ECM1001	Circuit Theory	L	T	P	J	C
		2	0	2	0	3

Prerequisite:	None

Objectives:

- This course will provide the students with an overview of the fundamental concepts in Electrical Engineering

Expected Outcome:

1. Derive the empirical relationship between power, voltage and current and analyze DC and AC circuits with dependent sources in steady state.
2. Understand application of network theorems for electrical circuits.
3. Understand transient behavior of first order RL, RC and second order RLC circuits.
4. Understand application of Laplace Transform in linear network analysis.
5. Understand basics of two port networks and its different parameters like Z,Y, h,ABCD.
6. Design passive filters for various applications

Student Learning Outcomes (SLO):	1,2,14

Module:1	DC Circuit analysis:	4	hours	SLO: 2

Mesh Analysis, Node voltage analysis, Network Theorems- Source transformation, Superposition theorem, Thevenin's & Norton's theorem, Maximum power transfer theorem

Module:2	DC Transients:	4	hours	SLO: 14

Source free RC circuits, Source free RL circuits, Step response of RC circuits, Step response of RL circuits, Response of second order circuit (RLC)-Series, parallel circuits.

Module:3	Sinusoidal Steady -State Analysis :	4	hours	SLO: 1

Sinusoids, Average value, Root Mean Square value, Phasors, Complex impedance, AC circuit analysis.

Module:4	Complex power and Resonance:	4	hours	SLO: 2

Concept of complex power, Series and parallel resonance, Introduction to coupled circuits.

Module:5	Circuit Analysis in the S domain:	5	hours	SLO: 1

Introduction to Laplace transform, Analysis of circuits using Laplace transforms, poles, zeros and transfer functions.

Module:6	Two-Port Networks:	4	hours	SLO: 1

Significance and applications of one port and two networks, Two port network analysis using Admittance (Y) parameters, Impedance (Z) parameters, S-Parameters, Hybrid (h) parameters, Transmission (ABCD) Parameters, Interconnection of Two port networks.				
Module:7	**Principles of Filters:**	**3**	**hours**	**SLO: 14**
Concept of filtering, Filter types- Constant K- Filter, Low pass, High pass, Band pass and Band stop and their characteristics.				
Module:8	**Contemporary Issues:**	**2**	**hours**	**SLO: 2**
	Total Lecture:	**30**	**hours**	
Text Books:				
1.	Charles K. Alexander, Matthew N. O. Sadiku, "Fundamentals of Electric Circuits," Fifth Edition, Tata McGraw Hill Education Private Limited, 2013.			
Reference Books:				
1.	W.H.Hayt, J.E.Kemmerly&S.M.Durbin, "Engineering Circuit Analysis", TMH, New Delhi, 7th Edition, 2011			
2.	Allan R. Hambley, "Electrical Engineering – Principles & Applications", Pearson Education, 6th Edition, 2013			
Lab		**30**	**Hours**	**SLO:2,14**

List of Challenging Experiments (Indicative)

1. Design a resistive circuit to derive the specified load voltage and load current from a DC power source.
2. Build and test the voltage across and the current through any element using appropriate circuit analysis techniques.
3. Build and test the voltage across and the current through any element driven by more than one source.
4. Build a circuit with appropriate number of nodes with a variable load and determine the voltage and current.
5. Design a circuit topology having star/delta connected network and determine the resistance at which the maximum brightness of the LED (Load device) occurs.
6. For a given time constant, design a RL/RC circuit. Determine its current/voltage response and analyse the step response and the source free response of your circuit with initial conditions.
7. Design a temporary power source using energy storage elements and determine the capacity of the power source.
8. Design a phase shifter circuit for a given phase shift and validate its phasor diagram.
9. For a given a reactive load (Inductive/Capacitive) and determine the power factor of the load.
10. Design a radio tuner circuit which tunes to a given frequency using a toroid.
11. Design and test the two port network that realizes the specified Z/Y parameters.
12. Realize the bandpass filter for the specified band of frequencies by cascading suitable high pass filter and low pass filter.