

**IV B.Tech I Semester Advance Supplementary Examinations, March - 2023
MECHANICAL MEASUREMENTS AND INSTRUMENTATION****(Open Elective)****Time: 3 hours****Max. Marks: 75**

*Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks*

UNIT I

- 1 a) Explain the basic functional elements of a generalized measurement system. [7]
b) A bourdon pressure gauge having a linear calibration has a 50 mm long pointer. It moves over a circular dial having an arc of 270° . It displays a pressure range of 0 to 15 bar (1 bar = 10^5 Pa). Determine the sensitivity of the Bourdon gauge in terms of scale length per bar (i.e., mm/bar). [8]

(OR)

- 2 a) A voltmeter with internal resistance of 200 k Ω is connected across an unknown resistance. It reads 250 V and the milliammeter connected in series with the same resistance reads 10 mA. Determine the apparent resistance, actual resistance and loading error due to the loading effect of the voltmeter. [7]
b) Define limiting errors. Derive the expression for relative limiting errors. [8]

UNIT II

- 3 a) Explain about analogue and digital transducers [7]
b) Explain signal conditioning system [8]
(OR)
- 4 a) Explain the generalized diagram of a digital data acquisition system? [7]
b) Explain different static performance characteristics of an instrument [8]

UNIT III

- 5 a) Explain the working of Bridgman pressure gauge for measurement of high pressure [7]
b) A well type manometer uses mercury as the manometric fluid. The displacement of mercury in the well is 25 mm. The area of well is 6500 mm². The maximum span of manometer is 25 KN/m². Calculate the inside diameter of the manometer tube. The density of mercury is 13.56 $\times 10^3$ kg/m³. [8]



(OR)

- 6 a) Explain the working of McLeod pressure gauge used for measuring vacuum pressure. [7]
- b) List out different types of manometers and explain the working of inclined tube manometer. [8]

UNIT IV

- 7 a) Describe the method of strain measurement in a cantilever using two active gauges [7]
- b) A bimetallic thermometer is made up of strips of a nickel-chromium alloy and Invar bonded together at 25°C. Each strip has a thickness of 1 mm and a length of 50 mm. Calculate the radius of curvature produced when the strip is unstrained and is subjected to a temperature of 200°C. For nickel chrome alloy and Invar the moduli of elasticity and coefficients of expansion respectively are 216 GN/m², 147 GN/m² and 12.5×10⁻⁶/°C, 1.7×10⁻⁶/°C. [8]

(OR)

- 8 a) Discuss the construction and principle of vapor pressure thermometer [7]
- b) Explain the working of electrical resistance type thermometer [8]

UNIT V

- 9 a) Explain the working of proving ring used for force measurement. [7]
- b) Explain the working of different mechanical tachometers [8]

(OR)

- 10 a) The sound pressure level measured at 10 m from an automobile horn is 110 dB. Determine the sound pressure level at distances of
i) 20 m and
ii) 80 m. Assume that the inverse square law holds good between intensity and distance [7]
- b) Explain the construction and principle of working of a LVDT [8]

