MODULE SPECIFICATION

Part 1: Information			
Module Title	Dynamics Modelling and Simulation		
Module Code	UFMFMS-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: 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. **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)

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.

Part 3: Assessment

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.

During the first semester formative e-assessments will be used to provide regular feedback to students with a written examination at the end of the semester to assess students ability to applying mathematical concepts and methods within an engineering context. The timing of this examination will allow students to work on any areas that need to be strengthened. (A1)

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 programming skills. As part of the engineering challenge, students 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. (B)

The final assessment will be a computer based examination 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 examination although the exact detail of the questions will be unseen. (A2).

Resit:
Resit assessment will take the form of a written examination, again focused on both application-specific problems, and a set exercise designed to assess simulation and modelling competencies.

First Sit Components	Final Assessment	Element weighting	Description
Examination - Component A	✓	40 %	End of TB2 — modelling and applications, dynamics. Scenario-based involving use of modelling software (2 hours)
Examination - Component A		30 %	End of TB1 — maths and dynamics (2 hours)
Set Exercise - Component B		30 %	Demonstration of programming knowledge (typically during Project Week 2) (15 minutes)
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Examination - Component A	✓	70 %	Written exam 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 exam (3 hours)
Set Exercise - Component B		30 %	Use of simulation and modelling tools (MATLAB) will be assessed through the set exercise, where the students will be working on a project that involve the application of these subjects to real engineering problems. The students will demonstrate their performance on the application of these subjects by presenting results, data analysis and a simulation activity using the dynamics knowledge, mathematical principles and software tools for visualisation and simulation. This work will be presented (30 mins).

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
Describe and explain key scientific principles, mathematical models and methodology through the proficient use of relevant methods tools and notations. (SM1b, SM2b)	MO1
Demonstrate understanding of engineering context of dynamics modelling and simulation and relevant developments and technologies through project based activities. (SM1b)	MO2
Apply engineering principles and mathematical methods to analyse key dynamics and engineering simulation processes. (SM2b, EA1b)	MO3
Accurately identify, classify and describe the performance of dynamics systems through the use of both analytical methods and simulation techniques. (EA2)	MO4
Apply appropriate quantitative and computational methods to solve dynamics and modelling problems and implement appropriate action. (EA3b)	MO5

Contact Hours	**Independent Study Hours:**	
	Independent study/self-guided study	228
	Total Independent Study Hours:	228
	Scheduled Learning and Teaching Hours:	
	Lectorials	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://rl.talis.com/3/uwe/lists/98FDBEA9-E449-1E5C-EA18-99DFA70DB095.html?lang=en-gb&login=1	

Part 5: Contributes Towards
This module contributes towards the following programmes of study: