University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Classical Mechanics			
Code: PHYS08007	**SCQF Level: 8 (Scottish Credit and Qualifications Framework)**	**Credit Points: 20**	**ECTS: 10 (European Credit Transfer Scheme)**
School:	School of Computing, Engineering and Physical Sciences		
Module Co-ordinator:	Maximilien Barbier		

Summary of Module

This module is a core module at Level 8 on Institute of Physics (IoP) accredited Physics programmes.

This module is designed to provide an introduction to classical mechanics, including the analytical mechanics formulations of Lagrangian and Hamiltonian approaches.

This first part of the module will provide a detailed overview of the ideas of classical mechanics from a Newtonian perspective. The module will begin with a review of Newton's laws and vector manipulations. Non inertial frames will be introduced, and centrifugal and Coriolis forces will be discussed. We will then proceed with a treatment of rigid-body dynamics, covering ideas of moment of inertia, torque, angular momentum and Euler angles.

The second part of the module will be a treatment of analytical mechanics focusing on variational principles. We will discuss the Lagrangian and Hamiltonian formalisms including Poisson brackets, generalised coordinates, phase space and the Hamilton-Jacobi equation. We will elucidate the topics of symmetries and conservation laws and describe Noether's Theorem.

Both approaches will then be applied to the study of mechanical oscillations.

The module will be taught using a combination of lectures and tutorials supplemented by laboratory sessions to reinforce the theoretical concepts.

We have defined a set of Graduate Attributes that are the skills, personal qualities and understanding to be developed through your university experience that will prepare for life and work in the 21st century (https://www.uws.ac.uk/current- students/your-graduate-attributes/). The Graduate Attributes relevant to this module are listed below.

- Graduate Attributes - Academic: critical thinker; analytical; inquiring; knowledgeable; digitally literate; problem solver; autonomous; incisive; innovative

- Graduate Attributes - Personal: effective communicator; influential; motivated

- Graduate Attributes - Professional: collaborative; research-minded; enterprising; ambitious; driven

Module Delivery Method					
Face-To-Face	**Blended**	**Fully Online**	**HybridC**	**Hybrid0**	**Work-Based Learning**
☒	☐	☐	☐	☐	☐
See Guidance Note for details.					

Campus(es) for Module Delivery						
The module will **normally** be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit) (tick as appropriate)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
☒	☐	☐	☐	☐	☐	Add name

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	☒	Term 2	☐	Term 3	☐

Learning Outcomes: (maximum of 5 statements) **These should take cognisance of the SCQF level descriptors and be at the appropriate level for the module.** At the end of this module the student will be able to:	
L1	Demonstrate knowledge of vector algebra applied to classical mechanics in three dimensions.
L2	Demonstrate knowledge and understanding of classical mechanics including rigid body kinematics and dynamics.
L3	Understand how to set up and solve problems using moving reference frames. Appreciation of fictitious forces.
L4	Demonstrate an appreciation of variational principles and the formalisms of Lagrangian and Hamiltonian mechanics and recognise where these descriptions are more useful than the Newtonian approach.
L5	Demonstrate practical ability in performing laboratory experiments, and recording and analysing the results, and maintaining a laboratory notebook.

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	During completion of this module, there will be an opportunity to achieve core skills in:
Knowledge and Understanding (K and U)	SCQF Level **8** • Concepts of vector algebra, matrices, calculus and 3-dimensional co-ordinate systems. • A critical understanding of underlying theories governing motion in space. • Abstract approaches of analytical mechanics. • A critical approach towards problem solving.
Practice: Applied Knowledge and Understanding	SCQF Level **8** • Using a selection of mathematical skills, techniques and practices applicable to modern day physics. • Confirmation of theoretical models with laboratory experiments. • Practicing literature searches and experimental methodologies such as uncertainty evaluation.
Generic Cognitive skills	SCQF Level **8** Critical appreciation of underlying physical concepts. Problem analysis, evaluation and solving.
Communication, ICT and Numeracy Skills	SCQF Level **8** • Use of calculators and computers. • Literary skills, enabling the communication of obtained results e.g. lab-report.
Autonomy, Accountability and Working with others	SCQF Level **8** • Individual studying and small project management. • Working towards deadlines and avoiding unnecessary penalties. • Team-working abilities, as lab work is encouraged to be done in groups.

Pre-requisites:	Before undertaking this module, the student should have undertaken the following:	
	Module Code: PHYS07006 PHYS07007 MATH07003 MATH07009	**Module Title:** Introductory Physics A Introductory Physics B Applied Mathematics Mathematical Analysis
	Other:	or equivalent
Co-requisites	**Module Code:**	**Module Title:**

*Indicates that module descriptor is not published.

Learning and Teaching
In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours. The delivery of the module is primarily lecture based, with relevant problems in associated tutorials (problems classes). The tutorials (problem classes) are focused on exercises which address different aspects of classical mechanics. A reading list of relevant books is provided, and students are encouraged to use the modern information retrieval systems for further material related to the subject area. Lecture notes will be available on Aula. Students are encouraged to use the Aula communication tools to give feedback on the teaching and taught material and to discuss topics with their peers and teaching staff. As physics is an experimental subject, a series of experiments are performed in the laboratory classes. In the laboratory, students gain hands-on practical experience using state-of-the-art equipment and computer systems for data analysis. A written report (in a laboratory notebook) is submitted for each experiment. It is expected that students will develop their knowledge using self-study, which is an important part of all physics modules.

Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Normally totalling 200 hours): (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture/Core Content Delivery	24
Tutorial/Synchronous Support Activity	12
Laboratory / Practical Demonstration / Workshop	12
Independent Study	152
	200 Hours Total

**Indicative Resources: (eg. Core text, journals, internet access)
The following materials form essential underpinning for the module content and ultimately for the learning outcomes: University Physics, Young and Freedman, Addison Wesley, (2011 or later) An Introduction to Mechanics, Kleppner and Kolenkow, Cambridge (2013 or later) Course of Theoretical Physics (Vol 1): Mechanics, Landau & Lifshitz, Elsevier (2003 or later)
(**N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements
In line with the Student Attendance and Engagement Procedure: Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.

Equality and Diversity
The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code.   Please ensure any specific requirements are detailed in this section. Module Co-ordinators should consider the accessibility of their module for groups with protected characteristics.
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	Engineering and Physical Sciences
Assessment Results (Pass/Fail)	Yes ☐No ☒
School Assessment Board	Physical Sciences
Moderator	Gregory V Morozov
External Examiner	H Boston
Accreditation Details	Institute of Physics (IoP)
Changes/Version Number	**2.0** Module descriptor amended to conform to the new template format and to reflect outcomes from ILR 2023.

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment 1 – Class Test (60%)
Assessment 2 – Written Coursework and Laboratory Work (40%)
(N.B. (i) **Assessment Outcomes Grids** for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed.   (ii) An **indicative schedule** listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Assessment Outcome Grids (See Guidance Note)

Component 1

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Learning Outcome (5)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Class Test	✔	✔	✔	✔		60	2

Component 2

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Learning Outcome (5)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Laboratory		✔			✔	20	12
Portfolio of Written Work	✔	✔	✔	✔		20	0
Combined Total for All Components						100	14