SEMESTER 2

NETWORK THEORY

Course code	Teaching hours per week				Credits	Exam hours	Course category	CIE Marks	ESE Marks
	L	T	P	R					
26NENPC201	2	1	0	0	3	2 Hrs. 30 Min.	Theory	40	60

PREAMBLE
Network Theory provides the foundational understanding of electrical circuits that forms the basis for all advanced courses in Electronics and Communication Engineering. This course introduces students to the systematic analysis of electrical networks using laws, theorems, and mathematical techniques. It enables learners to analyze, and interpret the behavior of linear circuits under DC and AC excitations. Through this course, students gain essential skills in solving circuit problems, understanding transient and steady-state responses, and applying network theorems to practical engineering systems.

PREREQUISITES
Introduction to Electrical & Electronics Engineering, Linear algebra, differential calculus and laplace transforms

COMPETENCY STATEMENT(CC)	
CC1	Apply fundamental circuit laws , analysis techniques and network theorems to model and solve linear electrical networks under DC and AC conditions .
CC2	Analyze transient and steady state behavior of electrical networks using Laplace transforms and evaluate network functions and two port parameters for engineering applications.
*A **Competency Statement (CC)** is a **clear description of the key ability or skill a student should develop after completing a course**.*	

COURSE OUTCOMES(CO)		
At the end of the course students should be able to:		
CO	**CO Statement**	**Blooms Taxonomy Level**
CO1	Analyze electrical networks using mesh and node methods	K3
CO2	Apply network theorems to analyze electrical networks	K3
CO3	Analyze transient behavior of electrical networks using Laplace transforms	K3
CO4	Identify the network functions and parameters of single-port and two port networks	K3
Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create		

CO-PO-PSO Mapping Table(Mapping of Course Outcomes to **Program Outcomes(PO) & Program Specific Outcomes(PSO)**														
CO	**Program Outcomes(PO) &Program Specific Outcomes(PSO) Correlation Matrix**													
	PO											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	3	3	-	-	-	-	-	-	-	1	3	-	1
2	3	3	2	-	-	-	-	-	-	-	1	3	-	1
3	3	3	3	2	-	-	-	-	-	-	1	3	-	1
4	3	3	2	3	-	-	-	-	-	-	1	3	-	1
Correlation [3: High, 2: Medium, 1: Low, -: No Correlation]														

SYLLABUS DESCRIPTION			
Module	**Title**	**Topics**	**Hrs**
1	**Network fundamentals and analysis methods**	**Network fundamentals and analysis methods:** Concept of networks and circuits, Circuit variables, Power absorbed and power delivered, Ideal and practical sources, Independent and dependent sources, Source transformation, Kirchhoff's laws. Mesh analysis, Node analysis, Super-mesh analysis and super-node analysis applied to both DC and AC networks containing independent and dependent sources.	**15**
2	**Network theorems and applications**	**Network theorems and applications**: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Millman's theorem and Maximum power transfer theorem for the analysis of DC and AC networks having independent and dependent sources.	**12**
3	**Laplace transforms and transient analysis**	**Laplace transforms and transient analysis:** Laplace transforms of standard signals and common functions, Laplace transform theorems (proof not required), Inverse Laplace transforms, Solution of differential equations. Transformation of basic signals and circuits to s – domain with and without initial conditions. Transient analysis of RL, RC and RLC networks with	**12**

		DC, impulse, step and sinusoidal inputs. Analysis of low pass and high pass RC circuits using Laplace transforms.	
4	**Network functions and two-port parameters**	**Network functions and two-port parameters:** Network functions for single-port and two-port networks, Properties of driving point and transfer functions, Significance of poles and zeros of network functions, Pole-zero plot. Impedance, Admittance, Hybrid and Transmission parameters of two port networks, Reciprocity and symmetry conditions (derivation not required), Inter-relationships between parameters, Series and parallel connections of two-port networks.	**11**
		Total hours	**50**

COURSE ASSESSMENT PATTERN		
Assessment		**Marks**
Continuous Internal Assessment		**40**
1	Attendance	5
2	Assignment/Microproject	15
3	Internal Examination I	10
4	Internal Examination II	10
End Semester Examination		**60**
1	Part A	24
2	Part B	36
Total		**100**

END SEMESTER EXAMINATION (ESE)		
In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.		
Part A	**Part B**	**Total**
• 2 Questions from each module. • Total of 8 Questions each carrying 3 marks. **(8x3 = 24 marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

LEARNING RESOURCES

TEXT BOOKS

Sl.No.	Title of Book	Author	Publication
1	Network analysis and synthesis	Ravish R	McGraw-Hil , 2/e, 2015
2	Engineering Circuit Analysis	William H Hayt, Jack E Kemmerly, Steven M Durbin	McGraw-Hil , 8/e, 2012
3	Fundamentals of Electric Circuits	Charles K Alexander, Matthe N O Sadiku	McGraw-Hil , 5/e , 2013
4	Network Analysis and Synthesis	Franklin F. Kuo	Wiley , 2/e , 2012

REFERENCE BOOKS

Sl.No.	Title of Book	Author	Publication
1	Network Analysis	Van Valkenburg M.E	Prentice Hall India, Revised 3/e,2019
2	Electric Circuits – Schaum's Outline Series	Joseph A. Edminister, K. Rao and M. Nahvi	McGraw-Hill, 5/e, 2017
3	Basic Engineering Circuit Analysis	R. Mark Nelms, J. David	Irwin Wiley, 12/e, 2020
4	Circuits and Networks Analysis and Synthesis	Sudhakar A and Shyammohan S. P	McGraw Hill, 5/e, 2015

WEB RESOURCES

1	https://www.youtube.com/playlist?list=PLbRMhDVUMngfNnABo5mre45ZbHqJE2sUn
2	https://www.youtube.com/playlist?list=PLdzewXO9j7aqkQARDMKuuboDmRahPHLWy

MODEL QUESTION PAPER

FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY (FISAT) (Autonomous)
SECOND SEMESTER B.TECH DEGREE EXAMINATION (2026 Scheme)

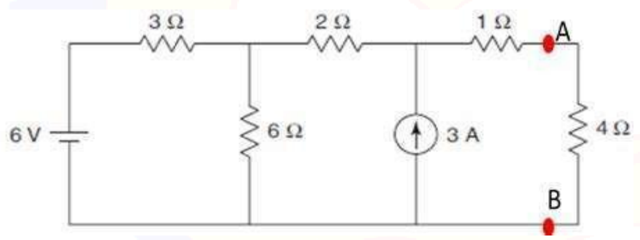
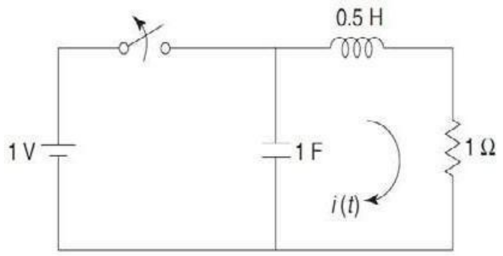
Course Code: 26NENPC201

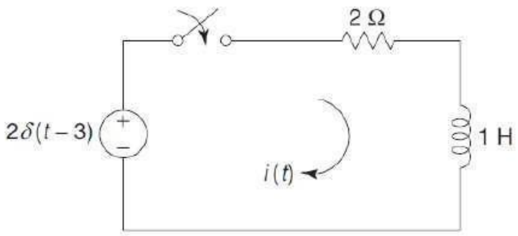
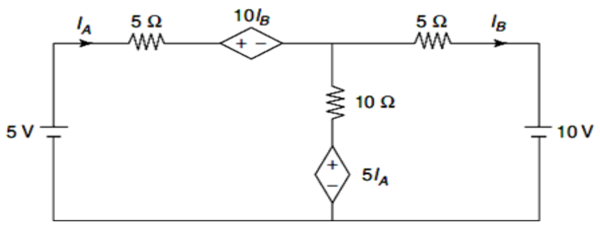
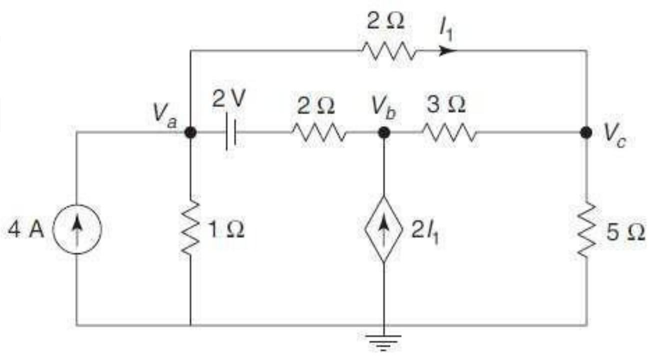
Course Name: NETWORK THEORY

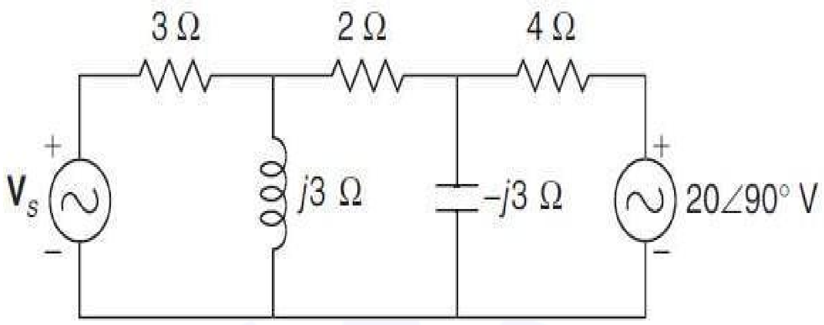
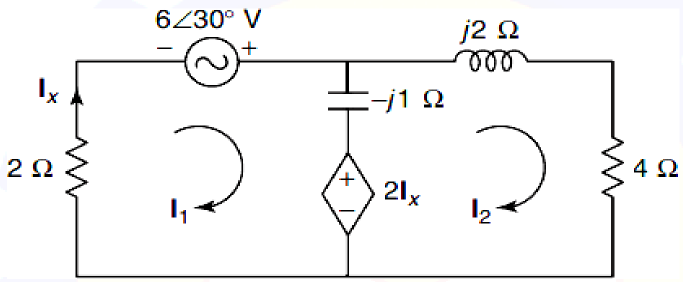
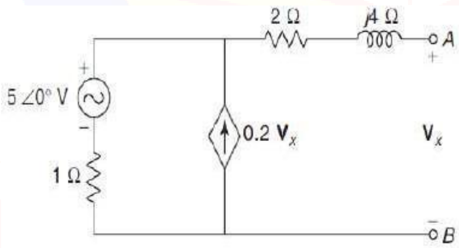
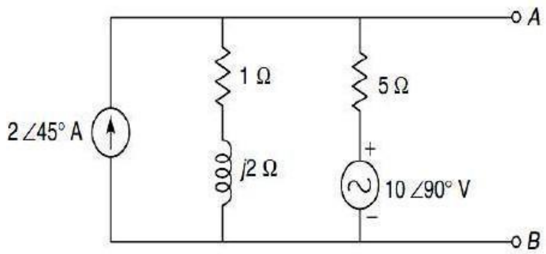
Max. Marks: 60		**Duration: 2 Hours 30 minutes**

PART A

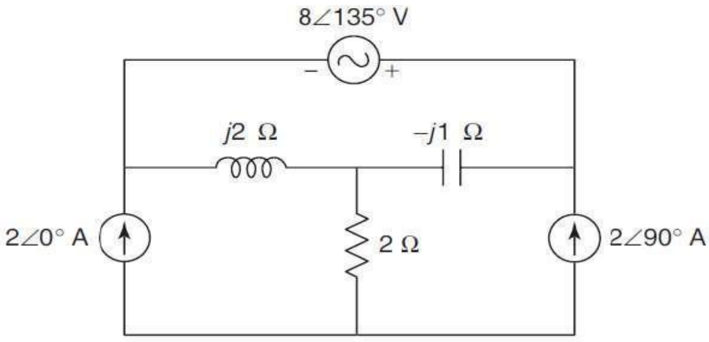
(Answer all questions; each question carries 3 marks)

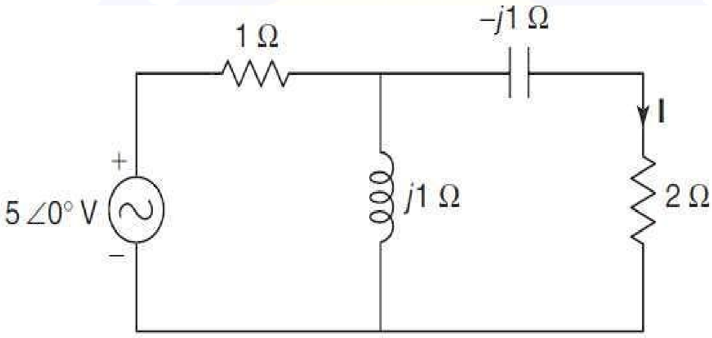
Q. No.	Description	CO	Marks
1	Identify and explain the different types of dependent sources seen in a typical electrical network.	CO1	3
2	Find the voltage across the 4 Ω resistor shown in network by source Transformation. 	CO1	3
3	State Thevenin's theorem. How do you find the Thevenin's equivalent circuit of a network with dependent sources?	CO2	3
4	State Norton's Theorem. How is a Norton's circuit converted to Thevenin's equivalent circuit?	CO2	3
5	Transform the following circuit to s domain and find the initial conditions relevant to inductor and capacitor if the switch is opened at t=0. 	CO3	3

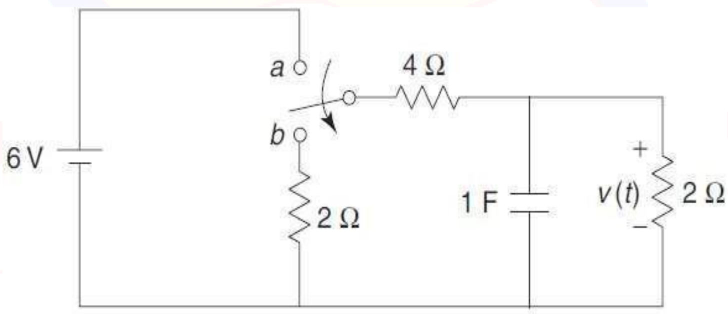
6	Determine the current through the inductor for t>o, if the initial current through the inductor is zero. 	CO3	3
7	The voltage V(s)of a network is given by $V(s)=\dfrac{3s}{(s+2)(s^2+2s+2)}$ Plot its pole zero diagram.	CO4	3
8	Write the equations that describe h parameter equivalent circuit, define the parameters and draw the equivalent circuit.	CO4	3
PART B ***(Answer one full question from each module, each question carries 9 marks)***			
Module 1			
9	a). Find I_A and I_B in the given network using mesh analysis 	CO1	5
	b). Find voltages Va , Vb and Vc in the network using nodal analysis. 	CO1	4

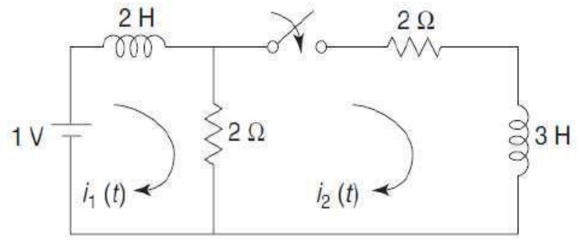
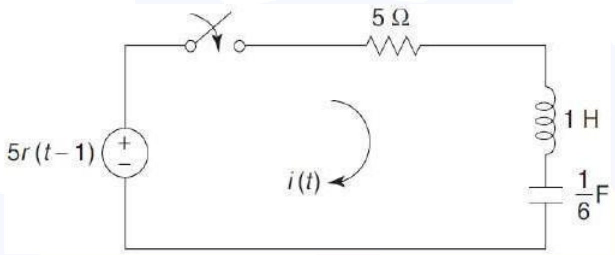
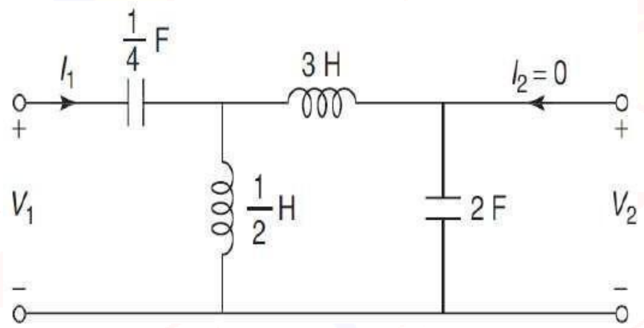
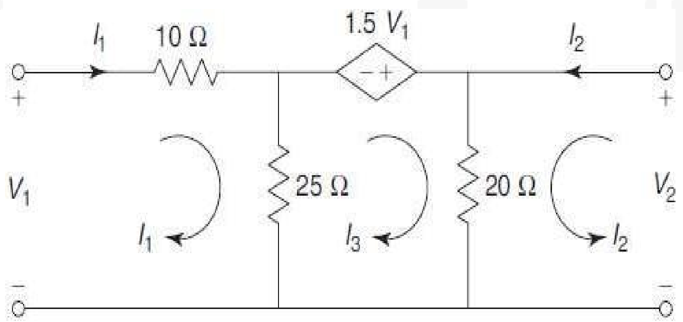
<table>
<tr><td rowspan="2">10</td><td>a). Determine the source voltage V_S so that the current through 2Ω resistor is zero in the network shown below.

</td><td>CO1</td><td>5</td></tr>
<tr><td>b). Find the voltage across the 4Ω resistor in the network

</td><td>CO1</td><td>4</td></tr>
<tr><td colspan="4">Module 2</td></tr>
<tr><td rowspan="2">11</td><td>a). Obtain Thevenin's and Norton's equivalent circuit between terminals A and B

</td><td>CO2</td><td>5</td></tr>
<tr><td>b). Obtain Thevenin's equivalent circuit between terminals A and B. Specify the condition for maximum power transfer and the maximum power transferred.

</td><td>CO2</td><td>4</td></tr>
</table>

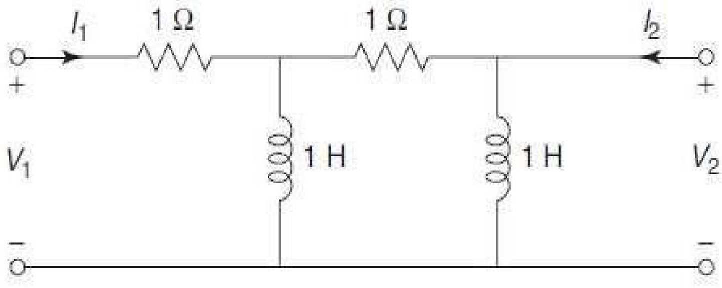
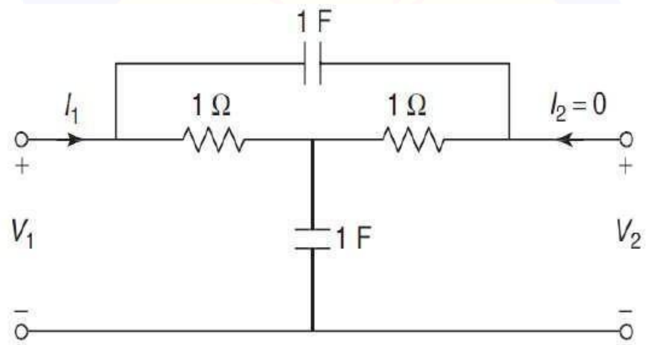
<table>
<tr><td rowspan="2">12</td><td>a). Find the current through the inductor using superposition theorem


</td><td>CO2</td><td>5</td></tr>
<tr><td>b). Find the current through 2Ω resistor and verify reciprocity theorem.


</td><td>CO2</td><td>4</td></tr>
<tr><td colspan="4">Module -3</td></tr>
<tr><td rowspan="2">13</td><td>a). The switch is moved from position a to b at time t=0. Find the voltage across the capacitor for $t \geq 0$.


</td><td>CO3</td><td>5</td></tr>
<tr><td>b). Find the step response of an RL series circuit using Laplace transforms and plot $i_L(t)$ and $v_L(t)$ for $t \geq 0$ and identify the transient and steady state parts of the responses.</td><td>CO3</td><td>4</td></tr>
</table>

14	a). In the circuit, the switch is closed at time t=0. Find the currents $i_1(t)$ and $i_2(t)$ through the inductors for $t \geq 0$ 	CO3	5
	b). Find the current i(t) when the switch is closed at t=0 with zero initial conditions. 	CO3	4
Module -4			
15	a). Find the network functions $\frac{V1}{I1}, \frac{V2}{V1}, \frac{V2}{I1}$ for the network 	CO4	5
	b). Find Transmission parameters of the following network. 	CO4	4

16	a). Find the z parameters for the network. Check whether the network is symmetrical and reciprocal.  	CO4	5
	b). Evaluate the three network functions relevant to the following network.  	CO4	4

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