SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B. Tech. Year II: Semester – 3
Subject Name: Circuit and Network Analysis **Subject Code: BTIC13303**

Type of course: PCC

Prerequisite (if any): Basic knowledge of Mathematics, especially integration, differentiation and complex numbers, Laplace Transformation, matrices, determinants and solutions of differential equations.

List of Courses where this course will be prerequisite: Industrial Drives & Control, Motion Control, Power Electronics

Rationale: This course will provide the students (i) the overview of the basic circuit types and theorems(ii) carry out analysis of simple and complex circuits (iii) applications of the circuit and network theory to real world systems (iv) design circuit/network for given specifications.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

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Content:

Sr. No.	Content	Total Hrs	Module % weightage
1	Introductionand brief overview of Circuit Analysis Basic circuit analysis laws, Kirchoff's Voltage Law, Kirchoff's Current Law, DC and AC circuits, active and reactive power, electrical energy and power factor, maximum power transfer theorem, circuit with current and voltage sources, Super Position theorem, Norton's theorem, Thevenin's theorem, circuit equations (ac-dc), node and mesh analysis, matrix representations, solutions of differential equations, expressions of current and voltage.	**10**	**22**
2	Filters, Bode Plots and Resonance Series and parallel resonance circuits, the quality factor(Q), bandwidth, design of RC and RL high pass and low pass filters, pass band and stop band filters,. selectivity, Bode plots	**08**	**18**
3	Use of Laplace Transformation in Circuit Analysis Modeling and transfer function of RC, RL, RLC circuits, Laplace Transformation basics, use of Laplace Transformation for circuit analysis, first and second order systems/electric circuits, transient responses, analysis of series and parallel RC, RL, and RLC circuits, state space model for series RLC circuit, initial conditions of voltage and current.	**08**	**18**
4	Magnetic Circuits Basics of magnetic field, self and mutual inductance, dot rule, ohm's law for magnetic circuits, reluctance, magnetizing force and hysteresis, series and parallel magnetic circuits, ampere-turn product, determining flux, transformer circuits.	**08**	**18**

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	Types of transformer, iron core and air core transformer, multi-load transformers, networks with magnetically coupled coils.		
5	Network Parameters Two port networks, z-parameters, h-parameters, y and g parameters.	**05**	**11**
6	Network Topology Graph of network, concept of tree and co-tree, incidence matrix, cut set and tie set, principle of duality, solution of matrix equations, finding currents and voltages in particular branch of network.	**06**	**13**

Suggested Specification table with Marks (Theory): (For B. Tech. only)

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

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	Pearson Education. ISBN-10 : 9353433126	2019	3rd

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2	Introductory Circuit Analysis	Robert L. Boylestad	Pearson/Prentice Hall ISBN-10 : 8131764761	2012	..
3	A textbook of electrical technology vol. 1	B L Theraja and A K Theraja (Vol. 1)	S Chand ISBN-10 : 8121924405	1959	23rd
4	Electric Circuits, (Schaum's Outline Series)	M. Nahvi and Joseph Edminister	McGraw Hill Education ASIN : B00GWSXY3O	2013	6th

Course Outcomes: After successfully completing this course, the student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	design circuits for given specifications,	40%
CO-2	carry out analysis of complex circuit and network,	30%
CO-3	design analog filters to improve signal quality,	10%
CO-4	explain the faults and diagnostics in real circuits based systems.	10%
CO-5	analyze various network topologies and solve practical problems	10%

Mapping CO-POs-PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1		1		1					3		
CO2		3												2	
CO3			3	1	1	1							3		2

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CO4							**1**	**1**	**1**	**1**	**1**	**1**			**2**
CO5	**1**				**2**		**1**		**2**		**1**	**2**	**2**	**2**	

List of Open learning website:

https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/index.htm

NPTEL/SWAYAM lectures on signals and systems
Network Analysis

https://onlinecourses.nptel.ac.in/noc22_ee07/preview

By Prof. Tapas Kumar Bhattacharya | IIT Kharagpur

List of Open Source Software:

Scilab/xcos/scicos/LTSPICE/PSIM(student edition) simulation software

FOR LAB SESSIONS:

List of Experiments:

1. Study the simulation of various circuits operations.
2. Design appropriate circuit and verify the Kirchoff's laws for simple circuits.
3. Verify the Norton's theorem and Thevenin's theorem for a given circuit with simulation study.
4. Using Matlab/Scilab/LTSPICE/PSIM simulation tool, test and verify the node analysis of a given complex network.
5. Using MATLAB/Scilab/LTSPICE/PSIM simulations tool, test and verify mesh analysis of a given complex network.
6. Implement a circuit in hardware and verify the results for node analysis.
7. Develop the series RLC circuit and check its step response/frequency response in hardware. Also, verify the capacitor voltage and current responses.
8. Verify the z and h parameters with simulation for a given circuit.
9. To obtain the B-H curve for a given transformer.
10. Design high pass and low pass RC/RL filters and verify with hardware implementation.

11. To implement network topology and analyze for branch current and voltage with cut-set or tie set matrices in simulation.

Major Equipment Needed:

MATLAB/Scilab/Proteus/Multisim/PSIM/LTSPICE software

Breadboard, power supply and other hardware practical kits/set ups for circuit analysis.