# Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

| Course Code | Course Name | Teaching Scheme (Hrs/week) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | L | T | P | Total |
| ET32 | Circuit Theory | 3 | 1 | -- | 3 | 1 | -- | 4 |
| | | Examination Scheme | | | | | | |
| | | ISE | | MSE | ESE | | | |
| | | 10 | | 30 | 100 (60% Weightage) | | | |

| Pre-requisite Course Codes | | ES21 (Basic Electrical Technology) |
|---|---|---|
| After successful completion of the course, students will able to | | |
| Course Outcomes | CO1 | Analyse the given circuits using theorems and transformation techniques |
| | CO2 | Analyse the given circuit using Graph Theory |
| | CO3 | Analyse the given RL, RC and RLC circuits in time domain |
| | CO4 | Analyse the given RL, RC and RLC circuits in frequency domain |
| | CO5 | Predict the circuits using Foster and Cauer realization methods |
| | CO6 | Explain the concept of two port network, relation between the parameters and their interconnection |

| Module No. | Unit No. | Topics | Ref. | Hrs. |
|---|---|---|---|---|
| 1 | 1.1 | Analysis of DC circuits: Analysis of circuits with and without controlled sources using generalized loop, node matrix, Superposition, Thevenin, Norton, Maximum Power transfer, Millman theorems | 3 | 10 |
| | 1.2 | Analysis of coupled circuits: Self and mutual inductances, coefficient of coupling, Dot convention, equivalent circuit, solution using loop analysis | 1 | |
| 2 | 2.1 | Graph Theory: Concept of loop, tree, co-tree, incidence matrix, cut set matrix and tie set matrix | 3 | 6 |
| | 2.2 | Tellegen's theorem, Planar and Non planar graphs, Duality principle | 3 | |
| 3 | 3.1 | Time domain analysis of R-L and R-C circuits: Forced and natural response, time constant, initial and final values<br>Solution using first order equation for standard input signals: Transient and steady state time response, solution using universal formula | 1,3 | 12 |

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|---|---|---|---|---|
| | 3.2 | Time domain analysis of R-L-C circuits: Forced and natural response, effect of damping<br>Solution using second order equation for standard input signals: Transient and steady state time response | 1,3 | |
| | 3.3 | Frequency domain analysis of RLC circuits: S-domain representation, applications of Laplace Transform in solving electrical networks | 1,3 | |
| 4 | 4.1 | Network Function: driving point and transfer function, Poles and Zeros, calculation of residues by analytical and graphical method, frequency response | 2 | 6 |
| | 4.2 | Positive real functions: Concept of positive real function, testing for Hurwitz polynomials, testing for necessary and sufficient conditions for positive real functions | 2 | |
| | 4.3 | Synthesis of RC, RL, LC circuits: Concepts of synthesis of RC, RL, LC driving point functions. | 2 | |
| 5 | 5.1 | Parameters: Open Circuit, Short Circuit, Transmission and Hybrid parameters, relationships among parameters, reciprocity and symmetry conditions | 1 | 8 |
| | 5.2 | Series/parallel connection: T and Pi representations, interconnection of Two-Port networks | 1 | |
| Total | | | | 42 |

**References:**


[1] A. Chakrabarti, "Circuit Theory", Dhanpat Rai and Co.,New Delhi

[2] Franklin F Kuo, "Network Analysis and Synthesis", Wiley Toppan

[3] M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi

[4] D. Roy Choudhury, "Networks and Systems", New Age International Pvt Ltd, Wiley