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Question Paper Code : 70082

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

Second Semester

Electronics and Communication Engineering

EC 3251 — CIRCUIT ANALYSIS

(Common to : Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Summarize the basic mesh analysis procedure.
2. State Ohm's law and its limitations.
3. Three resistors 10 ohm, 5 ohm and 20 ohm are connected in star. What are the equivalent delta resistors?
4. Define dual networks. List out four pairs of dual quantities.
5. What is admittance? What are its components?
6. Give the relation between apparent power, average power and relative power.
7. An RLC series circuit has $R = 10 \text{ ohm}$, $X_C = 62.833 \text{ ohm}$. Find the value of L for resonance at 50HZ.
8. Write the characteristics of series resonance.
9. Define mutual inductance and write an expression for it.
10. State the dot rule for coupled circuit.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Define the terms Nodes, Branches, Loops and Meshes. (5)
(ii) Find the number nodes, branches, loops and meshes present in the given circuit. [Fig. Q. 11(a): voltage source V on the left; two resistors along the top, two along the bottom, one vertical resistor in the middle and one vertical resistor on the right, forming two meshes side by side] (8)
- Or
- (b) (i) State and Explain Kirchhoff's laws. (10)
(ii) List the difference between series and parallel circuits. (3)

12. (a) Determine the current I in the network by using Thevenin's theorem. [Fig. Q. 12(a): three parallel branches between top and bottom lines: 4 ohm in series with a 10 V battery; 6 ohm in series with a 12 V battery; and a 10 ohm load between terminals A (top) and B (bottom) carrying current I downward]

Or

- (b) Find the current through 23 ohm resistor of the given circuit using superposition theorem. [Fig. Q. 12(b): between top and bottom lines from left to right: a 27 ohm resistor; a 47 ohm resistor in series with a 200 V source (+ at top); then a 4 ohm resistor in the top line; a 20 A current source (arrow up); and the 23 ohm resistor with current I downward]
13. (a) In a RLC series circuit, the applied voltage is 5V. Drops across the resistance and inductance are 3V and 1V respectively. Calculate the voltage across the capacitor. Draw the phasor diagram.

Or

- (b) Use nodal voltage method to find the power dissipated in the 10 ohm resistor on the circuit shown in the figure. Q. 13 (b) [Fig. Q. 13(b): 40 V battery in series with 4 ohm feeding node 1; 5 ohm from node 1 to node 2 and 5 ohm from node 2 to node 3; a 10 A current source connected between node 1 and node 3 over the top; 8 ohm from node 1 to node 4, 10 ohm from node 2 to node 4, 4 ohm from node 3 to node 4 (node 4 is the bottom reference); 8 ohm from node 3 to the bottom line; a 15 A current source (arrow up) on the right between the bottom line and node 3]
14. (a) A series RLC circuit has $R = 50$ ohm, $L = 0.2$ H and $C = 50$ microF. Constant voltage of 100V is impressed upon the circuit at $t = 0$. Find the expression for the transient current assuming initially relaxed conditions.

Or

- (b) For the circuit shown, determine the currents i_1 and i_2 when the switch is closed at $t = 0$. Assume that the initial current through the inductor is 0. [Fig. Q. 14(b): 20 V battery and switch S in series with a 5 ohm shunt resistor (mesh current $i_1(t)$); second mesh: the 5 ohm resistor, a 10 ohm resistor and a 2 H inductor (mesh current $i_2(t)$)]
15. (a) For the given coupled circuit, find the voltage across the 5 ohm resistor. [Fig. Q. 15(a): source 75 angle 0 deg in mesh 1 with an inductive reactance $j5$ ohm; common branch of 3 ohm in series with $-j4$ ohm; mesh 2 has inductive reactance $j10$ ohm and the 5 ohm resistor; the $j5$ ohm and $j10$ ohm coils are coupled with $k = 0.8$; mesh currents i_1 and i_2]

Or

- (b) For the network given, draw the graph and a tree. Show the link currents. Write the tie-set schedule for the tree, the equations for branch currents in terms of link currents. Also write independent equations. [Fig. Q. 15(b): network with nodes A, B, C, D and six resistive branches: 1 from B to D over the top, 5 from B to C, 6 from C to D, 3 from B to A, 4 from C to A, 2 from D to A]

PART C — (1 × 15 = 15 marks)

16. (a) A series circuit containing pure resistance and pure inductance the current and voltages are $i(t) = 5 \sin(314t + 2\pi/3)$ and $v(t) = 20 \sin(314t + 5\pi/6)$
- (i) What is the impedance of the circuit?
 - (ii) What are the values of resistance, inductance and power factor?
 - (iii) What is the power drawn by the circuit?

Or

- (b) When a voltage of 100 V at 50Hz is applied to choking coil 1, the current taken is 8 A and the power is 120 W. When the same supply is applied to choking coil 2, the current is 10 A and the power is 500 W. Find the current and power when the supply is applied to two coils connected in series.