NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING

INDUSTRIAL INSTRUMENTATION AND CONTROL SYSTEMS - TIE 3114

1st SEMESTER EXAMINATIONS APRIL 2009

Duration of Examination 3 Hours
Instructions to Candidates:

1. Answer any Five questions only.
2. Each question carries equal marks.
3. Show all your steps clearly in any calculation
4. Start the answers of each question on a fresh page.

Question 1

(a) Explain the principle of operation of a strain gauge .List three quantities that could be measured using a strain gauge. (10 marks)

(b) Draw a circuit diagram that shows the connection of a strain gauge for measuring one of these quantities when there is temperature variations .How is the measurement performed by the circuit. (10 marks)

Question 2

(a) Describe the operation of a capacitive level sensor .Give the expression of calculation of the capacitance of the level sensor. (7 marks)

(b) Describe what you under stand by transducer .Classify transducers. List at least five characteristics you would expect from a sensing element. (13 marks)

Question 3

(a) Give three applications of photo-electric sensors. State particular places where they are applied. (9 marks)

(b) Show the relative response of photoconductive detectors. Describe how they are chosen for their application, give examples where each is applied.

(11 marks)

Question 4

(a) Describe with the aid of a block diagram how a resistive transducer can be used to monitor the level of a liquid in a tank with audible alarm for low and high level ..Explain how the filling pump is switched on and off. [12 marks]

(b) Explain the principle of operation of a variable reluctance tachogenarator. [8 marks]

Question 5

(a) State FOUR reasons that make it compulsory to use screening when transmitting signals at the input of systems. [8 marks]

(b) Describe the operation of a current transmitter , explain how it is applied in control systems. Show a simplified schematic and block diagram of a millivolt converter. [12 marks]

Question 6

(a) Describe the operation of a Digital to analogue converter using resistor ladder network. Draw the circuit diagram of the application circuit. [14 marks]

(b) Describe a transducer that can be used to indicate the glow of a flame in a furnace [6 marks]

Question 7

(a) List the three standards used in measurement systems. [3 marks]

(b) List three errors that are found in measurement systems, state how each error can be reduced. [6 marks]

(c) Explain the term loading effect .State how loading effect can be reduced in measurement systems. [5 marks]

(d) The following sample data is given x_1=51.1,x_2 =50.7, x_3 =50.6 and x_4 =51.2. Find the mean ,and the standard deviation. [6 marks]

Question 8

A basic slide wire potentiometer has a working battery of 3V .The slide wire has a resistance of 300 ohms and a length of 200 cm. A 200cm scale placed along side the slide wire has 1mm scale divisions and interpolation can be made to one half of a division .The instrument is standardized against a voltage reference source of 1.019V with the slide set to the 101.9cm mark on the scale .Calculate the following:

(a) The working current [5 marks]

(b) The resistance setting [5 marks]

(c) The measurement range [5 marks]

END OF EXAM