

**16EE203 ELECTRICAL CIRCUIT ANALYSIS**

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	-	30	10	30	-	10	5	5

**Course Description and Objectives:**

This course deals with analysis of DC and AC circuits using methods like mesh, node and network theorems. It also introduces the concepts of magnetic circuits and two port networks. The objective of course is to introduce properties of network elements and methods of analysis for various electrical and magnetic circuits.

**Course Outcomes:**

The student will be able to:

- analyze DC and AC circuits using different methods.
- predict the occurrence of resonance in series and parallel networks.
- analyze balanced and unbalanced three phase circuits.
- analyze the transient behaviour of a network.
- analyze the different two-port parameters and their interrelations.

**SKILLS:**

- ü *Determine currents and voltages of all elements in any electrical network.*
- ü *Analyze simple house wiring diagram.*
- ü *Analyze simple magnetic circuits with and without air gap.*
- ü *Calculate power, current and voltage in any three phase circuit.*
- ü *Design suitable fuse for over current protection.*
- ü *Design suitable battery for small applications.*

**ACTIVITIES:**

- Design of AC 220V Power Strip for electronic work bench.
- Selection of switches, plugs, fuse and wire specifications for domestic loads.
- Realize the value of R, L and C for a given application.
- Verify different network theorems by conventional approach.
- Tune a given circuit for a specified frequency.
- Design of Power bank for mobile charger circuit.

**UNIT - 1****L- 10**

**CIRCUIT ANALYSIS:** Analysis of DC and AC circuits by Mesh and Nodal Analysis - Super mesh and super node analysis, Concept of capacitance, Effects, Energy stored, Series, Parallel and series parallel circuits.

**MAGNETIC CIRCUITS:** Parallel and Series parallel magnetic circuits-with and without air gap, Fringing effect.

**UNIT - 2****L- 08**

**NETWORK THEOREMS :** Superposition, Thevenin's, Norton's, Reciprocity, Compensation, Maximum Power transfer, Tellegan's and Millman's theorems for both DC and AC circuits

**UNIT - 3****L- 09**

**RESONANCE:** Series and Parallel Resonance, Different combinations, Quality factor, Bandwidth, Selectivity of different circuits.

**THREE PHASE SYSTEMS:** Three phase voltage generation, Wye and Delta connections, Relationships between line and phase quantities, Balanced and unbalanced systems, Power in three phase circuits.

**UNIT - 4****L- 08**

**TWO PORT NETWORKS:** Open circuit (impedance), Short circuit (admittance), Transmission (ABCD) and Inverse Transmission, Hybrid and inverse hybrid parameters, Interrelation between them, Inter connection of 2-port networks.

**COUPLED CIRCUITS:** Concept of mutual coupling, Energy considerations, Calculation of equivalent inductance in complex coupled circuit, Coupled impedance, Linear transformer, Ideal transformer considerations.

**UNIT - 5****L- 10**

**TRANSIENTS :** Initial value and final value theorems in laplace transforms, Response of simple R-L, R-C and R-L-C series and parallel circuits subjected to DC and sinusoidal excitations using differential equation approach and laplace transform method with initial conditions, Time constant of R-L, R-C, Series and parallel R-L-C circuits, Response of RL, RC, RLC circuits for impulse and pulse excitations using laplace transform method, Convolution integral, Applications.

**LABORATORY EXPERIMENTS****LIST OF EXPERIMENTS**

Total hours: 30

1. Verification of ohm's law, KVL and KCL
2. Determination of mutual inductance for 2 or 3 inductive coils connected in series and parallel.
3. Verification of source transformation technique.
4. Determination of Average and R.M.S. Values of various waveforms.
5. Determination of impedance in complex AC circuits.
6. Measurement of Active and Reactive Power for Star / Delta connected balanced load.
7. Measurement of 3-phase Power by two Wattmeter Method for balanced and unbalanced load (Star / Delta)
8. Verification of Thevenin's, Norton's Theorem, Super-position and Maximum Power Transfer Theorem
9. Determination of Z, Y, h and ABCD Parameters in a Two-Port Network
10. Determination of Time-Response in simple series RL and RC networks

**TEXT BOOKS:**

1. A.Chakrabarti, "Circuit Theory Analysis & Synthesis, 4<sup>th</sup> edition, Dhanpat Rai & Co, 2005
2. W.H.Hayt, J.E.Kimmerly and Steven.M.Durbin "Engineering circuit analysis" 6<sup>th</sup> edition, Tata Mc Graw Hill, 2009.

**REFERENCE BOOKS:**

1. Joseph Edminister and Mahmood Nahvi, "Electric circuits", 4<sup>th</sup> edition, Schaum Tata McGraw Hill, 2009.
2. Vanvalkenberg, "Network analysis", 3<sup>rd</sup> edition, Prentice Hall of India, 2009.
3. David K. Cheng, "Analysis of Linear systems", 1<sup>st</sup> edition, Narosa Publications, 2002.