

## Subject Description Form

Subject Code	<b>BSE417</b>
Subject Title	<b>Electrical Systems</b>
Credit Value	3
Level	4
Pre-requisite Co-requisite Exclusion	BSE3123 Power Distribution, or equivalent. Nil
Objectives	<p>The subjects in earlier stages of BEng programmes mainly deal with the design and operation of low voltage installations. These subjects have a limited coverage of other aspects in the systems and the solutions of more complex technical problems associated with electricity supply, distribution and utilization on the large industrial and commercial scale.</p> <p>The objectives of this subject are for the students to be able to explore critical issues such as reliability and quality of the supply as well as the solutions arising from design and operation of electrical installations, and to critically think how we achieve reliable, energy efficient, environmentally compatible electrical systems in the buildings.</p>
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a) design reliable LV building distribution systems by adopting innovative circuit arrangements, protection schemes, alternative power sources, etc.;</li> <li>b) evaluate lift traffic performance in buildings and design innovative vertical transportation plans</li> <li>c) analyze harmonics in building electrical systems, and to provide remedial solutions in the design and installations of electrical systems;</li> <li>d) perform risk assessment of lightning, and design lightning protection systems and give innovative solutions.</li> </ol>
Subject Synopsis/ Indicative Syllabus	<p><b>HV/LV distribution:</b> supply network and consumer interface at HV &amp; LV; ring and radial distribution circuits; flexible design and reliability studies; selection, installation and maintenance of HV/LV switchgears, transformers and others.</p> <p><b>System/Equipment protection:</b> requirements on system/equipment protection, system reliability; backup protection; discrimination in LV switchboards and in LV distribution circuits; isolation and switching.</p> <p><b>Uninterruptible power supply:</b> operation principles and modes; Inverter and converter technology; reliability and redundancy, operation and maintenance; UPS and generator compatibility; protection and coordination.</p> <p><b>Electromechanical drives:</b> compressor, fan and pump drives. Dynamic load characteristics for starting, motor starters, variable speed motor drive.</p> <p><b>Harmonics:</b> Harmonic problems and causes, neutral current, harmonic resonance; characteristics of harmonic sources; harmonics limits and responsibility; harmonics measurements and data; harmonics mitigation, passive and active harmonic filters.</p> <p><b>Lightning protection:</b> Lightning striking protection: lightning parameters, probability analysis, risk analysis, methods of protection and design, lightning protection system, integrated earthing and bonding schemes. Lightning surge protection.</p> <p><b>Lifts and escalators:</b> basic structures, traffic analysis, lift planning; lift control systems, local regulations; load characteristics, harmonics, transients, etc.; control and protection of lift supply circuits.</p>
Teaching/Learning Methodology	<p>In this subject lecturers will introduce broad issues of electrical systems in large buildings, and the technical solutions related to the electrical systems. Students will be required to read and discuss course material at seminars, and to prepare alternative solutions for existing and designed buildings, by way of case study. Tutorials will also be held regularly to equip students with the understanding of technical matters and the more complex engineering concepts. Teaching materials of this subject range from a number of selected technical papers drawn from recent conferences and engineering</p>

	journals to international standards.								
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						
			a	b	c	d			
	Assignments	30	✓		✓				
	Seminar	10	✓	✓	✓	✓			
	End-of-semester examination	60	✓	✓	✓	✓			
	Total	100							
Homework is assigned to students whenever a topic is covered and tutorial is given. This ensures students are learning through the lectures and tutorials. Tests are conducted in the middle of the semester to monitor the learning progress of the students. Students are asked to select one topic and discuss critical issues faced in electrical systems, and are tested whether they learn or not in this subject. The final examination reflects the overall learning performance of the students in this subject.									
Student Study Effort Expected	Class contact:		39 Hrs						
	▪ Lectures	26 Hrs.							
	▪ Seminars/Tutorials	11 Hrs.							
	▪ Online assignments	2 Hrs.							
	Other student study effort:								
	▪ Seminars	10 Hrs.							
	▪ Self-study	71 Hrs.							
	Total student study effort		120 Hrs.						
Reading List and References	Practical Power System Protection, Newnes, 2005. Günter G. Seip, LV electrical installation handbook, Wiley, 2000 R.C. Dugan, Electrical Power Systems Quality. McGraw Hill, 2003 A. C. King, Uninterruptible Power Supplies and Standby Power Systems, McGraw-Hill, 2003 Requirements for electrical installations : IEE wiring regulations, 2011 EMSD COP for the electricity (wiring) regulations, 2009 Transportation systems in buildings, London: CIBSE, 2000 IEC standard 62305-4, 2005								