WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 1st Semester Examination, 2021-22

ELSACOR01T-ELECTRONICS (CC1)

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

GROUP-A

1. Answer any ***five*** questions from the following: 2×5 = 10

(a) What is the 'time constant' of a RC circuit?

(b) Show that the voltage across an inductor leads the current by a phase angle of 90°.

(c) A circular ring is made of a continuous wire of resistance 12 Ω. The equivalent resistance between two points *P* and *Q* on the ring is $\frac{8}{3}\,\Omega$. Find the ratio of wire lengths (longest to shortest) between the points *P* and *Q*.

(d) "In a DC circuit, an inductor behaves as a resistor" — Explain the statement.

(e) State Millman's theorem.

(f) Why do we express AC voltages/currents in terms of rms values?

(g) "Thevenin's Theorem cannot be applied to a circuit which contains a diode" — Explain.

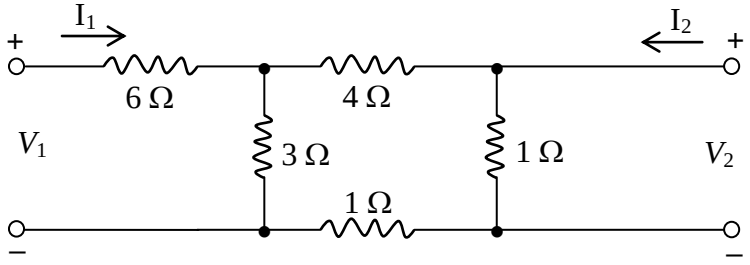
(h) Define: (i) Symmetric and (ii) Reciprocal network.

(i) A 25 Ω resistance has a voltage $v = 150\sin(377t)$ V. Find the average power delivered by the voltage sources in one complete cycle.

GROUP-B

Answer any *six* questions from the following 5×6 = 30

2. Find the *Z* parameters of the network shown below. 5



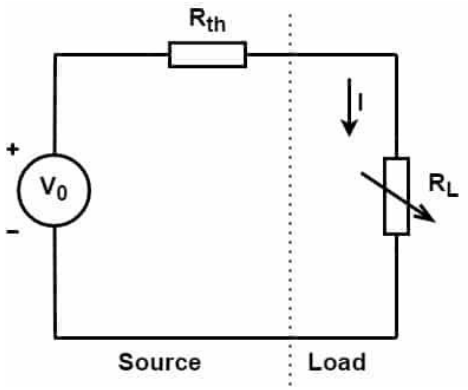
3. (a) Find relationship between bandwidth and quality factor. 3

   (b) Show that the resonant frequency is the geometric mean of the half power frequency. 2

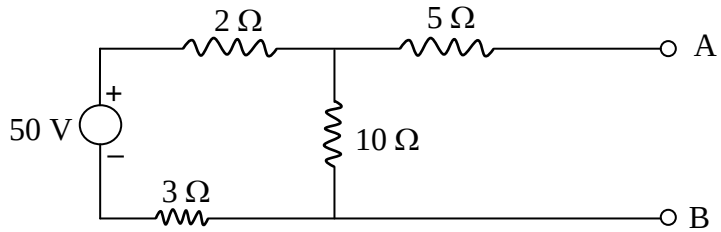
4. (a) Derive the transient response (growth OR decay) of a DC series L-R circuit. 3

   (b) For parallel combination of two inductors L_1 and L_2, show that the effective inductance (L) is given by $\frac{1}{L} = \frac{1}{L_1} + \frac{1}{L_2}$ (ignore the mutual inductance between L_1 and L_2). 2

5. (a) A typical circuit is shown below. Show that the maximum power is transferred when $R_L = R_{\text{Th}}$. Further, show that the maximum power transferred to load resistance R_L is $\frac{V_{\text{Th}}^2}{4R_{\text{Th}}}$. 3



   (b) For the following circuit, find the value of resistance to be connected at A – B so that maximum power is transferred by the source. What is maximum power? 1+1



6. (a) Find the expression for resonant frequency of a parallel RLC circuit. 3

   (b) Compare in brief, the series and parallel resonance. 2

7. (a) What is meant by a Ideal Current Source? 2

   (b) How a ideal current source differ from a ideal voltage source? 2

   (c) What is a dependent energy source? 1

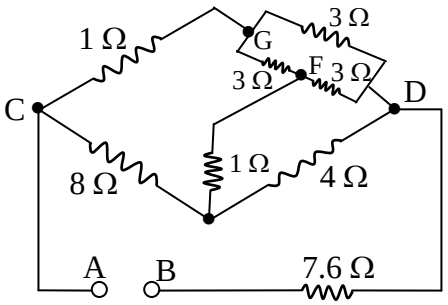
8. (a) Find expression for output voltage of a low pass filter. 2

   (b) Show how it works on 2+1

   (i) Phase-Log circuit

   (ii) Integrator.

9. Find the equivalent resistance across the terminals A and B (you may use star-delta or delta-star conversion). 5



10. A DC circuit is shown below. In this circuit, the variable resistance R_{var} is equally divided among the positions labelled by 0 to 5.

(a) Find the position of the R_{var} for maximum V_{out}. 1

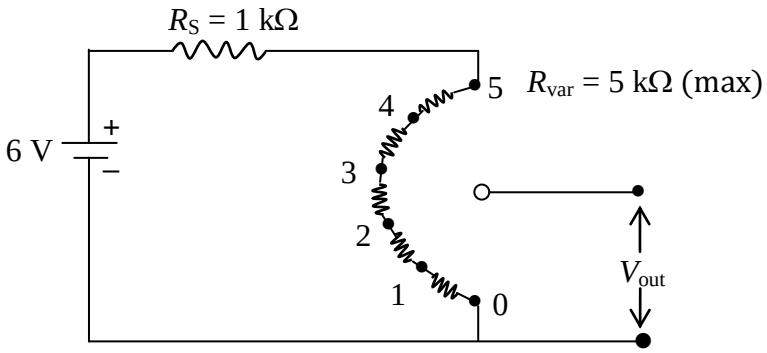
(b) Find the current flowing through the circuit for the case stated above. 1

(c) Let the position of the variable resistor be at 2, and consider a load resistance of 2 Ω (not shown in the figure) is connected across V_{out}. Under such condition, find 3

(i) V_{out},

(ii) current through R_S and

(iii) current through the load resistance.



11.(a) Why impedance is complex? 1

(b) What are the real and imaginary parts of a complex impedance called? 2

(c) Define power factor. 2

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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