Total number of printed pages–8

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

(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 130 Ω, calculate the change in resistance.

(i) $260\,\mu\Omega$

(ii) $26\times10^2\,\mu\Omega e^{j4\pi t}$

(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 : 5×3=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 $7.4\,\Omega$. 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 ± 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 $G(s) = \dfrac{1}{\tau s + 1}$.

(f) What is a capacitive transducer? Expalin how a capacitive transducer can be used as a microphone.

(g) Write short notes on : *(any four)*
$$2\tfrac{1}{2} \times 4 = 10$$

(i) Thermocouple

(ii) Thermistor

(iii) Electromagnetic Interference (EMI)

(iv) Thermal noise

(v) Piezo electric transducer

(vi) Diffusion pump

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