



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



THIRD SEMESTER B.TECH (INSTRUMENTATION & CONTROL ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: SENSORS AND TRANSDUCERS [ICE-2105]

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

✤ Answer ALL the questions.

• Missing data may be suitably assumed.

- 1A. Define the dimensions of the following mechanical quantities.
 1. Power 2. Energy 3. Momentum 4. Torque 5. Stiffness
 1B. One electrostatic unit of potential difference (PD) is how many 3
- 1B. One electrostatic unit of potential difference (PD) is how many 3 electromagnetic units of PD? Prove it.
 12. Surplain leading offect in potentiameter with proceeding derivation and 4
- Explain loading effect in potentiometer with necessary derivation and 4 diagram.
- 2A. Explain the following types of strain gauges: 1. Unbonded metal strain gauge.
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 2. Bonded metal strain gauge. 3. Bonded metal foil strain gauge.
- **2B.** A strain gauge is bonded to a beam 0.1 m long and has a cross-sectional area 4 cm². Young's modulus for steel is 207 GN/m². The strain gauge has an unstrained resistance of 240 Ω and a gauge factor of 2.2. When a load is applied, the resistance of gauge changes by 0.013 Ω . Calculate the change in length of the steel beam and the current of force applied to the beam.
- 2C. 4. Define the following: 2 Seebeck effect. ii) Law of Intermediate Metals i) 3A. How rotary and linear displacement can be measured using change in 4 distance between plates of a capacitor? **3B.** Explain the working of LVDT with necessary diagrams. 3 **3C.** Describe the working of Hall effect transducers with neat diagram. 3 **4A.** Explain the working of synchros with neat diagram and necessary equations. 6 4B. A quartz piezoelectric crystal having a thickness of 2 mm and voltage 3 sensitivity of 0.005 V - m/N is subjected to a pressure of 1.5 MN/m².
- sensitivity of 0.005 V m/N is subjected to a pressure of 1.5 MN/m². Calculate the voltage output. If the permittivity of quartz is 40.6 x 1012 F/m, calculate its charge sensitivity.
 4C. Draw the equivalent circuit of piezo electric transducers.
- **5A.** Explain the working of photomultipliers with neat diagram.**45B.** Describe photo transistor with diagram.**3**
- **5C.** Explain the working of contacting type translational encoder with diagram. **3**