

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : 30135

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

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. Define charge.
2. Write the characteristics of series connection of resistances.
3. Draw the Thevenin's equivalent circuit.
4. Define Dependent sources.
5. A resistance 100 ohm and capacitive reactance $-j150$ ohm are connected in series. The voltage applied is 50 V. Determine the power factor.
6. Write the expression for the total admittance of Y1 and Y2 in series and parallel combination.
7. Define resonance. What is the condition for resonance for an RLC series circuit?
8. An RLC circuit consists of a resistance of 1000 ohm, an inductance of 100 mH and a capacitance of 10 microF. Find the Q factor of the circuit.
9. Define Link.
10. What is the maximum possible mutual inductance of two inductively coupled coils, with self-inductances $L_1 = 25$ mH, $L_2 = 100$ mH?

PART B — (5 × 13 = 65 marks)

11. (a) Determine the current in the 4 ohm branch in the given circuit? Use mesh analysis method. [Figure: 12 V battery on the left and 10 V battery on the right; top line 2 ohm and 2 ohm with a 12 ohm resistor in the middle vertical branch; middle line 1 ohm and 3 ohm; bottom branch a 24 V battery in series with 4 ohm]

Or

- (b) A network of resistors has a pair of input terminals AB connected to a d.c supply and a pair of output terminal CD connected to a load resistor of 60 ohm. The resistances of the network are $AC = BD = 90 \text{ ohm}$, $AD = BC = 40 \text{ ohm}$. Find the ratio of the current in the load resistor to that taken from supply. [Figure: supply V across A-B; 90 ohm from A to C carrying I_2 ; 90 ohm from B to D; 40 ohm diagonals A-D and B-C; 60 ohm load from C to D carrying I_1 ; branch currents marked I, $I_2 - I_1$, $I - I_2$, $I - I_2 + I_1$]
12. (a) Find the current in the 2 ohm resistor between A and B for the network using superposition theorem. [Figure: 10 V battery on the left; 5 ohm from its top to A; 3 ohm from A to D; 20 V battery between D and C on the right; the 2 ohm resistor from A down to B; 4 ohm from B to C; the bottom of the 10 V battery is joined to B and also, through another 2 ohm resistor along the bottom, to C]
- Or
- (b) A loud Speaker is connected across the terminals A and B of the network shown in figure below. What should be the value of impedance of the speaker to obtain maximum power transferred to it and what is the maximum power? [Figure: source $V = 10 \text{ angle } 30 \text{ deg volts}$ in series with an impedance $(3 + j4) \text{ ohm}$ to terminal A; a capacitive reactance $-j5 \text{ ohm}$ across A-B]
13. (a) A voltage source of 100V with a resistance of 10 ohm, an inductance of 50mH and a capacitance of 50 microF are connected in series. Calculate the impedance when frequency is (i) 50Hz, (ii) 500Hz, (iii) Power factor at 100Hz.
- Or
- (b) Solve for V_1 and V_2 using nodal method for the circuit in the figure. $V = 100 \text{ Volts}$. [Figure: source V in series with $j2 \text{ ohm}$ to node V_1 ; from V_1 a 2 ohm resistor in series with $-j7 \text{ ohm}$ to the bottom line; $j5 \text{ ohm}$ from V_1 to node V_2 ; 4 ohm from V_2 to the bottom line]
14. (a) Explain in detail about the Source Free series RLC Circuit.
- Or
- (b) A series circuit has $R = 100 \text{ ohm}$, $L = 50\text{mH}$, and $C = 100 \text{ microF}$ and is supplied with 200 V, 50 Hz. Find the impedance, the current, the power factor, the power and the voltage drop across each element.
15. (a) 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. [Figure: nodes A, B, C, D; 1 ohm from B to D over the top; 5 ohm from B to C; 6 ohm from C to D; 3 ohm from B to A; 4 ohm from C to A; 2 ohm from D to A]
- Or

- (b) (i) Determine the T-equivalent circuit of the linear transformer shown. (3)
 [Figure: primary coil 10 H across terminals a-b with current I_1 , secondary coil 4 H across terminals c-d with current I_2 entering at c; mutual inductance 2 H; dots at the top of both coils]
- (ii) For the Ideal Transformer circuit shown here, find the source current I_1 , the output voltage V_o , and the complex power supplied by the source. (10)
 [Figure: source $120 \angle 0^\circ$ V rms in series with 4 ohm and $-j6$ ohm feeding the primary (voltage V_1) of a 1:2 ideal transformer; secondary voltage V_2 across a 20 ohm load with output voltage V_o and current I_2 ; dots at the bottom of the primary and at the top of the secondary]

PART C — (1 × 15 = 15 marks)

16. (a) (i) Find the current in the branches A, B, C of the following 2 source network. Apply super position principle. [Figure: 4 A source on the left; branch A of 2 ohm in the top line; branch C of 2 ohm vertical in the middle; branch B of 4 ohm in the top line; 2 A current source (arrow up) on the right] (12)
- (ii) A Y-connected resistive network consists of 2 ohm in each arm. Draw the equivalent delta-connected network and insert the values. (3)
- Or
- (b) (i) In the circuit of the figure, compute the current through the ∞ resistance ammeter. Use Norton's theorem. [Figure: bridge with 5 ohm from node a to the left node, 5 ohm from a to the right node, 8 ohm from the left node to node b, 2 ohm from the right node to b; ammeter A connected between the left and right nodes; 20 V battery connected between the left and right nodes through the bottom loop; mesh currents I_1, I_2, I_3] (10)
- (ii) Find the Norton's and the Thevenin's equivalent for the circuit shown. (5)
 [Figure: 2 A current source on the left; 5 ohm (current I_1) and 5 ohm (current I_2) in parallel branches; 10 V source on the right]