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3 (Sem-5/CBCS) PHY HE 1

2024

PHYSICS

(Honours Elective)

Paper : PHY-HE-5016

(Experimental Techniques)

Full Marks : 60

Time : Three hours

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

1. Choose the correct option from the given options : $1 \times 7 = 7$

(a) The expected and measured value of the voltage across a resistor are 80V and 79V respectively. Its percentage error is

(i) 1%

(ii) 1.25%

(iii) 2%

(iv) None of the above

Contd.

- (b) The signal to noise ratio is a ratio of
- (i) power of the signal to that of the noise
 - (ii) power of the noise to that of the signal
 - (iii) strength of the decibels to the noise
 - (iv) strength of the noise to that of the power signal
- (c) Which one is not the correct option of safety grounding ?
- (i) Rod earthing
 - (ii) Strip earthing
 - (iii) Electric shielding
 - (iv) Chemical earthing
- (d) Which one is not desirable in a dynamic characteristics of any measurement ?
- (i) Speed of response
 - (ii) Dynamic error
 - (iii) Response error
 - (iv) None of the above

(e) A parallel LCR circuit with an alternating source of emf works as

(i) acceptor circuit

(ii) rejector circuit

(iii) clipper circuit

(iv) clamper circuit

(f) The volume of a liquid is 26 ml. A student measures the volume and find it to be 26.2ml, 26.1ml, 25.9ml and 26.3ml in the consecutive measurement. Which one of the following statements is true for his measurements ?

(i) They are neither precise nor accurate

(ii) They have poor accuracy

(iii) They have good precision

(iv) They have poor precision

(g) Diffusion pump works based on the mechanism of

(i) power transfer

(ii) energy transfer

(iii) momentum transfer

(iv) All of the above

2. Answer the following questions : $2 \times 4 = 8$

- (a) Define arithmetic mean and average deviation for a set of variables.
- (b) Write the characteristics of shot noise.
- (c) What is electric shielding? Why it is safer to be inside a car with metallic cover than to be under a huge tree during a thunder storm?
- (d) Distinguish between analog and digital instruments.

3. Answer **any three** of the following questions : $5 \times 3 = 15$

- (a) What is a transducer? Give an example. Write characteristics of transducers. $1+1+3=5$
- (b) Discuss how noise in the frequency domain is described by the frequency spectrum.
- (c) Explain how a thermocouple can be used to measure temperature.
- (d) Discuss with a neat diagram to measure current using a multimeter.

- (e) Define resonant frequency and Q-factor of a series LCR circuit. Calculate the resonant frequency for the circuit.

with $L = 3H$, $C = 27 \mu F$ and $R = 7.4 \Omega$

$$2+3=5$$

4. Answer the following questions : (**any three**)

$$10 \times 3 = 30$$

- (a) (i) For the following data, calculate

(i) Arithmetic mean.

(ii) Deviation of each value.

(iii) Algebraic sum of the deviations.

given : $x_1 = 49.7$, $x_2 = 50.1$,

$x_3 = 50.2$, $x_4 = 49.6$, $x_5 = 49.7$

$$1+2+2=5$$

(ii) Show that frequency response for

the 1st order system is $G(s) = \frac{1}{\tau s + 1}$

The symbols have their usual meaning.

$$5$$

- (b) (i) Define 'passive' and 'active' transducers and give an example of each.

$$2+2+1=5$$

(ii) What is a strain gauge transducer? Write its working principle briefly. Give an application of strain/gauge.

$$1+3+1=5$$

(c) (i) Give the working of digital LCR meter.

$$5$$

(ii) Use a schematic diagram to explain the principle of action of a Pirani gauge. Write its range of measurement.

$$4+1=5$$

(d) Write characteristics and applications of vacuum system.

$$5+5=10$$

(e) (i) What is a linear variable differential transformer? Describe its operation with circuit diagram.

$$1+3=4$$

(ii) Describe briefly the working of semiconductor-type temperature sensors AD590, LM35 and LM75.

$$2+2+2=6$$

(f) Write short notes on : **(any four)**

$$2 \times \frac{1}{2} \times 4 = 10$$

(i) Mean free path

- (ii) Pumping speed
 - (iii) Electromagnetic Interference shielding
 - (iv) Periodic and aperiodic signal
 - (v) Accuracy and precision
 - (vi) Turbo modular pump
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