Techno India NJR Institute of Technology

Course File

Electrical Circuit Analysis (3EE4-05)

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For Techno India NJR Institute of Technology
पंकज पोरवाल
Dr. Pankaj Kumar Porwal
(Principal)

Syllabus:

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

SYLLABUS

2nd Year - III Semester: B.Tech. (Electrical Engineering)

3EE4-05 Electrical Circuit Analysis

Credit: 3 **Max. Marks: 150 (IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1.	**Network Theorems** Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.	10
2.	**Solution of First and Second order networks** Solution of first and second order differential equations for Series and parallel R-L, R-C, RL- C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.	8
3.	**Sinusoidal steady state analysis** Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.	8
4.	**Electrical Circuit Analysis Using Laplace Transforms** Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances	8
5.	**Two Port Network and Network Functions** Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.	6
	TOTAL	40

Course Overview:

The student will learn electrical circuit analysis in this 40-hour course. This course includes network theorems, solution of first and second order networks, sinusoidal steady state analysis, electrical circuit analysis using Laplace transforms, two port networks and network functions. This course will increase the student ability of solving the electrical circuits using the different types of theorems. It will also increase the knowledge about the response of the RL, RC and RLC network responses under different input conditions.

This course is very important for analysing any circuit. This is also necessary for the upcoming subjects during the course work. Also, most of the interviewers ask questions from this subject to check the fundamentals of circuit analysis that is why it plays vital role in recruitment process.

Course Outcome:

CO. NO.	Cognitive Level	Course Outcome
1	Synthesis	Student will be able to apply different techniques for analysis of electrical circuit.
2	Synthesis	Student will be able to explain transient response of different circuits using Laplace transform.
3	Analysis	Students will be able to analyse magnetically coupled circuits.
4	Synthesis	Students will be able to apply graph theory to formula network equations.
5	Application	Students will be able to use and solve fourier series for complex waveforms.

Prerequisites:

1. Fundamentals of basic circuit elements and their properties.
2. Students should be efficient in applying basic laws of circuit analysis like KVL, KCL.
3. Students should be proficient in solving algebraic equations.
4. Students should be proficient in integral and differential equations solution.

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Course Outcome Mapping with Program Outcome:

Course Outcome	Program Outcomes (PO's)											
CO. NO.	Domain Specific (PSO)					Domain Independent (PO)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	2	1	-	-	-	-	-	-	-
CO2	2	2	1	2	1	-	-	-	-	-	-	-
CO3	1	1	2	1	1	-	-	-	-	-	-	-
CO4	1	2	1	2	1	-	-	-	-	-	-	-
CO5	2	1	2	1	2	-	-	-	-	-	-	-
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)												

Course Coverage Module Wise:

Lect. No.	Unit	Topic
1	**1**	**NETWORK THEOREMS** Overview
2	1	Superposition theorem
3	1	Thevenin theorem
4	1	Norton theorem,
5	1	Maximum power transfer theorem
6	1	Reciprocity theorem
7	**1**	Compensation theorem
8	1	Analysis with dependent current
9	1	Voltage sources
10	1	Node and Mesh Analysis. Concept of duality and dual networks.
11	**2**	**SOLUTION OF FIRST AND SECOND ORDER NETWORKS:** Overview
12	2	Solution of first and second order differential equations for
13	2	Series and parallel R-L
14	2	R-C, RL- C circuits
15	**2**	Initial and final
16	2	Conditions in network elements,
17	2	Forced and free response, time constants
18	2	Steady state and transient state response
19	**3**	**SINUSOIDAL STEADY STATE ANALYSIS:** Overview

20	3	Representation of sine function as rotating phasor
21	3	Phasor diagrams
22	3	Impedances and admittances
23	3	AC circuit analysis
24	3	Effective or RMS values, average power and complex power.
25	**3**	Three-phase circuits. Mutual coupled circuits
26	3	Dot Convention in coupled circuits, Ideal Transformer.
27	**4**	**ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORM:** Overview
28	4	Review of Laplace Transform
29	4	Analysis of electrical circuits using Laplace Transform for standard inputs
30	4	Convolution integral
31	4	Inverse Laplace transform
32	4	Transformed network with initial
33	4	Conditions. Transfer function representation
34	4	Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances
35	**5**	**TWO PORT NETWORK AND NETWORK FUNCTIONS:** Overview
36	5	Two Port Networks, terminal pairs, relationship of two port
37	5	Variables, impedance parameters
38	5	Admittance parameters
39	5	Transmission parameters and hybrid parameters
40	5	Interconnections of two port networks.

Text/Reference Books:

1. Van Valkenburg, Network Analysis, PHI
2. Hayt & Kemmerly, Engineeirng Circuit Analysis, 6/e (TMH)
3. J. Edminster & M. Nahvi, Electric Circuits (SIE), 5/e, Scaum's Out Line.
4. Nagsarkar & Sukhija, Circuits & Networks, Oxford
5. John Bird, Electric Circuit Theory & Technology, ELSEVIER

Teaching and Learning resources:

NPTEL Course Link	https://nptel.ac.in/courses/108/105/108105159/
Quiz	https://www.objectivebooks.com/2016/11/circuits-circuit-theory-mcq-test.html
Notes	https://sites.google.com/site/eeenotes2u/courses/network-analysis

Assessment Methodology:

1. Assignments one from each unit.
2. Midterm subjective paper where they have to solve the given problem. (Twice during the semester)
3. Final paper at the end of the semester subjective

Previous Year Question Paper

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3E1143

Roll No. _____

Total No of Pages: 7

3E1143

B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019

PCC Electrical Engineering

3EE4-05 Electrical Circuit Analysis

Common For EE, EX

Time: 3 Hours

Maximum Marks: 120

Min. Passing Marks: 42

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Explain Maxwell's loop Current method.

Q.2 Define the Concept of duality and dual networks.

Q.3 Explain the suitable example of DOT Convention in Coupled Circuit.

Q.4 Find the transient response of series R-C Circuit having d.c. excitation.

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Q.5 Explain initial and final conditions in network element.

Q.6 Describe form factor and peak factor.

Q.7 Write the condition of Symmetry and Reciprocal network for ABCD.

Q.8 Write down the definition of the Laplace Transform.

Q.9 Write down the necessary Condition of Stability of a network function.

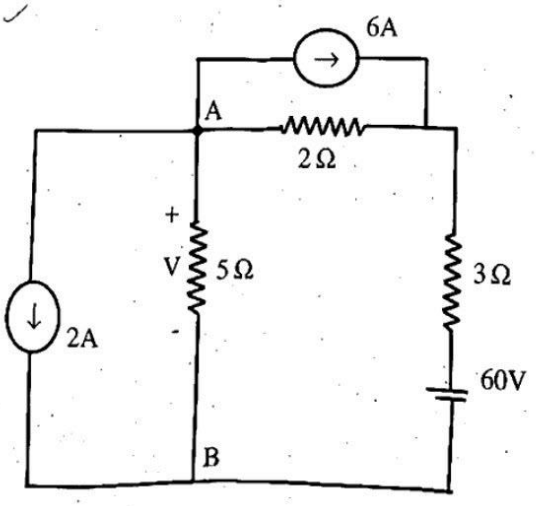
Q.10 Explain Power Triangle with diagram.

PART – B

(Analytical/Problem solving questions) **[5×8=40]**

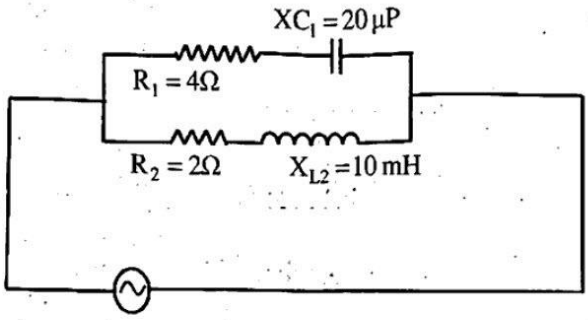
Attempt any five questions

Q.11 Apply superposition theorem to the given circuit for finding the voltage drop V across the 5 Ω resistor: [8]



Q.2 A Series RLC Circuit has R = 10 Ω, L = 1H, C = 20 μF. A 100 V, 50 Hz Supply is applied across the circuit. Find the input current and voltage across the elements. [8]

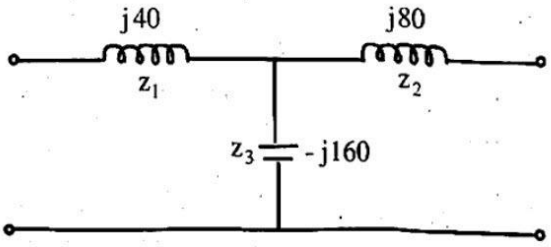
Q.3 Find the resonant frequency for the parallel Circuit shown in fig. [8]



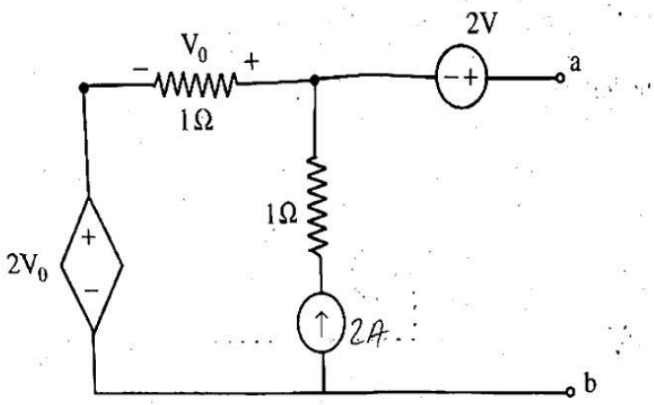
Q.4 The Current through a Circuit element is $\frac{4S^2}{S+7}$. Find the current in t domain at

$S \rightarrow 0$ and $S \rightarrow \infty$. [8]

Q.5 Find Y – Parameters of network shown in fig. from z-Parameters. [8]



Q.6 Find Norton's equivalent circuit at the left of terminals a – b for the Circuit given in fig. [8]



Q.7 Find the Conductively Coupled equivalent Circuit of given fig: [8]