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3 (Sem-5/CBCS) PHY HE 1

2022

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. Answer **any seven** : 1×7=7

(a) In an experiment, it is found that the experimental value is very close to actual value, hence the experimental value can be called

(i) accurate

(ii) precise

(iii) suitable

(iv) mean

Contd.

- (b) LVDT is a
- (i) capacitive transducer
 - (ii) resistive transducer
 - (iii) inductive transducer
 - (iv) None of the above
- (c) Pirani gauge can measure pressure range from
- (i) 1 - 500 mbar
 - (ii) 10^{-3} - 10^{-9} mbar
 - (iii) 10^{-4} - 10^{-7} mbar
 - (iv) 10^{-5} - 10^{-13} mbar
- (d) An amplifier having output SNR of 16 dB and input SNR of 21.4 dB. Its noise figure is
- (i) 37.4 dB
 - (ii) 5.4 dB
 - (iii) -37.4 dB
 - (iv) -5.4 dB
- (e) The principle of Q-meter is based on
- (i) Parallel resonance
 - (ii) Series resonance
 - (iii) Both (i) and (ii)
 - (iv) None of the above

(f) Which of the following are the types of Earthing ?

- (i) Plate Earthing
- (ii) Pipe Earthing
- (iii) Strip or Wire Earthing
- (iv) All of the above

(g) A resistance strain gauge with a gauge factor of 2 is cemented to a steel member, which is subjected to a strain of 1×10^{-6} . If the original resistance value of gauge is 130Ω , calculate the change in resistance.

- (i) $260 \mu\Omega$
- (ii) $26 \times 10^2 \mu\Omega e^{j4\pi t}$
- (iii) $26 \mu\Omega$
- (iv) $2.6 \mu\Omega$

(h) Function of transducer is to convert

- (i) electrical signal into non electrical quantity
- (ii) non-electrical quantity into electrical signal
- (iii) electrical signal into mechanical quantity
- (iv) All of the above

- (i) What is the number of significant figures in 433.00 ?
- (i) 2
 - (ii) 3
 - (iii) 4
 - (iv) 5
- (j) Earthing is necessary to give protection against
- (i) danger of electric shock
 - (ii) voltage fluctuation
 - (iii) overloading
 - (iv) high temperature of the conductors
- (k) The advantage of neutral earthing is
- (i) freedom from persistent arcing grounds
 - (ii) over voltages due to lightening can be discharged to earth
 - (iii) simplified design earth fault protection
 - (iv) All of the above
- (l) The signal-to-noise-ratio is a ratio of what ?
- (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

2. Answer **any four** from the following :

2×4=8

- (a) Define the terms Precision and Accuracy in a measurement.
- (b) Examine whether the signal is periodic or non periodic
 - (i) $\sin 12\pi t$
 - (ii) $e^{j4\pi t}$
- (c) What is electrostatic shielding ? Write the importance of electrostatic shielding.
- (d) Write *two* differences between analog instrument and digital instrument.
- (e) Give the characteristic of shot noise.
- (f) What do you understand of the mean free path ? Which factors affecting mean free path ?
- (g) What is frequency domain ? Why is it important ?
- (h) Give *four* applications of vacuum.

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

(a) Explain current measurement by a Multimeter with circuit diagram. 5

(b) Describe the working of LCR meter by making the use of its block diagram.

(c) What do you mean by static and dynamic characteristics of measurement of system ? Give examples. $2+2+1=5$

(d) For the following given data, calculate

(i) Arithmetic mean

(ii) Average deviation

(iii) Standard deviation.

Given $x_1 = 49.7$ $x_2 = 50.1$ $x_3 = 50.2$

$x_4 = 49.6$ $x_5 = 49.7$

(e) What is pumping speed ? How pumping speed measurement are done in mechanical pumps ?

(f) Explain briefly working principle of strain gauge.

(g) Describe semiconductor temperature sensor LM35 and LM75.

4. Answer **any three** of the following questions : 10×3=30

- (a) (i) What is Q-meter ? Describe the working principle of Q-meter. 5
- (ii) Calculate resonant frequency and Q-factor of a series L-C-R circuit containing a pure inductor of inductance $3H$, capacitor of capacitance $27 \mu F$ and resistor of resistance 7.4Ω . 5
- (b) (i) What is linear variable differential transducer (LVDT) ? Where is it used ? Explain the operating principle of an LVDT. 7
- (ii) An ac LVDT has the following data : Input = $6.3 V$, Output = $5.2 V$, range $\pm 0.5 in$. Determine the output voltage *vs* core position for a core movement going from $+ 0.45 in$. to $- 0.30 in$. 3
- (c) (i) Difference between transducer and sensors. 4
- (ii) Describe transducer as electrical elements. 6

- (d) (i) Explain how to measure the change of temperature using resistance temperature device. 5
- (ii) Explain briefly to showing all elements of a vacuum system. 5
- (e) Find the frequency response of 1st order system with $G(s) = \frac{1}{\tau s + 1}$.
- (f) What is a capacitive transducer? Explain how a capacitive transducer can be used as a microphone.
- (g) Write short notes on : **(any four)**
2½×4=10

(i) Thermocouple

(ii) Thermistor

(iii) Electromagnetic Interference (EMI)

(iv) Thermal noise

(v) Piezo electric transducer

(vi) Diffusion pump