**NETWORK ANALYSIS**

**(ECE & allied branches)**

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| **Course Category:** | | | Professional core | | **Credits:** | 3 | |
| **Course Type:** | | | Theory | | **Lecture-Tutorial-Practical:** | 3-0-0 | |
| **Pre-requisite:** | | | Fundamental concepts of Physics | | **Sessional Evaluation:**  **External Exam Evaluation:**  **Total Marks:** | 30  70  100 | |
| **Course Objectives** | | | Students undergoing this course are expected to | | | | |
| * To introduce basic laws, mesh & nodal analysis techniques for solving electrical circuits * To impart knowledge on applying appropriate theorem for electrical circuit analysis * To explain transient behavior of circuits in time and frequency domains * To teach concepts of resonance * To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship. | | | | |
| **Course Outcomes** | | | Upon successful completion of the course, the student will be able to: | | | | |
| **CO1** | | Understand basic electrical circuits with nodal and mesh analysis. | | |
| **CO2** | | Analyse the circuit using Network simplification theorems. | | |
| **CO3** | | Infer and evaluate Transient response and Steady state response of a network. | | |
| **CO4** | | Analyse electrical networks in the Laplace domain. | | |
| **CO5** | | Compute the parameters of a two-port network. | | |
| **Course Content** | | | **UNIT-I:**  Types of circuit components, Types of Sources and Source Transformations, Mesh analysis and Nodal analysis, problem solving with resistances only including dependent sources also. Principal of Duality with examples.  Network Theorems: Thevenin’s, Norton’s, Milliman’s, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens - problem solving using dependent sources also.  **UNIT-II:**  **Transients:** First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots.  **Laplace transform**: introduction, Laplace transformation, basic theorems, problem solving using Laplace transform, partial fraction expansion, Heaviside’s expansions, problem solving using Laplace transform.  **UNIT-III**  **Steady State Analysis of A.C Circuits**: Impedance concept, phase angle, series R-L, R-C, R-L- C circuits problem solving. Complex impedance and phasor notation for R-L, RC, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving  using Laplace transforms also  **UNIT-IV**  **Resonance:** Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies.  **Coupled Circuits**: Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.  **UNIT-V**  **Two-port Networks**: Relationship of two port networks, Z-parameters, Yparameters, Transmission line parameters, h- parameters, Relationships Between parameter Sets, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also.  **Image and iterative impedances**. Image and iterative transfer constants. Insertion loss. Attenuators and pads. Lattice network and its parameters. Impedance matching networks | | | | |
| **Text Books & Reference Books** | | **TEXT BOOKS:**  1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.  2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.  3. Network lines and Fields by John. D. Ryder 2nd Edition, PHI.  **REFERENCE BOOKS:**  1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.  2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum’s Outline Series, 7 th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017  3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education. | | | | | |

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| Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low) | | | | | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | - | 3 | 3 | - | - | - | - | 3 | 2 | 3 | - |
| CO2 | 3 | 3 | 2 | - | 3 | 3 | - | - | - | - | 3 | 3 | 3 | - |
| CO3 | 3 | 3 | 3 | - | 3 | 2 | - | - | - | - | 3 | 3 | 3 | - |
| CO4 | 3 | 3 | 2 | - | 3 | 2 | - | - | - | - | 3 | 2 | 3 | - |
| CO5 | 3 | 3 | 2 | - | 3 | 2 | - | - | - | - | 3 | 3 | 3 | - |