Independent Study Hours:** | |
| Independent study/self-guided study | 228 |
| **Total Independent Study Hours:** | 228 |
| **Scheduled Learning and Teaching Hours:** | |
| Face-to-face learning | 72 |
| **Total Scheduled Learning and Teaching Hours:** | 72 |
| **Hours to be allocated** | 300 |
| **Allocated Hours** | 300 |

Reading List

*The reading list for this module can be accessed via the following link:*

https://uwe.rl.talis.com/modules/ufmfh3-30-1.html

**Part 5: Contributes Towards**

This module contributes towards the following programmes of study:

Aerospace Engineering (Design) {Apprenticeship} [Sep][PT][UCW][4yrs] BEng (Hons) 2020-21

Aerospace Engineering [Sep][PT][UCW][8yrs] MEng 2019-20

Aerospace Engineering [Sep][PT][Frenchay][8yrs] MEng 2019-20

Aerospace Engineering with Pilot Studies {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies (Design) [Sep][PT][Frenchay][6yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies (Design) {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies (Design) {Foundation} [Sep][SW][Frenchay][5yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies [Sep][PT][Frenchay][6yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies (Manufacturing) [Sep][PT][Frenchay][6yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies (Systems) [Sep][PT][Frenchay][6yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies (Manufacturing) {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies (Systems) {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies (Manufacturing) {Foundation} [Sep][SW][Frenchay][5yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies (Systems) {Foundation} [Sep][SW][Frenchay][5yrs] BEng (Hons) 2019-20

Aerospace Engineering (Design) [Sep][PT][Frenchay][8yrs] MEng 2019-20

Aerospace Engineering (Manufacturing) [Sep][PT][Frenchay][8yrs] MEng 2019-20

Aerospace Engineering (Systems) [Sep][PT][Frenchay][8yrs] MEng 2019-20

Aerospace Engineering {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2019-20

Aerospace Engineering (Design) {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2019-20

Aerospace Engineering (Design) {Foundation} [Sep][SW][Frenchay][5yrs] BEng (Hons) 2019-20

Aerospace Engineering (Manufacturing) {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2019-20

Aerospace Engineering (Manufacturing) {Foundation} [Sep][SW][Frenchay][5yrs] BEng (Hons) 2019-20

Aerospace Engineering (Systems) {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2019-20

Aerospace Engineering (Systems) {Foundation} [Sep][SW][Frenchay][5yrs] BEng (Hons) 2019-20