EC2T3   **Network Theory**   **Credits: 4**

Lecture : 4 periods/week   **Internal assessment: 30 marks**
Tutorial: 1 period /week   **Semester end examination: 70 marks**

Course Objectives:

- To introduce basic circuit analysis concepts of DC Circuits
- To study network theorems for simplifying complex circuit analysis
- To familiarise about AC fundamentals
- To analyse transients affects in electric circuits

Learning Outcomes:
- Learn how to develop and employ circuit models for elementary electronic components, e.g., resistors, sources, inductors, capacitors.
- Become adept at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the node method.
- Appreciate the consequences of linearity, in particular the principle of superposition and Thevenin-Norton equivalent circuits.
- Be introduced to the concept of singularity functions and learn how to analyze simple circuits
- Containing step and impulse sources.
- Be introduced to the concept of sinusoidal-steady-state (SSS) and to use impedance methods to analyze the SSS response of first and second-order systems.

UNIT-I
Methods of Analysis:
Network reduction techniques- star-to-delta & delta-to-star transformation, Source transformation. Nodal analysis, mesh analysis, super node and super mesh, Nodal Versus Mesh Analysis for D.C excitations.

UNIT-II
Network Topology:
Definitions of branch, node, graph, directed graph, connected graph, planar graph, non planar
Graph, tree, cotree, twigs, links. Incidence matrix, properties of incidence matrix, incidence
Matrix and KCL, Tieset Matrix, Cut-set & Tree branch voltages.

UNIT-III
Network Theorems-I:
Linearity Property, Superposition Principle, Superposition,Thevenin's and Norton's theorems using Dependent sources only.

UNIT-IV
Network Theorems-II:
Maximum Power Transfer Theorem, Millman's theorem, Tellegen's, Reciprocity and compensation theorems for D.C Excitation.

UNIT-V
Two Port Networks:
Two port network parameters – Z, Y, ABCD and hybrid parameters and their relations, Interconnection of Two-Port networks.

UNIT-VI
Single Phase A.C Circuits:
Sinusoidal alternating quantities – Phase and Phase difference – Complex and polar forms of representations, J-notation, R.M.S, Average values and form factor for different periodic wave forms

UNIT-VII
Time Response of Circuits (DC Excitation):
Time(Transient) response of R-L, R-C, R-L-C series circuits for Zero input, Step input,pulse input -Initial conditions-solution method using differential equation and Laplace transforms.

UNIT-VIII
Steady State Analysis:
Steady state analysis of R,L and C (in series, parallel and series parallel combinations) with sinusoidal excitation-Concept of Reactance, Impedance Susceptance and Admittance-Power Factor and significance-Real and Reactive power, Complex Power.
Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, Condition for maximum impedance, current in anti resonance, Bandwidth of parallel resonance, general case- resistance present in both branches, anti resonance at all frequencies.

Learning resources

Text Books:

1. Network Analysis,Van Valkenburg; Prentice-Hall of India Private Ltd,3rd Edition 2009 .
2. Circuits & Networks Analysis & Synthesis, A. Sudhakar and Shyammohan. S. Palli, Tata McGraw-Hill, 4th edition, 2010.
3. Engineering Circuit Analysis, William Hayt and Jack E.Kemmerley, McGraw Hill Company, 6th edition,2008.

References:

1. Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N.O.Sadiku, Tata McGraw-Hill, 4th Edition, 2002.
2. 3000 Solved Problems in Electrical Circuit, Schaum's solved problem series Tata McGrawHill, 1st Edition, 1988.
3. Circuit Theory, A.ChakrabartiDanapatRai& Co publisher, 2008.
4. Network Analysis, N.C.Jagan, C.Lakshmi Narayana, BS publications, 2nd edition, 2006.