Total number of printed pages:5 **UG/3rd/ UECE304**

2021

NETWORK THEORY

Full Marks: 100

Time: Three hours

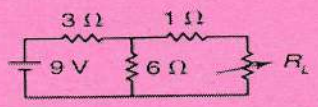
The figures in the margin indicate full marks for the questions.

Answer Q. No. 1 and any **four questions** from the rest

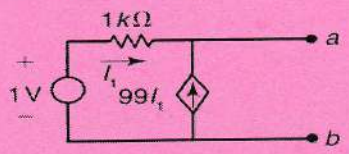
1) Answer any **ten** questions from the following: (10 x 2 = **20)**

(a) The maximum power that can be dissipated in the load in the given circuit is

(i) 3W (ii) 6W (iii) 6.75 W (iv) 13.5W

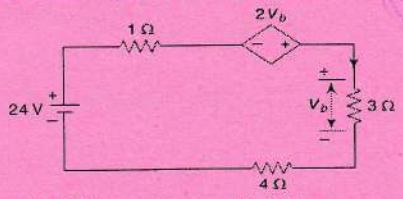


(b) Which one of the following combination of open-circuit voltage and Thevenin's equivalent resistance represents the Thevenin's equivalent of the circuit shown below?



(c)

The current in the given circuit with a dependent source is



(a) 10 A (b) 12 A (c) 14 A (d) 16 A

(d) A practical current source is generally represented by

(i) a resistance in series with an ideal current source

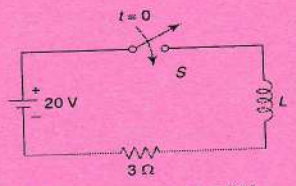
(ii) a resistance in parallel with an ideal voltage source

(iii) a resistance in parallel with an ideal current source

(iv) a voltage and a current source in parallel

(e)

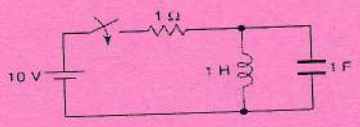
In the circuit shown in the given figure, switch S is closed at $t = 0$. After some time when the current in the inductor was 6A, the rate of change of current through it was 4 A/s. The value of the inductor is



(a) indeterminate (b) 1.5 H (c) 1.0 H (d) 0.5 H

(f)

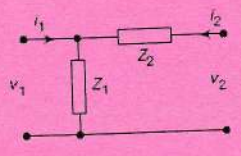
The switch in the circuit is closed at $t = 0$. The current through the battery at $t = 0+$ and $t = \infty$ is, respectively



(a) 10 A and 10 A
(b) 0 A and 10 A
(c) 10 A and 0 A
(d) 0 A and 0 A

(g)

For the two-port network shown in the figure, the z-matrix is given by



(a) $\begin{bmatrix} Z_1 & Z_1+Z_2 \\ Z_1+Z_2 & Z_2 \end{bmatrix}$ (b) $\begin{bmatrix} Z_1 & Z_1 \\ Z_1+Z_2 & Z_2 \end{bmatrix}$

(c) $\begin{bmatrix} Z_1 & Z_2 \\ Z_2 & Z_1+Z_2 \end{bmatrix}$ (d) $\begin{bmatrix} Z_1 & Z_1 \\ Z_1 & Z_1+Z_2 \end{bmatrix}$

(h) The dc gain of a filter having the transfer function $H(s)=\frac{12}{(s+2)\times(s+3)}$ is

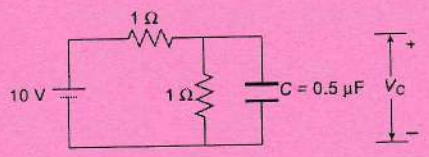
(i) 12 (ii) 2 (iii) 3 (iv) 0

(i) A series LC circuit is suddenly connected to a dc voltage of 'V' volts. The current in the series circuit just after the switch is closed will be

(a) V/L (b) V/C (c) zero (d) V/LC

(j)

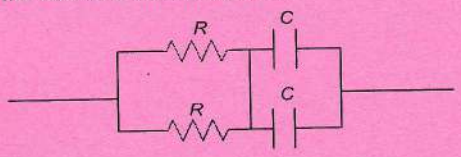
The steady-state voltage V_C in this given figure is



(a) 10 V (b) 15 V (c) 5 V (d) none of these.

(k)

Time constant of the network shown below is

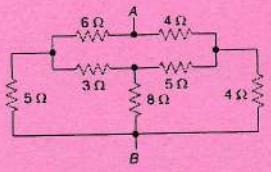


(a) *CR* (b) 2*CR* (c) *CR*/4 (d) *CR*/2

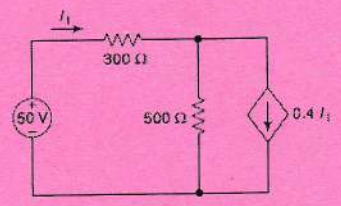
Answer any **four** questions from the following, all questions are of **equal marks**: (4 x 20 = **80**)

2) (7+5+8)

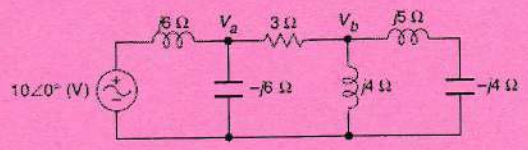
a) Find the equivalent resistance between the terminals **A** and **B** of the circuit shown below:



b) For the circuit shown below, find the current I_1 and the power absorbed by the 500-ohm resistor.



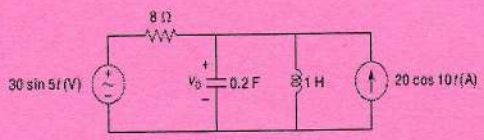
c) Determine V_a and V_b in the circuit shown below:



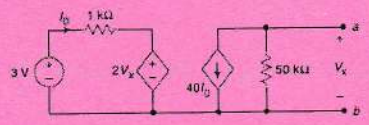
3) (8+6+6)

a) State and prove Millman's theorem.

b) Find v_o using superposition theorem for the circuit shown below.



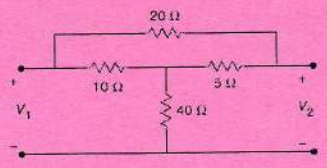
c) Find the Thevenin's equivalent between the terminals a and b for the circuit shown below.



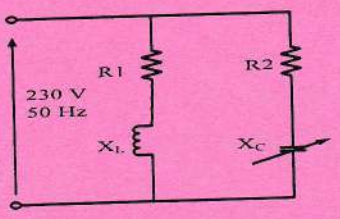
4) (7+5+8)

a) Represent Z-parameters in terms of Y-parameters for a two port network.

b) Find the y-parameters for the network shown below.



c) Show that it is possible to have more than one resonant condition for the given circuit by varying the capacitance only. Assume for the circuit: $R_1 = 20\,\Omega$; $R_2 = 10\,\Omega$; $X_L = j37.7\,\Omega$, and the input is a fixed frequency ac. Find the value of capacitors that will achieve this.



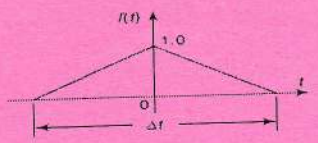
5)

a) Explain the formula of Fourier Series. State odd, even and half wave symmetry of the Fourier series. (2+2+2+2)

b) Prove Parseval's energy theorem for a signal $f(t)$ (periodic or non-periodic). (5)

$W = \int_{-\infty}^{\infty} f^2(t)\,dt = \frac{1}{2\pi}\int_{-\infty}^{\infty} |F(j\omega)|^2\,d\omega$; the symbols have their usual meaning.

c) Find the Fourier transform of the triangular pulse shown below. (7)



6) a) Draw the circuit diagram of a first order active low-pass filter and hence find out the expression for the cut-off frequency. Draw the magnitude response of the filter. (8+2)

b) What are 3-phase balanced voltage source and 3-phase balanced load? Establish the relation between the magnitude of line-to-line and the phase voltage in a 3-phase balanced Y-Y connection. Explain why a neutral line is not necessary in a 3-phase balanced Y-Y connection. Draw the phasor diagram between the line-to-line and the phase voltage for the above system. (1+1+4+3+1)