INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ELECTRICAL CIRCUITS								
I Semester: EEE / ECE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AEEE02	**Core**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Mathematics								

I.COURSE OVERVIEW:
This course introduces fundamental concepts of circuit laws, theorems, and various electrical elements. It covers steady-state analysis for both single-phase and three-phase circuits, along with concepts of resonance and power calculations. Students also explore network theorems and magnetic coupled circuits to enhance problem-solving skills. End the end of the course completion, learners will be able to analyze and design AC and DC electrical circuits using scientific and engineering principles

II. COURSE OBJECTIVES:
The students will try to learn:

I The fundamental circuit laws and transformations in electrical networks.
II The AC and DC circuits using network theorems and systematic methods like mesh and nodal analysis.
III The use of single-phase and three-phase circuits for balanced and unbalanced loads.
IV The resonance, power concepts, and mutual inductance in circuits with energy-storing elements

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO1 Identify and classify different electrical elements and apply Kirchhoff's laws, source, and Star-Delta transformations in network analysis.
CO2 Analyze AC single-phase circuits using phasor techniques and compute power, impedance, and resonance conditions.
CO3 Evaluate three-phase systems under balanced and unbalanced conditions and measure power using appropriate methods.
CO4 Apply various network theorems to simplify and solve complex AC and DC circuits.
CO5 Interpret and solve magnetic coupled circuits using concepts like mutual inductance, dot convention, and coefficient of coupling.

IV. COURSE CONTENT:

MODULE-I: NETWORK ELEMENTS & LAWS (09)
Network Elements: Active elements- Independent and dependent sources, Passive elements- R, L and C, Energy stored in Inductance and Capacitance, Laws: Kirchhoff's laws, Source transformation, Star-Delta transformation, Node voltage method, and Mesh current method.

MODULE-II: SINGLE-PHASE CIRCUITS (09)
Single-Phase Circuits: RMS and average values of periodic sinusoidal and non-sinusoidal waveforms, Phasor representation, j-Notation, Steady-state analysis of series, parallel circuits. Impedance, Admittance, Active and Reactive Powers, Complex Power.
Resonance: Series and parallel circuits, Bandwidth and Q-factor.

MODULE-III: THREE-PHASE CIRCUITS (10)
Three-phase Circuits: Analysis of balanced and unbalanced three-phase circuits, Star and delta connections,

Measurement of three-phase power for balanced and unbalanced loads.

MODULE-IV: NETWORK THEOREMS (10)
Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorems, Maximum power transfer theorem, Tellegen's theorem, Compensation theorem, Millman's theorem and Reciprocity theorem. (AC & DC).

MODULE-V: MAGNETIC COUPLED CIRCUITS (10)
Magnetic Coupled circuits: Concept of self and mutual inductance, Dot convention, Coefficient of coupling, Analysis of circuits with mutual inductance.

V. TEXT BOOKS:

1. Van Valkenburg M.E, "Network Analysis", Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, "Network Analysis and Synthesis", McGraw Hill, 2nd Edition, 2019.

VI. REFERENCE BOOKS:

1. B. Subramanyam, "Electric Circuit Analysis", Dreamtech Press & Wiley, 2021.
2. James W.Nilsson, Susan A.Riedel, "Electric Circuits", Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 5th Edition, 2017.
4. Jagan N.C, Lakshrninarayana C., "Network Analysis", B.S. Publications, 3rd Edition, 2014.
5. William Hayt H, Kimmerly Jack E. and Steven Durbin M, "Engineering Circuit Analysis", McGraw Hill, 6th Edition, 2002.
6. Chakravarthy A., "Circuit Theory", Dhanpat Rai & Co., First Edition, 1999.

VII. ELECTRONIC RESOURCES:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://www.researchgate.net
3. https://www.electrical4u.com
4. https://www.iare.ac.in

VIII. MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper - I
8. Model question paper - II
9. Lecture notes

10.E-learning readiness videos (ELRV)
11.Power point presentation