FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **BACHELOR OF TECHNOLOGY (Electronics and Communication Engineering)**

Semester: **III**

Course Code: **202060301**

Course Title: **Circuits and Networks**

Course Group: Professional Core Course

Course Objectives: The main objective of this course is to make students understand the concepts and principles of passive circuit analysis and synthesis by applying various circuit laws and theorems. Starting with the basic circuit elements and sources, the concepts of nodal & mesh analysis, important network theorems, time domain response, Laplace transform and two-port network parameters are covered in this subject.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50/18	50/17	25/9	25/9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Circuit Elements and Sources:** Two-terminal Capacitance –Inductance, Ideal and Practical Voltage and Current Sources. Conversion from one source into other, Internal Impedance of voltage and current source relative to load. Independent and Dependent Sources, Source Transformation Theorem, Multi-terminal Circuit Elements, Dot Convention.	8
2	**Nodal and Mesh/Loop analysis**; Nodal Analysis of Resistive Circuits Containing Independent and Dependent Sources, Mesh Analysis of Resistive Circuits with Independent and dependent Sources, Network Equations and their solution using determinants.	8
3	**Network theorems:** Superposition Theorem, Substitution Theorem, Compensation Theorem, Thevenin and Norton's Theorem, Reciprocity Theorem, Maximum Power Transfer Theorem, Duality Theorem.	8

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4	**Time Domain Response** of RL, RC and RLC circuits: Unit Step, Impulse and Exponential Inputs response analysis of RL, RC and RLC circuits, Solving Differential Equation, Sinusoidal Steady-State Response of First and second order RL, RC, and RLC Circuits.	**10**
5	**Laplace Transform Analysis:** Laplace Transforms of standard Functions, Properties of Laplace Transform, Invers Laplace Transforms, Solution of Differential Equations by Laplace Transforms, Application of Laplace transform in transient analysis, Examples.	**11**
		45

List of Practicals / Tutorials:

1	To measure and calculate currents and voltages for a given resistive circuit and verify KCL and KVL.
2	To verify superposition theorem experimentally for a given resistive circuit consisting of two independent sources
3	To verify Thevenin's theorem experimentally for a given circuit
4	To verify maximum power transfer theorem experimentally for a given circuit.
5	To verify reciprocity theorem experimentally for a given circuit.
6	To measure and calculate RC time constant for a given RC circuit.
7	To measure and calculate RL time constant for a given RL circuit
8	To measure and analyze (settling time, overshoot, undershoot, etc.) step response of for a given series RLC circuit for following cases: (1) $\zeta = 1$ (critically damped system), (2) $\zeta > 1$(over damped system), (3) $\zeta < 1$ (under damped system). Choose appropriate values of R, L, and C to obtain each of above cases one at a time
9	To measure and calculate Z-parameters for a given two-port system.
10	To measure and calculate Y-parameters for a given two-port system.
11	To measure and calculate h-parameters for a given two-port system.
12	To measure and calculate ABCD-parameters for a given two-port system

Reference Books:

1	M. E Van Valkenburg, **Network Analysis**, PHI Publication.
2	Charles Alexander and Matthew Sadiku, **Fundamentals of Electric Circuits**, 5th Edition, McGraw Hill.
3	S. K. Bhattacharya and Manpreet Singh, **Network Analysis & Synthesis**, Pearson Publication.
4	K. S. Suresh Kumar, **Electric Circuits and Networks**, Pearson Education
5	DeCarlo and Lin, **Linear Circuits Analysis**, 2nd Edition, Oxford University Press.

Supplementary learning Material:	
1	NPTEL and Coursera Video Lecture
2	www.vlab.co.in

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Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
10	25	10	25	10	10	

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.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To provide a methodical approach to problem-solving.	**10**
CO-2	To learn several powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation and several methods of simplifying networks.	**30**
CO-3	To understand the time domain analysis of RC, RL and RLC circuits.	**20**
CO-4	To develop a clear understanding of Laplace, transform and its applications.	**20**
CO-5	Different types of two-port network analysis using network parameters, with different types of connections.	**20**

Curriculum Revision:	
Version:	**2.0**
Drafted on (Month-Year):	June -2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025

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