Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 60033

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 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. State ohm's Law and specify the limitations of ohm's Law.

2. Three resistors R_A, R_B and R_C are connected in series to a 220 V source as shown in Fig. 1. Determine the value of resistors, R_B, and R_C.

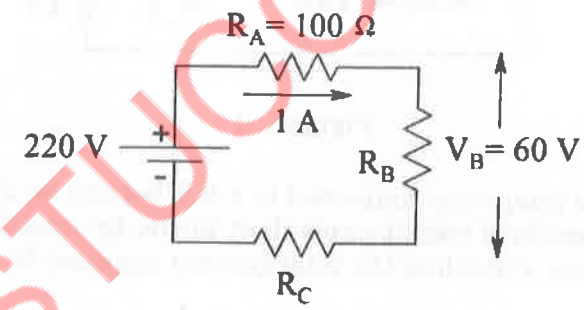

Figure – 1

3. State Reciprocity Theorem.

4. Determine the voltage across the 10 Ω resistor in Fig.2.

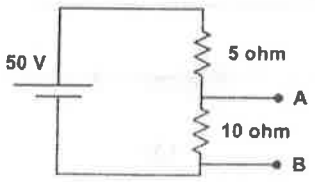

Figure – 2

5. Define the time constant of RL circuit.

6. A series RC circuit consists of resistor of 10 Ω and capacitor of 0.1 F. A constant voltage 10 of 20 V is applied to the circuit at time t = 0. Obtain the current equation.

7. Define Quality factor of the coil.

8. Two identical coils, each have self-inductance, L = 0.03 H. If coefficient of coupling, k is 0.8, determine the value of mutual inductance between the coils, M.

9. In two wattmeter method of three phase power measurement, compute the readings of wattmeters in terms of voltage, V_L. and current, I_L if the power factor is unity.

10. What is power factor leading and power factor lagging?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Determine the mesh currents I_1 and I_2 in the circuit shown in the Fig. 3. (7)

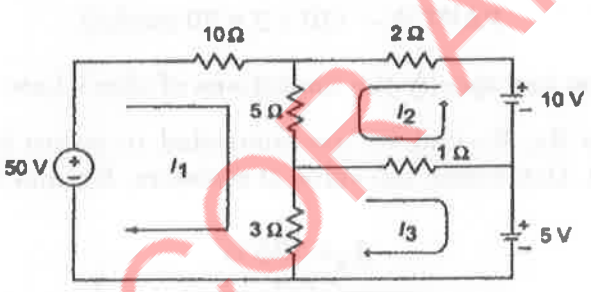

Figure – 3

(ii) Three lamps are connected to a 9 V battery as shown in Fig.4. Draw the resistive circuit equivalent model by modelling each lamp as a resistor. Calculate the total current supplied by the battery. (6)

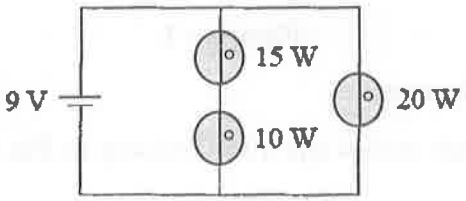

Figure – 4

Or

(b) (i) Using node voltage method, determine the voltages at node 1 and 2 in the circuit shown in Fig. 5. (7+6)

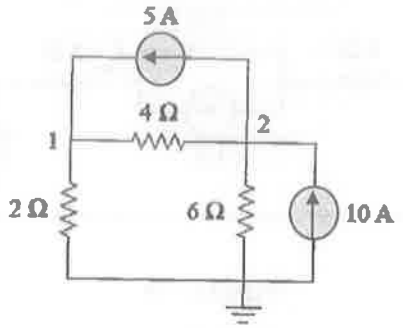

Figure – 5

(ii) If $R_{eq}=50\Omega$, in the circuit shown in Fig. 6, determine the value of R. (7+6)

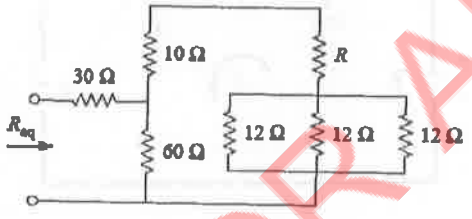

Figure – 6

12. (a) For the circuit shown in Fig.7, find the Thevenin's equivalent circuit and find the value of (i) R_L for maximum power transfer and (ii) the maximum power transferred to R_L using maximum power transfer theorem. (13)

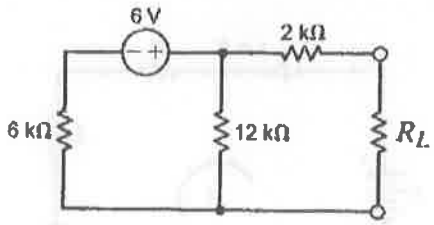

Figure – 7

Or

(b) Determine the current, I in the circuit shown in Fig. 8 using the superposition theorem. (13)

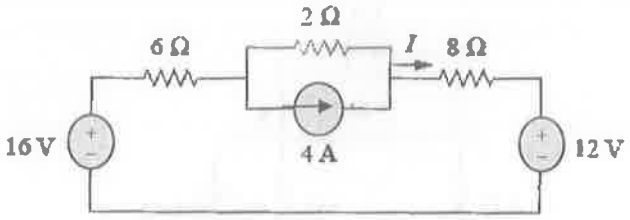

Figure – 8

13. (a) A series RL circuit as shown in Fig. 9, has a dc input voltage, E applied to it at t = 0 seconds through switch. At the instant of switching, the current, i is zero. Derive and find the expression for the transient current, i(t). Also, draw the transient response of the current (13)

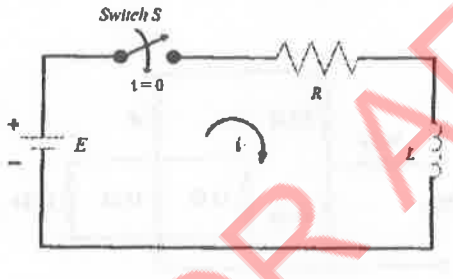

Figure – 9

Or

(b) A series RLC circuit as shown in Fig. 10 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 overdamped condition. Assume initial relaxed circuit conditions. (13)

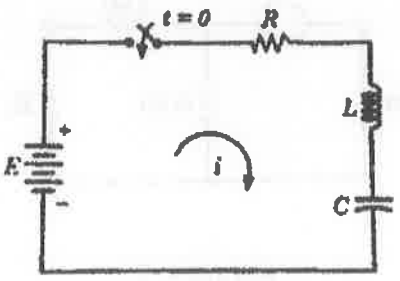

Figure – 10

14. (a) Derive the expression for equivalent inductance, L for the circuit shown in Fig. 11. L_1, L_2 are the self inductances and M is the mutual inductance. (13)

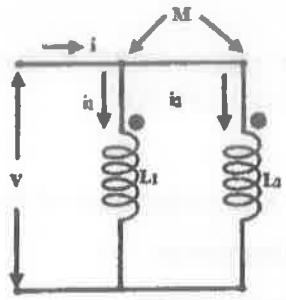

Figure – 11

Or

(b) Draw the frequency response of a series RLC circuit and derive the expression for bandwidth, B and Quality factor, Q in terms of resistance, R and inductance. L. (13)

15. (a) A balanced star connected load takes 9 kW at a lagging power factor of 0.8 when connected to a three phase, star connected 400 V, 50 Hz supply. Find the per phase values of load elements. Given supply voltage is line voltage. (13)

Or

(b) Three coils of resistance 4 Ω and inductive reactance 3 Ω are connected in delta across 400 V, 50 Hz supply. Find the current in the coil, line current, active, reactive and apparent power. (13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Why an unbalanced star connected load is not normally used in 3 wire 3 phase system? (6)

(ii) A balanced delta connected 3ϕ load is fed from 3ϕ, 400 V supply. The line current is 20 A and total power absorbed by load is 10 kw.

Calculate

(1) The impedance in each branch

(2) The power factor

(3) Total power consumed if some impedance are star connected. (9)

Or

(b) (i) Three single phase loads can be connected in either star or in delete to form a 3 phase load. Which of these connections results in higher current when connected to a 3 phase supply? (6)

(ii) A balanced 3ϕ star connected load is fed from 400V, 3ϕ, 50 Hz supply.

The current per phase is 25 A (lagging) and total active power observed by load is 13.86 KW.

Determine

(1) Resistance and inductance of load per phase

(2) Total reactive power

(3) Total apparent power. (9)

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EEE

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

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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.

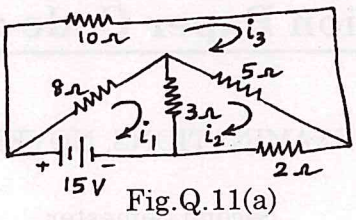

Fig.Q.11(a)

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)

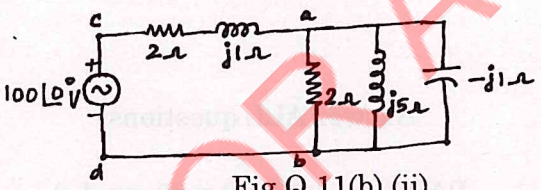

Fig.Q.11(b) (ii)

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)

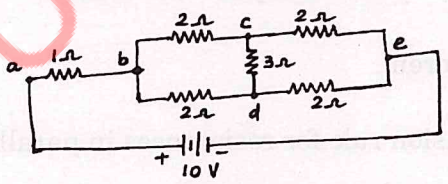

Fig.Q.12(a) (i)

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

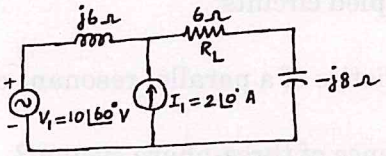

Fig.Q.12(a) (ii)

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.

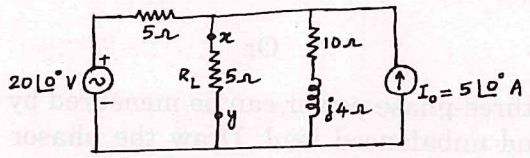

Fig.Q.12 (b)

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.

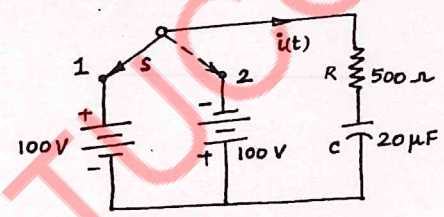

Fig.Q.14(a)

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.

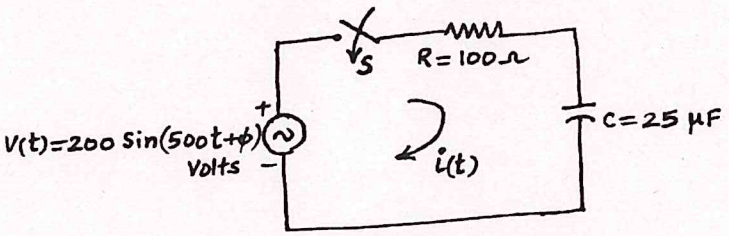

Fig.Q.14(b)

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).

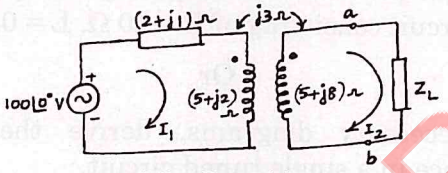

Fig.Q.16(a)

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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