

Module Details	
Module Title	Smart Grids Operation and Economics
Module Code	ELE7032-B
Academic Year	2022/3
Credits	20
School	Department of Biomedical and Electronics Engineering
FHEQ Level	FHEQ Level 7

Contact Hours	
Type	Hours
Lectures	30
Tutorials	4
Laboratories	6
Directed Study	160

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 2

Module Aims
The aim is to introduce the student to the operation of smart grids and power systems. The emphasis is placed on the need to balance the desire to operate (as well as plan) as economically as possible with the need to maintain the security of the system. In order to do so in a market context, the module gives an understanding of the economic principles underlying the introduction of competition in the supply and retail of electricity as well as the opening of the transmission and distribution systems to third party access.

Outline Syllabus
1) Fundamentals of power system and smart grid optimisation 2) Electricity market and smart grid economics 3) Smart grid and power system security 4) Smart grids and power system investment 5) Societal implications of energy smart grids including privacy (consumer usage), security (individual and national) and equity (access and cost)

Learning Outcomes	
Outcome Number	Description
LO1	Apply mathematical optimisation techniques to the economic operation of smart grids and power systems
LO2	Critically evaluate how security considerations affect the operation of a smart grid and power system
LO3	Critical evaluation of the techniques used to balance supply and demand in a smart grid and power system over different time scales
LO4	Critical awareness of the basic concepts power system economics from microeconomics and the theory of the firm
LO5	Critically evaluate the objectives/principles of market-based operation of smart grids and power systems in society
LO6	Evidence ethical and societal implications of smart grids
LO7	Evidence comprehensive understanding of the foundations of locational marginal pricing and its use in transmission congestion management
LO8	Critically analyse economic aspects of smart energy systems

Learning, Teaching and Assessment Strategy
Concepts are introduced using formal lectures, tutorials, laboratory practical, seminars and invited lectures from the energy and power system industries. Deeper/better understanding is developed during tutorials by solving practical problems. Oral feedback is given during tutorials and laboratory classes. Summative assessment: - A portfolio of laboratory and reports up to approximately 3000 words and software based simulation will be used as coursework. The coursework will assess the learning outcomes LO2, LO5 and LO7 and the weighting of the coursework is 30%. - A formal examination will assess the learning outcomes LO1, LO3 and LO5. The weighting of the summative exam is 60%. - An individual seminar presentation will assess learning outcomes LO1, LO3, LO4, LO6 and LO8 and its weighting is 10%. Formative assessment: - An interim portfolio of laboratory report (no more than 600 words) will be assessed and feedback will be given to each student.

Mode of Assessment			
Type	Method	Description	Weighting
Summative	Coursework - Portfolio/e-portfolio	Portfolio of written-up technical lab reports and software-based simulation (3000 words equivalent)	30%
Summative	Examination - Closed Book	Closed-book examination (2hrs)	60%
Summative	Presentation	Individual seminar presentation (0.5hrs)	10%

Reading List

To access the reading list for this module, please visit <https://bradford.rl.talis.com/index.html>

Please note:

This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.

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