

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
Electric Circuit Analysis

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Differentiate between :
- Active and passive elements
 - Unilateral and bilateral elements
 - Linear and non-linear elements
 - Independent and dependent sources
 - Ideal and practical sources.
- (10 Marks)
- b. Find the current through the 4Ω resistor using source transformation technique and hence determine the power absorbed in it for the circuit given in Fig.Q1(b).

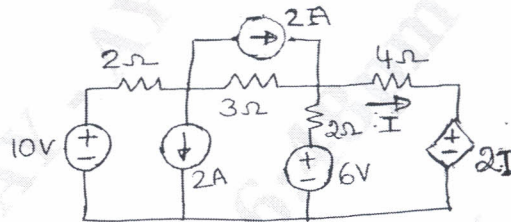


Fig.Q1(b)

(10 Marks)

OR

- 2 a. What is Supernode?
- b. Find the equivalent R_{PQ} between P and Q for the circuit given in Fig.Q2(b).

(03 Marks)

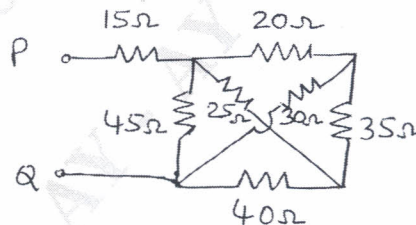


Fig.Q2(b)

(08 Marks)

- c. Find the Mesh currents for the circuit shown in Fig.Q2(c).

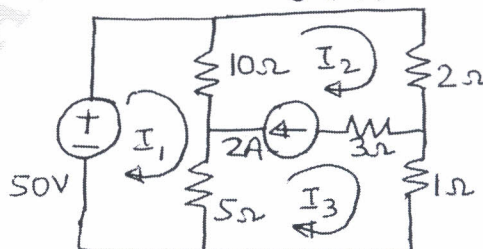


Fig.Q2(c)

(09 Marks)

Module-2

- 3 a. State and explain superposition theorem. (05 Marks)
 b. Find the current through the 24Ω resistor using thevenin theorem of the circuit shown in Fig.Q3(b).

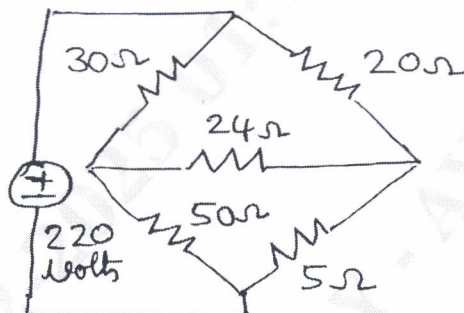


Fig.Q3(b)

(08 Marks)

- c. Determine the value of Z_L for which power transferred from the source is maximum for the circuit shown in Fig.Q3(c).

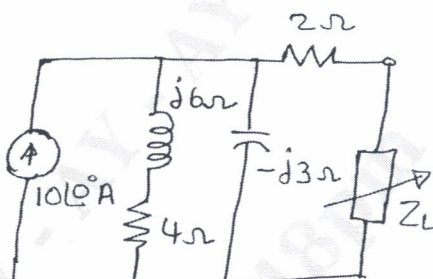


Fig.Q3(c)

(07 Marks)

OR

- 4 a. Find the current through the 10Ω resistor for the circuit shown in Fig.Q4(a). Use Millman's theorem.

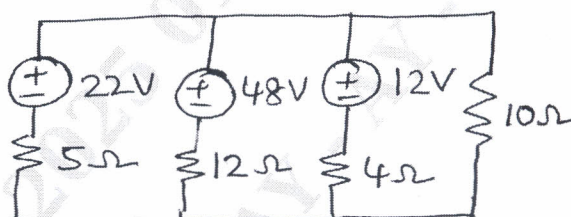


Fig.Q4(a)

(06 Marks)

- b. Use Norton's theorem to find I_x for the circuit shown in the Fig.Q4(b).

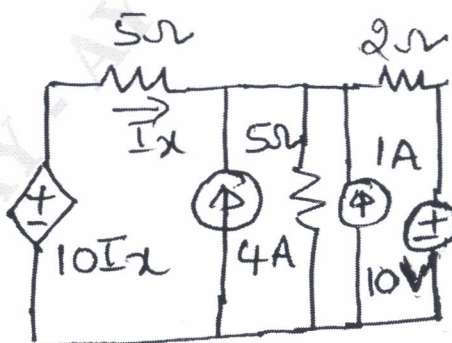


Fig.Q4(b)

(08 Marks)

(06 Marks)

- c. State and explain reciprocity theorem.

Module-3

- 5 a. Show that the resonance frequency is the geometric mean of the two half power frequencies. (06 Marks)
- b. An impedance coil having a resistance of 20Ω and an inductance of 0.02H is connected in series with capacitance of $0.01\mu\text{F}$. Calculate :
 i) Q-factor
 ii) Resonant frequency
 iii) The half power frequencies. (06 Marks)
- c. In the circuit shown in the Fig.Q5(c), the switch is closed at $t = 0$. Assuming all initial conditions as zero, find $i(t)$, $\frac{di(t)}{dt}$ and $\frac{d^2i(t)}{dt^2}$ at $t = 0^+$.

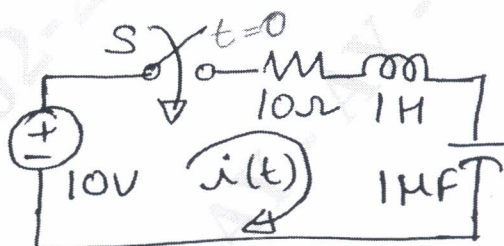


Fig.Q5(c)

(08 Marks)

OR

- 6 a. Determine the resonance frequency for the parallel circuit given in Fig.Q6(a).

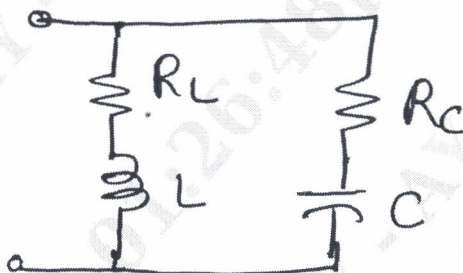


Fig.Q6(a)

(06 Marks)

- b. In the networks shown in Fig.Q6(b), the switch S is moved from the position 1 to the position 2 at $t = 0$, steady state condition having reached before switching. Find

$$i(t), \frac{di(t)}{dt} \text{ and } \frac{d^2i(t)}{dt^2} \text{ at } t = 0^+.$$

(10 Marks)

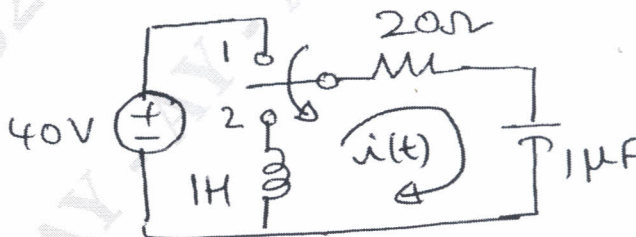


Fig.Q6(b)

- c. Define and derive the expression for dynamic impedance. Refer Fig.Q6(b).

(04 Marks)

Module-4

- 7 a. State and explain initial and final value theorem. (10 Marks)
- b. Find the Laplace transforms of : i) $\sin h wt$ ii) $\cos wt$. (04 Marks)
- c. State and explain first shifting theorem. (06 Marks)

OR

- 8 a. Find the Laplace transform of the periodic waveform shown in Fig.Q8(a).

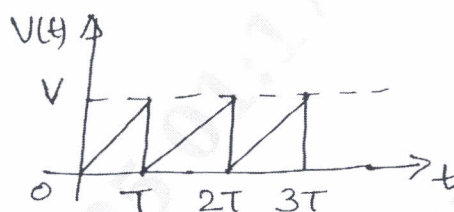


Fig.Q8(a)

(10 Marks)

- b. Find the initial value of: i) $10e^{5t}$ ii) $5 - e^{-3t}$.
c. Find the inverse Laplace transform of:

(05 Marks)

$$F(s) = \frac{5}{s^2 - 5s + 6}$$

(05 Marks)

Module-5

- 9 a. A 400 V, 3-phase supply feeds an unbalanced 3-wire star connected load consisting of impedances $Z_R = 7 \angle 10^\circ \Omega$, $Z_Y = 8 \angle 30^\circ \Omega$ and $Z_B = 8 \angle 50^\circ \Omega$. Assume phase sequence as RYB. Determine the line currents. (10 Marks)
b. Define Y-parameters and express Z-parameters in terms of Y- parameters. (10 Marks)

OR

- 10 a. In the network shown in Fig.Q10(a), find the Y and Z- parameters.

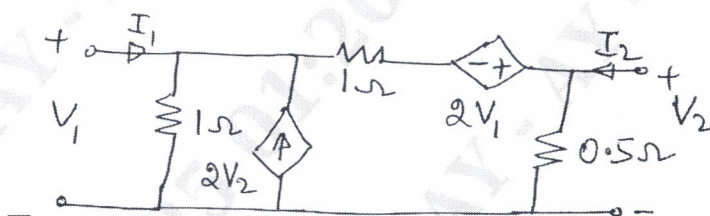


Fig.Q10(a)

(10 Marks)

- b. Define ABCD parameters. Establish the relationship between ABCD and Z- parameters given ABCD parameters. (10 Marks)
