IMPERIAL

Module Specification

Basic details

UID		Cohorts covered	Earliest cohort	Latest c
Long title	Advanced Applied Optimisation			
New code	ELEC70066	New short title		

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

The aim of this module is to equip you with the tools to formulate and solve applied optimisation problems. The module covers several advanced theoretical topics in optimisation such as convex optimisation and multi-objective optimisation with the aim of formulating and solving applied problems. Each theoretical topic is covered with an application-driven mindset. During the regular classes you will apply the theory on problems arising in a variety of practical domains such as fitting, finance, classification, biology, and advertising.

The module does not assume prior optimisation knowledge (the Autumn module "Optimisation" is not a pre-requisite as the topics are completely complementary). Basic knowledge of Python is assumed (self-study resources plus an optional catch-up lab are available on request). More information is available on the course homepage.

870 characters

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit	
Credit value	5	10	N	HECOS codes
FHEQ level	Level 7			

Allocation of study hours

	Hours	
Lectures	20	
Group teaching	20	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	0	
Other scheduled	2	*Incl. project supervision, fieldwork, external visits.*
Independent study	83	*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: Electronic and Electrical Engineering

Additional teaching:

departments	
Delivery campus	South Kensington

Collaborative delivery

Collaborative delivery?	N
External institution	N/A
External department	N/A
External campus	N/A

Associated staff

Role	CID	Given name	Surname
Module Leader		Giordano	Scarciotti

Learning and teaching

Module description

Learning outcomes	Upon successful completion of this module, you will be able to: 1 - Classify different families of optimisation problems 2 - Formulate an engineering/scientific/economic problem as an optimisation problem of a known class 3 - Apply the correct methods of optimisation to solve the problem 4 - Assess the approximation and computational cost of an optimisation algorithm 5 - Employ advanced optimisation techniques and analyse their limitations 6 - Write computer programmes to formulate and solve optimisation problems 7 - Compare the introduced ideas and tools with the more general theory of optimisation. 8 - Devise a toolbox of optimisation algorithms to solve various classes of problems.
Module content	Convex sets; Convex functions; Convex optimization problems; Approximation and estimation problems; Statistical applications; Geometric applications; Interior point methods; Integer programmming; Methods for solving integer programmes; Multi-objective programming; Pareto optimality; Complexity analysis; Applied optimisation: classes will focus on problems from different areas of engineering, science and finance.

Learning and Teaching Approach	This module is taught using flipped classroom with a Team-Based Learning approach in which the lecture time and revision time are flipped. You will watch a video lecture before coming to the class and we will do revision together. The revision in class has a precise team-based structure. The majority of the class is not assessed (a small portion is assessed). During our first meeting in the spring term, we will go through this method together and you will have the possibility to ask questions if something is not clear. During this first meeting we will also form the teams that will remain fixed for the rest of the year. The first set of video lectures will be released at this point and the team activities (and tests) will start on the second week of term. The lectures will cover the topics from a theoretical point of view. Concepts, problems and solution methods will be explained and justified from a theoretical and intuitive point of view. The group exercises will be used to push you to implement new algorithms as the lectures proceed. The exercises will be simple and the code written during the labs will be used by you for your courseworks. Them module will make use of smart handouts, which are interactive Python notebooks that integrate videos, theory and practical exercises that you can solve and run on the spot. This module will follow the BYOD (bring-your-own-device) policy of the department, i.e. group teaching will be in a classroom and you will need to have your own device.
Assessment Strategy	- During every group class, you will submit small programming assignments throughout the delivery of the module. I will use an approach similar to iRAT+tRAT. All these small assignments together counts 25% (iRAT 5% and tRAT 20%). Since some of the previous activities are done in groups, there will be a small peer assessment component at the end of the module (10%). Additional non-assessed assignments will be done just before or after the tRAT tests. The aim of the tests is to ensure that you prepare in advance (flipped classroom) and come to the classes (to ensure participation to the group activities). - A final exam will test the theoretical concepts covered during the lectures (65%).
Feedback	Formative feedback will be provided on an ongoing basis: in the classroom (as general comments) and during the group teaching (both from me and from peers). All deliverables submissions will receive formative feedback (as overall comments on the work and annotations of the code) and summative feedback will be provided as provisional letter grades.
Reading list	S. Boyd and L. Vandenberghe, Convex Optimization, Cambridge University Press

Quality assurance

Date of first approval	February 2022
Date of last revision	May 2023
Date of this approval	May 2025
Module leader	Giordano Scarciotti
Notes/ comments	

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Template version #####

Assessment details

Grading method	Numeric	Pass mark	50%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Coursework	Individual and group assignments (iRAT,tRAT,Peer assessment)	35%	50%	N
Examination	Final examination	65%	50%	N
		100%		