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Paper Id: 233304 **Roll No.** | | | | | | | | | | |

B.TECH.
(SEM III) THEORY EXAMINATION 2022-23
SENSOR AND INSTRUMENTATION

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

(a) Explain the characteristics of sensors.
(b) What are the factors to be considered while selecting transducer?
(c) Compare Thermocouple and Thermistor temperature transducer.
(d) Write down various material used in RTD (Resistance Temperature Detector) with it's temperature range.
(e) Write the syntax for two types of WHILE loop.
(f) What is Formula Node?
(g) Explain difference between counter and timer.
(h) What is use of Data Sockets for Networked Communication?
(i) Give the features of smart sensors
(j) Explain the use of smart sensor in industrial robots.

SECTION B

2. Attempt any *three* of the following: 10x3=30

(a) Give the construction and working of LVDT for displacement measurement, write advantages and disadvantages of LVDT.
(b) Describe the construction and working of thermocouple. A thermocouple circuit uses a chromel-alumelthermocouple which gives an emf of 33.3 mV. When measuring at emperature of 800 °C with reference temperature 0 °C. The resistance of the meter coil, R_m is 50Ω and a current of 0.1 mA gives full scale deflection. The resistance of junctions and leads, R_e is 12Ω .
Calculate: Resistance of the series resistance if a temperature of 800 °C isto give full scale deflection. (The resistance temperature co-efficient of coil is 0.00426/°C)
(c) Explain the essential need for Virtual Instrumentation and compare it with the traditional instruments.
(d) Discuss the Digital to Analog Converter :i. R-2R ladder network method
ii. Weighted resistors method
(e) With the help of block diagram discuss the architecture of smart sensors.

SECTION C

3. Attempt any *one* part of the following: 10x1=10

(a) How do you measure strain with the help of a strain gauge transducer also write the various characteristics of strain gauges?
(b) Discuss piezoelectric sensor or transducer withsuitable diagram.A quartz piezo-electric crystal having a thickness of2 mm and voltage sensitivity of 0.055 V-m/N is subjected to a pressure of 1.5 MN/m^2. Calculate the voltage output. If the permittivity of quartz is 40.6×10^{-12} F/m. Calculate its charge sensitivity.

4. Attempt any *one* part of the following: 10x1=10

(a) What is Hall Effect sensor? How it can be used to measurefluid levelposition?

(b) Discuss the working principle of capacitive levelsensors also write advantages, disadvantages and applications ofcapacitive level sensors.

5. Attempt any *one* part of the following: 10x1=1

(a) Discuss in detail about different structures with examples.

(b) Explain the role of different hardware's and software's in Virtual Instrumentation in detail.

6. Attempt any *one* part of the following: 10x1=10

(a) Why we use data acquisition system? Draw its block diagram & explain in detail its each component.

(b) Explain in detail Successive approximation A/D converter; write the applications of analog to digital converter (ADC).

7. Attempt any *one* part of the following: 10x1=10

(a) Explain the following characteristics of smart sensors in detail, Self-calibration, Multi-sensing, Communication, Self-Diagnosis.

(b) Explain in detail the various applications of smart sensors in smart cities.