63/1 (SEM–5) SEC3/PHYSE 5032

2023

PHYSICS

Paper : PHYSE 5032

(Electrical Circuits and Network Skills)

Full Marks : 50

Pass Marks : 20

Time : Two hours

The figures in the margin indicate full marks for the questions.

1. Choose the correct answer from the following ***(any five)*** : 1×5=5

   (a) The ripple factor of half wave rectifier is
   - *(i)* 1·21
   - *(ii)* 0·48
   - *(iii)* 1·12
   - *(iv)* 2·11

   (b) A wire of length l is drawn to length $2l$, then its resistance
   - *(i)* Increases four times
   - *(ii)* Decreases $1/4^{th}$ of its original length

(iii) Increases two times
(iv) Will not change

(c) A multimeter is an instrument that is used for the measurement of
(i) Current
(ii) Voltage
(iii) Resistance
(iv) Current, resistance and voltage

(d) Which type of transformer is required to create a 180° input to the rectifier ?
(i) Center-tapped secondary
(ii) Step-down secondary
(iii) Step-up secondary
(iv) Split-winding primary

(e) The total capacitance of 10 capacitors each of value 20 *F* in parallel is
(i) 100*F*
(ii) 200*F*
(iii) 400*F*
(iv) 300*F*

(f) DC power of an electrical circuit is
(i) Volt × Ampere
(ii) Volt × Ohm
(iii) Ampere × Ohm
(iv) Volt × Ampere × Ohm

(g) At resonance, the series LCR circuit is equivalent to
(i) Purely resistive
(ii) Purely inductive
(iii) Purely capacitive
(iv) Purely resistive-inductive

(h) An electrical motor converts
(i) Electrical energy to mechanical energy
(ii) dc power to ac power
(iii) dc current to dc current
(iv) None of the above

(i) A relay is
(i) Electrical switch
(ii) Mechanical switch
(iii) Connecting cable
(iv) Magnetic switch

(j) The full form of MCB is
(i) Miniature contact breaker
(ii) Mini circuit breaker
(iii) Miniature circuit breaker
(iv) Mini contact breaker

2. Answer the following questions ***(any five)*** : 2×5=10

(a) State Ohm's law in electricity. Define resistance.

(b) State Kirchhoff's law.

(c) Derive an expression for r.m.s. value of current.

(d) How can a voltmeter be used to measure the voltage of a cell ?

(e) Find the equivalent capacitance of *n*-capacitors connected in series.

(f) Define capacitive reactance and inductive reactance.

(g) Draw the circuit diagram of a bridge rectifier.

3. Answer the following questions ***(any five)*** : 5×5=25

(a) Derive an expression for equivalent resistance of three resistors connected *(i)* in series and *(ii)* in parallel. 2½+2½=5

(b) Derive an expression for the peak value of current flowing through a series LCR circuit. 1+4=5

(c) State and prove Thevenin's theorem. 1+4=5

(d) Write the steps to convert a given current source into an equivalent voltage source.

(e) Describe the working of an ac generator with the necessary diagram. 3+2=5

(f) Describe how a Zener diode can be used for voltage regulation.

(g) What is the Q-factor of an LCR scries circuit? Derive an expression for it. 1+4=5

(h) Write short notes on different types of electrical drawings and symbols.

(i) What are the different types of conductors and cables used in electrical wiring ? Explain.

4. Answer the following questions ***(any one)*** : 10×1=10

(a) What is a transformer ? What are the main types of transformers ? Discuss the principle, theory, construction, working and uses of transformer. 1+1+8=10

(b) What is ripple factor? Derive an expression of ripple factor for *(i)* half wave rectifier and *(ii)* full wave rectifier. 2+4+4=10

(c) Explain construction and working of an electric motor with diagram. 5+5=10
