C.V. Raman Global University
Bhubaneswar - 752 054 (Odisha)

SUBJECT: BASIC ELECTRICAL ENGINEERING	
Course Code	EE100
Teaching Hours/Week (L-P-T-E)	(3-0-1-0)
Credits	03
Course offering department	Department of Electrical Engineering
Total Contact Hours	42 + 14

Course objectives:

This course aims to

1) Explain the concept of different basic circuit elements, sources, and basic laws for dc, single-phase and three-phase ac, and magnetic circuits.
2) Evaluation of different parameters in electrical circuits using basic circuit laws for dc, single-phase, and three-phase ac circuits.
3) Apply the concepts of magnetic circuits for different ac and dc machines
4) Assess the working of different specialized motors
5) Analyze the use of electric Measuring instruments, transmission, and distribution, and various switchgear components in the electrical supply system.

Module – 1 (10hrs.)

DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits excited by independent voltage sources. Mesh analysis, Nodal Analysis, Star-Delta and Delta-star conversion, Superposition theorem, Thevenin's and Norton's theorems, and maximum power transfer theorem.

Module – 2 (10hrs.)

Single-phase circuits: Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form, and peak factors. Voltage and current relationship, with phasor diagrams, in R, L, and C circuits, j operators. Analysis of R-L, R-C, R-L-C Series circuits, series and parallel resonance, Real power, reactive power, apparent power, and Power factor. Measurement of power.

Three-phase circuits: Generation of three-phase power, representation of the balanced star (3 wire and 4-wire system) and delta connected loads, the relation between phase and line values of voltage and current from phasor diagrams, advantages of three-phase systems.

Module – 3 (6 hrs.)

Basics of Magnetic Circuits and DC Machines: Basics of Magnetic circuit, MMF, Flux, Reluctance calculations for simple magnetic cores, B-H curve, DC machines Construction, Principle of Operation, Basic Equations, and Applications:

Module – 4 (8 hrs.)

Transformers: Necessity of transformer, the principle of operation, Types, and construction of single-phase transformers, emf equation,

Three-phase induction Motors: Concept of the rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor, slip and problems on the slip, applications.

Specialized machines: Principle of operation of BLDC motor, Stepper motor.

Module-5 (8 Hrs.)

Measuring Instrument:
Classification of instruments, principles, and essentials of an instrument, moving coil instruments, Permanent Magnet Moving Coil (PMMC) Instruments, Moving Iron Type instruments, and Dynamometer-Type Instruments. Ammeters and voltmeters Measurement of Power and Energy.

Power transmission and distribution: Concept of power transmission and power distribution. Low voltage distribution system (400 V and 230 V) for domestic, commercial, and small-scale industries through block diagrams only.

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries.

Text Books :

1. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill Publication, 2009.
2. S. Salivahanan, R. Regaraj and G. R. Venkatakrishnan, "Basic Electrical, Electronics, and Measurement Engineering", McGraw Hill Publication, 2009.
3. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Reference Books :

1. T.K. Nagsarkar & M.S. Sukhija, "Basic Electrical & Electronics Engineering", Oxford, 2nd Edition 2011.
2. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India Publication, 1989.
3. D.P. Kothari and I. J. Nagrath, "Basic Electrical & Electronics Engineering", Tata McGraw Hill Publication, 2010

Open Sources:

1. Dr. Nagendra Krishnapura, "Basic Electrical Circuits", NPTEL - IIT Madras. https://nptel.ac.in/courses/108/106/108106172/
2. Prof. Mahesh B. Patil, "Basic Electronics", NPTEL – IIT Bombay. https://nptel.ac.in/courses/108/101/108101091/

COURSE OUTCOME:

Outcome	At the end of the course, the learner will be able to	Bloom's Level	Expected proficiency percentage	Expected Attainment percentage
CO-1	Understand the concept of basic circuit elements, sources, and basic laws for dc circuits and, the working principles of protective devices and personal safety measures	**2**	**70%**	**65%**
CO-2	Understand the circuit fundamentals for the single-phase and three-phase AC circuits magnetic circuits, and the working principles of different dc and ac machines	**2**	**70%**	**60%**
CO-3	Apply the circuit basic to calculate circuit parameters for dc, ac, and magnetic circuits.	**3**	**70%**	**70%**
CO-4	Apply the concept of magnetic circuits in understanding the basics of transformers and specialized machines	**3**	**70%**	**60%**
CO-5	Analyze the significance of different measuring instruments, basic concepts of power system	**4**	**60%**	**50%**

	transmission and distribution			

MAPPING OF COURSE OUTCOME ONTO PROGRAM OUTCOME (CO –PO MAPPING)

Course Outcome	PO1-**Engineering knowledge**	PO2- **Problem analysis**	PO3-**Design/development of solutions**	PO4-**Conduct investigations of complex problems**	PO5-**Modern tool usage**	PO6-**The engineer and society**	PO7-**Environment and sustainability**	PO8-**Ethics**	PO9-**Individual and team work**	PO10-**Communication skill**	PO11-**Project management and finance**	PO12 **Life-long learning**
CO-1	3	3	1	1	1	1	2	2	2	2	0	1
CO-2	3	3	1	1	1	1	2	2	2	2	0	1
CO-3	3	3	1	1	1	1	1	1	2	2	1	1
CO-4	3	3	1	1	1	1	1	1	2	2	1	1
CO-5	2	2	1	1	1	1	1	1	2	2	1	1

Course utilization Plan / Lesson Plan

Module No	Module Name	Required contact Hours	COs addressed	References book Used
Module-1	**DC Circuits**	**10**		
	Student assessment, and introduction to Electrical circuit elements (R, L and C)	1	1, 2	1-3
	voltage and current sources, Kirchoff's current	1	1, 2	1-3
	Kirchoff's voltage laws, analysis of simple circuits with dc excitation,	1	1, 2	1-3
	Mesh analysis	1	1, 2	1-3
	Nodal Analysis	1	1, 2	1-3
	Star-Delta and Delta-star conversion	1	1, 2	1-3
	Superposition theorem	1	1, 2	1-3
	Thevenin's theorem	1	1, 2	1-3
	Norton's theorems	1	1, 2	1-3
	maximum power transfer theorem	1	1, 2	1-3
Module-2	**AC Circuits**	**10**		
	Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form, and peak factors	2	2,3	1-3
	Voltage and current relationship, with phasor diagrams, in R	1	2,3	1-3
	Voltage and current relationship, with phasor diagrams, in L and C	1	2,3	1-3
	Analysis of R-L &R-C Circuits, R-LC series circuit	2	2,3	1-3

	series and parallel resonance	1	2,3	1-3
	Real power, reactive power, apparent power, and Power factor	1	2,3	1-3
	Generation of three-phase power, representation of the balanced star (3 wire and 4 wire system) and delta connected loads the relation between phase and line values of voltage and current from phasor diagrams, advantages of three-phase systems	1	2,3	1-3
MODULE-3	**Basics of Magnetic Circuits and DC Machines**	**6**		
	Basics of Magnetic circuit, MMF, Flux	2	2,3,4	1-3
	Reluctance calculations for simple magnetic cores, B-H curve	1	2,3,4	1-3
	DC machines: Construction, Principle of Operation OF Generator	1	2,3,4	1-3
	DC machines: Construction, Principle of Operation of motor	1	2,3,4	1-3
	Basic Equations, and Applications.	1	2,3,4	1-3
MODULE-4	**Transformer, Three phase Induction motor, Specialized motors**	**8**		
	Transformers: Necessity of transformer, the principle of operation	1	3,4,5	1-3
	Types, and construction of single-phase transformers, emf equation	1	3,4,5	1-3
	Three-phase induction Motors: Concept of the rotating magnetic field, Principle of operation	1	3,4,5	1-3
	slip, constructional features of motor	1	3,4,5	1-3
	types – squirrel cage and wound rotor, applications	1	3,4,5	1-3
	Principle of operation and application of BLDC motor	1	3,4,5	1-3
	Stepper motor	1	3,4,5	1-3
	Single Phase Induction Motor	1	3,4,5	1-3
MODULE-5	**Measuring Instruments, Power transmission and distribution, Electrical Installations**	**8**		
	Classification of instruments, principles, and essentials of an instrument, moving coil instruments Permanent Magnet Moving Coil (PMMC) Instruments	1	1,2,3,4,5	1-3
	Moving Iron Type instruments, Dynamometer-Type	1	1,2,3,4,5	1-3
	Ammeters and voltmeters Measurement of Power and Energy	1	1,2,3,4,5	
	Power transmission and distribution: Concept of power transmission and power distribution. Low voltage distribution system (400 V and 230 V) for domestic	1	1,2,3,4,5	1-3
	Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB and Earthing	2	1,2,3,4,5	1-3
	Types of Wires and Cables	1	1,2,3,4,5	1-3
	Types of Batteries, Important Characteristics for Batteries	1	1,2,3,4,5	1-3
	TOTAL	**42 HOURS**		

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Learning Assessments

Bloom's Level of Cognitive Task		Teacher Assessment / Formative Assessment (40 %)				Summative Assessment (60 %)	
		Quiz (10%)	Assignment (10%)	Experiential learning * (10%)	Attendance (10%)	Mid Sem (20%)	End Sem (40%)
Level-1	Remember	40%	40%	20%		40%	30%
	understand						
Level-2	Apply	60%	40%	40%		60%	50%
	Analyze						
Level-3	Evaluate		20%	40%			20%
	Create						
Total		100%	100%	100%		100%	100%

***NOTE: Experiential Learning : class test/simulation project/survey paper/ case study presentation/team project**

Course Prepared By: Prof. Priyanka Sen, Asst. Professor, EE , CGU-Odisha
Course Verified By: Prof. Ashwin Kumar Sahoo, Professor, EE , CGU-Odisha