IMPERIAL

Module Specification

Basic details

UID		Cohorts covered	Earliest cohort	Latest c
Long title	Modelling and Control of Multi-body Mechanical Systems			
New code	ELEC70022	New short title		

Brief description of module *(approx. 600 chars.)*

This module introduces theoretical approaches for the modelling and control of multibody mechanical systems. You will apply tools from classical mechanics to develop models of real mechanical systems. You will also apply techniques from control theory to improve the behaviour of systems represented by multibody models. Special emphasis is given to the use of computer tools for the modelling aspect.

401 characters

Available as a standalone module/ short course? No

Statutory details

	ECTS	CATS	Non-credit
Credit value	5	10	N
FHEQ level	L7		

HECOS codes

Allocation of study hours

	Hours	
Lectures	20	
Group teaching	0	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	0	
Other scheduled	7	*Incl. project supervision, fieldwork, external visits.*
Independent study	98	*Incl. wider reading/ practice, follow-up work, completion of assessments*
Placement	0	*Incl. work-based learning and study that occurs overseas.*
Total hours	125	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed? No

Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Term 1	Other	

Ownership

Primary department	Department of Electrical and Electronic Engineering
Additional teaching departments	0
Delivery campus	South Kensington

Collaborative delivery

Collaborative delivery?	No
External institution	
External department	
External campus	

Associated staff

Role	CID	Given name	Surname
Module Leader		Simos	Envangelou
		0	0
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		0	0

Learning and teaching

Module description

Learning outcomes

Upon successful completion of this module, you will be able to:
1. Distinguish between the two main branches of Classical Mechanics: Newtonian (vectorial) and Lagrangian (analytical) mechanics
2. Make confident use of the basic tools of Classical Mechanics related to these two main branches
3. Represent real mechanical systems as multibody systems
4. Develop models, in the form of differential equations, of real mechanical systems using the two main methods from Classical Mechanics (Newton's laws and Lagrangian equations of motion);
5. Derive equations of motion for mechanical systems with holonomic and nonholonomic constraints;
6. Apply techniques from control theory to improve the behaviour of systems represented by multibody models
7. Model and control multibody systems using SimScape Multibody software tool

Module content

Basic vector calculus;
Newtonian mechanics;
Holonomic and nonholonomic systems;
Control of nonholonomic systems;
Kinematics of rigid body motion;
Dynamics of rigid body motion;
Variational principles and analytical mechanics: Calculus of variations and Lagrange multipliers, Euler-Lagrange differential equations, Virtual work, D'Alembert's principle, Hamilton's principle and Lagrangian equations of motion;
Multibody building software.

Learning and Teaching Approach

Duration: 10 weeks. Lectures: 2h / week. The lectures include both asynchronous lectures and weekly interactive sessions during which solved examples are presented and discussed, Q&A takes place, and also involve classroom study through problem classes.

Assessment Strategy

Assessment is by open-book exam (75%) and coursework (25%). The coursework includes a) an individual assignment involving the use of a multibody computer modelling tool (Simscape Multibody), b) problem classes (formative), and peer assessment.

Feedback	Feedback on coursework (individual assignment report) will be provided within two weeks from coursework submission deadline. Problem classes, together with their solutions, provide another form of regular feedback.
Reading list	1) Goldsetin, H: Classical Mechanics. Addison-Wesley, any edition, 1951. 2) Lanczos, C: Variational Principles of Mechanics, Dover, 1986. 3) Wells, D: Schaumn's Outline of Lagrantian Dynamics, McGraw Hill, 1967

Quality assurance

Date of first approval	
Date of last revision	July 2025
Date of this approval	
Module leader	Simos Evangelou
Notes/ comments	

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Template version #####

Assessment details

Grading method	Numerical	Pass mark	50%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Examination	3 hour open book written examination	75%	50%	N
Coursework	Individual assignment report, problem class solutions, peer assessment	25%	50%	N
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
		100%		