IMPERIAL

Module Specification

Basic details

			Earliest cohort	Latest c
UID		Cohorts covered		

Long title	Design of Linear Multivariable Control Systems

New code	ELEC70006	New short title	

Brief description of module *(approx. 600 chars.)*	The course is aimed at providing the principles for designing linear multivariable control systems to meet a range of practical applications. You will derive models of linear multivariable control systems and analyse the structural properties of these models. You will also design control laws to achieve the desired objectives and performance.

344 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	0	*Incl. project supervision, fieldwork, external visits.*
Independent study	105	*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 2	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		Imad	Jaimoukha
		0	0
		0	0
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		0	0
		0	0
		0	0
		0	0

Learning and teaching

Module description

Learning outcomes	On successfully completing this module you should be able to (1) model linear multivariable control systems using tranfer matrix and state variable methods, (2) determine the poles and zeros, including the type of zeros, for such systems and (3) analyse the controllability, observability, detectability, stabilizability and minimality properties for such systems. You should also be able to (4) formulate design objectives as optimisation procedures in terms of norm-based objective functions and (5) to choose and apply the most appropriate controller synthesis techniques.
Module content	Analysis: system representations, return difference matrix, stability theory, including internal stability, multivariable poles and zeros; Design: design criteria, LQG design methods (including the optimal linear quadratic regulator and the Kalman filter), singular value and norm-based methods, robust stability and performance. H-infinity design techniques, including the generalised regulator problem and LMI techniques. Model reduction, including modal and balanced truncation; Design examples: use of CAD techniques in the design of controllers for industrial processes.
Learning and Teaching Approach	Ths module is taught through lectures. Problems sheets will be handed out but not assesed. The aim of these problem sheets is to ensure you have a good understanding of the taught material.
Assessment Strategy	The module is assessed by a 3-hour, closed book, written examination (75%) and a coursework assignment (25%), given in week 7, to allow you to carry out a multivariable control system design, through simulations, using H_infinity techniques.
Feedback	You will have access to an extensive library of past papers with model answers. You will also be given the solutions to the problem sheets. Furthermore, formative feedback is provided in an on-going basis as you are welcome to ask for clarifications during class or afterwards.
Reading list	1) Maciejowski, J.M.: Multivariable Feedback Design, Addison-Wesley. 2) Anderson and Moore: Optimal Control: linear quadratic methods, Prentice-Hall. 3) Kailath, T: Linear Systems, Prentice-Hall

Quality assurance

Date of first approval	
Date of last revision	July 2023
Date of this approval	
Module leader	Imad Jaimoukha
Notes/ comments	

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Template version #####

Assessment details

Pass mark

Grading method Numerical 50%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Examination	3 hour closed book written examination	75%	50%	N
Coursework	An Introduction to H_infinity Design	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%		