3 (Sem–5/CBCS) PHY HE 1

2021

(Held in 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. Choose the correct answer from the given options : 1×7=7

   (a) In a series RLC circuit which is operating above the resonance frequency, the current

   (i) lags the applied voltage

   (ii) leads the applied voltage

   (iii) is in phase with the applied voltage

   (iv) is zero

(b) The method of safety grounding is

(i) EMI shielding

(ii) strip earthing

(iii) three terminal

(iv) None of the above

(c) The number of significant figures in 30.69 is

(i) 1

(ii) 2

(iii) 3

(iv) 4

(d) Diffusion pump works based on the mechanism of

(i) power transfer

(ii) momentum transfer

(iii) energy transfer

(iv) All of the above

(e) The relation between pumping speed (S), conductance (C) and pressure ratio (K) is

(i) $C = \frac{S}{K-1}$

(ii) $K = 1 + \frac{S}{C}$

(iii) Both of the above

(iv) None of the above

(f) A parallel LCR circuit with an alternating source of emf works as a/an

(i) acceptor circuit

(ii) rejector circuit

(iii) clipper circuit

(iv) clamper circuit

(g) Coupling coefficient for an ordinary electrical transformer is

(i) 1

(ii) < 1

(iii) > 1

(iv) 0

2. (a) What do you mean by the terms 'periodic signal' and 'aperiodic signal' of a system? 2

(b) Explain the significance of 'accuracy of measurement' and 'precision of measurement' with suitable examples. 2

(c) Why do we need electromagnetic interference shielding and what is its importance? 2

(d) Write what you understand by S/N ratio and noise figure. 2

3. (a) What do you mean by impulsive response of a dynamical system? Derive its relation with transfer function of the system. 2+3=5

(b) Explain how to measure the change of temperature using resistance temperature device. 5

Or

Explain how we can use a thermocouple for the measurement of temperature. 5

(c) Describe the working of a digital multimeter by making the use of its block diagram. 5

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

(a) (i) Use proper block diagram to explain the working principle of a RLC bridge. How does such a bridge function? 3+2=5

(ii) A resistance R of 20Ω, an inductance L of $0.2H$ and a capacitance C of $100\mu F$ are connected in series across a $220V$, $50Hz$ mains. Determine the impedance and current of the circuit. Also find out the voltages across the elements R, L and C. 5

(b) (i) What is a linear variable differential transformer? Use electrical circuit diagram to describe its operation. 1+3=4

(ii) Explain in brief how the semiconductor-type temperature sensors AD590, LM35 and LM75 work. 2+2+2=6

(c) (i) Define the speed S of a pump. Show that

$$S = \frac{V}{(T-t)} ln \frac{P}{p}$$

where V is the volume of the vessel. P and p are respective pressures at the instants T and t. 1+4=5

(ii) Use schematic diagram to explain the principle of action of a Pirani gauge. What is its range of measurement? 4+1=5

(d) (i) What do you mean by static and dynamic characteristics of measurement of a system? Give examples. 2+2=4

(ii) In an examination a student scored 85, 67, 81, 78 and 93 in different subjects out of total marks 100 in each subject. Calculate the arithmetic mean, mean deviation and standard deviation for his test scores. 1+2+3=6

(e) Write short notes on: ***(any four)*** 2½×4=10

(i) Strain gauge

(ii) Thermistor

(iii) Piezoelectric crystal

(iv) Electrostatic shielding

(v) Linear position transducer

(vi) Penning gauge
