

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**FACULTY OF INDUSTRIAL TECHNOLOGY**

**DEPARTMENT OF INDUSTRIAL AND MANUFACTURING**

**SUPPLEMENTARY EXAMINATION OCTOBER 2009.**

**INDUSTRIAL INSTRUMENTATION AND CONTROL SYSTEMS –TIE 3114**

**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 following terms: precision ,accuracy and resolution. ( 9 marks )
- (b) Describe the principle of operation of a moving coil meter in terms of construction ,application and method of connection in circuit. (11 marks )

**QUESTION 2**

- (a ) Describe the operation of a resistive level sensor .Give the expression of calculation used in the level sensor. (7 marks)
- (b) Describe what you understand 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) With the help of diagrams describe the operation of an electro-dynamometer instrument. state the function of each component (12 marks)
- b) Explain the principle of operation of a variable reluctance tachogenerator. (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) Draw the circuit diagrams of eight operation amplifiers used in signal conditioning (16 marks)
- (b) Describe a transducer that can be used to indicate the glow of a flame in a furnace (4 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) Draw a block diagram to show the basic elements of an electronic instrument. Describe the function of each block in the diagram. (10 marks)
- (b) State the units and show the symbol of the following quantities: luminous intensity, volume flow rate, pressure, electric charge and mass (5 marks)
- (c) Describe the operation of a thermocouple. (5 marks)

**END OF EXAM**