NITC/ECE/10/02/2025

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Department of Electronics and Communication Engineering
II[nd] Semester B.Tech. Mid-Semester Examination
Winter Semester 2024 - 2025

EC1011E Electric Circuit and Network Theory

Time: 120 minutes

Maximum Marks: 30

1. In the circuit shown in the Fig. 1, R is the load resistor. Find the
   (a) Thevenin equivalent circuit — 2 marks
   (b) What is the maximum power (in watts) delivered to the resisto — 1 mark

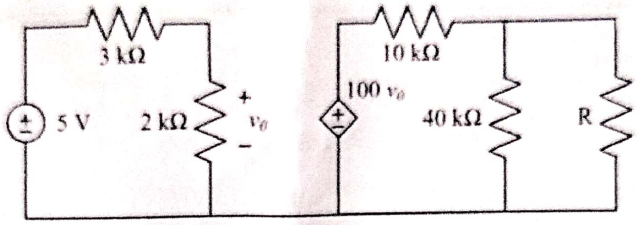

Fig. 1

2. Using the superposition theorem, find the current I in the circuit shown in Fig. 2 — 3 marks

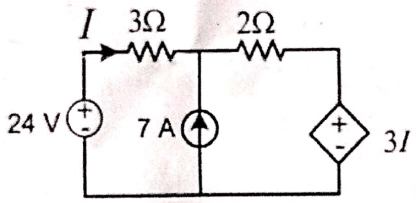

Fig. 2

3. An RC circuit consists of a series connection of a 120-V source, a switch, a resistor, and a capacitor. The circuit is used in estimating the speed of a horse running a 4-km racetrack. The switch closes when the horse begins and opens when the horse crosses the finish line. Assuming that the capacitor charges to 85.6 V, calculate the speed of the horse. — 3 marks

R = 34 MΩ
C = 15 μF

4. At $t = 0.15$ s in the circuit given below, find the value of
   (a) i_L — 2 marks
   (b) i_1 — 1mark
   (c) i_2 — 1mark

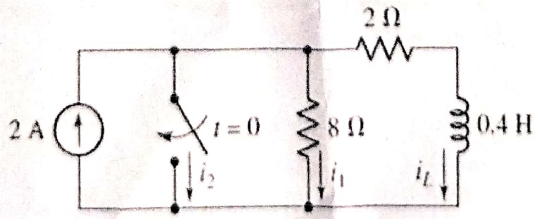

Fig. 3

5. For the circuit shown in Fig. 4, find

(a). The voltage across the capacitor at t = 0-. 1 mark

(b). The voltage across the capacitor at t = 0+. 1 mark

(c). Final (steady state) voltage across the capacitor v(∞). 1 mark

(d). The voltage across the capacitor at t = 0.08 s. 2 marks

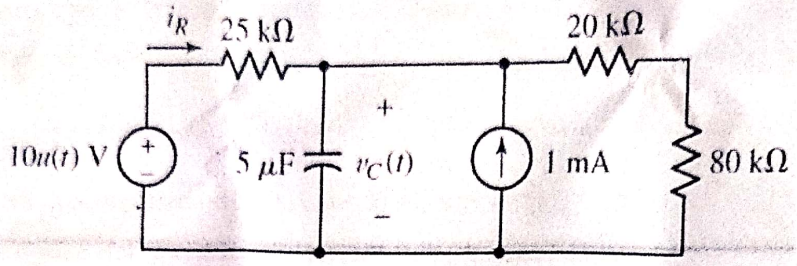

Fig. 4

6. The response of a series RLC circuits are

3 marks

$$V_C(t) = 30 - 10e^{-20t} + 30e^{-10t}$$
$$I_L(t) = 40e^{-20t} - 60e^{-10t} \text{ mA}$$

where V_C and I_L are the capacitor voltage and inductor current, determine the values of R, L, and C.

7. In the circuit of Fig. 5, the switch has been in position 1 for a long time but moved to position 2 at t = 0. Find

(a) V(0+), dV(0+)/dt 2 marks

(b) The voltage across the capacitor for t > 0 2 marks

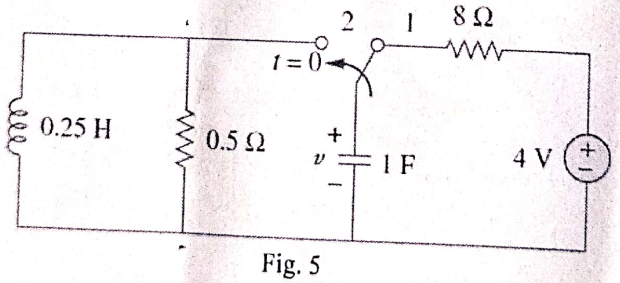

Fig. 5

8. Consider the circuit shown in Fig . 6, find

(a). Current across the inductor just before and after the switch is opened, $i(0^-)$ and $i(0^+)$ 1 mark

(b). Find i(t) for t > 0 2 marks

(c). Classify the circuit based on its damping behavior and draw the typical waveform pattern (shape) expected for the transient solutions. The exact values of the time and amplitude are not needed 2 marks

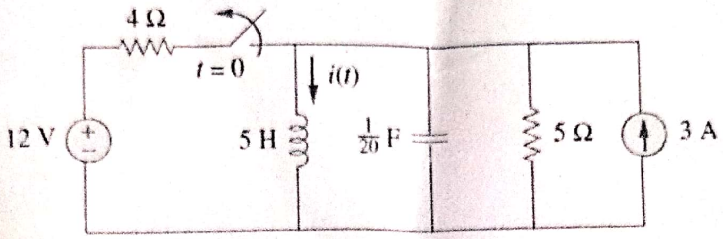

Fig. 6

Question Nos.	1	2	3	4	5	6	7	8	9	10	11	12
Course Outcomes	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO1				
Difficulty Level *	3	2	3	2	4	4	3	3				
Marks	3	3	3	4	5	3	4	5				

CO1: Evaluate the steady state and transient performance of first and second-order electric circuits

CO2: Analyze electric circuits in s-domain and obtain the frequency response of linear circuits and systems

CO3: Model two-port electric networks using two-port network parameters.

CO4:

CO5:

*1. Knowledge / Recall Level; 2. Understand / Comprehend Level; 3. Apply / Analyze Level; 4. Evaluate / Create Level