Subject Description Form

Subject Code	**BSE1101**
Subject Title	**Electrical Fundamentals**
Credit Value	3
Level	1
Pre-requisite Co-requisite Exclusion	Nil Nil Nil
Objectives	a. To provide students with the fundamentals of electrical engineering, and the knowledge of electrical components and equipment found in building electrical systems. b. To provide students with basic analytical tools, e.g. equivalent circuits, for appreciating operation of electrical installations, and evaluating the performance of electrical installations
Intended Learning Outcomes	Upon completion of the subject, students will be able: a. to model electrical components, such as cables and capacitors with basic electrical parameters such as R, L and C; b. to model electrical systems using equivalent circuits and to use such skills in practical problem solving; c. to analyse basic d.c. and a.c. systems using analytical tools such as Thevenin's Theorem, etc; and d. to evaluate the performance of electrical components and systems found in buildings on the basis of undertaking experiments.
Subject Syllabus	*Induction* - overview of electricity supply, distribution and utilisation in high-rise and large buildings. *Simple dc systems* - circuit model and analysis for battery systems, internal resistance, maximum power, voltage drop, inductance, transient performance, short-circuit analysis by Thevenin equivalent circuit. Ring and radial circuits, interconnecting network and their effects on voltage drop and network efficiency. *Electromagnetism* - magnetic fields, electrical and magnetic circuit parameters. Physical meaning of self, mutual and leakage inductance. Equivalent circuit parameters for dc and single-phase conductors, coupled coils in air, iron cored coils, current transformers. Frequency effects, hysteresis, eddy currents. *Single phase ac circuits* - simple ac generator, waveform and phasor representations of voltage, current and power. Circuit modelling and analysis, transients, non-linearity and harmonics. Supply-load interaction. Principles of power factor correction. *Three phase systems* - concepts of three-phase generation, transmission, distribution and utilisation. Balanced and unbalanced operation. Single-phase equivalent circuits. Power measurements. Power factor correction, harmonics. Circuit analysis, Kirchhoff's laws, and star-delta transformation. *Single phase transformers* - Construction and principles. Auto-transformer, current transformers, and equivalent circuit models. *Electrical conductors* - power lines, cables, busbar systems, etc. Internal and external fields, R, L parameters, voltage drop, thermal characteristics, current rating, etc. Cabling rating data in IEE Regulations, etc.
Teaching/ Learning Methodology	*Teaching approach* emphasises the development of system models, and the realisation of system parameters from design or test data. The operation of equipment is examined as part of a system, with real and interdependent connections to input and output ports. Models of systems so developed are subject to qualitative and quantitative analysis, with due account for practical constraints and limitations appropriate to building services systems and equipment. Internal design detail of plant is not considered in detail, except insofar as it affects the students understanding of electro-mechanical, thermal and environmental aspects of performance. *Lecture* - 13 sessions of 2-hour lecture are provided. Lectures are to introduce students the basic

concepts and relevant theory of each topic, and are taught in whole class.

Tutorial - 11 sessions of 1-hour tutorial with a group size of no more than 40 students are provided. Tutorials mainly focus on problem solving based on examination type questions, practical examples and related laboratory work.

Laboratory work - 2 sessions of 3-hour laboratory work associated with the subject are provided with a group size of about 3. Laboratory works aim to help students in well-understanding of the lecture contents through practical operation and testing of relevant electrical system. It includes:

Lab 1 - Measurement of Electrical Parameters

Lab 2 - Single Phase Equivalent Circuits and Non-linearity

Lab 3 - Single Phase Equivalent Circuit of Current Transformer

Lab 4 - Polarity Marking and Testing of Single-phase Transformer

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		
1. Coursework	100	√	√	√	√		
Total	100 %						

** For details, please refer to the 2020/21 Semester 1 Subject teaching scheme/schedule.*

Coursework is made up from two in-class tests (25%) and the laboratory works (15%).

Test 1 - held in first half of the semester to assess outcomes a) &b) and to get feedback for teaching improvements.

Test 2 – held in second half of the semester to assess outcomes c) & d) and to find out the aspects that need to be strengthened further in teaching.

Laboratory work – assess the students' skills of recognizing, operating and testing of particular electrical components of a building electrical system.

Examination - held in the end of the semester with questions aligned with the intended subject learning outcomes.

Student Study Effort Expected

Class contact:	39 Hrs
▪ Lectures	26 Hrs.
▪ Tutorials	11 Hrs.
▪ In-class assessment	2 Hrs.
Laboratory sessions	6 Hrs.
Other student study effort:	75 Hrs.
Total student study effort	120 Hrs.

Reading List and References

1) Handbook of electric power calculations, New York: McGraw-Hill, c2001, 3rd ed., editor: H. Wayne Beaty (Reference Coll TK1005 .H29 2001).

2) Comprehensive dictionary of electrical engineering, FL: CRC Press, 2005, 2nd ed., editor-in-chief: Phillip A. Laplante and Boca Raton (Reference Coll TK9 .C575 2005).

3) Standard handbook for electrical engineers, New York: McGraw-Hill, 2007, 15th ed., editor-in-chief: H. Wayne Beaty and Donald G. Fink (Reference Coll TK147.S8 2007).

4) Study guides prepared by the Department of Building Services Engineering:

- D.C. current system; - Electromagnetism; - Single-phase A.C. system
- Three-phase A.C. system; - Single-phase transformer; - Electrical conductors;

	- Electronic devices.