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ME-404

B. TECH.

FOURTH SEMESTER EXAMINATION, 2003–2004

MEASUREMENT AND METROLOGY

Time : 2 Hours *Total Marks : 50*

Note : (1) Attempt **ALL** questions.

(2) Marks are shown against each question.

1. Attempt any FOUR of the following :— **(3·5×4=14)**

(*a*) Enumerate desirable static performance characteristics of measuring instruments. Explain the terms, DEAD ZONE and HYSTERESIS.

(*b*) The temperature of a furnace is increased at the rate of 240 °C per hour. The measuring instrument used should not show an error of more than 8 °C. What maximum time constant is permissible, if the instrument has a first order type response ?

(*c*) Explain the principle of operation of a L.V.D.T.

(*d*) Explain how a compound gear-train can be used to achieve amplification of a mechanical signal.

(*e*) The resistance R of a circuit is found by measuring the current and the power fed into the circuit. Find the limiting error in measurement of R, if the limiting errors in the measurement of power and current are ± 1·5% and ± 1·0% respectively.

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(*f*) Describe the construction and operation of a D'ARSONVAL galvanometer.

2. Attempt any FOUR of the following :— (3×4=12)

(*a*) Describe the principle and operation of a stroboscopic tachometer.

(*b*) Sketch the basic functional form of a seismic instrument. How is the same instrument used for measurement of displacement as well as acceleration ?

(*c*) What is a ring balance and how is it used for measurement of pressure ?

(*d*) A strain gauge having an electrical resistance of 120 ohms and a gauge factor of 2·1 is used to test a steel specimen subjected to an axial tensile load. Calculate the induced strain if the increase in gauge resistance is shown to be 0·134 ohms.

(*e*) Describe, with the help of a sketch, a hydraulic load cell for force measurement.

(*f*) What does IPTS stand for ? Describe the functioning of a disappearing filament type optical pyrometer.

3. Attempt any TWO of the following :— (6×2=12)

(*a*) Why are comparators used in metrology ? Describe, with the help of a sketch, the essential features of a SIGMA comparator.

(*b*) What are the devices commonly used for precision measurement of angles ? Explain how a precision spirit level can be used for this purpose.

(*c*) Write short notes on :

(*i*) Slip gauges

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(*ii*) Combination angle gauges

(*iii*) Unilateral and bilateral system of tolerances

(*iv*) The meaning of 50 H_7 in the context of limit and fits.

4. Attempt any TWO of the following :— **(6×2=12)**

(*a*) What are the important parameters which should be checked while inspecting a precision screw thread ? Describe, briefly, the three-wire method for ascertaining the effective diameter of a screw thread.

(*b*) Explain the meaning of the following terms with reference to surface finish and its measurement :—

(*i*) Roughness

(*ii*) Waviness

(*iii*) LAY

(*iv*) Sampling Length

(*v*) Ra Value

(*vi*) Ten point height of irregularities (R_z)

(*c*) What do you understand by the term, "flatness" ? What methods are used for checking flatness ?

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