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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING  
END TERM EXAMINATION - JUN 2023**

**Semester :** Semester VI - 2020

**Course Code :** EEE3046

**Course Name :** Sem VI - EEE3046 - Sensors and Transducers

**Program :** EEE

**Date :** 19-JUN-2023

**Time :** 9.30AM - 12.30PM

**Max Marks :** 100

**Weightage :** 50%

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**Instructions:**

- (i) Read all questions carefully and answer accordingly.
  - (ii) Question paper consists of 3 parts.
  - (iii) Scientific and non-programmable calculator are permitted.
  - (iv) Do not write any information on the question paper other than Roll Number.
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**PART A**

**ANSWER ALL THE QUESTIONS**

**(10 X 3 = 30M)**

1. Liquid level sensors are used for detecting liquid levels or interfaces between liquids such as water and oil or solids and liquids. List any two types of liquid level sensors with their working. (CO4) [Knowledge]
2. **The Thermistor is a solid state temperature sensing device which acts a bit like an electrical resistor** but is temperature sensitive. Define the self heating effect of a thermistor. (CO3) [Knowledge]
3. Proximity Switch consists a sensor circuit and a driver circuit. The sensor circuit is used to detect any nearby objects. Draw a neat driver circuit for the proximity switch which uses NPN transistor and briefly explain its working. (CO4) [Knowledge]
4. Light Dependent Resistor or LDR is a device whose resistivity is a function of the incident electromagnetic radiation. With neat sketch draw the resistance vs. illumination curve for a LDR and define the concept of dark current. (CO2) [Knowledge]
5. Capacitive and inductive sensors are two very common non-contacting sensors which are used to detect the presence of an object. List the differences between Capacitive and Inductive proximity sensors. (CO1) [Knowledge]
6. A photovoltaic (PV) cell, commonly called a solar cell, is a non-mechanical device that converts sunlight directly into electricity. A large set of PV cells can be connected together to form solar modules, panels, or arrays. List the advantages and disadvantages of PV cells. (CO2) [Knowledge]
7. Bolometer is an instrument that is used to detect and measure the heat or power of incident electromagnetic radiation of microwave . List the two types of temperature-sensitive resistors used in the Bolometer bridge circuit. (CO3) [Knowledge]

8. The piezoelectric effect is very useful for many applications that involve the production and detection of sound, generation of high voltages, electronic frequency generation, microbalances, and ultra fine focusing of optical assemblies. Define the terms piezoelectric effect and inverse piezoelectric effect. Also list the name of the materials that exhibits piezoelectric effect. (CO1) [Knowledge]
9. In photo beam detectors interruption of a beam of light triggers a warning or a mechanism. List the two ways light beam in a typical photoelectric smoke detector can be obscured. (CO4) [Knowledge]
10. A thermocouple is a sensor that measures temperature. It consists of two different types of metals, joined together at one end. List any two types of thermocouples with their composition and the operating temperature range. (CO3) [Knowledge]

### PART B

#### ANSWER ALL THE QUESTIONS

(3 X 10 = 30M)

11. A manufacturing industry need a sensor for the remote monitoring of its plant temperature. The temperature has to be monitored continuously and is to be used for temperature control. Identify a sensor which is having a linear characteristic for this industry. With neat circuit diagram explain its working. (CO3) [Comprehension]
12. Suggest a low cost smoke detector to install in a large warehouse building. It should be less prone to false alarms from cooking fumes or shower steam and do not contain radioactive materials, making them safer for use. Explain briefly its working. (CO4) [Comprehension]
13. A spectrophotometer used in a laboratory require a photodetector which measure the intensity of incident light. The photodetector should have high gain, good responsivity, large dynamic range and long lifetime. Identify a suitable photodetector for the spectrophotometer and with neat sketches explain its principle of operation and working. (CO2) [Comprehension]

### PART C

#### ANSWER ALL THE QUESTIONS

(2 X 20 = 40M)

14. a) The thermistor is a solid state temperature sensing device which acts a bit like an electrical resistor but is temperature sensitive. The working principle of a thermistor is that its resistance is dependent on its temperature. A 10k $\Omega$  NTC thermistor has a " $\beta$ " value of 3455 between the temperature range of 25 degree Celcius and 100degree Celcius. Calculate its resistive value at 25degree Celcius and again at 100degree Celcius.  
b)A thermocouple having an internal resistance of 30 $\Omega$  and lead resistance of 10 $\Omega$  produces a voltage of 100mV. If the output is read by a voltmeter having an internal resistance of 150 $\Omega$ , what will be the voltage indicated by the voltmeter. (CO3) [Application]
15. A barium titanate pick up has the dimensions of 5mm X 5mm X 1.25mm. The force acting on it is 5N. The charge sensitivity of barium titanate is 150pC/N and its permittivity is  $12.5 \times 10^{-9}$  F/m. If the modulus of elasticity of barium titanate is  $12 \times 10^6$ N/m<sup>2</sup>, calculate the strain. Identify all other unknown quantities that can be calculated using the given data and find the values. (CO1) [Application]