Subject Code: 01EE0101

Subject Name: Elements of Electrical Engineering

B.Tech. Year - I

Objective: Students are expected to learn basics of Electrical Engineering which will help them to apply these concepts in day to day life. The course is divided into two parts: DC circuits and AC circuits. The course also discusses three phase supply which is used in many commercial, industrial as well as agricultural applications. Keeping in view wide applications of batteries, a special unit of battery is introduced.

Credits Earned: 4 Credits

Course Outcomes: After completion of this course, student will be able to

- Recognize importance of electrical energy and its day to day applications.
- Interpret the role of resistor, capacitor and inductor and their behaviour under various system conditions.
- Describe qualitative comparison between AC and DC system, single phase and three phase systems.
- Analyze and solve DC Circuits, AC Single phase and Three Phase Circuits.
- Analyze and solve magnetic circuits.
- Explain the need of batteries, its characteristics and charging methods.

Pre-requisite of course: NA.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA	(CSE)	Viva (V)	Term work (TW)	
3	0	2	4	50	30	20	25	25	150

Contents:

Unit	Topics	Contact Hours
1	**Fundamental of DC circuits:** Definition of Current, Voltage, e.m.f., Power Energy, Resistance, Ohm's Law, Effect of variation in temperature on resistance, Series, Parallel and series-parallel connection of resistances, Comparison between series and parallel circuits, Open circuit and Short circuit, Delta-Star and Star-Delta transformation, Kirchoff's Laws, Nodal Analysis, Mesh Analysis of Electrical Networks	6
2	**Magnetic Circuits and Electromagnetics:** Definition of magnetic quantities, Magnetic circuits, Comparison of electric and magnetic circuits, Calculation of Ampere turns, Leakage flux, Magnetization Curve Electromagnetic induction, Faraday's Laws, Induced emf and direction of induced emf, self inductance, mututal inductance, coefficient of coupling, inductance of coupled coils, energy stored in magnetic field, Charging and discharging of inductor, magnetic hysteresis, eddy current losses	6
3	**Electrostatics and Capacitance:** Electric charge, permittivity, Coulomb's law, Electric Flux, Electric Field, Flux density, Electric field Intensity, Electric potential and potential gradient, Dielectric strength. Capacitor, Parallel-plate capacitor, types of capacitors, series and parallel connection of capacitors, energy stored in capacitor, charging and discharging of capacitor.	6
4	**Fundamental of AC Quantities:** Generation of Alternating voltage and current, sinusoidal function-Terminology, Form Factor and Peak Factor, Phase and Phase Difference, Phasor representation of alternating quantities, Phasor addition and subtraction, Application of Fourier Analysis in Alternating Quantities	5

5	**Analysis of AC circuits:** Current flow in AC circuits, Behaviour of purely resistive, inductive and capacitive circuits, Phase relation between voltage and current Active, Reactive and Apparent Power, Power Factor and its significance in series RL circuit, series RC circuits, series RLC circuit Parallel and series-parallel AC circuits, phasor method, admittance method	7
6	**Resonance** Introduction, series resonance, selectivity and bandwidth, quality factor, voltage/current magnification, parallel resonance, bandwidth and Q-factor of parallel resonant circuits, Comparison of series and parallel resonance circuits, Application of resonance in Electrical Engineering	2
7	**Three Phase Systems:** Polyphase systems, Generation of three phase emf, phase sequence, Interconnection three phases, star connection, delta connection, power in three phase systems, Measurement of power and power factor in balanced three phase load, Advantages of three phase system	6
8	**Batteries:** Electric cell, types of cells, Equivalent circuits, grouping of cells, batteries, capacity of battery, efficiency of battery, charging method, Life of battery, Application of battery, Battery maintenance procedure.	2
9	**Safety and Protection** Electric Shock, First aid for electric shock, importance of grounding, Fuse, MCB, ELCB.	2
	Total Hours	**42**

References:

1. E. Hughes, 'Electrical and Electronic Technology', Prentice Hall India, 10th edition, 2008
2. V.N. Mittal, 'Basic Electrical Engineering', Tata Mcgraw-Hill,2nd edition, 2006.
3. V. Del Toro, 'Electrical Engineering Fundamentals', Prentice - Hall India, 2nd edition, 2006.
4. D. P. Kothari and I. J. Nagrath, '*Theory and Problems in Basic Electrical Engineering*', Prentice Hall India
5. A. Chakrabarti, S. Nath, C. Chanda, '*Basic Electrical Engineering'*, Tata McGrawHill Education India Pvt. Ltd, 2013.
6. B. L. Theraja, '*Electrical Technology*', S. Chand Publication, 2012.
7. U. A. Patel, '*Elements of Electrical Engineering*', AtulPrakashan, 8th edition, 2009

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

Suggested List of Experiments:

1. To verify star-delta transformation in electric network
2. To verify ohm's law in an electric circuit
3. To observe the variation of temperature on resistance
4. Determination of equivalent capacitance of series and parallel connection of capacitors
5. Determination of B-H curve of magnetic material
6. To study function of basic instruments
7. To determine basic terminology of alternating waveform

8. To determine power in a single phase circuit using wattmeter
9. Determination of parameters in series RL circuit
10. Determination of parameters in series RLC circuit
11. Study series resonance in RLC circuit
12. Phase and Line quantity relationship in star and delta connection in a three phase systems
13. Determination of power in a three phase balanced circuit using two wattmeter method

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

1. http://nptel.ac.in/courses/108108076/
2. http://nptel.ac.in/downloads/108105053/
3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/
4. https://www.facstaff.bucknell.edu/mastascu/eLessonsHTML/EEIndex.html
5. http://www.electrical4u.com/nature-of-electricity/
6. http://vlab.amrita.edu/index.php