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63/1 (SEM-6) DSE4/PHYHE6046

2024

PHYSICS

Paper : PHYHE6046

**[Experimental Techniques
(Or Dissertation)]**

Full Marks : 60

Pass Marks : 24

Time : Three hours

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

1. Choose the correct answer : **(any five)**
1×5=5
- (a) The bandwidth of a measurement system must be chosen to fit _____
- (i) signal frequency
 - (ii) signal intensity
 - (iii) signal range
 - (iv) signal bandwidth

(b) The resonance frequency of a tuned LCR circuit is

(i) $\omega_0 = \frac{2\pi}{f_0}$

(ii) $\omega_0 = 2\pi f_0$

(iii) $\omega_0 = \frac{1}{LC}$

(iv) $\omega_0 = \frac{1}{RC}$

(c) In which distribution function the term 'FWHM' is associated ?

(i) Binomial distribution

(ii) Gaussian distribution

(iii) Poisson distribution

(iv) Both Binomial and Poisson distribution

(d) In instrumentation how power ratio is described by units ?

(i) Watt

(ii) Horse Power

(iii) No unit.

(iv) A logarithmic unit *dB*

(e) Thermocouple is a transducer, based on which effect ?

(i) Peltier effect

(ii) Joule's effect

(iii) Thomson effect

(iv) Seebeck effect

(f) Which one of the following is not applicable for photoconductive devices ?

(i) Wavelength sensitive

(ii) Resistive elements

(iii) Relatively slow

(iv) Nonlinear

(g) What is the range of operation in Penning gauge ?

(i) 10^{-3} to 10^{-9} mbar

(ii) 10^{-1} to 10^{-3} mbar

(iii) 10^{-4} to 10^{-7} mbar

(iv) 1 to 500 mbar

(h) What is the correct expression for power loss of a non-ideal capacitor ?

(i) $D = \sin \delta$

(ii) $D = \cos \delta$

(iii) $D = \cot \delta$

(iv) $D = \tan \delta$

(i) Which one of the following is not a semiconductor temperature sensor ?

(i) AD590

(ii) LM35

(iii) LM75

(iv) FT-H10

(j) Q-meter is used to measure

(i) electrical properties of the capacitors only

(ii) electrical properties of both the coils and the capacitors

(iii) mechanical properties of coils only

(iv) electrical properties of the coils only

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

(a) What is variance? How can it be reduced to standard deviation for N readings? 1+1=2

(b) Distinguish between periodic and aperiodic signals with examples. 1+1=2

(c) What is distortion of a periodic signal ?

(d) What do you mean by electrostatic shielding?

(e) Write *any four* Transducer properties. $\frac{1}{2} \times 4 = 2$

(f) What is a thermistor? Write *any two* characteristics of it. 1+1=2

(g) There is a particular problem with diffusion pump. What is it? How is it minimised? 1+1=2

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

(a) Find the expression for pumping speed for a vacuum system. What is pumping time? 3+2=5

(b) Write a short note on digital Voltmeter.

- (c) What is a digital LCR bridge? Draw the necessary circuit diagram and explain. $1+4=5$
- (d) Describe the method to determine dynamic error for first-order system.
- (e) Briefly write the reasons for the popularity of resistors for use as transducers.
- (f) What are the merits of a thermocouple system for the measurement of temperature as compared with the resistance thermometer and the thermistor.
- (g) Write briefly on scintillation counter.
- (h) Distinguish between systematic and random errors in a measurement. How are they usually minimised?
- (i) Write short notes on Photodiodes and Phototransistors.

4. Answer the following questions : **(any two)**
 $10 \times 2 = 20$

- (a) What are the statistical distribution functions used in experimental data simulation? Describe any one of it with necessary graph. $2+6+2=10$

- (b) What are various vacuum gauges? Write briefly about each of them with proper range of operation.
- (c) Describe how a piezoelectric crystal is cut to serve as a transducer and the crystal is most suitable for force measurement.
- (d) Write short notes of the following :
 $5 \times 2 = 10$
- (i) Static and dynamic characteristics of a measurement system.
- (ii) Capacitance charge transducer.

