



Subject Code: 01EE0104

Subject Name: Electrical Circuits

B. Tech. Year – I (Semester 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. Analysis of DC circuit using theorems will be useful to solve any electronics network. Grounding and Bonding will ensure safe and quality working conditions.

Credits Earned: 05 Credits

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

1. Understand characteristic and behaviour of resistor, inductor and capacitor.
2. Understand fundamentals of electromagnetics and electrostatic.
3. Describe qualitative comparison between AC and DC system.
4. Analyse and solve DC Circuits and AC Circuits.
5. Apply network theorems to solve electric circuits.
6. Obtain two port parameters of given electric network
7. analyse earth resistance to ensure safe and quality working environment.

Pre-requisite of course: Basic concepts of Physics

Teaching and Examination Scheme:

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial / Practical Marks		Total Marks
Theory	Tutorial	Practical		E	I		V	T	
				ESE	IA	CSE	Viva	Term Work	
4	0	2	5	50	30	20	25	25	150



Contents:

Unit	Topics	Contact Hours
1	Fundamentals 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	Network Theorems: Ideal voltage and current sources, Practical Sources, Dependent Sources: Voltage Dependent Voltage Source, Voltage Dependent Current Source, Current Dependent Voltage Source, Current Dependent Current Source. Network theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem.	8
3	Two Port Parameters: Need and application of Two Port parameters: Z-parameters, Y-parameters, h-parameters, ABCD-parameters	6
4	Magnetic Circuits and Electromagnetics: Definition of quantities related to magnetic circuits, Comparison of electric and magnetic circuits, Concept of Ampere turns, Leakage flux, Magnetization curve Electromagnetic induction, Faraday's Laws, Induced emf and direction of induced emf, self-inductance, mutual inductance, coefficient of coupling, energy stored in magnetic field, Charging and discharging of inductor, magnetic hysteresis, eddy current losses	6
5	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, Types of capacitors, series and parallel connection of capacitors, energy stored in capacitor, charging and discharging of capacitor.	6
6	Fundamental of AC Quantities: Generation of Alternating voltage and current, Sinusoidal function- Terminologies, Form Factor and Peak Factor, Phase and Phase Difference, Phasor representation of alternating quantities, Phasor addition and subtraction.	5
7	Analysis of AC circuits: Behaviour of purely resistive, inductive and capacitive AC circuits, Phase relation between voltage and current in AC circuit, Power Factor and its significance in series RL circuit, RC and RLC circuit, Active, Reactive and Apparent Power, Series, Parallel and Series-Parallel AC circuits, phasor method, admittance method of analysis of AC circuits.	7
8	Resonance: Introduction, series resonance, selectivity and bandwidth, quality factor, voltage/current magnification, parallel resonance, bandwidth and Q-factor of	3



	parallel resonant circuits, Comparison of series and parallel resonance circuits, Application of resonance in Electrical and Electronics Engineering	
9	Grounding and Bonding: Introduction, Shock and Fire Hazards, National Electrical Code Grounding Requirements, Essentials of a Grounded System, Ground Electrode, Earth Resistance Tests, Earth–Ground Grid Systems, Power Ground System, Signal Reference Ground, Signal Reference Ground Methods, Single-Point and Multipoint Grounding, Ground Loops, Electrochemical Reactions Due to Ground Grids, examples of Grounding Abnormalities or Problems, Loss of Ground Causes Fatality, Stray Ground Loop Currents Cause Computer Damage	5
Total Hours		52

Suggested Text books / Reference books:

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. A. Chakrabarti, S. Nath, C. Chanda, ‘Basic Electrical Engineering’, Tata McGrawHill Education India Pvt. Ltd, 2013.
4. B. L. Theraja, ‘Electrical Technology’, S. Chand Publication, 2012.
5. Boylestad, Robert L. Introductory circuit analysis’, Pearson Education India, 2016.
6. Kumar, KS Suresh, ‘Electric circuits and networks’, Pearson Education India, 2009.
7. C. Sankaran, ‘Power Quality’, CRC Press, 2002.

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
15%	45%	20%	15%	5%	0%

Suggested List of Experiments:

1. To study and demonstrate function of basic instruments
2. To observe the effect of temperature variation on resistance
3. To determine of B-H curve of magnetic material
4. To determine equivalent capacitance of series and parallel connection of capacitors
5. To determine basic terms of alternating waveform
6. To determine power in a single-phase circuit using wattmeter
7. To determine parameters in series RL, RC and RLC circuit
8. To study and observe series resonance in RLC circuit



9. To verify Superposition theorem
10. To verify Maximum Power Transfer theorem
11. To obtain and verify h-parameter and ABCD-parameters of electric network

Instructional Method:

1. 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.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

1. <http://nptel.ac.in/courses/103107081>
2. <http://nptel.ac.in/courses/103106109>
3. <https://ocw.mit.edu/courses/audio-video-courses/#chemical-engineering>