

**M.Sc. Physics Semester – 4 Examination**  
**Instrumentation**  
**Paper Phys-E401 Code : 4754**

**Total Marks – 70**

*APRIL - 2015*

**Duration – 2 Hrs 30 Min**

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|------------|---|------------|
| <b>Q.1</b> | a. What is Hall Effect? Explain Hall Effect devices in detail.  | <b>[5]</b> |
|            | b. Explain a generalized measurement system with block diagram.   | <b>[5]</b> |
|            | c. Explain problem analysis.  | <b>[4]</b> |
| <b>OR</b>  |   |            |
| <b>Q.1</b> | a. Describe first-order system. Explain step-response of first-order system in detail.  | <b>[5]</b> |
|            | b. Explain variable capacitance transducer in detail.   | <b>[5]</b> |
|            | c. Give major electrical transduction principles used for displacement measurements.  | <b>[4]</b> |
| <b>Q.2</b> | a. Which are the types of strain gauges? Explain each type in detail.   | <b>[5]</b> |
|            | b. Explain the gauging techniques and other factors. Explain temperature effect in detail.  | <b>[5]</b> |
|            | c. Which are the materials used for strain gauges? Explain each in detail.  | <b>[4]</b> |
| <b>OR</b>  |   |            |
| <b>Q.2</b> | a. Which are the factors affecting strain measurements?   | <b>[5]</b> |
|            | b. Which are the types of electrical strain gauges? Explain wire gauges in detail.  | <b>[5]</b> |
|            | c. What is temperature compensation? Explain temperature compensated gauges.  | <b>[4]</b> |
| <b>Q.3</b> | a. Describe metal diaphragms in the range of large deflections (Membranes).   | <b>[5]</b> |
|            | b. Which are the basic types of elastic pressure-sensing elements used in electrical transducers? Explain Bellows in detail.                | <b>[5]</b> |
|            | c. Explain potentiometric pressure transducer.  | <b>[4]</b> |
| <b>OR</b>  |   |            |
| <b>Q.3</b> | a. Describe pressure multiplexer.   | <b>[5]</b> |
|            | b. Explain vibrating element pressure sensors.  | <b>[5]</b> |
|            | c. Explain thin film pressure transducers.  | <b>[4]</b> |
| <b>Q.4</b> | a. What is piezoelectric effect and how the effect is applicable to measure pressure in piezoelectric pressure transducer, explain briefly. | <b>[5]</b> |
|            | b. What voltage is generated from a crystal 8mm thick if 2 MPa ( $2 \times 10^6 \text{ N/m}^2$ ) of pressure is applied and the crystal is  | <b>[5]</b> |
|            | i. X-cut longitudinal Quartz $S_v = 0.055 \text{ V m/N}$  |            |
|            | ii. Barium titanate $S_v = 0.011 \text{ V m/N}$   |            |
|            | where $S_v$ is the voltage sensitivity of material.   |            |
|            | c. Describe digital pressure transducer.  | <b>[4]</b> |
| <b>OR</b>  |   |            |
| <b>Q.4</b> | a. Explain diaphragms in terms of pressure transducers.   | <b>[5]</b> |
|            | b. Describe variable reluctance sensor.   | <b>[5]</b> |
|            | c. Explain pressure calibration.  | <b>[4]</b> |
| <b>Q.5</b> | a. What is mechanical temperature sensor? Explain liquid-filled systems.  | <b>[5]</b> |
|            | b. Explain temperature scales.  | <b>[5]</b> |
|            | c. Explain calibration of thermometer in detail.  | <b>[4]</b> |
| <b>OR</b>  |   |            |
| <b>Q.5</b> | a. Explain solid-state sensors.   | <b>[5]</b> |
|            | b. Explain temperature measurement by radiation methods.  | <b>[5]</b> |
|            | c. Explain thermistors in detail.   | <b>[4]</b> |