SARVAJANIK UNIVERSITY
SarvajanikCollege of Engineering and Technology
Bachelor of Technology

B.Tech. – I Year Semester I

Subject Name:Electrical Network Analysis **Subject Code: BTEL13181**

Type of course: **Professional Core Course**

Prerequisite: BEE (Basic Electrical Engineering)

Rationale: Electrical circuits are the integral elements of the power system. Analysisof 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:

				Theory Marks		Practical Marks		Total
L	T	P	C	TEE	CAT	TEP	CAP	
3	1	2	5	60	40	30	20	150

CAT: Continuous Assessment (assignments/projects/open book tests/closed book tests **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CAP:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course.

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage %
1.	**Network Theorems and applications in circuits solving** Mesh current and Nodal voltage analysis, Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem,Millman's theorem, Compensation theorem, Use of network theorems in DC and AC circuit analysis with Independent and Dependent electrical sources, Concept of duality and dual networks.	10	22
2.	**Coupled Circuit Analysis** Review of self and mutual inductance, coefficient of coupling, dot convention, series-parallel coupled circuits, equivalent inductance, ideal transformer,solution of coupled circuit using network theorems.	4	10
3.	**Electrical Circuit Analysis Using Laplace Transform** Solution of first and second order networks, initial and final conditions in network elements, forced and free response, time constants, steady state and transient response, Review of Laplace Transform and Inverse Laplace transform, Initial value and Final Value theorem, waveform synthesis, Analysis of electrical circuits using Laplace Transform for standard inputs, transformed network with initial conditions, DC and AC transient analysis.	10	22

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4.	**Two Port Network Parameters** Two Port Networks, terminal pairs, relationship of two port variables, Impedance parameters, Admittance parameters, Transmission parameters and Hybrid parameters, Inverse parameters, relationship between parameters, condition for reciprocity and symmetry of a two-port network, interconnections of two port networks.	**6**	**12**
5.	**Network Functions** Transfer function representation, Poles and Zeros of a function, significance of poles and zeros, driving point impedance /admittance and transfer functions, properties of driving point and transfer functions, restrictions on locations of poles and zeros in S-plane, time domain behavior from pole-zero locations in the S-plane, Frequency response plots (magnitude, phase and polar plots).	**5**	**12**
6.	**One Terminal Pair Reactive Networks** Reactive networks and their properties, external and internal critical frequencies, four reactive function forms on the basis of external critical frequencies, Synthesis of one port networks using Foster and Cauer forms, separation property for reactive functions, Symmetrical lattice network. **Two Terminal Pair Reactive Networks** Ladder network and its decomposition into tee, pie, and L sections, image impedance, image transfer function, low pass, highpass, band pass, band elimination filters; constant K-filters, m-derived filters, composite filters**,** Bartlett's bisection theorem.	**10**	**22**

Suggested Specification table with Marks (Theory/Practical):

% Distribution of 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, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**
Note: This specification table shall be treated as a general guideline for students andteachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	**Title of book /article**	**Author(s)**	**Publisher and details like ISBN**	**Year of publication**	**Publication Edition**
1.	Network Analysis	M. E. Van Valkenburg	Prentice Hall	2009	Third
2.	Electric Circuit Analysis	K. S. Suresh Kumar	Pearson Publications	2009	

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3.	Network Analysis and Synthesis	Franklin F. Kuo	John Wiley & Sons		Second
4.	Circuits and Networks: Analysis and Synthesis	A. Sudhakar, Shyammohan S. Pilli	Tata McGraw-Hill.	2006	Third
5.	Engineering Circuit Analysis	W. H. Hayt and J. E. Kemmerly	McGraw Hill Education	2013	Eighth
6.	Electric Circuits	C. K. Alexander and M. N. O. Sadiku	McGraw Hill Education	2004	Fifth
7.	Circuit Theory: Analysis and Synthesis	A. Chakrabarti	Dhanparrai& Co.	2010	Sixth

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Apply the knowledge of basic circuital law, simplify the network using reduction techniques and solve the circuit.	13
CO-2	Analyze the circuit using network theorems.	20
CO-3	Infer and evaluate transient and steady state response for R-L, R-C, RLC circuits using Laplace transform.	20
CO-4	Obtain and analyze network functions using Laplace transform for various electrical circuits.	12
CO-5	Synthesize a network for a given network function and design a filter.	20
CO-6	Evaluate two-port network parameters.	15

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	3	3	3	2	1	-	-	2	2	-	3	3	3	-
CO-2	3	3	2	3	3	1	-	-	2	2	-	3	3	3	2
CO-3	3	3	2	3	3	-	-	-	2	2	-	3	3	3	-
CO-4	3	3	2	1	3	-	-	-	2	2	-	3	3	3	-
CO-5	3	3	2	1	3	-	-	-	2	2	-	3	3	3	2
CO-6	3	3	2	3	3	-	-	-	2	2	-	3	3	3	-
Rationale *															

Rationale*: Explaining why it is matching this particular program outcome

LIST OF PRACTICALS: (Minimum ---10 to 12 ---need to be performed.)

(1) To verify Superposition theorem for electrical circuit.
(2) To verify Reciprocity theorem for electrical circuit.
(3) To verify Thevenin's and Norton's theorems.

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(4) To verify Maximum Power Transfer Theorem.
(5) To obtain and verify steady state and transient response of R-L circuit using Matlab/Simulink.
(6) To obtain and verify steady state and transient response of R-C circuit using Matlab/Simulink.
(7) To obtain the solution of first order and second order linear differential equations with Laplace transform.
(8) To verifyimpedance parameters for a given two-port network.
(9) To verifyadmittance parameters for a given two-port network.
(10) To verify hybrid parameters for a given two-port network.
(11) To verify transmission parameters for a given two-port network.
(12) To obtain magnitude, phase and polar plot for a given function.
(13) To synthesis given network function using Cauer and Foster Form.
(14) To design low pass, high pass, band pass filters.

Reference Text Books: Same as mentioned for theory

Major Equipment:
Ammeters, Voltmeters, Wattmeters, Rehostate, Capacitors and Inductors of appropriate rating, Multi-meters, Digital storage oscilloscope, Power supply (0-30 V).

List of Open Source/learning website:

1. MIT OPEN COURSEWARE by Massachusetts Institute of Technology - website: ocw.mit.edu
2. https://onlinecourses.nptel.ac.in/noc21_ee99/

List of Open Source Software:

Website: **www.vlabs.co.in**