Module Specification

Dynamics Modelling and Simulation

Version: 2021-22, v3.0, 31 May 2022

Contents

Part 1: Information

Module title: Dynamics Modelling and Simulation

Module code: UFMFMS-30-1

Level: Level 4

For implementation from: 2021-22

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: None

Delivery locations: City of Bristol College, Frenchay Campus, University Centre Somerset, University Centre Weston

Field: Engineering, Design and Mathematics

Module type: Standard

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module will cover fundamentals of dynamics and modelling, with the underpinning mathematical methods and software tools supporting the content being taught concurrently. The philosophy is to teach the mathematical methods in an engineering context to increase motivation and confidence in application. A variety of applications will be used to provide engineering context.

Reflective practice is encouraged throughout the module where students are working in groups to allow them to share and discuss any aspects or challenges that the module may bring to light. The module takes the students through a journey of examples and applications based around a single platform example, where learning is reinforced with numerical modelling, laboratory based activities and interactive quizzes, allowing the students to practise their mathematics and challenge their understanding.

Features: Not applicable

Educational aims: Successful completion of this module will establish a solid technical foundation for engineering analysis, modelling and programming met at higher levels in the degree.

Outline syllabus: Uniform acceleration equations (SUVAT) incorporating the mathematical topics of linear, quadratic, exponential and trigonometric functions and using software tools to visualise data, applying conditional statements and piecewise functions. Applications may include projectile motion, tanks, missiles, sports balls, parachute jumps.

Displacement, velocity and acceleration – rate of change incorporating the mathematical topics of basic calculus: differentiation and integration, notation. This will extend to non-uniform acceleration incorporating the mathematical topics of numerical methods (including numerical integration), series and functions of several variables. Programming procedures (for, while).

Vectors and coordinate systems – incorporating the mathematical topics of trigonometry, vectors, matrices. Programming basics (numbers, arithmetic, variables, vectors, matrices). The applications include mechanisms (four bar linkages, crank slider).

Newton’s Laws (particles and rigid body). Incorporating the mathematical topics of summation, vectors, application of integration (centre of mass).

Work and energy (linear and rotational), incorporating the mathematical topics of

application of integration (moment of inertia).

Momentum and force impulse, Torque and centrifugal force – incorporating the mathematical topics of applications of differentiation and integration (moment of inertia)

Part 3: Teaching and learning methods

Teaching and learning methods: This module will combine lectures, lectorials, class-based interactive workshops, technical workshops to allow the students to experience working on real engineering challenges. The module prioritises time spent using numerical modelling tools as well as laboratories in order to demonstrate the importance of both approaches to solving problems and allowing the students to develop skills to work in a safe and professional manner with their peers.

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

MO1 Describe and explain key scientific principles, mathematical models and methodology through the proficient use of relevant methods tools and notations. (SM1b, SM2b)

MO2 Demonstrate understanding, through project based activities, of the applications and technologies of dynamics modelling and simulation. (SM1b)

MO3 Apply engineering principles and mathematical methods to analyse key dynamics and engineering simulation processes. (SM2b, EA1b)

MO4 Accurately identify, classify and describe the performance of dynamics systems through the use of both analytical methods and simulation techniques. (EA2)

MO5 Apply appropriate quantitative and computational methods to solve dynamics and modelling problems and implement appropriate action. (EA3b)

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Lectorials = 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/ufmfms-30-1.html

Part 4: Assessment

Assessment strategy: The assessment strategy is designed to support the development of students who will typically enter the course with experience of solving mathematical problems without context using pen and paper methods to a position where they will be able to solve engineering problems using mathematical methods implemented through computer based technology.

Throughout the year formative and summative e-assessments will be used to provide regular feedback to students. The timing of these assessments will allow students to work on any areas that need to be strengthened. (B)

The integration of mathematical and computing knowledge to solve engineering problems continues as the module progresses with an assessment point during the project week mid way through the second semester. Students will work in groups on an engineering challenge that brings together engineering knowledge from a number of modules in the programme and will involve the demonstration of dynamics modelling and programming skills. As part of the engineering challenge, these groups will demonstrate code they have developed as part of the solution to the engineering challenge. The timing of this assessment will allow students to identify any further work required on their understanding of how to write a computer program. (A1)

The final assessment will be a computer based timed written assignment where students demonstrate their ability to create computer based solutions to engineering

problems that require a mathematical approach. Students will be provided with a number of outline scenarios prior to the assessment although the exact detail of the questions will be unseen. (A2).

Resit:
Resit assessment (A) will take the form of an individual timed written assignment, again focused on both application-specific problems. The e-assessments (B) will be assessed at referral by one resit e-assessment test bringing together content covered in first sit e-assessments.

Assessment components:

Set Exercise - Component A (First Sit)
Description: Demonstration of programming knowledge (typically during Project Week 2) (15 minutes)
Weighting: 25 %
Final assessment: No
Group work: Yes
Learning outcomes tested:

Written Assignment - Component A (First Sit)
Description: End of TB2 — modelling and applications, dynamics. Scenario-based involving use of modelling software (24 hour coursework)Time constrained task.
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested:

Portfolio - Component B (First Sit)
Description: Sequence of tests throughout academic year for formative as well as summative assessment "assessment for learning".
Weighting: 25 %
Final assessment: No
Group work: No

Learning outcomes tested:

Written Assignment - Component A (Resit)
Description: Written assignment to comprise one section on small application-specific problems to assess mathematical competencies in an engineering context, and one section following a controlled conditions coursework methodology based on lab activities. That is students will be given an extended investigation to work on and this activity will be assessed in the timed assignment (24 hours) Time constrained task
Weighting: 75 %
Final assessment: Yes
Group work: No
Learning outcomes tested:

Portfolio - Component B (Resit)
Description: Referral similar to first sit, except series of tests will be combined into one test with questions taken from previous tests.
Weighting: 25 %
Final assessment: No
Group work: No
Learning outcomes tested:

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mechanical Engineering [Sep][FT][Frenchay][3yrs] BEng (Hons) 2021-22

Mechanical Engineering [Sep][SW][Frenchay][4yrs] BEng (Hons) 2021-22

Aerospace Engineering {Apprenticeship-UWE} [Sep][FT][UCW][4yrs] BEng (Hons) 2021-22

Mechanical Engineering {Apprenticeship-UCW} [Sep][FT][UCW][3yrs] FdSc 2021-22

Aerospace Engineering {Apprenticeship-UCW} [Sep][FT][UCW][4yrs] BEng (Hons) 2021-22

Aerospace Engineering {Apprenticeship-UCW} [Sep][FT][UCW][5yrs] BEng (Hons) 2021-22

Aerospace Engineering [Sep][FT][Frenchay][3yrs] BEng (Hons) 2021-22

Aerospace Engineering [Sep][SW][Frenchay][4yrs] BEng (Hons) 2021-22

Aerospace Engineering [Sep][FT][Frenchay][4yrs] MEng 2021-22

Aerospace Engineering [Sep][SW][Frenchay][5yrs] MEng 2021-22

Aerospace Engineering with Pilot Studies [Sep][SW][Frenchay][5yrs] MEng 2021-22

Aerospace Engineering with Pilot Studies [Sep][FT][Frenchay][4yrs] MEng 2021-22

Aerospace Engineering with Pilot Studies [Sep][FT][Frenchay][3yrs] BEng (Hons) 2021-22

Aerospace Engineering with Pilot Studies [Sep][SW][Frenchay][4yrs] BEng (Hons) 2021-22

Automotive Engineering [Sep][SW][Frenchay][4yrs] BEng (Hons) 2021-22

Automotive Engineering [Sep][FT][Frenchay][3yrs] BEng (Hons) 2021-22

Automotive Engineering [Sep][SW][Frenchay][5yrs] MEng 2021-22

Automotive Engineering [Sep][FT][Frenchay][4yrs] MEng 2021-22

Mechanical Engineering [Sep][SW][Frenchay][5yrs] MEng 2021-22

Mechanical Engineering [Sep][FT][Frenchay][4yrs] MEng 2021-22

Mechanical Engineering with Manufacturing {Apprenticeship-UWE} [Sep][FT][UCW][4yrs] BEng (Hons) 2021-22

Mechanical Engineering with Manufacturing {Apprenticeship-UWE} [Sep][FT][COBC][4yrs] BEng (Hons) 2021-22

Mechanical Engineering {Apprenticeship-UCS} [Sep][FT][UCS][3yrs] FdSc 2021-22

Mechanical Engineering {Apprenticeship-GlosColl} [Sep][FT][GlosColl][3yrs] FdSc 2021-22

Mechanical Engineering [Sep][PT][Frenchay][7yrs] MEng 2020-21

Aerospace Engineering {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2020-21

Aerospace Engineering {Foundation} [Sep][SW][Frenchay][5yrs] BEng (Hons) 2020-21

Aerospace Engineering with Pilot Studies {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2020-21

Aerospace Engineering with Pilot Studies {Foundation} [Sep][SW][Frenchay][5yrs] BEng (Hons) 2020-21

Mechanical Engineering {Foundation}[Sep][FT][Frenchay][4yrs] BEng (Hons) 2020-21

Mechanical Engineering {Foundation}[Sep][SW][Frenchay][5yrs] BEng (Hons) 2020-21

Mechanical Engineering [Sep][PT][Frenchay][6yrs] BEng (Hons) 2020-21

Automotive Engineering {Foundation}[Sep][FT][Frenchay][4yrs] BEng (Hons) 2020-21

Automotive Engineering {Foundation}[Sep][SW][Frenchay][5yrs] BEng (Hons) 2020-21