

09 DEC. 2025 FE (SEM-II) (NEP-2020) ALL BRANCHES PMS QP CODE: 10099181

Duration: 1Hr 30 Minutes

[M. Marks: 45]

N.B.: (1) Question No 1 is Compulsory.

(2) Attempt any two questions out of the remaining four.

(3) Assume suitable data, if required and state it clearly.

1. Attempt any FIVE

[15]

- (a) Define: Range, calibration and sensitivity with proper examples.
- (b) In an experiment performed by a student the readings are 75, 82, 88, 76, 82, 75, and 78. Find the sample mean and sample standard deviation.
- (c) Signify the importance of monochromatic light in interference.
- (d) Classify transducers based on their function, with suitable examples.
- (e) Ultrasonic transducer works using inverse piezoelectric effect. Justify
- (f) State the factors influencing the selection of a thermometer.
- (g) Explain the optical, electrical, and mechanical properties of materials at the nanoscale.

2. Attempt the following questions.

- (a) Exemplify the various parameters associated with a given measuring instrument. Enlist the various sources of errors in the measurement. **[5]**
- (b) What is an optical flat? Describe its application in checking the flatness of a surface using fringe pattern analysis. **[5]**
- (c) Explain the construction and working of a strain gauge transducer. How it is different from resistive temperature transducers? **[5]**

3. Attempt the following questions.

- (a) Draw the experimental diagram for Hall Effect. Give an expression for Hall voltage and Hall coefficient. A sample carries a current of 10 mA in a magnetic field of 0.4T. If the sample thickness is 5 mm and the charge carrier concentration is $n = 8 \times 10^{22} / \text{m}^3$, find the Hall voltage. **[5]**
- (b) Illustrate the thermoelectric thermometer with its working principle, temperature range, accuracy, response time and applications. **[5]**
- (c) Differentiate Scanning Electron Microscope (SEM) with Atomic Force Microscope (AFM). **[5]**

4. Attempt the following questions.

- (a) Using the principle of least squares method find the equation of best fit line for the given data:
 $(x_1, y_1) = (2, 4), (x_2, y_2) = (4, 16), (x_3, y_3) = (6, 36), (x_4, y_4) = (8, 64)$ [5]
- (b) Illustrate how an LVDT can be used to measure linear displacement. Support your answer with a labelled diagram and appropriate equations. [5]
- (c) What is bimetallic thermometer? Elaborate each type with proper diagram. [5]

5. Attempt the following questions.

- (a) Describe the surface contour test. A scratched surface is tested using an optical flat using a light of wavelength 5893 \AA . If the distance between two fringes is 1 mm and the distance due to scratch is 0.5 \mu m . Determine the depth of the scratch. [5]
- (b) Differentiate ultrasonic flow meters based on their working principles and applications. [5]
- (c) Explain the process of gas sensing capacitors and water purification using the principles of nanotechnology. [5]
