# NETWORK ANALYSIS

**III Semester: EEE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | **CIA** | **SEE** | **Total** |
| **AEEC05** | **Core** | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **Contact Classes: 45** | **Tutorial Classes: Nil** | **Practical Classes: Nil** | | | | **Total Classes: 45** | | |

**Prerequisite: Electrical Circuits**

## I.   COURSE OVERVIEW:

This course introduces the basic concepts of net work theory which is the foundation for all subjects of the electrical engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes three phase circuits, transient analysis of DC and AC circuits, network functions, and two port net work parameters, Fourier analysis of AC circuits, design and analysis of filters.

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

| | |
|---|---|
| I | Understand the three phase systems for star and delta connected systems and perform three phase power calculations for balanced and unbalanced loads. |
| II | Present the necessary mathematical background for the transient analysis of DC and AC circuits and study the transients using differential equation and Laplace transform approach for series and parallel circuits |
| III | The concept of locus diagram for series and parallel circuits and discuss network functions and the stability criteria |
| IV | The steady state response of complex electrical circuits with AC supply and application of concept of electrical resonance |
| V | Classify and design different types of filters and study their characteristics. |

## III. COURSE OUTCOMES:
**After successful completion of the course, students should be able to:**

| CO 1 | **Discuss** the steady state response and resonance of electrical circuits to AC supply | Understand |
|---|---|---|
| CO 2 | **Understand** the concept of initial conditions of RLC elements to determine the transient response of first and second order electric circuits using differential equation approach and Laplace transform technique. | Understand |
| CO 3 | **Illustrate** the locus diagram for series and parallel circuits and describe the network functions in time domain and frequency domain approach. | Understand |
| CO 4 | **Solve** the relation between line and phase quantities of three phase star and delta connected systems to analyze balanced and unbalanced circuits. | Apply |
| CO 5 | **Demonstrate** the operation of wattmeter to measure the three-phase active and reactive power in three phase systems. | Understand |
| CO 6 | **Develop** the various types of active filters and understand their characteristics, execute digital simulation using MATLAB. | Apply |

## IV. COURSE SYLLABUS:
**MODULE-I: ANALYSIS OF AC CIRCUITS (10)**
**Steady state analysis:** Steady state analysis of RL, RC and RLC circuits (in series, parallel and series parallel combinations) with sinusoidal excitation; Resonance: Series and parallel resonance, concept of band width and Q factor.

**MODULE-II: SOLUTION OF FIRST AND SECOND ORDER NETWORKS (08)**
**Transient response:** Initial conditions, transient response of RL, RC and RLC series and parallel circuits with DC and AC excitations, differential equation and Laplace transform approach.

**MODULE-III: LOCUS DIAGRAMS AND NETWORKS FUNCTIONS (10)**
**Locus diagrams:** Locus diagrams of RL, RC, RLC circuits.

**Network Functions:** The concept of complex frequency, physical interpretation, transform impedance, series and

parallel combination of elements, terminal ports, network functions for one port and two port networks, poles and zeros of network functions, significance of poles and zeros, properties of driving point functions and transfer functions, necessary conditions for driving point functions and transfer functions, time domain response from pole-zero plot.

## MODULE-IV: THREE PHASE CIRCUITS (10)
**Three phase circuits:** Star and delta connections, phase sequence, relation between line and phase voltages and currents in balanced systems(both Y&Δ), three phase three wire and three phase four wire systems, analysis of balanced and unbalanced three phase circuits, measurement of active and reactive power.

## MODULE-V: FILTERS (07)
**Filters:** Classification of filters, filter networks, classification of pass band and stop band, characteristic impedance in the pass and stop bands, constant-k low pass filter, high pass filter, m-derived T-section, band pass filter and band elimination filter.

## V. 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.

## VI. REFERENCE BOOKS:
I. John Bird, "Electrical Circuit Theory and technology", Newnes, 2nd Edition, 2003.
II. C L Wadhwa, "Electrical Circuit Analysis including Passive Network Synthesis", New Age International, 2nd Edition, 2009.
III. David A Bell, "Electric Circuits", Oxford University press, 7th Edition, 2009.
IV. M E Van Valkenberg, "Network Analysis", Prentice Hall India, 3rd Edition, 2014.
V. Rudrapratap, "Getting started with MATLAB: A Quick Introduction for Scientists and Engineers", Oxford University Press, 1st Edition, 19994.

## VII. WEB REFERENCES:
1. https://www.igniteengineers.com
2. https://www.ishuchita.com/PDF/Matlab%20rudrapratap.pdf
3. https://www.ocw.nthu.edu.tw
4. https://www.uotechnology.edu.iq

## VIII. E-TEXT BOOKS:
1. https://www.bookboon.com/en/concepts-in-electric-circuits-ebook
2. https://www.jntubook.com
3. https://www.allaboutcircuits.com
4. https://www.archive.org