WM174-15 Static Mechanics and Energy Methods

21/22

Department
WMG
Level
Undergraduate Level 1
Module leader
Jane Rayner
Credit value
15
Module duration
13 weeks
Assessment
30% coursework, 70% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module is to provide a foundation of static mechanics, mechanics of materials and thermodynamics principles and laws in the field of mechanical engineering. Students will learn the relevant theories and will be able to apply them to solve engineering problems. They will also be able to apply subject knowledge in a real-world scenario, analyse and present the results.

Module aims

This module is aligned academically and chronologically to the engineering mathematics, electrical/electronic systems and design module in order to deliver a holistic learning experience. As a fundamental subject in engineering context; the intention of this module is; to give an overview of different concepts in mechanical science and how to employ them in order to solve mechanical and manufacturing engineering problems. Students need to understand fundamental mechanical laws and principles and develop their problem solving skills enabling simulation of the engineering problems by Mathematical/Physical and analytical approaches for mechanical and manufacturing systems.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Solid Mechanics:

- Basic Concepts
- Force and moment; equivalent forces
- Degrees of freedom (DoF)
- Free body diagrams
- Force in truss
- Introduction to Mechanics of materials
- Beam analysis

Energy Methods:

- Introduction
  - o Importance and applications
  - o Systems and control volumes, processes and cycles, …
  - o State and equilibrium
- Properties of a system
  - o Temperature scale—Zeroth law of thermodynamics
  - o Pressure—Pascal's principle
  - o Property diagrams
  - o Equation of state—Ideal gas
- Forms of energy and energy transfer
  - o Types of energy
  - o Energy transfer by heat
  - o Energy transfer by work
  - o Energy transfer by mass
- First law of thermodynamics
  - o Definition
  - o Energy balance
  - o Specific heat
  - o Mixing chambers
  - o Heat exchangers
- Second law of thermodynamics
  - o Definition o Heat engine
  - o Refrigerators o Heat pumps
  - o The Carnot cycle

Learning outcomes

By the end of the module, students should be able to:

- Apply principles of static mechanics

- Solve statistical equilibrium problems
- Analyse statically determinate trusses and beams
- Explain properties and types of thermodynamic systems and processes; mechanical work and power; Laws of Thermodynamics and definitions of temperature, heat, heat capacity and energy storage
- Contemplate the applications of energy methods in appropriate industrial sectors.

Indicative reading list

- Mechanical Science (Bolton) (Blackwell Pub., 2006. 3rd ed.), ISBN 9781405191104.
- Fundamentals of Thermal – Fluid Sciences (Y.A. Cengel, R.H. Turner) (McGraw-Hill, 3rd or 4th ed.) ISBN 9781259151323.
- Vector Mechanics for Engineers: Statics and Dynamics, F.P. Beer, E.R. Johnston Jr., D. Mazurek, P.J. Cornwell, B. Self, 11th Edition, McGraw-Hill, 2015, ISBN 9780077687441.
- Fluid Mechanics (Swaffield) (Pearson)
- Analysis and Design of Energy Systems (Hodge) (Pearson) ISBN 978-0135259733
- Fundamentals of Thermodynamics, Richard E. Sonntag, Claus Borgnakke, Gordon J. Van Wylen, 6th Edition, Wiley, 2002 ISBN 9780471152323
- Fundamentals of Thermodynamics, Claus Borgnakke, Richard E Sonntag, 8th Edition, Wiley, 2012, ISBN 9781118131992

View reading list on Talis Aspire

Subject specific skills

Methods for solving static mechanics problems
Analysing trusses and beams
Understanding of simple thermodynamics processes and laws

Transferable skills

Mathematical problem visualisation and solving
Application of mathematical formulae and manipulating equations

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Study

Study time

Type	Required
Lectures	10 sessions of 1 hour (7%)
Seminars	8 sessions of 1 hour (5%)
Practical classes	3 sessions of 2 hours (4%)
Total	150 hours

Type	Required
Online learning (scheduled sessions)	10 sessions of 1 hour (7%)
Online learning (independent)	5 sessions of 2 hours (7%)
Private study	56 hours (37%)
Assessment	50 hours (33%)
Total	150 hours

Private study description

Pre-delivery revision (e.g. Math skills)

Online quiz

Additional questions on the subject matter.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D

	Weighting	Study time	Eligible for self-certification
Lab poster and presentation	30%	10 hours	Yes (extension)
Students will make an A2 size poster on a lab, which will be conducted during face-to-face teaching. An oral presentation (recorded) will be submitted along with a poster.			
Written Exam	70%	40 hours	No

Feedback on assessment

Formative feedback during tutorial sessions
Formative feedback; solution to the tutorial questions
Formative feedback through online support
Summative feedback on lab posters
Summative feedback on exam question

Past exam papers for WM174

Availability

Courses

This module is Core for:

- Year 1 of UWMS-H7C3 Undergraduate Applied Professional Engineering (Control/Technical Support Engineer)
- Year 1 of DWMS-H7C7 Undergraduate Applied Professional Engineering (Control/Technical Support Engineer) (Degree Apprenticeship)
- Year 1 of UWMS-H7C2 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer)
- Year 1 of DWMS-H7C6 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer) (Degree Apprenticeship)
- Year 1 of UWMS-H7C1 Undergraduate Applied Professional Engineering (Manufacturing Engineer)
- Year 1 of DWMS-H7C5 Undergraduate Applied Professional Engineering (Manufacturing Engineer) (Degree Apprenticeship)
- Year 1 of UWMS-H7C4 Undergraduate Applied Professional Engineering (Product Design and Development Engineer)
- Year 1 of DWMS-H7C8 Undergraduate Applied Professional Engineering (Product Design and Development Engineer) (Degree Apprenticeship)