ELECTRICAL CIRCUITS

II Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE002	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the basic parameters, formation of circuit and network.
II. Apply different network reduction techniques to solve complex electrical networks..
III. Use network topology technique to solve complex electrical networks.
IV Analyze single phase AC circuits and their behavior.
V Summarize the conditions for electrical resonance.
VI Explain the importance of magnetic circuits and their behavior in electrical engineering.
VII Examine complex electrical networks using network theorems.

COURSE LEARNING OUTCOMES (CLOs):

At the end of the course, the student will have the ability to:

1 Define the various nomenclature used to study the characteristics of DC networks.
2 Understand the concept of circuit, classification of elements and types of energy sources.
3 State different laws associated with electrical circuits and apply source transformation technique to determine equivalent resistance and source current.
4 Apply the network reduction techniques directly and indirectly to calculate quantities associated with electrical circuit
5 Define the various nomenclature related with network topology and give the importance of dual network.
6 Formulate incidence, tie-set and cut-set matrix which are used to solve the behavior of complex electrical circuits.
7 Identify the alternating quantities with it instantaneous, average and root mean square values.
8 Demonstrate the impression of reactance, susceptance, impedance and admittance in estimating power of AC circuits.
9 Analyze the steady state behavior of series and parallel RL, RC and RLC circuit with sinusoidal excitation.
10 Design the series and parallel RLC for the required bandwidth, resonant frequency and quality factor.
11 State the faraday‟s laws of electromagnetic induction used in construction of magnetic circuit.
12 Determine magnetic flux, reluctance, self and mutual inductance in the single coil and coupled coils magnetic circuits.
13 Prove the law of conservation of energy, superposition principle, reciprocity and maximum power transfer condition for the electrical network with DC and AC excitations.
14 Summarize the procedure of thevenin‟s, norton‟s and milliman‟s theorems to reduce complex network into simple equivalent network.
15 Explain the steps of compensation, zero current and voltage shift theorem to predict constraints of electrical networks.

16 Apply the network reduction techniques , concept of graph theory, resonance and faraday‟s laws to solve real constraints of electrical and magnetic circuits.
17 Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.

Unit-I	INTRODUCTION OF ELECTRICAL CIRCUITS	Classes: 09

Circuit concept: Basic definitions, Ohm‟s law at constant temperature, classifications of elements, R, L, C parameters, independent and dependent sources, voltage and current relationships for passive elements (for different input signals like square, ramp, saw tooth, triangular and complex), temperature dependence of resistance, tolerance, source transformation, Kirchhoff‟s laws, equivalent resistance of series, parallel and series parallel networks..

Unit-II	ANALYSIS OF ELECTRICAL CIRCUITS	Classes:09

Circuit analysis: Star to delta and delta to star transformation, mesh analysis and nodal analysis by Kirchhoff‟s laws, inspection method, super mesh, super node analysis; Network topology: definitions, incidence matrix, basic tie set and basic cut set matrices for planar networks, duality and dual networks.

Unit-III	SINGLE PHASE AC CIRCUITS	Classes: 09

Single phase AC circuits: Representation of alternating quantities, instantaneous, peak, RMS, average, form factor and peak factor for different periodic wave forms, phase and phase difference, „j‟ notation, concept of reactance, impedance, susceptance and admittance, rectangular and polar form, concept of power, real, reactive and complex power, power factor.
Steady state analysis: steady state analysis of RL, RC and RLC circuits (in series, parallel and series parallel combinations) sinusoidal excitation

Unit-IV	RESONANCE AND MAGNETIC CIRCUITS	Classes: 09

Resonance: Series and parallel resonance, concept of band width and Q factor.
Magnetic circuits: Faraday‟s laws of electromagnetic induction, analysis of series and parallel magnetic circuits, composite magnetic circuits, coupled coils, concept of self and mutual inductance, dot convention, coefficient of coupling, multi winding analysis.

Unit-V	NETWORK THEOREMS (DC and AC)	Classes: 09

Theorems: Zero current theorem, Tellegen‟s, superposition, reciprocity, voltage shift theorem, Thevinin‟s, Norton‟s, maximum power transfer, Milliman‟s and compensation theorems for DC and AC excitations

Text Books:

1.A Chakrabarthy, “Electric Circuits”, Dhanpat Rai & Sons, 6th Edition, 2010.
2.A Sudhakar, Shyammohan S Palli, “Circuits and Networks”, Tata McGraw-Hill, 4th Edition, 2010.
3. M E Van Valkenberg, “Network Analysis”, PHI, 3rd Edition, 2014.
4. Rudrapratap, “Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers”, Oxford University Press, 1st Edition, 1999.

REFERENCE

1. John Bird, “Electrical Circuit Theory and technology”, Newnes, 2nd Edition, 2003.
2. C L Wadhwa, “Electrical Circuit Analysis includingPassive Network Synthesis”, New Age International, 2nd Edition, 2009.
3. David A Bell, “Electric Circuits”, Oxford University Press, 7th Edition, 2009.

Web References:

1.https://www.igniteengineers.com
2.https://www.ocw.nthu.edu.tw
3.https://www.uotechnology.edu.iq
4.https://www.iare.ac.in

E-Text Books:

1. https://www.bookboon.com/en/concepts-in-electric-circuits-ebook
2. https://www.www.jntubook.com
3. https://www.allaboutcircuits.com