

Mansoura University
Faculty of Engineering
Level 300 Students.
Biomedical Engineering Program.



Subject: Sensors.
Course Code: CSE 352.
Date: 27/11/2018.
Time allowed: 1 Hour.

Mid-Term Exam.

Name: ID:

Assume any missing data....The exam is three questions.

*Books & notes are not allowed.

Attempt the following questions:

Max. Marks (30)

Question 1: (14marks)

(1-a) Describe the difference between: (9marks)

I. **Bimetallic strip temperature sensors**

Thermocouples temperature sensors

II. **Hall Effect sensors**

Optical encoder sensors

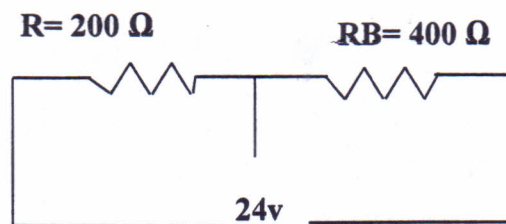
III. LVDT sensors

Push-pull displacement sensors

(1-b) The initial sensitivity of different elements comprising a temperature measuring system are: transducer = $0.3 \text{ ohm/}^{\circ}\text{C}$; Wheatstone bridge = 0.01 v/ohm ; amplifier = 80 v/v ; pen recorder = 1.2 mm/v . Determine the overall sensitivity and the temperature change corresponding to a pen recorder movement of 30mm. (5marks)

Question 2:**(10marks)**

- (2-a) A strain gauge having a resistance of $200\ \Omega$ and gauge factor 2.5 is connected in series with a ballast resistance of $400\ \Omega$ across a 24v. Determine the change in the output voltage when a stress of $140\ \text{MN}/\text{m}^2$ is applied the modulus of elasticity is $200\ \text{GN}/\text{m}^2$.

(6marks)

- (2-b) A $250\ \Omega$ platinum RTD is being used to measure the temperature of an oven. The present resistance reading is $330\ \Omega$. What is the oven's temperature? Temperature coefficient for platinum is $0.0039\ \Omega/\Omega/^{\circ}\text{C}$.

(4marks)**Question 3:****(10marks)**

- (3-a) A chromed-Constant thermocouple has a cold junction at $20\ ^{\circ}\text{C}$ as shown in next table, what will be the thermoelectric emf when the hot junction is at $200\ ^{\circ}\text{C}$.

(4marks)

T($^{\circ}\text{C}$)	0	20	200
Emf(mv)	0	1.192	13.419

(3-b) A steel diaphragm is used for pressure measurement. It is 50 mm in diameter, and is to be designed to measure a maximum pressure of 1.5 MN/m^2 . The modulus of elasticity of steel is 200 GN/m^2 , and the Poisson's ratio is 0.3. Calculate the thickness of the diaphragm in order that the maximum deflection is not more than $1/3$ of its thickness.

(6marks)

With my best wishes,

Dr. Mahmoud M. Saafan,

12:45 PM, Tuesday, 27th Nov. 2018.