18-05-2026 FE SEM-II (NEP-2020) PMS QP CODE: 20011844

Time: 1:30 hour **Marks: 45**

Note: (1) Q.1 is compulsory
(2) Attempt any two from remaining
(3) All Questions are of 15 marks.

Q.1 Attempt any five **[15M]**

(a) Write 3 points as the difference between Precision and Accuracy for measurements.

(b) Justify the statement: "Concept of Interference yields better results when employed as measuring Instrument"

(c) Fill in the gap: Full form of LVDT is Linear Variable _____Transformer. It works on the principle of _____. It measures_____.

(d) Draw the diagram to measure hall Voltage of a semiconductor slab with width "w", and thickness "t", Draw the direction of current I and Magnetic field B Tesla on the diagram

(e) Describe Seebeck effect .What is the approximate range of potential difference it generates?

(f) Assuming that atoms are perfect spheres of diameter "D", write the expression of Surface to volume ratio.

(g) In reference to measurements instruments, what do you mean by (i) Static error (ii) Calibration error (iii) Zero error?

Q.2 (a) In an experiment to find length using ultrasonic distance meter, a student performed it for five times and the results are 38m, 51m, 46m, 79m, 57m Find the Sample standard Deviation. **[5M]**

(b) Apply the knowledge of monochromatic light in interference and explain its application to determine the flatness of the surface. A surface under investigation for flatness shows 5 dark bands evenly spaced when illuminated by a LASER source of wavelength 6000 Angstrom. Find the flatness error. **[5M]**

(c) Explain working of LVDT with a neat diagram **[5M]**

Q.3 (a) Using a neat diagram, Derive the expression for Hall Voltage for a "n" type semiconductor under the magnetic field intensity B Tesla. **[5M]**

(b)The resistance of a Platinum thermometer is 100 Ohm at 0 Degree Centigrade. Find its resistance at 100 Degree Centigrade Take temperature coefficient 9.92×10^{-3}. Sketch the variation of Resistance with respect to temperature in case of material with (1) Positive temperature coefficient (2) Negative temperature coefficient **[5M]**

(c) Apply the knowledge of optical microscope to determine its limitation to study nano particles. Explain Scanning Electron Microscope (SEM) works in study of nano particles. **[5M]**

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Q.4 (a) In an experiment to determine Resistance using Ohm's law, Voltage vs Current readings are as under. A straight line is to be drawn using x and y coordinates as mentioned below. Using the concept of least square fit. Find the equation of straight line. **[5M]**

X (Volt)	1	2	3	4	5	6	7	8	9
Y(Current)	4	7	8	11	12	15	17	21	20

(b) Explain the working of Ultrasonic Flow meter using neat diagram. **[5M]**

(c) What is heat? Write at least two points as the difference between heat and Temperature. Explain the use of bimetallic thermometer for measurements of temperature. **[5M]**

Q.5 (a) Explain why optical interferometry is one of the best concept for testing the flatness of a surface? **[5M]**

(b) A sample of a n-type Silicon has a donor density of 10^{21} /m ^{3}. It is used in the Hall effect experiment. If the sample of width 6 mm is kept in a magnetic field of 0.6T with current density of 500 A/m ^{2} . Find Hall voltage developed. **[5M]**

(c)Draw the neat diagram and explain how AFM works. **[5M]**

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