Mansoura University | Faculty of Engineering | Biomedical Engineering Program

Course Title: Sensors and effects

Course Code: CSE352

Year: Level 300 students

Semester: First term 2019 / 2020

No. of pages: [4]

Date: Tuesday, 12/11/2019, 12:45 PM

Time allowed: 1 hour

Total mark: 30 Marks

Mid-term exam

Examiner: Dr. Eman M. El-Gendy

- Assume Any Missing Data.
- Books and notes are not allowed.
- Attempt all the following questions.
- Total number of questions = 6.

الاسم:

رقم ID:

Question 1: (8 Marks)

Explain the difference between:

a) Accuracy and precision.

b) Resolution and Sensitivity.

c) Incremental and absolute encoder.

d) Potentiometer and LVDT.

Question 2: **(3 Marks)**

A potentiometer has a total winding resistance of 8 KΩ and a maximum displacement range of 5 cm. The power dissipation at maximum displacement doesn't exceed 50 mW. **Determine** the O/P voltage of the potentiometer when the I/P displacement is 2 cm?

Question 3: (6 Marks)

Plot a graph of the following readings for a pressure sensor to determine if there's hysteresis. If so, **Calculate** the hysteresis as a percentage of the full scale deflection?

True pressure (Kpa)	0	20	40	60	80	100	80	60	40	20	0
Gauge pressure (Kpa)	0	15	32	49.5	69	92	87	62	44	24	3

Question 4: (5 Marks)

A strain gauge is bonded to a beam of 150 mm long having a cross sectional area of 5 cm2. The young's modulus for steel is 200 GPa. The strain gauge has an unstrained resistance of 220 Ω and a GF of 2. When a load is applied, the resistance of the gauge changes by 0.015 Ω. **Find** the change in length of the steel beam and the amount of force applied to the beam?

Question 5: **(4 Marks)**

Consider a parallel rectangular plate air-spaced capacitor of 30cm*20cm and the distance between the plates is 1.2mm. If the relative permittivity for air is 1.006, **calculate** the displacement sensitivity of the device assuming that permittivity of free space is 8.854×10-12 F/m?

Question 6: **(4 Marks)**

The O/P of an LVDT is connected to a 10A ammeter through an amplifier whose amplification factor is 200. An O/P of 3 mA appears across the terminals of the LVDT when the core moves a distance of 0.75 mm. **Calculate** the sensitivity of the LVDT and that of the whole setup. The milliammeter scale has 100 divisions. The scale can be read to 1/10 of a division. **Determine** the resolution of the instrument.

Best Wishes,

Dr. Eman M. El-Gendy

Tuesday, 12/11/2019, 12:45 PM