IMPERIAL

Module Specification

Basic details

UID		Cohorts covered	Earliest cohort: Latest c:
Long title	Smart Grid and Data Science		
New code	ELEC70044	New short title	
Brief description of module *(approx. 600 chars.)*	This module focuses on the role of digital technologies and data science applications in the future power grids. It will educate students on upcoming opportunities and challenges for developing digitalised power systems from a techno-economic-socio perspective. The module will introduce the foundations for data science in energy systems and emphasise the efficiency of asset utilisation to establish the case for smart grids. It also covers the cyber security and privacy concerns associated with the deep digitalisation of power systems. 540 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	0	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	9	
Other scheduled	0	*Incl. project supervision, fieldwork, external visits.*
Independent study	96	*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	N/A
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		Fei	Teng
Module Leader		Goran	Strbac

Learning and teaching

Module description

Learning outcomes	On successfully completing this module, you will be able to: • Assess the role of digital technologies and data science applications in facilitating a cost-effective transition to a zero-carbon energy system • Evaluate the difference between preventive and corrective control • Apply advanced approaches in the scheduling of flexible demand • Apply big data analytics in smart grids • Construct and evaluate basic reliability models and metrics • Use Monte Carlo risk computations • Formulate a basic cyber attack and defence mechanism
Module content	• Economic challenges of reliable operation of low carbon electricity systems; • Bulk and distributed storage, demand side response, flexible generation, smart network technologies; • Preventive and corrective control of the electricity network; • Design of distribution and transmission networks under uncertainty; • Data science applications in smart grids; • Cybersecurity in smart grids; • Privacy and Data Sharing in power grids; • Reliability and risk modelling and analysis for distribution networks; • Monte Carlo sampling for risk analysis;
Learning and Teaching Approach	The module will be delivered primarily through 10 in-person lectures introducing the key concepts and methods, supported by a variety of delivery methods combining traditional and online. The content is presented via a combination of slides, whiteboard and visualiser. Learning will be reinforced through three lab sessions.
Assessment Strategy	This module presents opportunities for both formative and summative assessment. You will be formatively assessed through practical sessions with additional opportunities to self-assess your learning via example exercises. You will be summatively assessed by a written closed-book examination at the end of the module and a written coursework report.
Feedback	You will receive feedback on examinations in the form of an examination feedback report on the performance of the entire cohort. You will receive individual written feedback on your coursework report You will receive feedback on your performance whilst undertaking practical exercises, during which you will also receive instruction on the correct solution to the problems. Further individual feedback will be available to you on request via this module's online feedback forum, through staff office hours and discussions with tutors.

Reading list	- Ekanayake, J. B. Smart Grid : Technology and Applications. Chichester: Wiley, 2012. - Chowdhury, Ali A., and D. O. Koval. Power Distribution System Reliability : Practical Methods and Applications. Hoboken [New Jersey: John Wiley & Sons, 2015. - O'Connor, Patrick D. T., Patrick D. T. O'Connor, and Andre. Kleyner. Practical Reliability Engineering. 5th ed. Hoboken, N.J: Wiley, 2012. - Kirschen, Daniel Sadi, and Goran Strbac. Fundamentals of Power System Economics. Second edition. Hoboken, NJ, USA: Wiley, 2019. - 'Digitalisation of Energy', Energy Futures Lab Briefing Paper

Quality assurance

Date of first approval	January 2024
Date of last revision	
Date of this approval	February 2024
Module leader	Fei Teng
Notes/ comments	updated after FTC in Feb 2024 before going to Programmes committee

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?
Examination	Close-book written examination	75%	50%	N
Coursework	A written report assessment	25%	50%	N
		100%		