Seat No:_____ Date:_____

GANPAT UNIVERSITY
B.TECH SEM- VI MECHATRONICS ENGINEERING
REGULAR EXAMINATION MAY/JUNE-2012
MC-602 Metrology and Instrumentation

[Time: 3 Hour] **[Total Marks: 70]**

Instructions:

(1) Attempt all questions.
(2) Assume suitable data if necessary.
(3) Figures to the right indicate full marks.

Section – I

Que:1 Answer the following. **12**

(A) Describe briefly the construction and working of Strain Gauge Load Cell. State its fields of application.

(B) Enlist the type of Angular Velocity Measuring Instruments and briefly explain Digital Tachometers.

(C) A shaft running at a constant speed of 1500 RPM transmits max. power of 60 kW. Measurements of torque are made by a pair of strain gauges which are bonded on a specially machined portion of the shaft. Each gauge has a nominal resistance of 100 Ω gauge factor of 2.0 and are connected electrically to the two arms of a half activated Wheatstone bridge circuit which is energized with an excitation voltage of 6 V. The gauges have a maximum strain of 0.0012. The shear modulus of elasticity of the shaft material is 200 GN/m^2.
Calculate the following:
(i) The diameter of the shaft.
(ii) The output voltage and the sensitivity of the measuring system.

OR

Que:1 Answer the following. **12**

(A) What is Acceleration and explain Seismic Accelerometer with neat sketch.

(B) Explain Strain Gauge Torsion Meter with neat sketch, construction and working.

(C) The following data relate to strain gauge load cell arranged with four identical strain gauges.
Diameter of the steel cylinder = 60 mm; Nominal resistance of each gauge = 120 Ω; Gauge factor = 2.0; Supply voltage (v) = 6 V; Modulus of elasticity for steel = 200 GN/m^2; Poisson's ratio = 0.3.
Calculate the sensitivity of the load cell.

Que:2 Answer the following. **11**

(A) Derive equation of U- Tube Manometer for positive pressure and negative pressure with neat sketch.

(B) Define pressure and explain U-Tube double column manometer with neat sketch for (a) Px > Pa and (b) Px< Pa

OR

Que:2 Answer the following. **11**

(A) Briefly explain all features of Pitot Tubes and Enlist merits and demerits of Pitot Tubes.

(B) Enlist the types of Mechanical Pressure Gauge and explain briefly Bourdon Tube Pressure Gauge.

Que: 3 Attempt any three. **12**

(A) Write basic working principle of thermistors, its application for PTC & NTC Thermistors.

(B) Derive the equation of Gauge factor for strain gauge.

(C) Explain Variable Resistance Displacement Sensors with its mounting methods.

(D) Difference between Venturimeter & Orifice meter.

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Section – II

Que:4 Answer the following. 12

(A) State the principle of micrometer and explain its construction and working with neat sketch.

(B) Describe in brief the construction, and working of a Toolmaker's microscope with neat sketch.

(C) Explain the following terms:
i) Limits, ii) Fit, iii) Allowance and iv) Tolerance.

OR

Que:4 Answer the following. 12

(A) Explain construction and working of combination set with neat sketch.

(B) Describe in brief the construction, and working of a sigma comparator with neat sketch.

(C) Explain the term Parallax error with suitable sketch.

Que:5 Answer the following.

(A) Explain construction and working of Parkinson Gear tester with neat sketch. 05

(B) In a hole and shaft assembly of 20mm nominal size, the tolerance for hole and shaft are as specified below: 04

Hole: $20^{+0.02}_{-0.00}$ mm Shaft: $20^{-0.04}_{-0.07}$

Determine: i) Maximum and minimum clearance obtainable
ii) Allowance
iii) Hole and Shaft tolerance and
iv) MML shaft and hole.

(C) Explain C.L.A method of surface roughness measurement. 02

OR

Que:5 Answer the following.

(A) Explain two and three wire method of measuring effective diameter of screw thread. 05

(B) In the measurement of surface roughness, height of 20 successive peaks and valleys were measured from a datum as following: 04

45, 25, 40, 25, 35, 16, 40, 22, 34, 25, 40, 20, 36, 28, 18, 20, 25, 25, 30, 38 microns.

If these measurements were obtained over length of 20 mm , determine the C.L.A and R.M.S values of the surface.

(C) Explain use of Planer gauge and Feeler gauge. 02

Que: 6 Attempt any three. 12

(A) Explain the following terms:
i) Calibration, ii) Readability, iii) Sensitivity and iv) Magnification

(B) Give the procedure of measuring Major diameter of screw thread by using a bench micrometer.

(C) Describe briefly the systems of obtaining different types of fits, with suitable sketches.

(D) Distinguish between Line standard and End standard, Give their example.

END OF PAPER