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Question Paper Code : 13012

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Third Semester

Electrical and Electronics Engineering

EE 1151 — ELECTRIC CIRCUIT ANALYSIS

(Common to Electronics and Instrumentation Engineering/Instrumentation and Control Engineering)

(Regulation 2007)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between an independent and dependent sources.

2. State Kirchoff's current law.

3. Define transfer impedance.

4. Give the Laplace transform of unit step function.

5. Why are phasor diagram drawn interms of RMS value?

6. Mention the characteristics of parallel resonance circuit.

7. Write the equation for finding the number of linearly independent mesh current in a network.

8. State Tellegan's theorem.

9. Two 50 μH coils have a mutual inductance of 20 μH. Find the total inductance when they are connected in series aiding connection.

10. In three phase power measurement using two wattmeters if one wattmeter reads zero what will be the power factor of the circuit?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A voltage wave is represented by $V(t) = 200 \sin 314\, t$. Find (1) maximum value (2) RMS value (3) average value (4) frequency (5) time period and (6) instantaneous value after 0.05 seconds. (8)

(ii) Determine the voltage applied at x-y terminal of the network shown in Fig. Q. 11 (a) (ii) such that the voltage across 4 Ω resistor is 5 volts. (8)

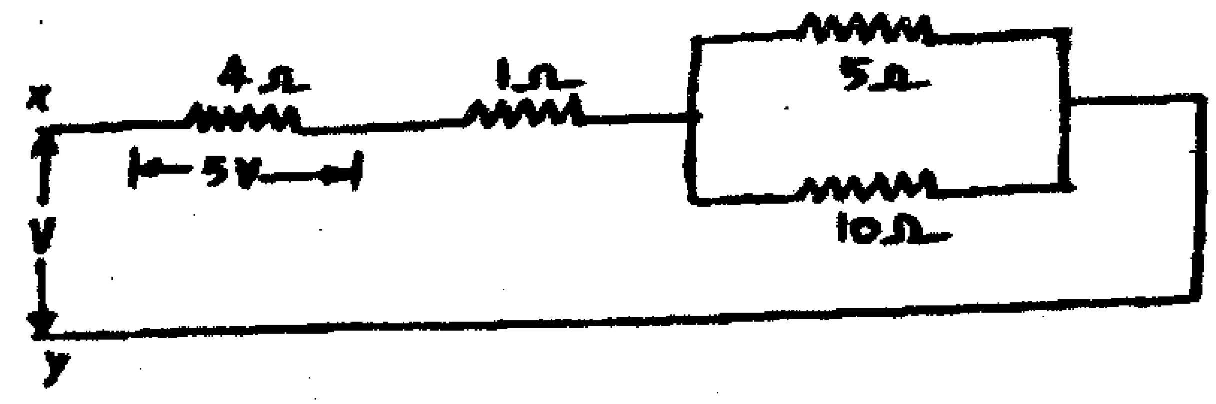

Fig. Q. 11 (a) (ii)

Or

(b) Using mesh analysis, find the loop currents i_1, i_2 and i_3 in the network shown in Fig. Q. 11 (b). (16)

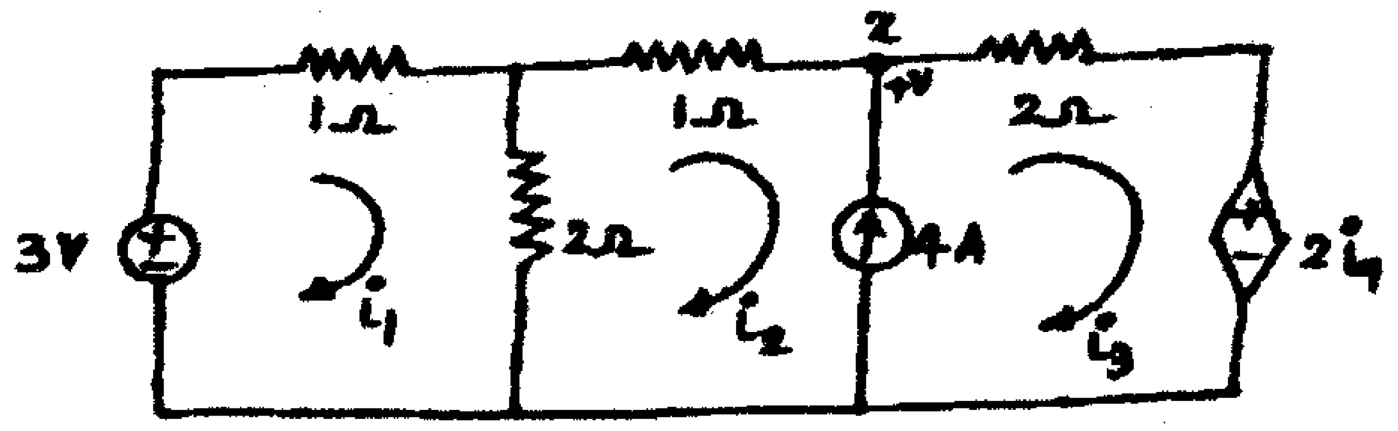

Fig. Q. 11 (b)

12. (a) (i) Obtain the driving point impedance function for the network shown in Fig. Q. 12 (a) (i) and plot the pole-zero diagram for the network function. (8)

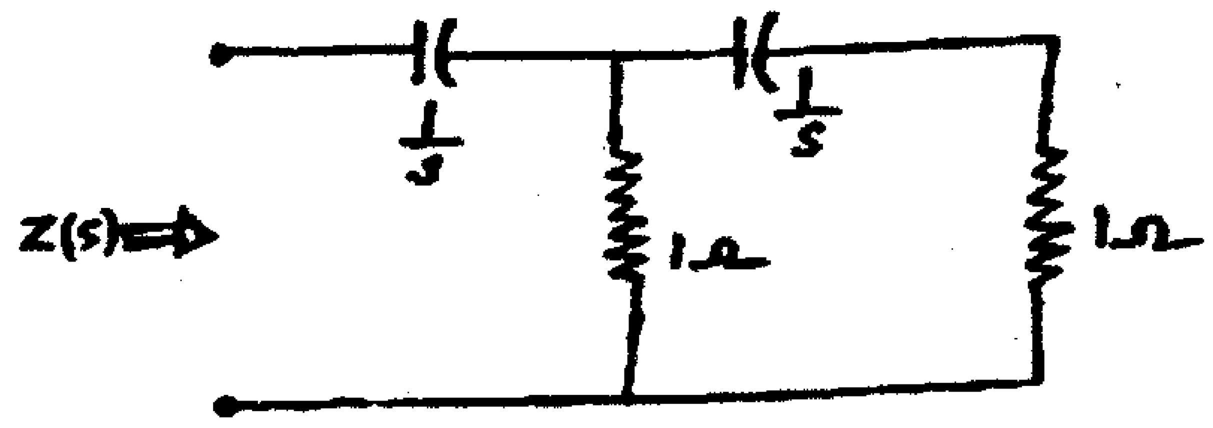

Fig. Q. 12 (a) (i)

(ii) State and explain Initial and Final value theorem. Also give its applications. (8)

Or

(b) Find the current $i_2(t)$) at $t = 0^+$ following switching at $t = 0$ in the circuit Fig. Q. 12 (b). Assume that network previously de-energized. (16)

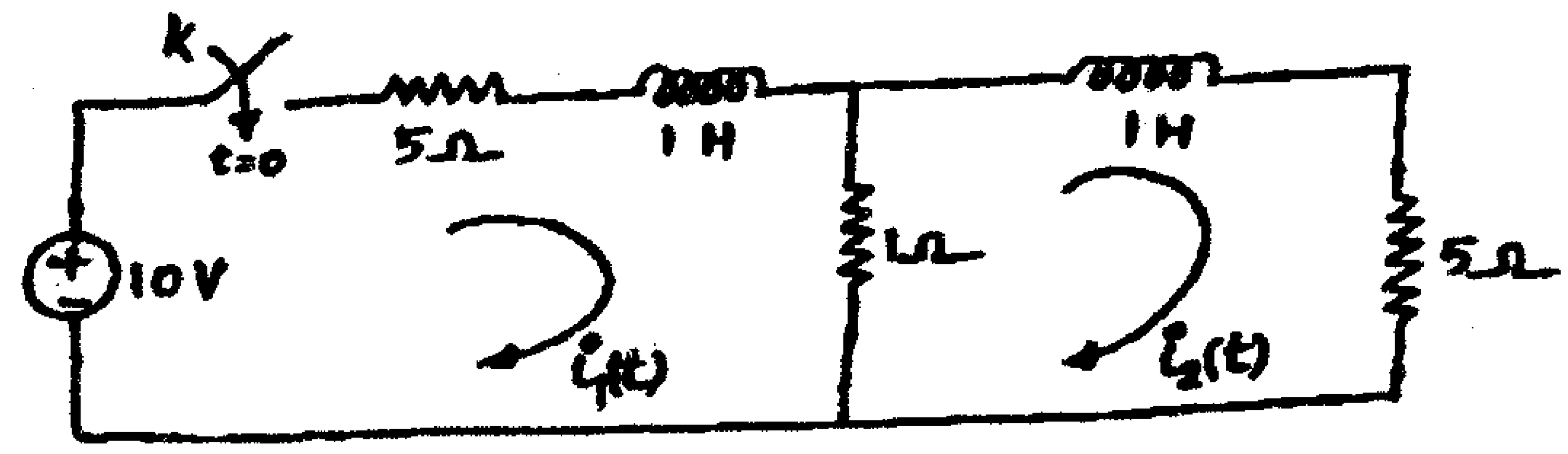

Fig. Q. 12 (b)

13. (a) (i) Determine the power factor, true power, reactive power and apparent power in the circuit shown in Fig. Q. 13 (a) (i). (8)

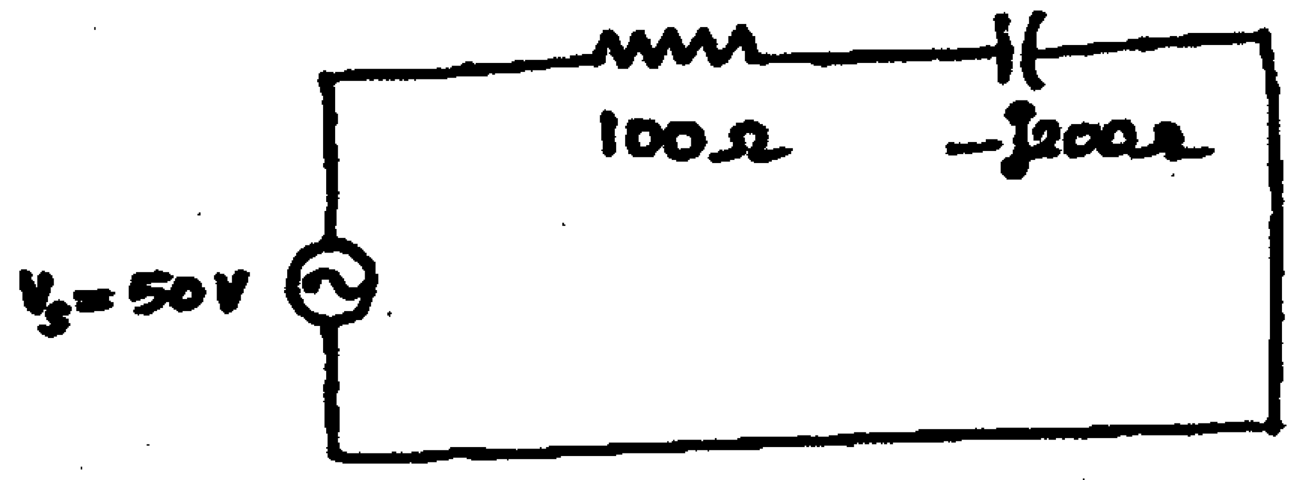

Fig. Q. 13 (a) (i)

(ii) For the circuit shown in Fig. Q. 13 (a) (ii), determine the total impedance, total current and phase angle. (8)

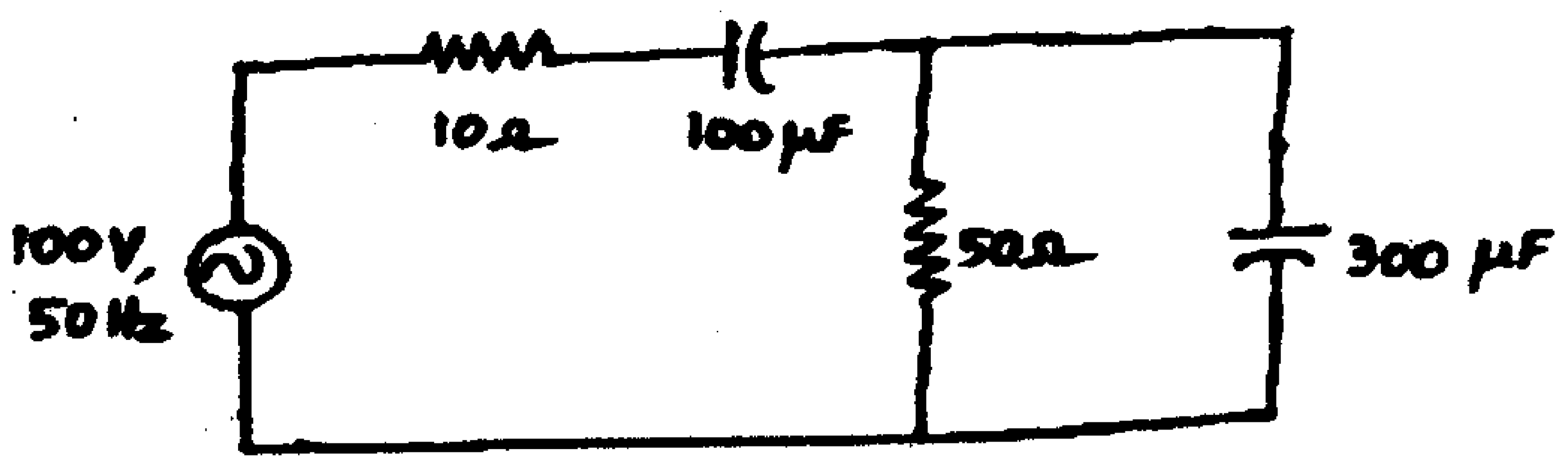

Fig. Q. 13 (a) (ii)

Or

(b) (i) Derive the expression for resonant frequency of a tank circuit. (8)

(ii) An RLC series circuit has R = 12 Ω, L = 0.2 H and C = 100 μF. It is fed from a 100 V variable frequency supply. Plot the variation of current with frequency. Mark the regions of lagging and leading power factors. Take the variation of frequency from 0 to 200 Hz. (8)

14. (a) (i) State and explain Superposition theorem with simple circuits. (6)

(ii) Using Millman's theorem, find the current in the load Z_L as shown in Fig. Q. 14 (a) (ii). (10)

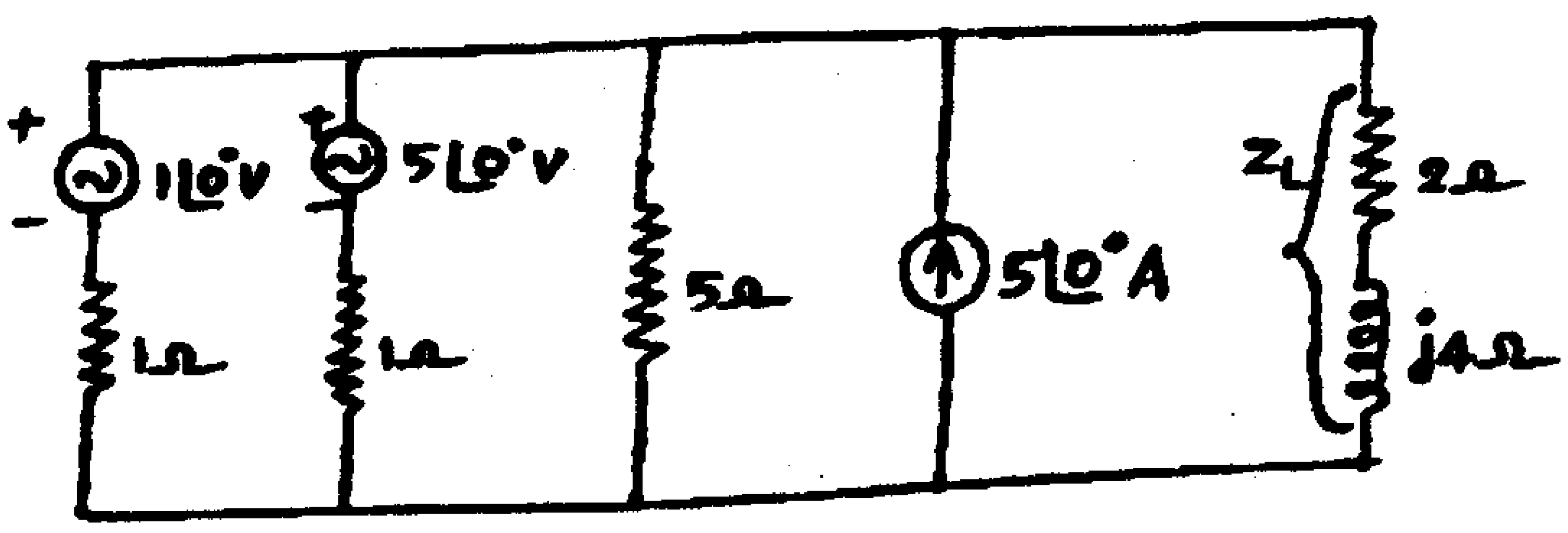

Fig. Q. 14 (a) (ii)

Or

(b) (i) Determine the current flowing through the 5 Ω resistor in the circuit shown in Fig. Q. 14 (b) (i) using Norton's theorem. (8)

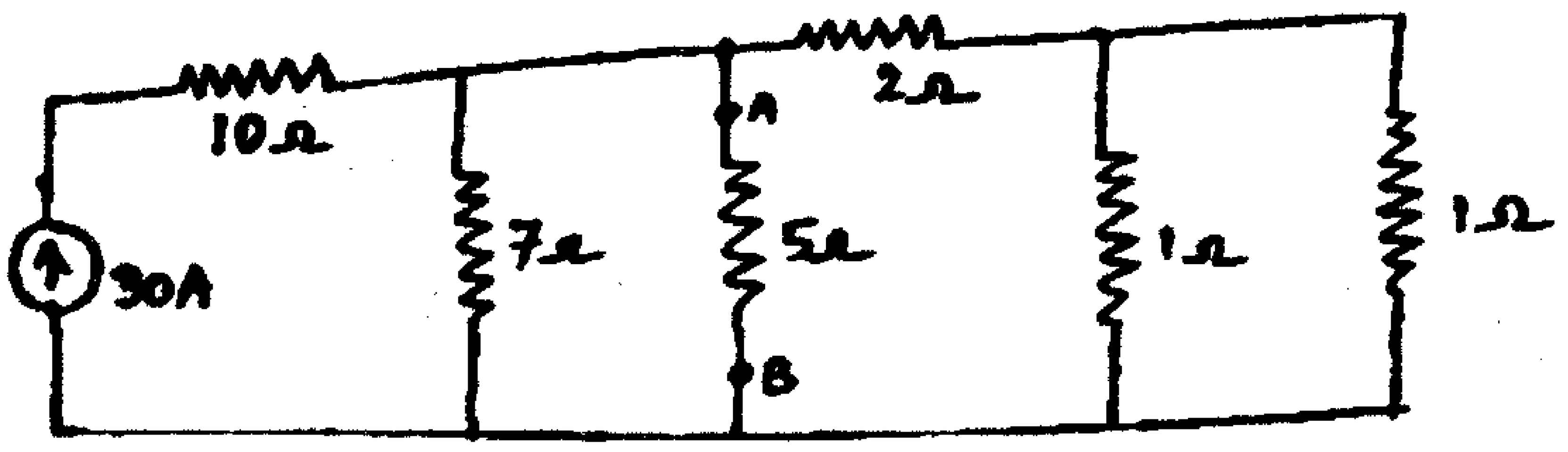

Fig. Q. 14 (b) (i)

(ii) Using the compensation theorem, determine the ammeter reading where it is connected to the 6 Ω resistor as shown in Fig. Q. 14 (b) (ii). The internal resistance of the ammeter is 2 Ω. (8)

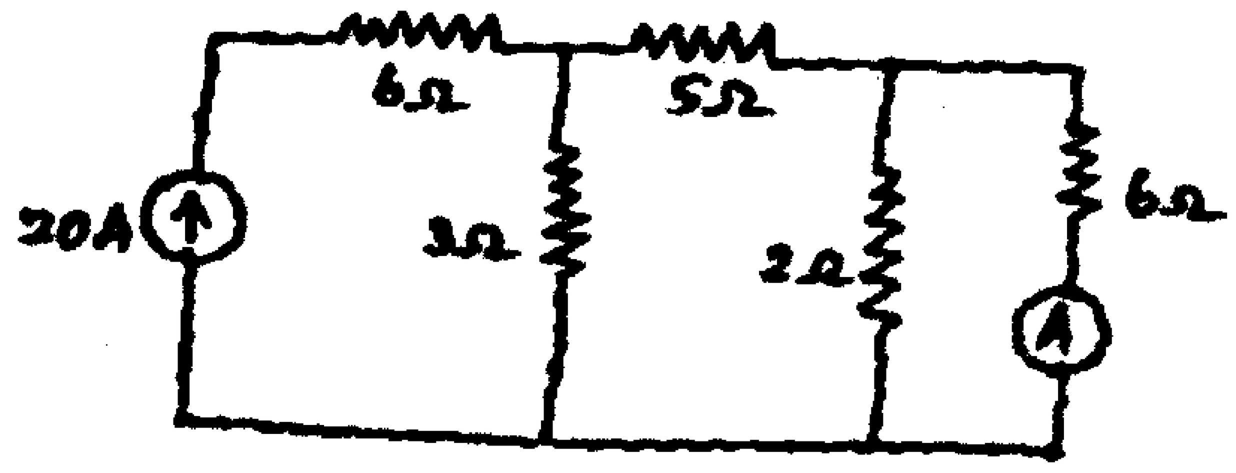

Fig. Q. 14 (b) (ii)

15. (a) (i) For an ideal transformer, show that $\frac{V_1}{V_2} = \sqrt{\frac{L_1}{L_2}}$, where L_1 and L_2 are the self inductance of the primary and secondary winding respectively. (8)

(ii) Two coupled coils have self inductances $L_1 = 10$ mH and $L_2 = 20$ mH. The coefficient of coupling K being 0.75 in the air, find voltage in the second coil and the flux of first coil provided the second coil has 500 turns and the circuit current is given by $i_1 = 2\sin(314t)$ ampere. (8)

Or

(b) A symmetrical three phase 100 V, three wire supply feeds an unbalanced star connected load with impedances of the load as $Z_R = 5\angle 0^\circ\ \Omega$, $Z_Y = 2\angle 90^\circ\ \Omega$ and $Z_B = 4\angle -90^\circ\ \Omega$. Find the line currents, voltage across the impedances and the displacement neutral voltage. (16)

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