EEE-I

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Question Paper Code : 41027

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Second Semester

Electrical and Electronics Engineering

EE 3251 – ELECTRIC CIRCUIT ANALYSIS

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

Also Common to : PTEE 3251 – Electric Circuit Analysis (PTBE EEE for – Regulations 2023)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the various powers available in the AC circuits? Also, write the expressions for these powers.

2. In the circuit shown in Fig. 1, compute the equivalent resistance between a and b.

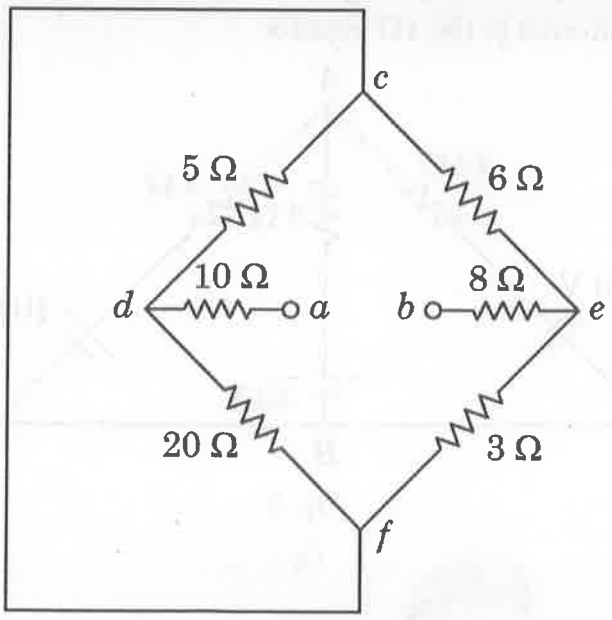

Fig. 1

3. State Millman's Theorem.

4. Using current–division principle, determine the current i_1 in the circuit shown in Fig.2.

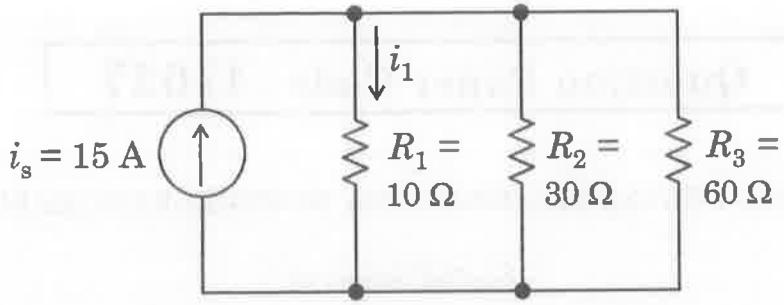

Fig. 2

5. Specify the condition for which the transient current in a series RLC circuit is oscillatory.

6. A series RL circuit consists of resistor of 30 Ω and inductor of 15 H. A constant voltage of 60 V is applied to the circuit at time t = 0. Obtain the current equation.

7. Write the expression for the bandwidth of a series RLC circuit.

8. Determine the maximum possible mutual inductance of inductively coupled coils with self–inductances, L_1 = 25 mH and L_2 = 100 mH.

9. Write the relationship between Line current, (I_L) and Phase current, (I_{ph}) in a delta connected system.

10. In two wattmeter method of three phase power measurement, the readings of wattmeter are 400 W and –35 W. Compute the power factor.

PART B — (5 × 13 = 65 marks)

11. (a) In the circuit shown in Fig.3, use mesh current analysis and find the power delivered to the 4 Ω resistor.

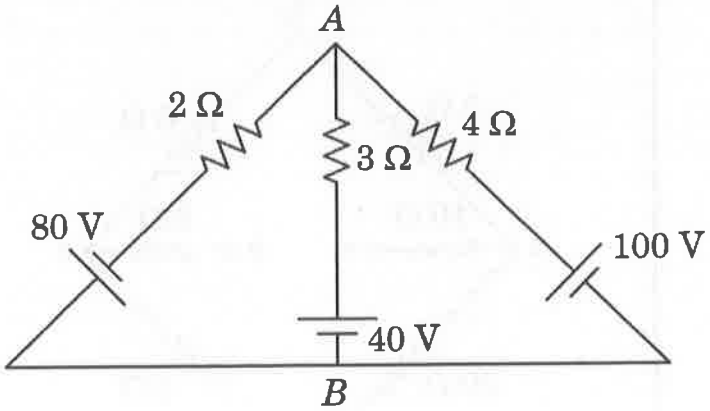

Fig. 3

Or

(b) Using node voltage method, determine the voltages at node 1 and 2 in the circuit shown in Fig. 4.

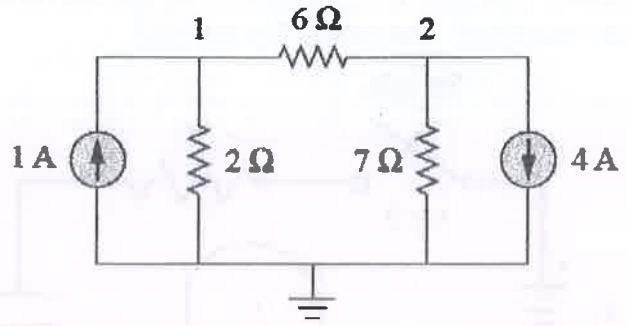

Fig. 4

12. (a) For the circuit shown in Fig.5, find the resistance across the terminals *a* and *b* and determine the current, *i* using star–delta conversion method.

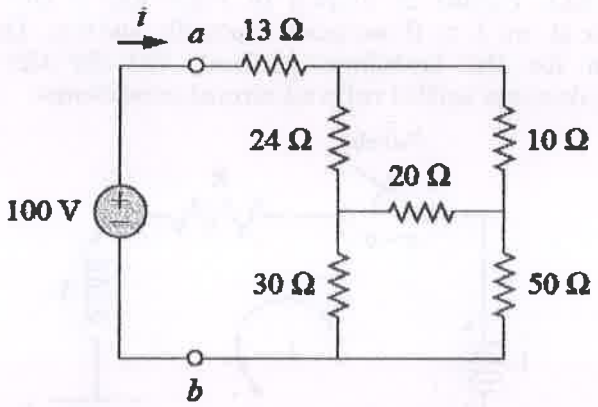

Fig. 5

Or

(b) Determine the voltage, V_0 in the circuit shown in Fig. 6 using superposition theorem.

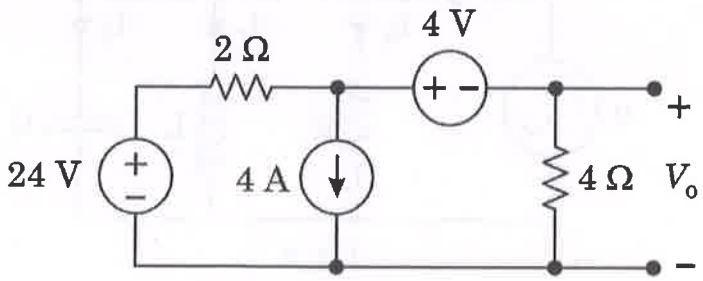

Fig. 6

13. (a) A Series RC circuit as shown in Fig.7, has a DC input voltage, E applied to it at t = 0 seconds through switch. At the instant of switching, there is no initial charge on capacitor and the initial voltage across capacitor is zero. Derive and find the expression for the transient current, i(t). Also, draw the transient response of the current.

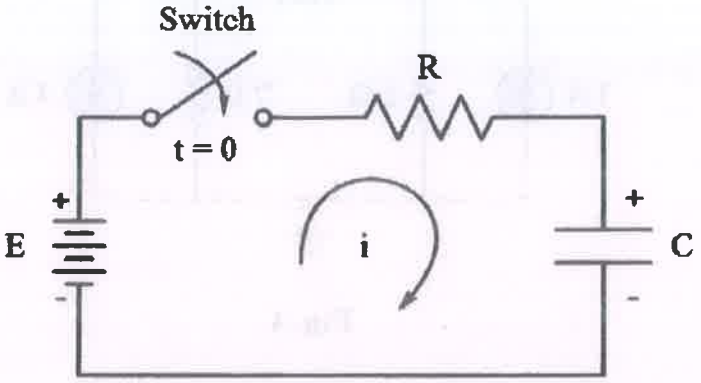

Fig. 7

Or

(b) A Series RLC circuit as shown in Fig.8 has a DC input voltage of E applied to it at t = 0 seconds through switch. Derive and find the expression for the transient current, i(t) for the critically damped condition. Assume initial relaxed circuit conditions.

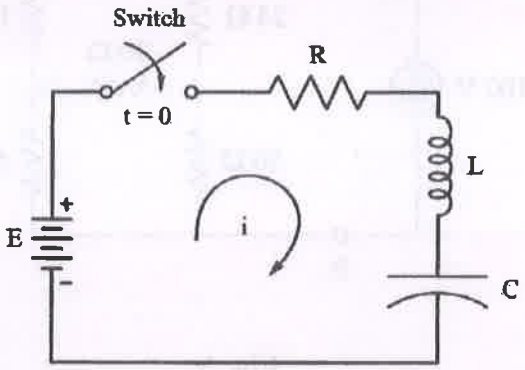

Fig. 8

14. (a) Draw the frequency response of a parallel RLC circuit shown in Fig.9 and derive the expression for bandwidth, B in terms of resistance, R and capacitance, C.

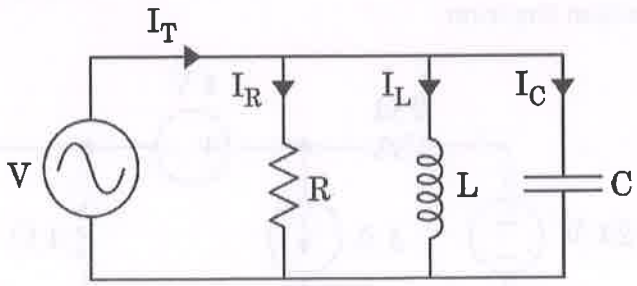

Fig. 9

Or

(b) Derive the expression for equivalent inductance, L for the circuit shown in Fig. 10. L_1, L_2 are the self-inductances and M is the mutual inductance.

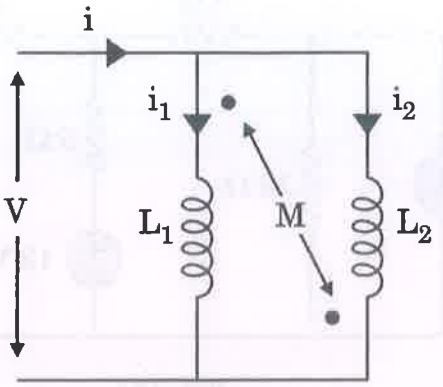

Fig. 10

15. (a) Three identical impedance are connected in star to a 3–phase balanced star connected supply of 400 V. Given that the line current is 35 A and the total real power absorbed is 15 kW. Determine the values of resistance and reactance of the star connected impedances. Note that the given supply voltage is line voltage.

Or

(b) A 3-phase, 415 V, 50 Hz supply is applied across a delta connected circuit with an impedance of 4 + j6 Ω in each phase. Determine the three phase power supplied to the delta connected circuit.

PART C — (1 × 15 = 15 marks)

16. (a) Determine current, I_0 in the circuit shown in Fig. 11 using mesh current analysis.

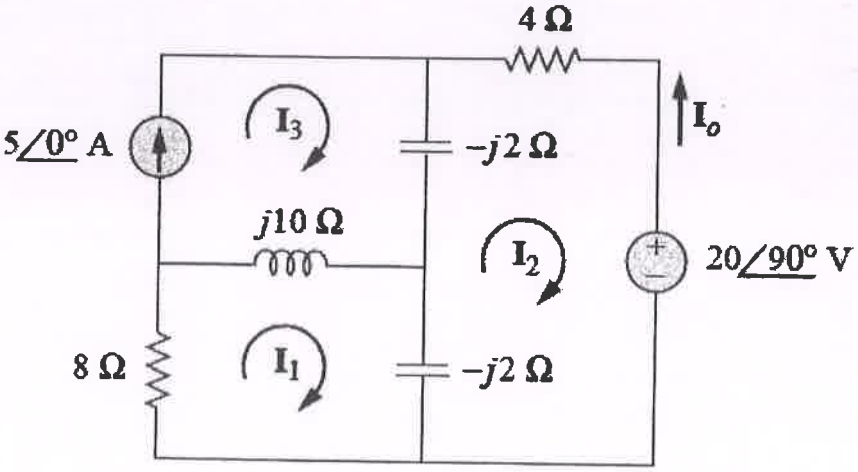

Fig. 11

Or

(b) For the circuit shown in Fig. 12, find the Thevenin's equivalent circuit and determine the voltage, V_o.

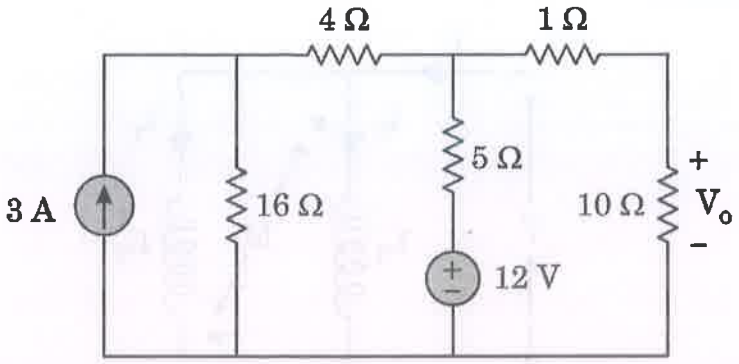

Fig. 12