

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 2736**

Roll No.

6809621619

**B.Tech.**

(SEM. VII) THEORY EXAMINATION 2011-12

**ELECTRICAL INSTRUMENTATION AND  
PROCESS CONTROL****EEE504**

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 2114**

Roll No.

(SEM. V) THEORY EXAMINATION 2011-12

**ELECTRICAL INSTRUMENTATION AND  
PROCESS CONTROL***Time : 3 Hours**Total Marks : 100***Note** :— Attempt all **five** questions. Each question carries equal marks.

1. Answer any **four** parts of the following : **(5×4=20)**
- (a) What is primary sensing element and why is it important ?  
Enlist most commonly used primary sensing elements.
- (b) Explain digital transducers. Why are these preferred over analog transducers ? Explain.
- (c) What is a load cell ? What for it is used ?

- (d) Why is it necessary to protect transmission channel from sources of interferences in voltage telemetry system ?
- (e) What are the differences between a closed loop system and a open loop system ? Where these system are used ?
- (f) Why is scope of hydraulic and pneumatic methods of data transmission limited ?

2. Answer any **two** parts of the following : **(10×2=20)**

(a) Discuss the classification of transducers. Why selection of a transducer is important ? Explain the points to be considered in determining a transducer suitable for a specific measurement.

(b) Define gauge factor of a strain gauge. Show that for a wire wound resistance strain gauge, the gauge factor,  $G_f$  is

given by the expression  $G_f = 1 + 2\gamma + \frac{\delta\rho/\rho}{S\ell/\ell}$ , where symbols used have usual meanings.

(c) What is a piezoelectric transducer ? Draw its equivalent circuit. Derive an expression for the output voltage by making suitable simplifying assumptions.

A piezoelectric crystal has a thickness of 2 mm and a voltage sensitivity of 0.04 V-m/N. Determine the output voltage when it is subjected to a pressure of  $1.5 \times 10^6$  N/m<sup>2</sup>.

3. Answer any **two** parts of the following : (10×2=20)

(a) A 25 mm diameter steel shaft is used for transmission of power. Determine the maximum power that can be transmitted at 1,200 rpm through this shaft if the maximum allowable strain in the gauges bonded to it is 0.0025 and modulus of elasticity of steel is 200 GN/m<sup>2</sup>. Also determine the output voltage and overall, sensitivity of the bridge if the strain gauges used for measuring torque are bonded to shaft in a pair and connected to an equal arm wheatstone bridge. The resistance of each strain gauge is of 160 Ω. The gauge factor of each gauge is 2 and applied voltage to the bridge is 8V.

(b) Describe various electrical methods used for measurement of liquid level. Also enlist their merits and limitations.

(c) (i) Describe with diagram the moving magnet type transducer used for measuring linear velocity. Also enlist its merits and demerits.

(ii) Discuss stroboscopic method of measuring rotational speed of a machine with suitable diagram.

4. Answer any **two** parts of the following : (10×2=20)

(a) Draw and explain frequency division multiplexing system and time-division multiplexing system with neat sketches. Also compare their performance.

(b) What is x-y recorder ? How is it different from x-t and y-t recorders ? Describe its functioning with a suitable diagram. Explain the various techniques employed in digital tape recording. Enlist their merits and demerits.

(c) Explain in detail the following :

(i) Digital to Analog conversion

(ii) Digital Frequency counter.

5. Answer any **two** parts of the following : **(10×2=20)**

(a) Explain how the following are determined from the trace on an oscilloscope :

(i) the rms value of a sine wave and

(ii) the phase difference between two voltages of the same frequency.

(b) Write short notes on the following :

(i) On-off control

(ii) PID control.

(c) Draw the neat diagram of pneumatic controller used in thermal power plant. Also compare the performance of pneumatic controller over hydraulic controller.