TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING (PLANT OPTION)(DPL5)

ECI 2350
INSTRUMENTATION SYSTEMS

SPECIAL/SUPPLEMENTARY EXAMINATIONS

SERIES: JULY, 2014

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. You should have the following for this examination:
   - Answer Booklet
   - Scientific Calculator

2. This paper consists of **FIVE** Questions.
3. Answer **ANY THREE** Questions.
4. All Questions carry equal marks.
5. **This paper consists of *THREE* printed pages.**

Question ONE

(a) Explain the following types of displays and the recorder output devices giving one application of each:

(i) Single number output devices
(ii) Time domain output devices
(iii) Machine interpretable output

(6 marks)

(b) (i) State the important requirement of recorders.

(ii) Using a diagram, explain the operation of a strip chart recorders.

(10 marks)

(c) Explain the operation of a seven segment LED display. **(4 marks)**

Question TWO

(a) Explain the following terms used in digital to analog converters (DAC):

(i) Step size
(ii) Resolution
(iii) Quantization error

(6 marks)

(b) (i) With the aid of a circuit diagram, describe the binary weighted resistance DAC.

(ii) A DAC gives a digital output of 10 bits. Calculate the percentage resolution.

(10 marks)

(c) (i) Explain the purpose of using a filter in an instrumentation system.

(ii) Using a circuit diagram and characteristics curves, explain the operation of a low pass filter.

(4 marks)

Question THREE

(a) Define the following terms as applied to instrumentation systems:

(i) Precision
(ii) Repeatability
(iii) Working standards
(iv) Reliability

(6 marks)

(b) Draw a labeled block diagram of a digital instrumentation system and explain the functions of each block. **(14 marks)**

(c) State **TWO** advantages of digital over analog instrumentation system. **(2 marks)**

Question FOUR

(a) (i) Explain the **TWO** constituent elements of a transducer.

(ii) Differentiate between an analog transducer from a digital encoder. **(6 marks)**

(b) With the aid of a diagram explain the resistance linear strain gauge transducer stating the desirable characteristics. **(10 marks)**

(c) Explain the operation of a thermocouple stating the different types. **(4 marks)**

Question FIVE

(a) (i) State the meaning of the following instrumentation terms:

(I) Calibration
(II) Set Point

(ii) Draw a circuit diagram of a multiplexed Analog to digital converters hence explain its operation. **(12 marks)**

(b) With the aid of a circuit diagram, explain how common mode and differential mode noise from a temperature transducer is eliminated. **(8 marks)**