**Registration No.:** | | | | | | | | | | |

**Total Number of Pages: 02** **Course: B.Tech**
**Sub_Code: REI5D001**

**5th Semester Regular Examination: 2024-2025**
**SUBJECT: Sensors and Actuators**
**BRANCH(S): AEIE**
**Time: 3 Hours**
**Max Marks: 100**
**Q.Code: R188**
**Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.**
**The figures in the right-hand margin indicate marks.**

**Part-I**

**Q1** **Answer the following questions:** **(2 x 10)**

**a)** Explain the working of Hall sensor.
**b)** Explain the operation of variable inductance type transducer.
**c)** Describe the principle of operation of diaphragm pressure transducers and their typical applications.
**d)** What factors influence the value of Reynolds number in a fluid flow system?
**e)** Explain the concept of Poisson's ratio and define the gauge factor.
**f)** State Bernoulli's theorem.
**g)** Explain the function of an LDR (Light Dependent Resistor) in robotic systems.
**h)** Mention the importance of links and joints in kinematic chains.
**i)** What is piezoelectric effect?
**j)** What are the advantages of using paddlewheel sensors for flow rate measurement in pipelines?

**Part-II**

**Q2** **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

**a)** Describe the operating principle of a piezoelectric pressure sensor and explain how it converts pressure into an electrical signal.
**b)** A strain gauge with a gauge factor of 2.5 is bonded to a steel specimen. The resistance of the strain gauge changes from 150 Ω to 152 Ω due to the applied strain. The length of the specimen is 200 mm, and the cross-sectional area is 10 mm². Calculate the strain experienced by the specimen and the applied force if the Young's modulus of steel is $2 \times 10^{11}$ N/m².
**c)** Explain briefly how displacement is sensed by an LVDT (Linear Variable Differential Transformer) and describe its characteristic curve.
**d)** Explain the working Potentiometer.

e) What is mechanical actuation system? Explain the important functions of mechanical actuation system.

f) Describe in detail the various types of pressure control valves and their working.

g) Explain the operation of a solenoid and its applications in automation systems. Discuss the factors that affect its performance.

h) Distinguish Hydraulic and Pneumatic actuators.

i) Explain the working principle of belt and chain drives. Discuss their types, advantages, and disadvantages, and compare their applications in mechanical systems.

j) Identify the different types of proximity sensors and explain the working principles of inductive and optical proximity sensors.

k) Briefly describe the working principle of Photoelectric sensor.

l) Discuss the working principle of Variable-Reluctance Stepper Motor.

## Part-III

**Only Long Answer Type Questions (Answer Any Two out of Four)**

**Q3** With a neat diagram, explain the working principle of process control valves in controlling the rate of fluid flow. Discuss the different types of control valves used in industrial applications, their components, and how they help in maintaining the desired flow rate, pressure, and temperature in a process system. **(16)**

**Q4** Explain the principle of operation of a Rota-meter with necessary sketches and equations. List out its advantages and disadvantages. **(16)**

**Q5** Analyze the working principle of a variable capacitance transducer and critically evaluate its application as a capacitive displacement transducer, discussing its advantages and limitations in measurement systems. **(16)**

**Q6** What is basically the concept of “smart sensors”? Explain the essential elements of a “Smart sensor” unit with a neat diagram. **(16)**