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6 SEM TDC DSE PHY (CBCS) 3 (H)

2023

(May/June)

PHYSICS

(Discipline Specific Elective)

(For Honours)

Paper : DSE–3

(Experimental Techniques)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct option from the following : 1×5=5

(a) The number of significant figures in 12300 is

(i) 5

(ii) 3

(iii) 1

(iv) 4

(b) The noise figure (F) is defined as

(i) $\frac{S/N\text{ (input)}}{S/N\text{ (output)}}$

(ii) $\frac{S/N\text{ (output)}}{S/N\text{ (input)}}$

(iii) $\frac{S/N\text{ (input)}}{S/N\text{ (output)}}+1$

(iv) $\frac{S/N\text{ (output)}}{S/N\text{ (input)}}+1$

(c) Which of the following is not a static characteristic of instruments?

(i) Accuracy

(ii) Sensitivity

(iii) Speed of response

(iv) Reproducibility

(d) Thermocouples operate on the principle of

(i) Seebeck effect

(ii) Peltier effect

(iii) Thomson effect

(iv) None of the above

(Continued)

(e) The Penning gauge is designed for vacuum measurement in the pressure range of

(i) 10^{-5} to 10^{-13} mbar

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

(iii) 10^{-1} to 10^{-5} mbar

(iv) 10^{-5} to 10^{-9} mbar

2. What are systematic and random errors? Calculate mean value, mean deviation, sample variance and standard deviation from the following data : 2+4=6

Serial No. of Measurements	*Light intensity* (W/m^2)
1	10·3
2	12·6
3	11·5
4	14·3
5	15·2
6	13·6
7	12·3
8	14·5
9	12·9
10	10·8

(Turn Over)

3. What are the different sources of noise in instruments? Obtain an expression for r.m.s. value of shot noise current. 3+3=6

Or

Define transfer function of systems. Obtain an expression for transfer function of first-order instruments. Discuss its frequency response. 1+3+2=6

4. What is meant by electrical earthing or grounding? Why is it so important? Describe briefly the different methods of electrical grounding. 1+1+2=4

5. Answer any *three* from the following questions : 6×3=18

(a) Obtain an expression for transfer function of second-order instruments. Hence find natural frequency and damping ratio of a mass-loaded spring.

(b) What are the three different types of temperature transducers? Describe their working principles.

(c) Describe the working principle of a strain gauge (Resistance Strain Gauge). Derive an expression for gauge factor.

(d) Write a short note on semiconductor-type temperature sensors AD590 and LM35.

(e) What are radiation sensors? Describe the working of a gas-filled detector with proper diagram.

(f) Explain the working principles of piezoelectric and capacitance transducers.

6. What is the difference between an analog and a digital meter? Draw the block diagram of a digital multimeter. How is it used to measure voltage? 2+2+1=5

7. What is a *Q*-meter? Write its working principle. 1+1=2

8. *(a)* What are the characteristics of vacuum? Describe the elements of a vacuum system. 1+3=4

(b) Write a short note on any *one* of the following : 3

(i) Diffusion pump

(ii) Penning gauge

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