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EEE

Question Paper Code : 70088

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Second Semester

Electrical and Electronics Engineering

EE 3251 — ELECTRIC CIRCUIT ANALYSIS

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

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw the power triangle for inductive load and capacitive load.

2. Give the procedure for nodal analysis of a circuit.

3. State Tellegen's theorem.

4. What is current division rule for resistances in parallel circuit?

5. What is meant by free and forced response?

6. Define damping ratio.

7. State Dot rule' for coupled circuits.

8. List out the characteristics of a parallel resonant circuit.

9. What is a phase sequence of three-phase system?

10. Write down the expression of neutral current in a unbalanced four-wire star connected load.

PART B — (5 × 13 = 65 marks)

11. (a) Determine loop currents in the network shown in Fig. Q.11 (a) using mesh current analysis. Also calculate the power loss in the 10 Ω resistor.

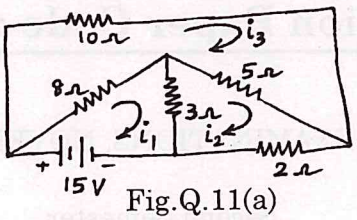

Fig.Q.11(a)

Or

(b) (i) A series RLC circuit has R = 4.2 Ω, L = 0.03 H, c = 450 μF. If the circuit current I = 10 A, find the voltage drop across each element, supply voltage and power factor. Also draw the phasor diagram. Assume the supply frequency is 50 Hz. (8)

(ii) Find the amount of reactive power drawn by the circuit shown in Fig.Q.1 1 (b) (ii). (5)

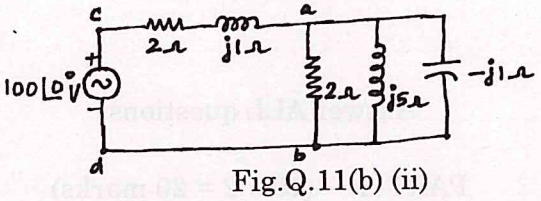

Fig.Q.11(b) (ii)

12. (a) (i) Reduce the given network shown in Fig. Q. 12(a)(i) using star-delta conversion technique and hence calculate the power loss in 1 Ω resistor. (8)

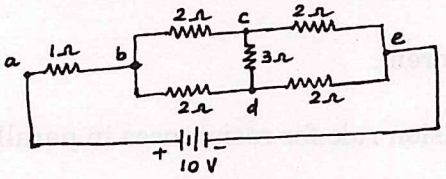

Fig.Q.12(a) (i)

(ii) Find the current in the resistor R_L using the principle of superposition in Fig. Q. 12 (a) (ii). (5)

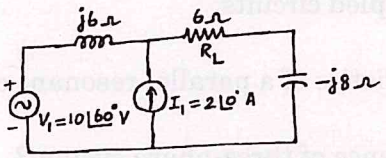

Fig.Q.12(a) (ii)

Or

(b) In the circuit of Fig.Q.12 (b), find the current through load resistor R_L connected across x-y terminals using Thevenin's theorem.

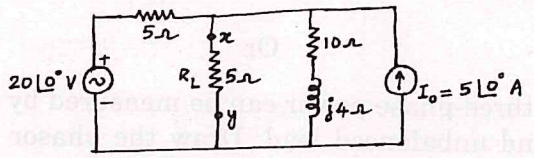

Fig.Q.12 (b)

13. (a) (i) A coil of resistance R and inductance L is in parallel with a capacitance C. Show that the effective resistance under the parallel resonant condition is L/RC. (8)

(ii) Determine the resonant frequency and quality factor of a coil for the series circuit consisting of R = 10 Ω, L = 0.1 H and C = 10 ΩF. (5)

Or

(b) (i) With necessary diagrams, derive the expression for mutual inductance in a single tuned circuit. (8)

(ii) Two coils connected in series have an equivalent inductance of 0.4 H when connected in aiding and 0.2 H if connected in opposing. Calculate the mutual inductance of the coil. (5)

14. (a) In the circuit of Fig. Q.14 (a), the switch is closed on position-1 at t = 0 and after 1 time constant is moved to position-2. Find the transient current response before and after moving position-2. Assume that no initial charge on the capacitor. Also plot the transient current response.

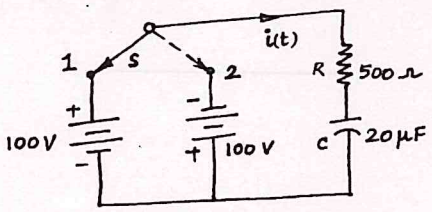

Fig.Q.14(a)

Or

(b) In the circuit shown in Fig. Q. 14 (b), consists of series RC elements R = 100 Ω , C = 25 μF. A sinusoidal voltage v(t) = 200 Sin(500t + ϕ°) volts is applied to the circuit at the time when phase angle ϕ = 0. Determine the transient current response.

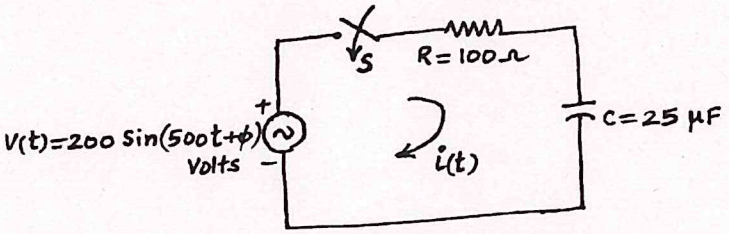

Fig.Q.14(b)

15. (a) With necessary phasor and circuit diagram, deduce the voltage, current, impedance and power relations in the three-phase balanced star connected system.

Or

(b) Show that three-phase power can be measured by two watt meters in the balanced and unbalanced load. Draw the phasor diagrams. Also, derive an expression for power factor in terms of wattmeter readings.

PART C — (1 × 15 = 15 marks)

16. (a) Find the value of load impedance such that maximum power transfer takes place from source to load impedance in the circuit shown in fig. Q. 16(a).

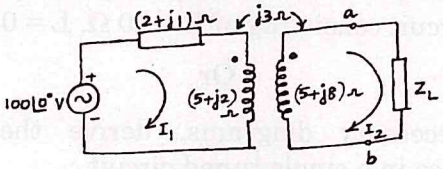

Fig.Q.16(a)

Or

(b) A star connected alternator has 231 V/phase. It supplies a set of lighting loads at phase-R, having phase impedance of 40 ∠ 0° Ω, a capacitive load of 10 ∠–60° Ω at phase-Y and an inductive load of 5 ∠45° Ω at phase-B. The loads are connected in delta. Obtain the phase currents, line currents and line voltages.

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