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(Pre-CBCS)

(1st Semester)

ELECTRONICS

FIRST PAPER

(Electronic Measuring Instruments and Circuit Analysis)

Full Marks : 55

Time : 2½ hours

Simple calculator may be used in this paper

(PART : A—OBJECTIVE)

(*Marks* : 20)

The figures in the margin indicate full marks for the questions

SECTION—A

(*Marks* : 5)

Put a Tick (✓) mark against the correct answer in the brackets provided : 1×5=5

1. The first three colour bands of a resistor indicate
(a) tolerance ( )
(b) resistance value ( )
(c) reliability ( )
(d) power rating ( )

2. The working of a transformer essentially depends on
(a) mutual inductance ( )
(b) self-inductance ( )
(c) magnetic circuit ( )
(d) number of turns of coil ( )

3. The power in an a.c. circuit is given by

(a) $VI \sin$ ( )

(b) I^2Z ( )

(c) I^2X_L ( )

(d) $VI \cos$ ( )

4. According to Kirchhoff's voltage law, the algebraic sum of all IR drops and EMFs in any closed loop of a network is always

(a) zero ( )

(b) positive ( )

(c) negative ( )

(d) greater than unity ( )

5. Maximum power will be transferred from a source of 10 resistance to a load of

(a) 5 ( )

(b) 20 ( )

(c) 10 ( )

(d) 40 ( )

SECTION—B

(*Marks* : 15)

Answer any *five* questions of the following : 3×5=15

1. Explain the construction of an electrolytic capacitor.

2. Explain the working of multimeter as a voltmeter.

3. Define phasor and phasor diagram.

4. Differentiate between unilateral and bilateral elements giving one example each.

5. State and prove the superposition theorem.

6. Discuss the working principle of varactor.

7. Compare among air core, iron core and ferrite core inductors.

8. Define self-inductance and mutual inductance of a coil.

(PART : B—DESCRIPTIVE)

(*Marks* : 35)

The figures in the margin indicate full marks for the questions

1. *(a)* Discuss the factors that control the capacitance of a capacitor. 2

(b) What do you mean by power rating of a resistor? Describe briefly the preparation of wire-wound resistor and carbon composition resistor. 1+2+2=5

OR

2. *(a)* Describe the construction of ceramic capacitor. Why is ceramic capacitor preferred over mica or paper capacitor? 2+2=4

(b) Define inductance of a coil. Two coils each having an inductance of 300 H have combined inductance of 620 H when connected series-aiding and 500 H when connected series-opposing. Calculate *(i)* their mutual inductance, and *(ii)* coefficient of coupling. 1+2=3

3. *(a)* Describe in detail the construction and working principle of a transformer. Mention two uses of a transformer. 3+2=5

(b) What are thermistor and strain gauge? 2

OR

4. With a neat diagram, describe the construction and principle of working of Cathode-ray Oscilloscope (CRO). 1+2+4=7

5. *(a)* What is quality factor of a resonant circuit? Derive the expression for quality factor of a series resonant circuit. 1+3=4

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

OR

6. *(a)* Derive an expression of alternating current through a series *L-C-R* circuit. 4

(b) A circuit consists of a capacitor of 100 pF connected in series with a coil of resistance 5 and inductance of 100 H. Calculate *(i)* resonance frequency, *(ii)* *Q*-factor and *(iii)* bandwidth. 3

7. *(a)* What are active and passive elements? Give one example of each. 2+2=4

(b) How will you convert a voltage source into a current sources? 3

OR

8. *(a)* Discuss the current and voltage division law. 4

(b) Define branch and node. Briefly explain nodal analysis. 1+2=3

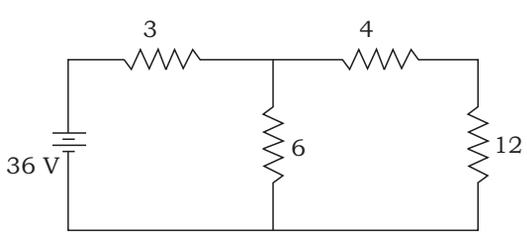
9. *(a)* Derive the condition for transfer of maximum power from a source to a load. 3

(b) Show that the Norton's equivalent circuit can be found from the Thevenin's equivalent circuit. 4

OR

10. *(a)* State Thevenin's theorem and prove it for a two-terminal network. 4

(b) Apply Norton's theorem to calculate the current through 12 resistor in the following circuit : 3



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