BASIC ELECTRICAL ENGINEERING

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2017 -2018)

SEMESTER - I/II

Course Code	:	17ELE15/17ELE25	CTE Marks	:	40
Number of Lecture Hours/Week	:	04	SEE Marks	:	60
Total Number of Lecture Hours	:	50	Exam Hours	:	03

CREDITS - 04

Course Objectives:

* Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
* Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
* Develop selection skill to identify the type of generators or motors required for particular application.
* Highlight the importance of transformers in transmission and distribution of electric power.
* Emphasize the effects of electric shock and precautionary measures.
* Improve the ability to function on multi-disciplinary teams.

Module - 1

D C circuits: Ohm's Law and Kirchhoff's Laws, analysis of series, parallel and series- parallel circuits excited by independent voltage sources. Power and Energy. Illustrative examples.

5 - Hours

Electromagnetism:

Review of field around a conductor and coil, magnetic flux and flux density, magnetomotive force and magnetic field intensity, reluctance and permeability, definition of magnetic circuit and basic analogy between electric and magnetic circuits. (These topics are not to be considered for setting the examination questions).

Electromagnetic Induction: Definition of Electromagnetic Induction, Faradays Laws, Fleming's right hand rule, Lenz's Law, Statically and dynamically induced emf. Self-inductance, mutual inductance and coefficient of coupling. Energy stored in magnetic field. Illustrative examples. Force on current carrying conductor placed in a magnetic field, Fleming's left hand rule.

5 - Hours

Module - 2

DC Machines:

Working principle of DC machine as a generator and a motor. Types and constructional features. Types of armature windings, Emf equation of generator, relation between induced emf and terminal voltage with a mention of brush contact drop and drop due to armature reaction. Illustrative examples, neglecting armature reaction.

Operation of DC motor, back emf, torque equation. Types of DC motors, characteristics and applications. Significance of back emf. Necessity of a starter for DC motor. Illustrative examples on back emf and torque.

7 - Hours

Measuring Instruments: Construction and Principle of operation of dynamometer type wattmeter and single phase induction type energy meter.

3 - Hours

Module - 3

Single-phase AC circuits:

Generation of sinusoidal voltage, frequency of generated voltage, definition and numerical values of average value, root mean square value, form factor and peak factor of sinusoidally varying quantities, phasor representation of alternating quantities. Analysis, with phasor diagrams, of R, L, C, R-L, R-C and R-L-C circuits and, parallel and series- parallel circuits. Real power, reactive power, apparent power and power factor. Illustrative examples.

7 - Hours

Domestic wiring:

Service mains, meter board and distribution board. Brief discussion on concealed conduit wiring. Two-way and three-way control. Elementary discussion on Circuit protective devices: fuse and Miniature Circuit Breaker (MCB's). Electric shock, precautions against shock, Objectives of Earthing, types of earthing; pipe and plate earthing, Residual current circuit breaker (RCCB).

3 - Hours

Module - 4

Three Phase Circuits:

Necessity and advantages of three phase systems, generation of three phase power. Definition of Phase sequence, balanced supply and balanced load. Relationship between line and phase values of balanced star and delta connections. Power in balanced three-phase circuits, measurement of power by two-wattmeter method. Determination power factor using wattmeter readings. Illustrative examples.

6 - Hours

Three PhaseSynchronous Generators:

Principle of operation, Types and constructional features, Advantages of rotating field type alternator, Synchronous speed, Frequency of generated voltage, Emf equation. Concept of winding factor (excluding the derivation of distribution and pitch factors). Illustrative examples on calculation of distribution factor, pitch factor and emf equation.

4 - Hours

Module - 5

Single Phase Transformers:

Necessity of transformer, Principle of operation and construction of single-phase transformers (core and shell types). Emf equation, losses, variation losses with respect to load, efficiency, Condition for maximum efficiency, Voltage regulation and its significance (Open Circuit and Short circuit tests, equivalent circuit and phasor diagrams are excluded). Illustrative problems on emf equation and efficiency only.

6 - Hours

Three Phase Induction Motors:

Principle of operation, Concept and production of rotating magnetic field, Synchronous speed, rotor speed, Slip, Frequency of the rotor induced emf, Types and Constructional features. Slip and its significance. Applications of squirrel - cage and slip - ring motors. Necessity of a starter, starting of motor using stars-delta starter. Illustrative examples on slip calculations.

4 - Hours

Course outcomes:

After the completion of the course, the student should be able
* To predict the behaviour of electrical and magnetic circuits.
* Select the type of generator / motor required for a particular application.
* Realize the requirement of transformers in transmission and distribution of electric power and other applications.
* Practice Electrical Safety Rules & standards.
* To function on multi-disciplinary teams.

Question paper pattern:
* The question paper will have ten questions.
* Each full Question consisting of 20 marks
* There will be 2 full questions (with a maximum of four sub questions) from each module.
* Each full question will have sub questions covering all the topics under a module.
* The students will have to answer 5 full questions, selecting one full question from each module.

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Text Books

1 Basic Electrical Engineering, D. C. Kulshreshtha, TMH, 1" Edition, Revised.

2 Electrical Technology, Edward Hughes, Pearson, 10ᵗʰ Edition, 2014

Reference Books

1 Fundamentals of Electrical Engineering, Rajendra Prasad PHI Third Edition 2014.

2 Basic Electrical Engineering, Abhijit, Chakrabarti, ChandanKumar, Chanda, Sudiptanath, TMH, 1" Edition, 2010

3 Fundamentals of Electrical Engineering and Electronics, B. L. Theraja, S.Chand & Company Ltd, Reprint Edition 2013

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