



## **SENSORS & ACTUATORS (19EC4102) QUESTION BANK**

### **UNIT –I**

1. A) Briefly explain the principles of sensors. [CO1][L2][8M]  
B) Mention the sensors which are used in industrial applications. [CO1][L2][4M]
2. Define sensor. Classify different types of sensors. [CO1][L1][12M]
3. A) Explain briefly about the dynamic characteristics of sensors. [CO1][L2][6M]  
B) Write a short note about the following  
i) Mechanical sensors ii) Electromechanical sensors [CO1][L1][6M]
4. Explain briefly about the static characteristics of sensors. [CO1][L2][12M]
5. A) Write a short note on environmental parameters of a sensor. [CO1][L2][3M]  
B) Mention the applications of emerging sensor technologies. [CO1][L2][5M]  
C) Write about precision and resolution of a sensor. [CO1][L2][4M]
6. What is meant characterization of a sensor? Explain briefly about mechanical and thermal characterization of a sensor. [CO1][L2][12M]
8. Define potentiometer. Explain about the resistive potentiometers in detail [CO1][L2][12M]
9. A) Write a short note on strain gauge. [CO1][L2][2M]  
B) Discuss in detail about the resistance strain gauge. [CO1][L2][10M]
10. What are the semiconductor strain gauges? Explain them in detail. [CO1][L2][12M]

### **UNIT-II**

1. A) Define thermal sensor. Classify various temperature sensors. [CO2][L1][6M]  
B) Describe about the two relations used in the development of dielectric constant and refractive index thermo-sensors. [CO2][L3][6M]
2. What is the principle of gas thermometric sensors? Briefly explain about gas thermometric sensors. [CO2][L2][12M]
3. A) Explain the working principle of thermal expansion type thermometric sensors. [CO2][L2][10M]  
B) Mention the applications of thermal expansion type thermometric sensors. [CO2][L2][2M]
4. A) Write short notes on helium low temperature thermometer. [CO2][L1][2M]  
B) Explain in brief about the nuclear thermometer. [CO2][L2][5M]  
C) Explain in brief about the magnetic thermometer. [CO2][L2][5M]
5. With a neat sketch, explain the principle operation of resistance change type thermometric sensors in detail. [CO2][L2][12M]
6. With the help of a neat diagram, explain the construction and working principle of thermo-emf sensors. [CO2][L2][12M]
7. Explain in brief about the types of junction semiconductor. [CO2][L2][12M]
8. What are the three important aspects of a radiation thermometer? Discuss their involvement in the measurement of temperature. [CO2][L3][12M]
9. A) How are quartz crystal sensors used temperature sensors? Describe how is resonant frequency related to temperature. [CO2][L2][8M]  
B) Explain the working principle of nuclear quadrupole resonance thermometer. [CO2][L2][4M]
10. A) Describe the principle of spectroscopic thermometry. [CO2][L2][6M]  
B) Define noise thermometer. Explain various schemes of noise thermometry. [CO2][L2][6M]

### UNIT-III

1. A) Write a short note on radiation sensor working principle. [CO3][L2][2M]  
B) Discuss the basic characteristics of radiation sensors. [CO3][L2][10M]
2. A) Explain about the photo-emissive cell and the photo-multiplier. [CO3][L2][6M]  
B) Explain about the photoconductive cell. [CO3][L2][6M]
3. A) Explain about the Position-sensitive cell. [CO3][L2][6M]  
B) Explain about the Phototransistors and Photo FETs. [CO3][L2][6M]
4. A) Write a short note on relative biological effectiveness (RBE). [CO3][L3][2M]  
B) Discuss about the sensor techniques used for the detection of X-ray and nuclear radiation. [CO3][L3][10M]
5. Describe an optical fiber sensor for temperature measurement. Comment on its range, accuracy, and resolution. [CO3][L3][12M]
6. A) Describe the basic construction and operation of an electrochemical cell. [CO3][L2][9M]  
B) Define the terms- electrode potential, cell potential and half-cell potential. [CO3][L2][3M]
7. A) What is a standard hydrogen electrode? Explain about its utility in instrumental analysis. [CO3][L2][6M]  
B) What is a junction potential? Mention the factors that it depends. [CO3][L2][6M]
8. A) How is cell potential affected by polarization? Discuss about different types of polarization. [CO3][L2][6M]  
B) Why is a reference electrode needed in a sample analysis? Explain about the commonly used reference electrodes. [CO3][L1][6M]
9. What different types of sensor electrodes are known to be used commercially? Explain how they are different from construction-wise and operation-wise. [CO3][L2][12M]
10. Describe the characteristics of electro-ceramics such as  $ZrO_2$ ,  $TiO_2$ , and  $(SiO_2, ZrCr_2O_4)$  and explain how they use their ionic conductivity, semi-conductivity, and surface ionic conductivity respectively for measuring oxygen content and humidity. [CO3][L2][12M]

### UNIT-IV

1. What is basically the concept of “smart sensors”? Explain the essential elements of a “Smart sensor” unit with a neat diagram. [CO4][L2][12M]
2. Describe with the help of diagram, how the primary sensors are being integrated with signal processing ensembles. [CO4][L2][12M]
3. A) Mention the different deviations that need be compensated in sensor system. [CO4][L1][3M]  
B) Explain how nonlinearity is taken care of in a present-day smart sensor. [CO4][L1][9M]
4. A) Describe the principles of a “smart transmitter” with a neat diagram. [CO4][L1][8M]  
B) Discuss some aspects of “smart transmitter” development in recent years. [CO4][L2][4M]
5. A) Explain the signal communication standards in modern control systems. [CO4][L1][6M]  
B) Write a short note on excitation, amplification and filters. [CO4][L2][6M]
6. Explain the following sensors used in automobiles(on-board) [CO4][L2][12M]  
i)Flow-rate                      ii) Pressure                      iii) Temperature                      iv)Torque and position
7. A) Draw the sketch of a pyroelectric IR sensor and explain its operation as it is used in microwave oven. [CO4][L5][6M]  
B) How is the water level sensed in washing machines? Sketch the sensor and explain its operation. [CO4][L5][6M]
8. A) How is static pressure measured in aerospace studies? Explain with a graph that how it is dependent on total pressure, isentropic ratio and match number. [CO4][L5][6M]

- B) Describe the technique of computation of air speed on aircraft by measuring the static pressure, total pressure and temperature. [CO4][L5][6M]
9. A) Explain with a block diagram to show how sensors interact with the automated manufacturing process. [CO4][L5][4M]
- B) Draw the sketch of a laser beam operated system of distance sensing and explain different types of detectors used and their operation. [CO4][L2][8M]
10. A) Draw and explain with a neat block diagram on how are environmental hazards spread? [CO4][L2][8M]
- B) With some examples, explain how instrumentation has improved the studies of ecology. [CO4][L1][4M]

## UNIT-V

1. A) Define Actuators? Mention the different types of Actuation systems. [CO5][L4][4M]
- B) Explain the following with neat a neat block diagram.
- i) Pneumatic system power supply      ii) Hydraulic system power supply [CO5][L2][8M]
2. A) Explain the importance of directional control valves in pneumatic and hydraulic systems. [CO5][L2][4M]
- B) With help of neat diagrams explain the symbols of directional control valves. [CO5][L2][8M]
3. A) Write a short note on Pilot-operated valves and Directional valves. [CO5][L2][4M]
- B) Explain about the different pressure control valves in detail. [CO5][L2][8M]
4. A) Explain the principle operation of hydraulic or pneumatic cylinder. [CO5][L2][6M]
- B) Describe how the cylinders are operated in hydraulic or pneumatic system when connected sequentially. Explain its principle. [CO5][L6][6M]
5. With a neat diagram explain how the process control valves are used to control the rate of fluid flow. [CO5][L6][12M]
6. A) Explain about the different mechanisms used in rotary actuators. [CO5][L2][6M]
- B) What are mechanical actuation systems? Explain the important functions of mechanical actuation systems. [CO5][L2][6M]
7. Draw and explain various types of motion involved in mechanical actuation systems. [CO5][L1][12M]
8. A) Mention the importance of links and joints in kinematic chains. [CO5][L1][3M]
- B) Explain various mechanisms involved in the kinematic chain systems. [CO5][L2][9M]
9. A) With a neat sketch explain the working principles of cams used for oscillatory or reciprocating motion. [CO5][L1][5M]
- B) Explain how the gear trains mechanisms are used for transfer and transform rotational motions. [CO5][L2][7M]
10. A) Write a short note on Ratchet and pawl mechanism. [CO5][L1][3M]
- B) Explain the working principle of belt and chain drives mechanisms. [CO5][L2][9M]
11. Draw and explain how bearing mechanisms used as mechanical actuation systems. [CO5][L1][12M]