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(CBCS)

(1st Semester)

ELECTRONICS

Paper : EL–101

(Electronics Instruments and Circuit Analysis)

Full Marks : 75

Time : 3 hours

(PART : A—OBJECTIVE)

(*Marks* : 25)

The figures in the margin indicate full marks for the questions

SECTION—A

(*Marks* : 10)

Tick (✓) the correct answer in the brackets provided : 1×10=10

1. When checked with an ohmmeter, an 'open' resistor reads

(a) infinite ( )

(b) zero ( )

(c) low but not zero ( )

(d) high but not infinite ( )

2. The main function of a capacitor is to

(a) block current flow ( )

(b) help current flow ( )

(c) store energy ( )

(d) dissipate heat ( )

3. An ammeter should have _____ resistance.

(a) infinite ( ) *(b)* very large ( )

(c) zero ( ) *(d)* very low ( )

4. The most accurate device for measuring voltage is

(a) voltmeter ( ) *(b)* multimeter ( )

(c) CRO ( ) *(d)* VTVM ( )

5. Voltage leads current in the circuit containing pure resistor by

(a) 0° ( ) *(b)* 180° ( )

(c) 90° ( ) *(d)* 360° ( )

6. At resonance in an a.c. circuit, we have

(a) $^{2} \quad 1/\quad C$ ( ) *(b)* $1/\sqrt{\quad C}$ ( )

(c) $^{2} \quad 1/\sqrt{LC}$ ( ) *(d)* $1/\sqrt{LC}$ ( )

7. The sum of resistance through which two current loops are passing, is called

(a) mutual resistance ( )

(b) self-resistance ( )

(c) internal resistance ( )

(d) input resistance ( )

8. What is the equivalent voltage for a current source of 5 A in series with 2 resistance?

(a) 10 V ( )

(b) 2·5 V ( )

(c) 7 V ( )

(d) 3 V ( )

9. Superposition theorem can be applied only to circuit having _____ elements.

(a) non-linear ( )

(b) passive ( )

(c) linear bilateral ( )

(d) resistive ( )

10. To get the Norton's current, you have to

(a) short the load resistor ( )

(b) open the load resistor ( )

(c) short the voltage source ( )

(d) open the voltage source ( )

SECTION—B

(*Marks* : 15)

Answer the following questions : 3×5=15

1. How will you interpret the colour bands of a resistor?

OR

Explain how to check capacitors with ohmmeter.

2. State and explain the classification of instrument according to their functions.

OR

With a circuit diagram, explain the operation of bridge rectifier voltmeter.

3. Discuss the phase relation between voltage and current waves in a pure resistor.

OR

Derive the voltage and current relations in an a.c. circuit containing *R* and *C*.

4. How will you convert a current source into voltage source?

OR

Derive an expression for current division law.

5. Prove that the maximum power is transferred to the load when internal impedance is equal to load impedance.

OR

A generator develops 200 V and has an internal resistance of 100 . Find the power delivered to a load of *(a)* 100 and *(b)* 300.

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* Explain how to check resistors with an ohmmeter. 3

(b) Two capacitors of 4 F and 12 F capacitance and each of working-voltage rating of 24 V are connected in series across a 24 V battery. Calculate *(i)* charge across each, *(ii)* voltage across each and *(iii)* combined voltage rating. 3

(c) Describe the constructional details of ceramic capacitors. Give some advantages of ceramic capacitor over other non-electrolytic capacitors. 2+2=4

OR

2. *(a)* Define resistor. Write the uses of resistor. 1+2=3

(b) Explain the impedance offered by a coil. 3

(c) A 50 F capacitor is charged a 40 K resistor to a potential difference of 400 V. Calculate *(i)* time constant of the circuit, *(ii)* value of full charge, *(iii)* charge acquired in one time-constant and *(iv)* energy stored in the fully-charged capacitor. 4

3. *(a)* Explain the sensitivity of a multimeter. Write down the application of multimeter. 2+1=3

(b) Explain the application of VTVM for resistance measurements. 3

(c) A PMMC instrument with a full-scale deflection (f.s.d.) current of 100 A and R_m 1 k is to be used as a voltmeter of range 0–100 V (r.m.s.). The diodes used in the bridge rectifier circuit are of silicon. Calculate the value of multiplier resistor R_s required. 4

OR

4. *(a)* Explain with circuit diagram, the working of balanced bridge type VTVM. 4

(b) Explain with the diagram, the construction and action of CRO. 6

5. *(a)* What is harmonics? How will you obtain a complex wave from sinusoidal harmonics? 1+1=2

(b) What is meant by bandwidth? Show that bandwidth of a resonant circuit = f_o / Q_s, where symbols have their usual meanings. 1+3=4

(c) Discuss the phase relation between voltage and current waves in a pure capacitor. 4

OR

6. *(a)* What are the uses of low-pass filters and high-pass filters? 3

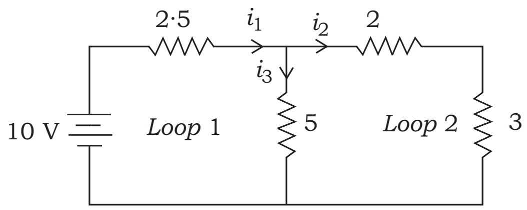
(b) What is skin effect? How will you minimize this effect? 1+2=3

(c) Derive the condition of having a perfect choke for a series LCR circuit. 4

7. *(a)* Differentiate between active and passive elements. 2

(b) Explain briefly ideal and practical current sources. 2

(c) From the circuit, find all the branch current and voltage drops across all the resistors : 3+3=6

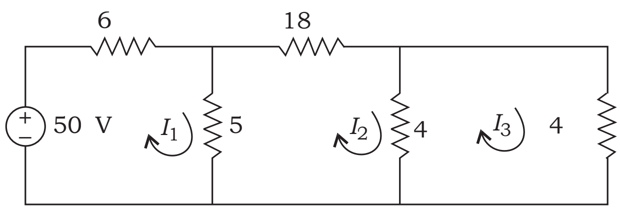


OR

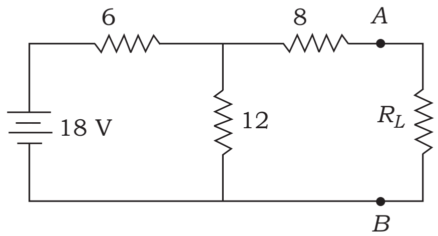
8. *(a)* Differentiate between open and short circuits. 2

(b) What is lumped circuit? State and explain ladder method of network analysis. 1+3=4

(c) Find I_1, I_2 and I_3 using Mesh analysis : 4



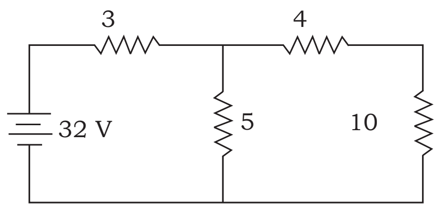
9. *(a)* In the following circuit, find the value of load resistance R_L to be connected across terminals A and B which would abstract maximum power from the circuit. Also find the value of this maximum power. 4



(b) State and prove the reciprocity theorem. 6

OR

10. *(a)* Apply Norton's theorem to find current through 10   resistor of the circuit shown in the figure below : 4



(b) State and prove Thevenin's theorem. 6

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