MINISTRY OF EDUCATION
MANDALAY TECHNOLOGICAL UNIVERSITY
Department of Mechatronic Engineering
2017-2018 Academic Year

Fifth Year **Second Semester Examination**

McE-52066 Sensors for Mechatronic System

Date: 2.10.2018 (TUE) **Time: 9:00 to 12:00 noon**

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Attempt **ALL** Questions.

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1. (a.) Fill in the blanks in the following sentences. **(5.Marks)**

i. Actuators are needed to perform the … …… as well as drive the plant directly.

ii. Sensors and transducers are necessary to measure … ……(process responses) and to measure input signals for feedforward control.

iii. In feedback control, ……. is determined according to plant response.

iv. Transducer can be classified into two types: (i) ……. and (ii) Self-Generating Transducer(Active).

v. Motion transducers that employ the principle of electromagnetic induction are termed ……..

1. (b.) Choose the **correct answer** from the following sentences**.** **(15.Marks)**

i. The transducers which requires an external power and their output is a measure of some variation such as resistance, inductance, capacitance etc., are called as

(1.) Active transducer

(2.) Primary Sensor

(3.) Passive transducer

(4.) Self generating transducer

ii. When the temperature rises, resistance of negative temperature coefficient thermistor

(1.) Increase

(2.) Decrease

(3.) Zero

(4.) Infinity

iii. The transducer that converts the input signal into the output signal which is a discrete function of time is known as …….. transducer.

(1.) Active

(2.) Analog

(3.) Digital

(4.) Pulse

iv. …….. consists of two different metals connected at two point.

(1.) Thermister

(2.) Resistance Thermometer

(3.) Thermocouple

(4.) Semiconductor based sensor

v. Inductive proximity sensors can be effective only when the objectives are of …….. materials.

(1.) Ferromagnetic

(2.) Diamagnetic

(3.) Paramagnetic

(4.) All of the above

vi. The principle of operation of variable resistance transducer is

(1.) Deformation leads to change in resistance

(2.) Displacement of a contact slider on a resistance

(3.) Coupling of two coils changes with displacement

vii. Which sensor can detect the present of nearby object without any physical contact?

(1.) Proximity Sensor

(2.) Humidity Sensor

(3.) Touch Sensor

viii. The noise that affects pulse code modulation

(1.) Transition noise

(2.) Quantizing noise

(3.) Transient noise

(4.) Both 1 and 2 are correct

ix. In a Linear Variable Differential Transformer (LVDT), the two secondary voltages

(1.) Are independent of the core position

(2.) Vary unequally depending on the core position

(3.) Vary equally depending on the core position

(4.) Are always in phase quadrature

x. The sensors are classified on the basis of

(1.) Functions

(2.) Performance

(3.) Output

(4.) All of the above

xi. Which among the below stated does not belong to the category of analog transducer?

(1.) Shaft encoder

(2.) Linear Variable Differentiate Transformer

(3.) Strain guage

(4.) Thermister

xii. What is the principle of operation of Linear Variable Differential Transformer (LVDT)?

(1.) Mutual inductance ,

(2.) Self-inductance,

(3.) Permanence,

(4.) Reluctance

xiii. Device which converts an input device state into a binary representation of ones or zeros is termed as

(1.) Encoder

(2.) Decoder

(3.) Multiplexer

(4.) Data selector

xiv. The electron reconfiguration produces a voltage, and is known as the ……..

(1.) Phase shift

(2.) Null Voltage

(3.) Seebeck effect

(4.) Magnetizing voltage

xv. A piezoelectric accelerometer senses …….and converts it into an electric charge.

(1.) rotation

(2.) displacement

(3.) velocity

(4.) acceleration

2. (a.) Discuss about digital signals have several advantages in comparison with analog signal.

(10 .Marks)

2. (b.) On what factors the displacement resolution of an incremental encoder depends? **(5.Marks)**

2. (c.) For an ideal design of an incremental encoder, obtain an equation relating the parameters d, ω, and r, where

d =diameter of encoder disk

ω =number of windows per unit diameter of disk

r = word size (bits) of the angle measurement.

Assume that quadrature signals are available. If r = 15 and ω = 700/cm, determine a suitable disk diameter. **(5.Marks)**

3. (a.) Consider the rotary potentiometer shows in Figure 1. Discuss the significance of the electrical **loading nonlinearity error** caused by a purely resistive load connected to the pot. **(10.Marks)**

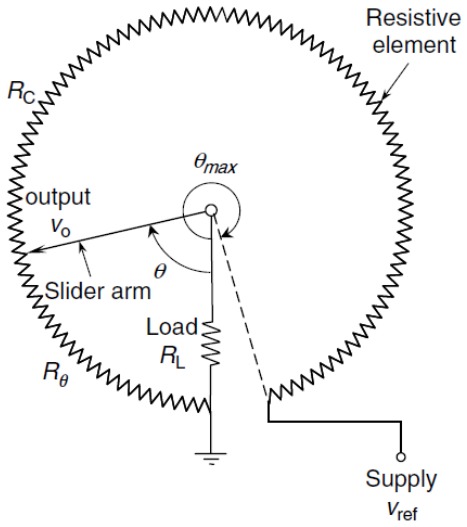

Figure.1

3. (b.) Discuss about the Mutual-Induction Proximity Sensor with schematic diagram and its some typical applications. **(10.Marks)**

4.(a.) An incremental encoder with 500 windows in its track is used for speed measurement. Suppose that

i. In the pulse-counting method, the count (in the buffer) is read at the rate of 10 Hz

ii. In the pulse-timing method, a clock of frequency 10 MHz is used.

Determine the percentage resolution for each of these two methods when measuring a speed of 1 rev/s and 100 rev/s. **(10.Marks)**

4.(b.) Drive formula for calculating the digital resolution and physical resolution of an encoder.

(10.Marks)

5.(a.) Briefly explain the signal-conditioning methods for a differential transformer**. (10.Marks)**

i. Rectification

ii.Demodulation

5.(b.) What are the advantages and limitations of resolver? **(10.Marks)**

----------**End of the Questions**----------