

Subject Description Form

Subject Code	EE524
Subject Title	Open Electricity Market Operation
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	<ol style="list-style-type: none"> 1. To enable students to understand the key and practical issues of restructuring electricity supply industry and to establish a broad knowledge of open electricity market operation. 2. To enable students to understand the key issues in open electricity market operation including deregulated power system operation, transmission pricing, procurement of ancillary services, congestion management, available transmission capacity so that students are provided with knowledge and techniques they need to meet the electric industry's challenges in the 21st century.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. Acquire a good understanding of the rationale and key issues for restructuring electricity supply industry, practical operation and design considerations for real world electricity markets, and financial tools to hedge risks used in electricity supply industries. b. Analyse the available transmission capacity and formulate equitable transmission pricing in electricity markets. c. Assess ancillary services requirements and values based on security, economic and performance considerations. d. Present technical results in the form of technical report and verbal presentation
Subject Synopsis/ Indicative Syllabus	<ol style="list-style-type: none"> 1. Restructuring of the Electricity supply industry (ESI): ESI structures; Privatisation and competition; Market structures and architectures; Regulation of Electricity Markets; Role of existing players. 2. Electricity market: Timeline coordination, design considerations and practical operation of a real-world electricity market system. Use of different financial contracts/tools including derivatives and electricity futures for risk management in electricity markets. Game theory approach for market competition analysis. Transmission congestion management in electricity market. Security considerations. 3. Transmission and ancillary services: Transmission ownership and restructuring. Measuring available transmission capacity in energy markets. Purchasing transmission capacity. Network and point to point transmission services. Fixed and firm transmission rights. Ancillary services and technical specifications, and performance based cost model. 4. Transmission pricing: The costs of transmission services. Locational marginal pricing. Embedded cost allocation methods. Stranded assets. Short-run marginal cost. Long-run marginal cost. Integrated approach of transmission pricing.

Teaching/Learning Methodology	<p>The concept of electricity market modelling and economic analysis framework will be presented through lectures and tutorials with reference to real-life market environment. Students will be required to form groups to work through cases covering the market structure and operational aspects so as to develop ability to critically evaluate principles and operation of electricity markets. Tutorials will be structured on different sessions for better understanding on the theoretical concepts which require sufficient contributions from students. Students will also learn through active participation in the presentation of finding of their case studies.</p>																																							
	Teaching/Learning Methodology		Outcomes																																					
		a	b	c	d																																			
	Lectures	✓	✓	✓																																				
	Case Studies & Presentation	✓	✓	✓	✓																																			
Assessment Methods in Alignment with Intended Learning Outcomes	<table border="1"> <thead> <tr> <th data-bbox="416 712 815 846" rowspan="2">Specific assessment methods/tasks</th> <th data-bbox="815 712 963 846" rowspan="2">% weighting</th> <th colspan="4" data-bbox="963 712 1479 792">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th data-bbox="963 792 1086 846">a</th> <th data-bbox="1086 792 1209 846">b</th> <th data-bbox="1209 792 1332 846">c</th> <th data-bbox="1332 792 1479 846">d</th> </tr> </thead> <tbody> <tr> <td data-bbox="416 846 815 898">1. Examination</td> <td data-bbox="815 846 963 898">62%</td> <td data-bbox="963 846 1086 898">✓</td> <td data-bbox="1086 846 1209 898">✓</td> <td data-bbox="1209 846 1332 898">✓</td> <td data-bbox="1332 846 1479 898"></td> </tr> <tr> <td data-bbox="416 898 815 949">2. In-class tests</td> <td data-bbox="815 898 963 949">19%</td> <td data-bbox="963 898 1086 949">✓</td> <td data-bbox="1086 898 1209 949">✓</td> <td data-bbox="1209 898 1332 949">✓</td> <td data-bbox="1332 898 1479 949"></td> </tr> <tr> <td data-bbox="416 949 815 1001">3. Cases study & presentation</td> <td data-bbox="815 949 963 1001">19%</td> <td data-bbox="963 949 1086 1001">✓</td> <td data-bbox="1086 949 1209 1001">✓</td> <td data-bbox="1209 949 1332 1001">✓</td> <td data-bbox="1332 949 1479 1001">✓</td> </tr> <tr> <td data-bbox="416 1001 815 1055">Total</td> <td data-bbox="815 1001 963 1055">100%</td> <td data-bbox="963 1001 1086 1055"></td> <td data-bbox="1086 1001 1209 1055"></td> <td data-bbox="1209 1001 1332 1055"></td> <td data-bbox="1332 1001 1479 1055"></td> </tr> </tbody> </table> <p>The outcomes on the concepts of modelling, analysis and applications are assessed by the usual means of examination and tests whilst those on problem-solving techniques and presentation of findings, as well as technical reporting and teamwork, are evaluated by the case study exercise.</p>					Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				a	b	c	d	1. Examination	62%	✓	✓	✓		2. In-class tests	19%	✓	✓	✓		3. Cases study & presentation	19%	✓	✓	✓	✓	Total	100%					
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Reading List and References	<p>Reference books:</p> <ol style="list-style-type: none"> <li data-bbox="416 1749 1479 1816">1. D. Gan, D. Feng and J. Xie, Electricity Markets and Power System Economics, CRC Press, 2013 <li data-bbox="416 1816 1479 1883">2. D. Kirschen, G. Strbac, Fundamentals of Power System Economics, 2nd Edition, John Wiley & Sons, 2018 <li data-bbox="416 1883 1479 1951">3. K. Bhattacharya, M.H.J. Bollen, and J.E. Daalder, Operation of Restructured Power Systems, Kluwer Academic Publishers, 2001 																																							