Question Paper

Exam Date & Time: 08-Dec-2022 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

THIRD SEMESTER B.TECH END SEMESTER EXAMINATIONS, DEC 2022

NETWORK ANALYSIS AND SIGNALS [ICE 2154]

Marks: 50 **Duration: 180 mins.**

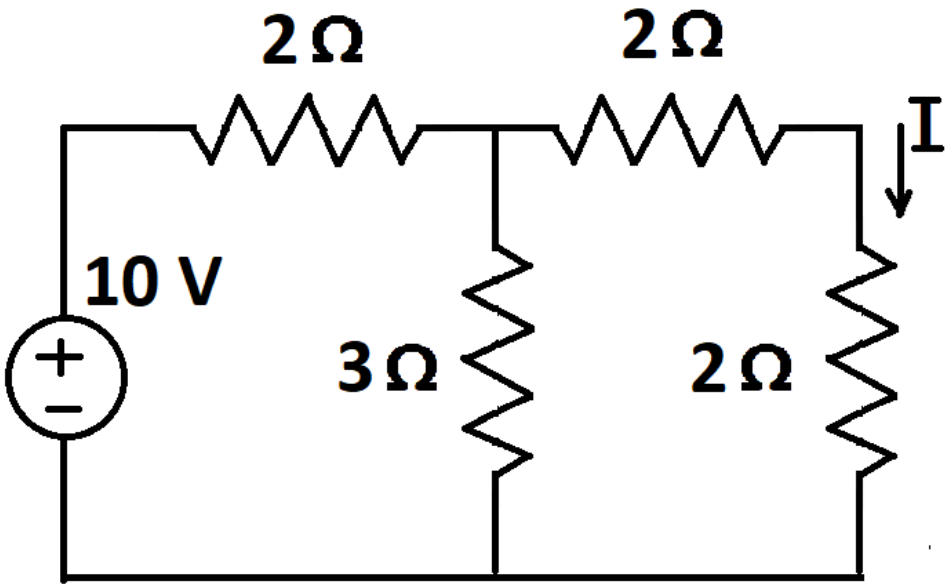
A

Answer all the questions.

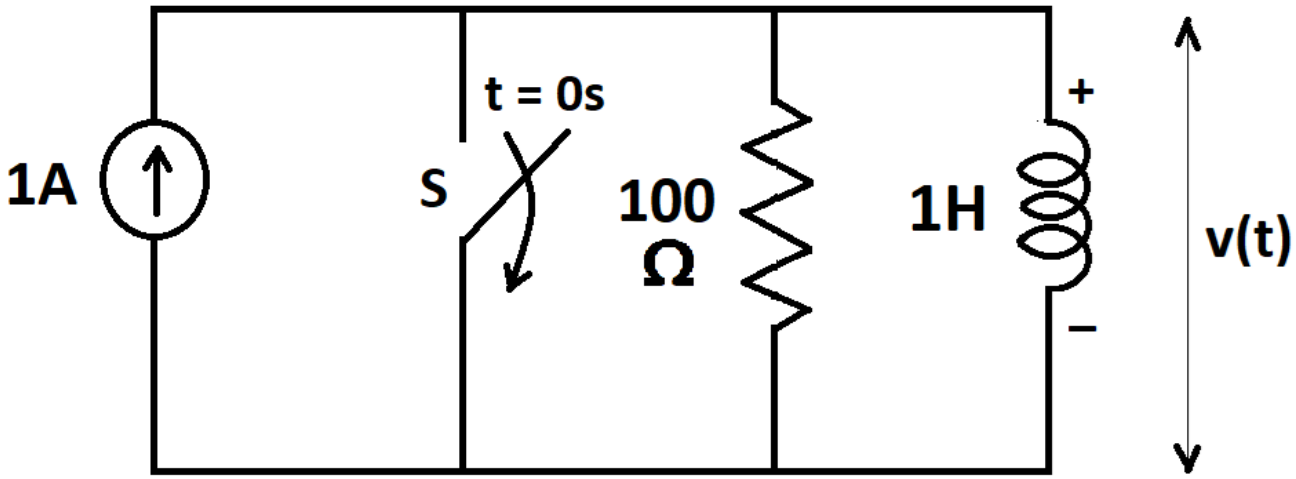
Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Prove the Reciprocity theorem for voltage V and current I in the network shown [CO1, PO 1-2, BL3] (3)

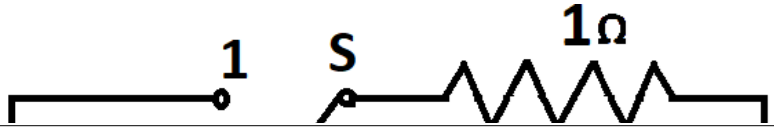
A)

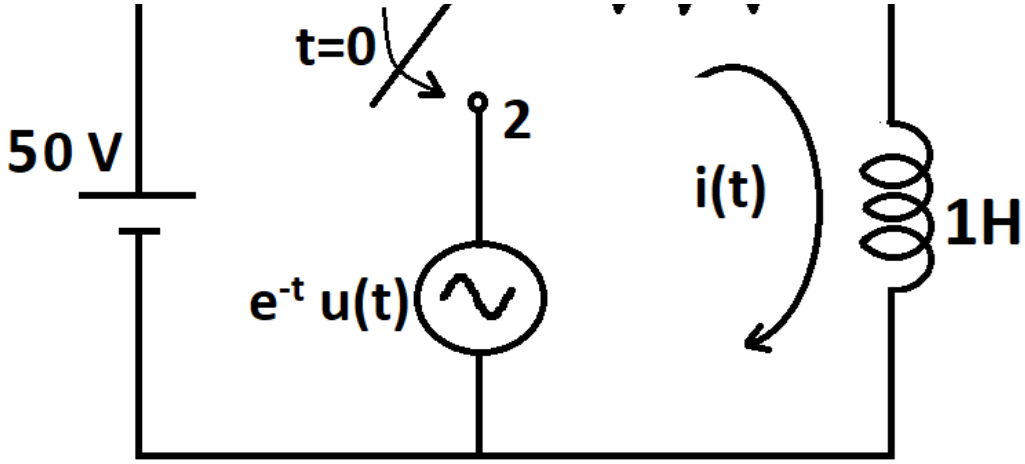


B) In the network shown switch 'S' is opened at t=0, network prevailed in steady state. Find v, dv/dt and $\partial v/dt^2$; all evaluated at $t=0^+$ [CO2, PO1-2 , BL3] (2)



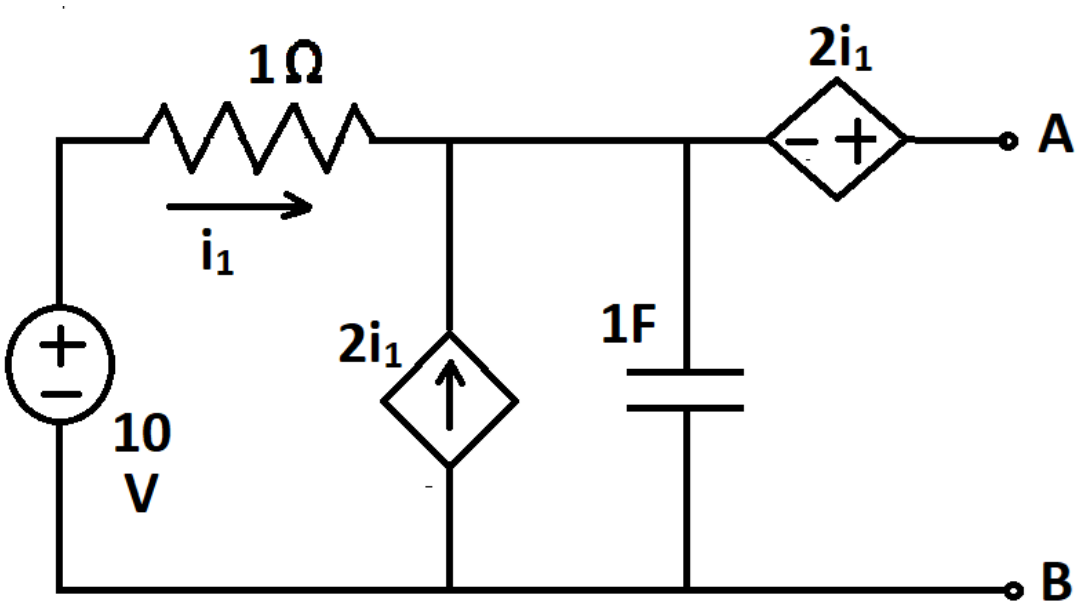
C) Determine the current through the circuit, when the switch 'S' is moved from position '1' to '2'.Use Laplace transform approach. [CO3, PO 1-2 , BL3] (5)



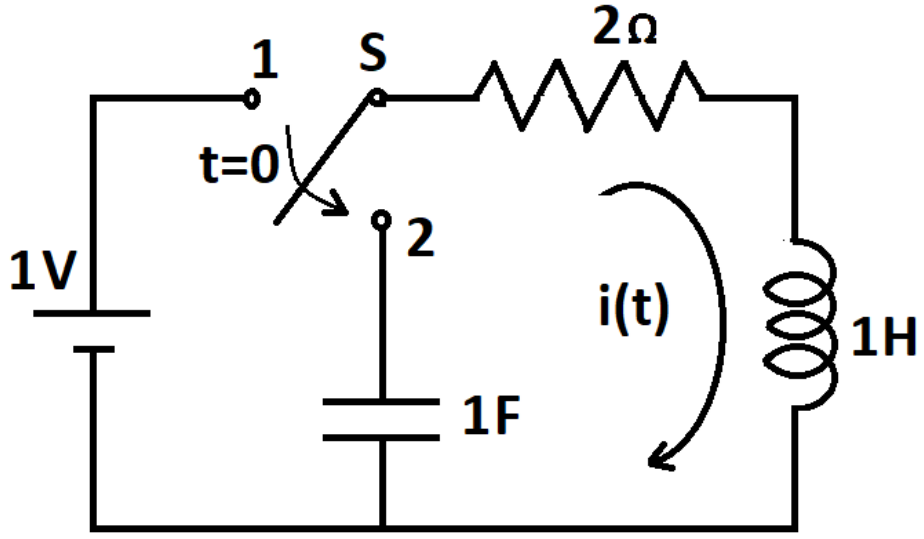


2) Obtain the Norton's equivalent circuit as seen from terminals A-B for the network shown in figure. Use Transform approach[CO3, PO 1-2, BL3] (4)

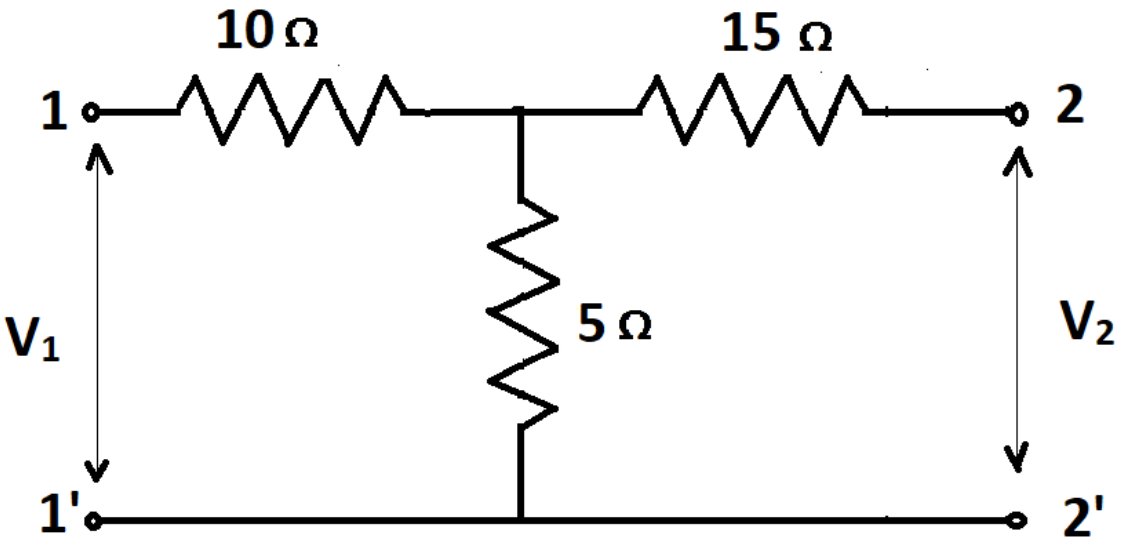
A)



B) In the circuit shown switch 'S' is moved from position 1 to 2 at t=0; steady state being prevailed. Assuming that the initial charge on the capacitor is 5 Coulombs, determine the expression for current i(t) for t 0. Use conventional time domain approach. [CO2, PO 1-2. BL4] (3)

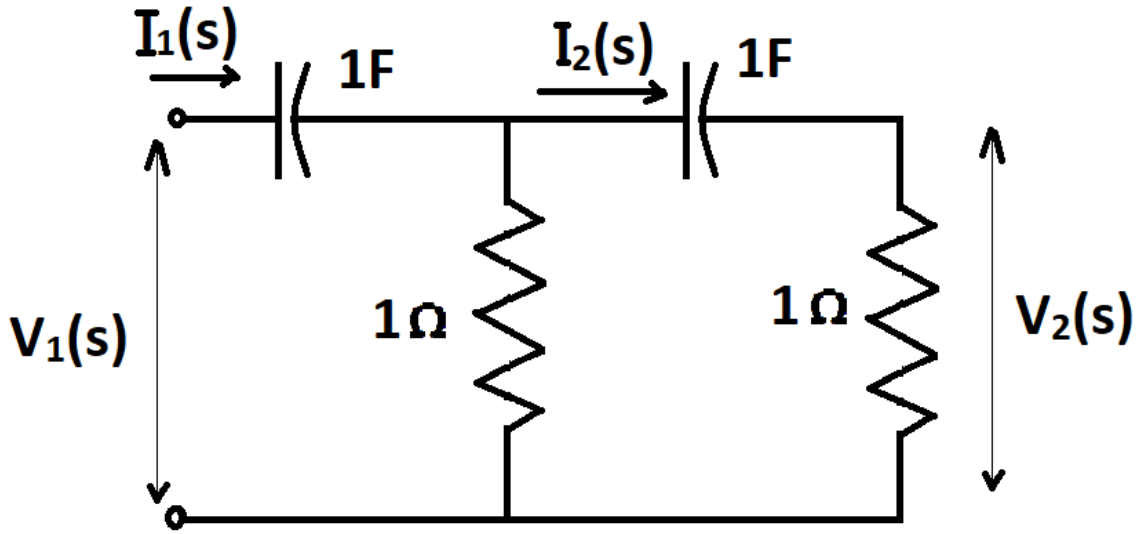


C) Determine the Y parameters of the given T-network and hence obtain its equivalent Pi-network. [CO3, PO1-2, BL3] (3)



3) Derive the network functions voltage ratio transfer function {$V_2(s) / V_1(s)$}, Current ratio transfer function {$I_2(s) / I_1(s)$} and driving point impedance function {$V_1(s) / I_1(s)$} for the network shown in figure. [CO3, PO1-2,4 BL3] (3)

A)



B) Obtain the continuous-time Fourier Series trigonometric coefficients for the following periodic signal x(t) with a periodicity of 2T. [CO5, PO1-2, BL3] (4)

$$x(t) = \begin{cases} 1 - 0.5sin\left(\frac{\pi t}{T}\right) & ;0 \le t < T \\ 0 & ;else \end{cases}$$

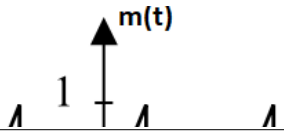
C) Consider the following signal x(t). Sketch the function for x(-0.5t + 3). [CO4, PO1-2, BL3] (3)

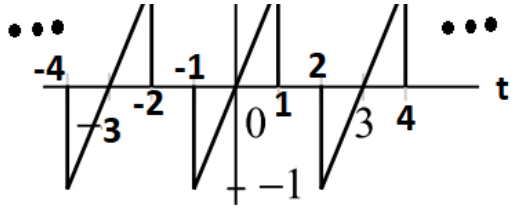
$$x(t) = \begin{cases} t+2 & -2 \le t \le -1 \\ 1 & -1 \le t \le 1 \\ -t+2 & 1 < t \le 2 \\ 0 & \text{elsewhere.} \end{cases}$$

4) Determine whether the following signal is periodic/aperiodic, as well as power/energy signal. [CO4, PO 1-2, BL3] (2)

A) **y(t) = 2cos(πt) sin(3πt)**

B) Find the time period for the following periodic signal x(t). Also, obtain the continuous-time Fourier Series exponential coefficients a_{-1} and a_1 defined over this time period. [CO5, PO 1-2, BL2-3] (4)



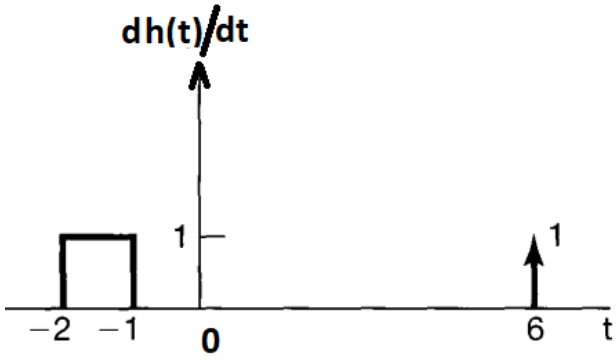


C) Let the expression of a periodic signal x(t) with fundamental period T=2 is given as follows. Determine the Fourier series representation of dx(t)/dt. [CO5, PO1-2, BL4] (4)

$$x(t) = \begin{cases} t, & 0 \le t \le 1 \\ 2 - t, & 1 \le t \le 2 \end{cases}$$

5) Given that the signal d(h(t))/dt as follows, plot the signal h(t). [CO4, PO1-2, BL4] (3)

A)



B) Obtain the Fourier transform for the following signal f(t). [CO5, PO 1-2, BL3] (4)

f(t) = [e^{-at} cos3t] . u(t), a > 0

C) Determine f(t) if the Fourier Transform of the function is given as follows. [CO5, PO1-2 , BL4] (3)

$$\boldsymbol{F(j\omega) = \begin{cases} 4e^{j0.5\pi};\ \omega \in (-\pi, 0) \\ 2e^{-j0.5\pi};\ \omega \in (0, \pi) \end{cases}}$$

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