

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), November 2017

B. Tech in Electrical Engineering, Semester III

Roll No.....

EE301: Network Theory - I

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Short answer/objective type questions (10 questions @ 1 mark)

10

- i. In a network containing only independent current sources and resistors, if the value of all resistors are doubled, the value of node voltages
A. are doubled
B. remain the same
C. are halved
D. change in some other way
- ii. Two resistors R_1 and R_2 give combined resistance of 4.5Ω when in series and 1Ω when in parallel. The resistances are
A. 2.5Ω and 2Ω
B. 1Ω and 3.5Ω
C. 1.5Ω and 3Ω
D. 0.5Ω and 4Ω
- iii. An ideal voltage source will charge an ideal capacitor
A. in infinite time
B. exponentially
C. instantaneously
D. none of these
- iv. If there are b branches and n nodes, the number of KVL equations required would be
A. b
B. $b - n$
C. $n - 1$
D. $b - n + 1$
- v. Three parallel resistive branches are connected across a dc supply. What will be ratio of branch currents $I_1:I_2:I_3$ if the branch resistances are in the ratio $R_1:R_2:R_3 :: 2:4:6$?
(a) 3:2:6
(b) 2:4:6
(c) 6:3:2
(d) 6:2:4
- vi. Which one of the following is a linear system
(a) $y(t) = 2u(t)$
(b) $y(t) = 2u(t) + 5$
(c) $y(t) = 2u^2(t)$
(d) $y(t) = 2u^2(t) + 5$
- vii. A two terminal network is one of the R-L-C network elements. The element is connected to the ac supply. The current through the element is I . When a capacitor is inserted in series between the source and the elements then current through the element becomes $2I$. The element
(a) is a resistor
(b) is an inductor
(c) is a capacitor
(d) cannot be a single element

- viii. Thevenin's theorem can be applied to calculate the current in
 (a) a passive load only (b) a linear load only
 (c) a bilateral load only (d) any load

- ix. The laplace transform of $i(t)$ is given by

$$I(s) = \frac{2}{s(1+s)}$$

As $t \rightarrow \infty$, the value of $i(t)$ tends to

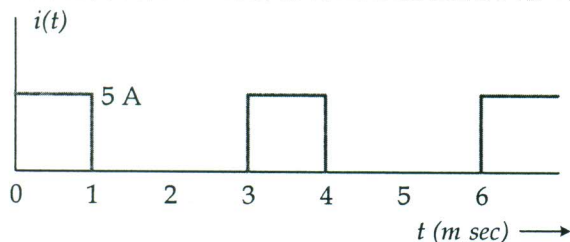
- (a) 0 (b) 1 (c) 2 (d) ∞
- x. A high Q coil has
 (a) large bandwidth (b) high losses
 (c) low losses (d) flat response

Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

- Briefly explain Source Transformation.
- Differentiate between Dependent and Independent energy sources.
- What do you mean by periodic waveform?
- How to find out Form factor of any periodic waveform? What does it denote?

Q.3A



The current $i(t)$ in a 10Ω resistor is shown in Fig. Draw the profile of $v(t)$ and show the peak voltage magnitude. What is peak power?

05

Q.3B A voltage is defined as

05

$$v(t) = \begin{cases} 0 & \text{for } t < 0 \\ 2t & \text{for } 0 < t < 2 \text{ sec} \\ 4e^{-(t-2)} & \text{for } 2 < t \text{ sec} \end{cases}$$

and is applied to a $10 \mu F$ capacitor. Find $i(t)$.

Q.4A How can neutral current calculated in three-phase unbalanced load conditions? Derive the expression for it.

05

Q.4B A 3-phase 220 V supply is applied to a balanced delta connected 3-phase load. The phase current being $I_{ab} = 10 \angle -30^\circ A$, find I_a . Compute the total power received by the delta load. Find the value of the resistance portion of the phase impedance.

05

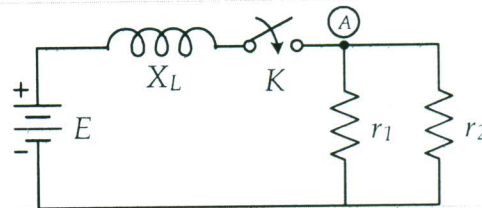
Q.5A Define Laplace transform. Why do we use it in circuit analysis? Derive the Laplace transform of sinusoidal function.

1+2
+2

Q.5B A function in Laplace domain is given by $I(s) = \frac{s+1}{s(s^2+4s+4)}$. Obtain its inverse Laplace.

05

Q.6A Apply nodal analysis to find the voltage at node (A) in the circuit of given Fig. in s-domain. Assume the initial current through the inductor to be zero.



2+3

Q.6B Derive the response of RL series circuit with pulse input.

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OR

Derive the response of RC series circuit with pulse input.

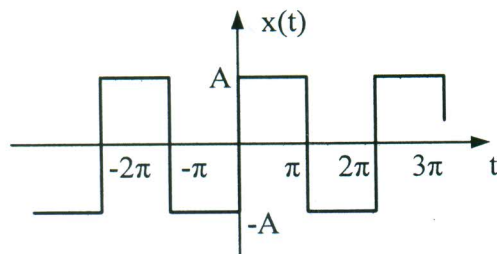
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Q.7A Define the following terms used in graph theory:

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1. Branch
2. Node
3. Degree of a node
4. Tree
5. Loop

Q.7B

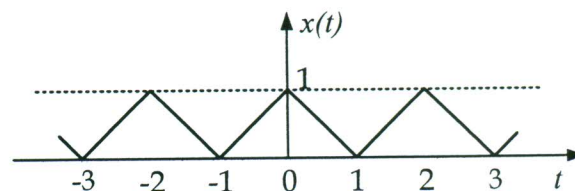


Find the trigonometric Fourier series for the square wave shown in Fig. and plot the line spectrum.

05

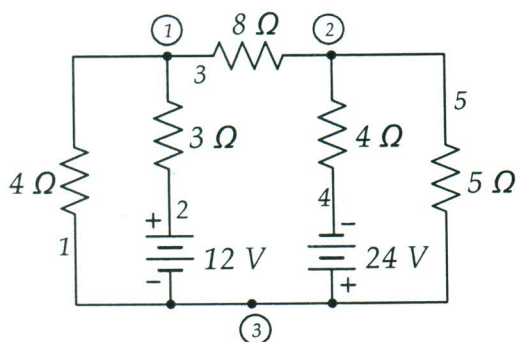
OR

Find the trigonometric Fourier series for the triangular wave shown in Fig. and plot the line spectrum.



05

Q.8



A network has been displayed in Fig. Draw a graph of the network and select a tree with branches 2 and 4. Draw the cut-set matrix. Using topological form of KCL equation, find various branch voltages and currents. The branch numbers are marked with integers in the figure while node numbers are encircled.

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Q.9A Derive the expression for any 2 of the following:

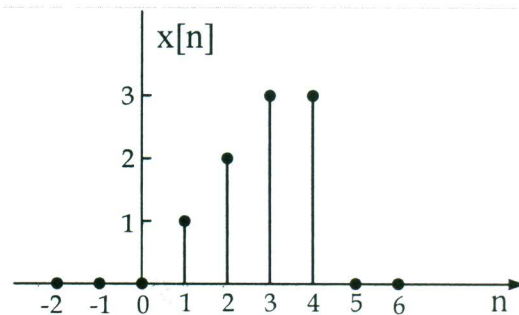
5+5

1. Average value of a periodic complex wave
2. RMS value of periodic complex wave
3. Expression for power with non-sinusoidal voltage and current

Q.9B

A discrete-time signal $x[n]$ is shown in Fig. below. Sketch and label each of the following signals:

- (a) $x[n - 2]$
- (b) $x[2n]$
- (c) $x[-n]$
- (d) $x[-n + 2]$

2.5×
4

OR

Show the conversion process from trigonometric Fourier series to Exponential Fourier series. Also show the relation between the Fourier coefficients.