IMPERIAL

Module Specification

Basic details

UID		Cohorts covered	Earliest cohort: Latest c:
Long title	Power System Dynamics Stability and Control		
New code	ELEC70074	New short title	
Brief description of module *(approx. 600 chars.)*	This module presents modelling of major components in interconected electricty network for stability analysis and control from system perspective. The knowledge provided will involve how power system behaves during and after the steady opearting equilibrium is disturbed. It will provide understanding of the mechanism of interactions between major components in the systems. Both synchronous, asynchronous generation technologies, their associated control for system voltage, frequency support will be explained.		
	515 characters		
Available as a standalone module/ short course?	N		

Statutory details

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

Allocation of study hours

	Hours	
Lectures	20	
Group teaching		*Incl. seminars, tutorials, problem classes.*
Lab/ practical		
Other scheduled	2	*Incl. project supervision, fieldwork, external visits.*
Independent study	103	*Incl. wider reading/ practice, follow-up work, completion of assessments*
Placement		*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	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		Bikash	Pal

Learning and teaching

Module description

Learning outcomes	On successfully completing this module you should be able to: 1. Develop model for power generation systems - both synchronous and asynchronous - for power system dynamic studies. 2. Interprete the parameters of the common dynamic modelling blocks in a power system dynamic simulation software. 3. Assess and validate generation system dynamic response through frequency domain analysis, eigen-value analysis and other common dynamic system analysis tools. 4. Evaluate system stability margins for control design in power systems control.
Module content	Module A: Synchronous generation modelling for stability studies (i) overview of power system stability problem, definition, power system structure, classification and characterisation of the problems over different time scales. (ii) transient stability, small signal stability (iii) Operating models of fuel supply, furnace boiler and reservoir. (iv) turbine, hydro turbine, steam turbine, governor, generator (v) Park Transformation or d-q Transformation. (vi) Dynamic model of synchronous machine in d-q reference frame. (vii) Modelling of prime mover and generator mechanical dynamics as lumped mass (viii) Development of swing equations, H constants of machines (ix) Machine network co-ordinate transformations Module B: Wind generation stability modelling and analysis (i) Principle of operation of Type 1 (Squirrel cage induction machine) and Type 2 (slip ring induction machine); (ii) Principle of operation of Type 3 (doubly fed induction generator) and Type 4 (full converter induction generator FCIG) (iii) Dynamic modelling (transient and small signal stability) of Type 1 wind generator in d-q reference frame (iv) Dynamic modelling (transient and small signal stability) of Type 2 wind generator in d-q reference frame will be detailed (v) Dynamic modelling of Type 3 wind generator for transient stability and small signal stability wind generator in d-q reference frame (vi) Dynamic modelling of Type 4 wind generator for transient stability and small signal stability wind generator in d-q reference frame (vii) Model for voltage, power control and pitch control (viii) Modelling of interface to power system (ix) Overall small signal model including synchronous and wind generations

Learning and Teaching Approach	The module will be taught through a series of in-person lectures. Lecture materials will be uploaded in Blackboard in advance. The teaching will be interactive and participation oriented.
Assessment Strategy	The summative assessment will be through an end of year closed book examination. Formative assessment will be provided through Q&A, revision and discussion of the content of the module as part of the lectures.
Feedback	You will receive feedback on examinations in the form of an examination feedback report on the performance of the entire cohort. During the term, you will be asked questions in class. The answers will be discussed as part of the formative strategy - questions in class will not be used for grading but to ascertain that you are following the module.
Reading list	-Power System Stability and Control : Prabha Kundur, Mc Graw Hill -Bin Wu, Y.L., Navid Zargari, Samir Kouro Power Conversion and Control of Wind Energy Systems2011: Wiley- IEEE Press

Quality assurance

Date of first approval	
Date of last revision	
Date of this approval	
Module leader	Bikash Pal

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Notes/ comments	

Template version #####

Assessment details

Grading method	Numeric	Pass mark	50%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Examination	Closed book written exam	100%	50%	N
		100%		