GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: ELECTRICAL ENGINEERING
SUBJECT NAME: ELECTRICAL CIRCUIT ANALYSIS
SUBJECT CODE: 2910902
P.D.D.C. 1st SEMESTER

Type of course:

Prerequisite:

Rationale: Electrical circuits are the integral elements of the power system. Analysis of response of electrical circuits for various inputs is the basic requirement to understand the behavior of the system. The responses for various inputs are in turn helpful to design, implement, operate and control a network effectively. This subject is intended to provide the basic insight into the theory and problems related to electrical circuit analysis.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Network Theorems** Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.	10	20
2	**Solution of First and Second order networks** Solution of first and second order differential equations for Series and parallel R-L, R-C, RLC circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.	08	20
3	**Sinusoidal steady state analysis** Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.	08	20
4	**Electrical Circuit Analysis Using Laplace Transforms** Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances	08	20
5	**Two Port Network and Network Functions** Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters	08	20

	and hybrid parameters, interconnections of two port networks.		

Reference Books:

- M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
- A. A. Nimje and D. P. Kothari, "Electrical Circuit Analysis and synthesis", New Age International Publications, 2017
- K.S.Suresh Kumar, "Electric Circuit Analysis", Pearson Publications, 2013.
- D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
- W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
- C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
- K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

Course Outcome:

Students will be able to:

- Apply network theorems for the analysis of electrical circuits.
- Obtain the transient and steady-state response of electrical circuits.
- Analyse circuits in the sinusoidal steady-state (single-phase and three-phase).
- Analyse two-port circuit behaviour.

List of Experiments :

This is a suggestive list only:

(1) To verify the Superposition theorem.
(2) To verify the Thevenin and Norton's theorems.
(3) To verify the maximum power transfer theorem.
(4) To verify the reciprocity theorem.
(5) To measure and verify the steady-state and transient time-response of R-L circuit.
(6) To measure and verify the steady-state and transient time-response of R-C circuit.
(7) To measure and verify the steady-state and transient time-response of R-L-C circuit.
(8) To verify the current and voltage phasors in complex AC circuits by measurement and theoretical analysis.
(9) To obtain the solution of first order and second order linear differential equations with Laplace transform.
(10) To obtain the solution of R-L-C networks with impedance functions.
(11) To verify the impedance parameters for a two port network.
(12) To verify the admittance parameters for a two port network.
(13) To verify the hybrid parameters for a two port network.
(14) To verify the transmission parameters for a two port network.

Major Equipment:

List of Open Source Software/learning website:

- E-materials available at the website of NPTEL- http://nptel.ac.in/