1.	**Module Code**	**CFM2104**	
2.	**Module Title**	**Applied Mathematics**	
3.	**Schools involved in delivery**	Computing and Engineering	
4.	**Name of Course(s)**	BSc(Hons) Mathematics MMath Mathematics	
5.	**Module Leader**	Ciprian D. Coman	
6.	**Location**	Queensgate	
7.	**Module Type**	Core	
		Choose an item.	
8.	**Credit Rating**	20	
9.	**Level**	F (FHEQ 4)	
10.	**Learning Methods**	Lectures	**44** hr
		Tutorials	**22** hr
		Choose an item.	hr
		Guided Independent Study	**134** hr
		Total hours	200 hr
11.	**Pre-requisites**	None	
12.	**Recommended Prior Study**	None	
13.	**Co-requisites**	None	
14.	**Shared Teaching**	None	
15.	**Professional Body Requirements**	None	
16.	**Graded or Non Graded**	Graded	
17.	**Barred Combinations**	None	

18.	**Synopsis** This module will introduce you to mechanics and the modelling of real-world systems by using calculus tools and vector methods. More specifically, you will be introduced to the language of vectors and related concepts in the context of 3D geometry, as well in the statics and dynamics of rigid bodies. Another goal of the module will be to provide you with an example of building up a subject from basic assumptions (e.g., Newton's laws of motion) to theorems (e.g., the impulse-momentum theorem) to applications (e.g., the motion of a rocket). Finally, during the course of this module you will learn how to formulate and solve sets of algebraic or differential equations describing mechanical systems (e.g., by using the method of integrating factors for vector linear ordinary differential equations).
19.	**Learning Strategy** Lectures will provide the theoretical base for the subject and examples of problem solving. Tutorials will give students an opportunity to solve problems and develop their understanding by themselves.
20.	**Outline Syllabus** Vectors: representation of 2D and 3D vectors, algebraic operations, products (scalar, vector, and mixed), applications to 3D geometry (lines, planes, intersection between lines and planes, angle between a line and a plane, etc.) Static equilibrium: calculation of tensions in simple mechanical systems involving rigid struts and strings. Kinematics in 1D: velocity, acceleration, Newton's Laws, motion of connected bodies (pulleys), frictional forces. Kinematics in 2D and 3D: differentiation and integration of vector functions, Newton's equation of motion in general form, projectile motion, uniform circular motion. Linear momentum and the concept of impulse, the impulse-momentum theorem and its application to dynamics problems with variable mass (e.g., rockets, falling raindrops, etc), collisions.

	The concepts of mechanical work and power; kinetic and potential energy; the work-kinetic energy theorem; principle of conservation of mechanical energy and applications; conservative forces; the work-energy principle. Simple harmonic motion, the phenomenon of resonance, pendulum problems (non-uniform circular motion).
21.	**Learning Outcomes** On successful completion of this module, students will be able to:
	Knowledge and Understanding Outcomes: **1.** Understand the underlying concepts and principles associated with applied mathematical modelling. **2.** Develop an understanding and appreciation for the use of vectors and related concepts in a range of different situations.
	Ability Outcomes **3.** Formulate and solve a number of first- and second-order ordinary differential equations describing the dynamics of material particles (including equations in vector form). **4.** Be able to analyze mechanical systems based on various conservation principles.
22.	**Assessment Strategy**
	22.1 ***Formative assessment*** Feedback to students will be given in tutorials and in-class tasks. Graded exercises will be set and model answers and solutions to problems will be provided.

22.2 *Summative Assessment*

Assessment tasks (including assessment weightings)

Assessment Task		Assessment Weighting (%)	Learning outcomes
1. Written Assignment	2,000 words	50%	1, 2
The coursework will consist of several exam-type problems, and will test the learner's understanding of vectors and their use in solving simple statics and dynamics questions (these will include differentiation and integration of vector functions).			
Tutor assessed			
Available for tutor re-assessment			
Not anonymously marked			

2. Examination	2-hour exam	50%	1, 3, 4
This is a closed-book exam; a formula sheet with a summary of some of the formulae in this module will be provided, and will be made available in advance of the written examination. The learners will be expected to demonstrate a knowledge of the main physical principles and key mathematical modelling techniques required in the solution of various physical applications (motion of a pendulum, projectile motion, motion down an incline, etc). It will be assumed that the learners have already mastered learning outcomes 1 and 2.			
Tutor assessed			
Not available for tutor reassessment			
Anonymously marked			
This is the final element of assessment			

Assessment Criteria

Component 1 (Coursework) will be submitted for marking with an approved cover sheet containing the student's name, identity number, and date of submission. Students will be required to provide written answers to exercises. Students will be assessed on their ability to use vectors and related concepts in the context of analyzing simple mechanical systems involving statics and dynamics. This coursework is not marked anonymously.

Component 2 (Examination). Students will be assessed on their ability to: recall key

	concepts and results taught in lectures and developed through tutorial exercises, demonstrate an understanding of both theoretical and practical knowledge, and demonstrate an awareness of issues related to mathematical modelling and general physical principles (e.g., solving concrete example of vector ordinary differential equations, stating and using main conservation principles, etc). This exam is marked anonymously. Component 2 (Examination) is the final assessment for this module. **Note:** Only Component 1 (Coursework) will be eligible for tutor re-assessment. Component 2 (Examination) is not eligible for tutor re-assessment.
	My Reading http://library3.hud.ac.uk/myreading/lists/CFM2104