GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130906
Semester – III
Subject Name: Electrical Circuit Analysis

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	1	2	5	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 and hybrid parameters, interconnections of two port networks.	08	20

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**30**	**30**	**15**	**10**	**-**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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 Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Apply the knowledge of basic circuital law and simplify the network using reduction techniques	20
CO-2	Analyze the circuit using Kirchhoff's law and Network simplification theorems	20
CO-3	Infer and evaluate transient response, Steady state response, network functions	25
CO-4	Obtain the maximum power transfer to the load , and Analyze the series resonant and parallel resonant circuit	20
CO-5	Evaluate two-port network parameters.	15

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/