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(CBCS)

(1st Semester)

ELECTRONICS

(Electronic Instruments and Circuit Analysis)

Full Marks : 75

Time : 3 hours

Simple Calculator may be used in this paper

(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. Mutual inductance between two coils when connected in series is given by

(a) $M \quad \frac{L_o \quad L_a}{4}$ (   )

(b) $M \quad \frac{L_a \quad L_o}{4}$ (   )

(c) $M \quad \frac{L_o \quad L_a}{2}$ (   )

(d) $M \quad \frac{L_a \quad L_o}{2}$ (   )

2. Ferrite cores commonly used at high frequencies

(a) decrease core losses ( )

(b) increase core losses ( )

(c) decrease inductance ( )

(d) increase resistance ( )

3. A galvanometer in series with a high resistance is called

(a) an ammeter ( )

(b) a voltmeter ( )

(c) a wattmeter ( )

(d) an ohmmeter ( )

4. If alternating current (a.c.) is passed through a permanent magnet moving coil (PMMC), the driving torque would be

(a) increased ( )

(b) decreased ( )

(c) zero ( )

(d) constant ( )

5. In a series R-L-C circuit, R 100 , X_L 300 and X_C 200 . The phase angle of the circuit is

(a) 90° ( )

(b) 45° ( )

(c) 0° ( )

(d) 60° ( )

6. A resonance curve for a series circuit is a plot of frequency versus

(a) voltage ( )

(b) impedance ( )

(c) current ( )

(d) reactance ( )

7. What is the equivalent current for a voltage source of 12 V in series with 4 resistance?

(a) 3 A ( )

(b) 12 A ( )

(c) 2 A ( )

(d) 0 A ( )

8. An ideal current source is one whose internal impedance is

(a) very low ( )

(b) zero ( )

(c) infinity ( )

(d) very high ( )

9. Efficiency of maximum power transfer is

(a) 75% ( )

(b) 25% ( )

(c) 60% ( )

(d) 50% ( )

10. Thévenin's theorem can be applied to the circuit having

(a) linear network ( )

(b) passive network ( )

(c) resistive network ( )

(d) non-linear network ( )

SECTION—B

(*Marks* : 15)

Answer the following questions : 3×5=15

1. Explain different factors controlling the capacitance of a capacitor.

OR

Describe the working of potentiometer used in a tone control circuit.

2. What are the essentials of an electronic instrument?

OR

How do you provide protection for the multimeter in the event of an accidental overload?

3. Show that $Q \quad \frac{1}{R}\sqrt{\frac{L}{C}}$ for a series R-L-C resonant circuit.

OR

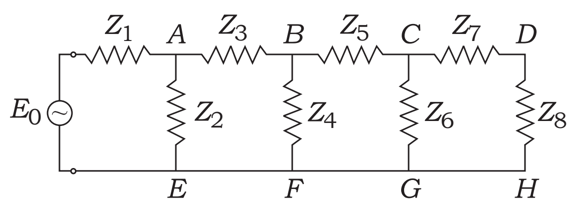
Briefly explain the sharpness of resonance.

4. Explain ideal and practical voltage source.

OR

What is lumped circuit? Differentiate between loop and mesh.

5. From the following figure, how do you find feeder current and input impedance using ladder network or method?



OR

Show that when Thévenin's equivalent circuit of a network is converted into Norton's equivalent circuit, $I_N \quad E_0 / R_0$. Here E_0 and R_0 are Thévenin voltage and Thévenin resistance respectively.

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* What do you mean by inductance of a coil? Two coils each having an inductance of 250 H have combined inductance of 550 H when connected series-aiding and 450 H when connected series-opposing. Calculate *(i)* their mutual inductance and *(ii)* coefficient of coupling. 1+2+2=5

(b) Define capacitor. Describe the preparation, uses and disadvantages of electrolytic capacitors. 1+4=5

OR

2. *(a)* Describe the fabrication of paper capacitor and mica capacitor. Two capacitors of 0·0003 F and 0·0006 F are connected in series. Find their combined capacitance, if they are connected in parallel. 3+2=5

(b) What do you mean by power rating of a resistor? Two resistors with colour codes yellow, green, black and brown, red, brown are connected in series. Calculate the combined resistance. 1+2=3

(c) Explain the reactance offered by a coil. 2

3. *(a)* With circuit diagram, explain the working of multimeter as *(i)* ammeter, *(ii)* voltmeter and *(iii)* ohmmeter. 2+2+2=6

(b) With circuit diagram, explain simple VTVM circuit. Explain the application of VTVM for d.c. current measurements. 2+2=4

OR

4. *(a)* With a circuit diagram, explain the operation of transistor voltmeter. The emitter-follower circuit has V_{CC} 12 V, R_m 1 k W and a 2 mA meter. If transistor 80, calculate *(i)* the suitable resistance for R_S to give full-scale deflection when E 5 V and *(ii)* the voltmeter input resistance. 3+3=6

(b) Define deflection sensitivity of cathode-ray tube (CRT). The deflection sensitivity of a CRT is 0·03 mm/V. If an unknown voltage is applied to the horizontal plates, the spot shifts 3 mm horizontally. Find the value of unknown voltage. 2

(c) What are the merits and demerits of a vacuum tube voltmeter (VTVM)? 2

5. *(a)* Derive the expression for power consumed in an a.c. circuit. 4

(b) Discuss the working of a high-pass filter. 3

(c) Derive the voltage and current relations in a.c. circuit containing R and C. 3

OR

6. *(a)* Derive an expression for impedance in an a.c. circuit containing L and C. 4

(b) What is quality factor of resonant circuit? Derive the expression for quality factor of a series resonant circuit. 1+2=3

(c) In a series R-L-C circuit, L 1 5 H, R 45 and C 22 F. Calculate—

(i) the frequency at resonance;

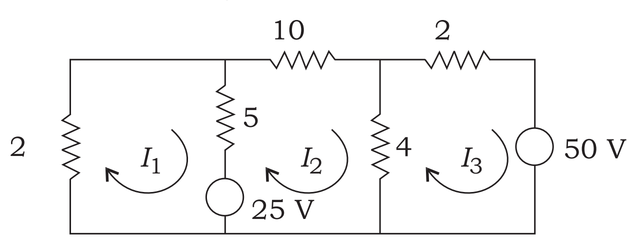
(ii) the current drawn from the supply when voltage is 120 V;

(iii) the voltage across the capacitor. 3

7. *(a)* What are Kirchhoff's current law and Kirchhoff's voltage law? 2

(b) Differentiate between *(i)* active and passive elements and *(ii)* open and short circuit. 2+2=4

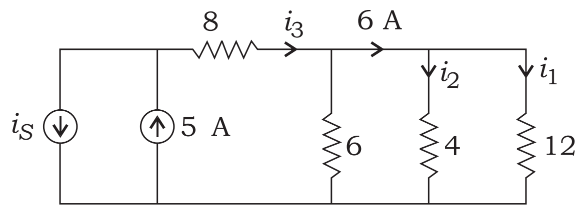
(c) Find the current I_1 and I_2 using Mesh analysis : 4



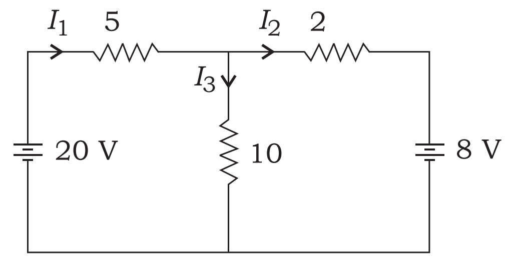
OR

8. *(a)* Derive an expression for voltage division law. 3

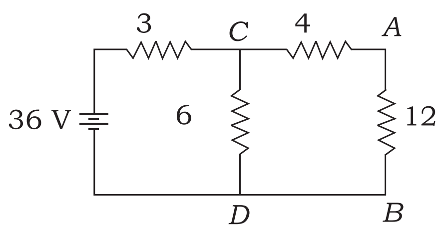
(b) Using current divider formula determine i_1, i_2, i_3 and i_S from the given circuit : 3



(c) For the given circuit, find the current I_1 and I_2 using Nodal analysis : 4



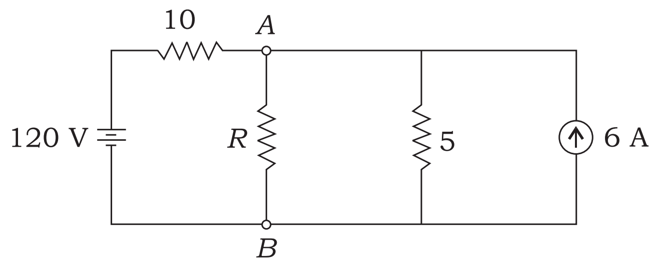
9. *(a)* Apply Thevenin's theorem to find current through the 12 resistor of the circuit shown in the figure : 4



(b) State and explain Norton's theorem. 6

OR

10. *(a)* Calculate the value of R which will absorb maximum power from the circuit of the following figure :



Also find the value of this maximum power. 5

(b) State and prove superposition theorem. 5

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