



TECHNICAL UNIVERSITY OF MOMBASA
**Faculty of Engineering &
Technology**

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING
DIPLOMA IN INSTRUMENTATION & CONTROL ENGINEERING
(DICE 5, Y3 S2)

ECI 2203: MEASUREMENT TECHNOLOGY II

END OF SEMESTER EXAMINATION

SERIES: APRIL 2014

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- Answer booklet

This paper consists of **FIVE** questions. Answer question **ONE (compulsory)** and any other **TWO** questions

Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

- a) In an experiment to calibrate a platinum resistance thermometer, the temperature was varied and the resistance measured using digital multimeter. The following data was obtained:

Temperature, T (°C)	10	20	30	40	50	60	70	80
Resistance, R (Ω)	106	112	116	123	132	140	148	160

- (i) Plot a graph of resistance vs. temperature
(ii) Calculate the slope of the graph
(iii) From the graph estimate the intercept (R_0)
(iv) Hence calculate the coefficient of resistance (α) **(14 marks)**
- b) Draw and describe the following characteristics of a thermistor.
(i) Voltage-current, indicating the desired temperature variations
(ii) Current-time indicating the desired voltage variations **(8 marks)**
- c) With an aid of a well labeled diagram, describe both the constructional features and the working principle of an electromagnetic flow meter. **(8 marks)**

Question Two

- a) Define the following terms as they apply in flow measurements (use sketches)
(i) Laminar flow
(ii) Turbulent flow **(4 marks)**
- b) Discuss any FOUR reasons as to why a.c excitation is preferred to d.c excitation in electromagnetic flow meters. **(8 marks)**
- c) Using well labeled sketches, explain the principle of operation of a optical pyrometer. **(8 marks)**

Question Three

- a) State any THREE properties that a material should have to be selected for bimetallic thermometers. **(3 marks)**
- b) Figure Q3 below is a cross sectional view of a Three wire RTD. Name the parts labeled 1 to 6 **(5 marks)**

- c) Explain the meaning of the following terms as they apply in thermocouples:
- (i) Law of homogeneous circuit
 - (ii) Law of intermediate temperature
 - (iii) Law of intermediate metals
- (6 marks)
- d) Using a well labeled diagram, explain the basic principle of a turbine flow meter. (6 marks)

Question Four

- a) Explain the meaning of the following terms as they apply in measurement systems (use sketches) (6 marks)
- (i) Von Karman vortex street
 - (ii) Thermopile
- b) Thermocouple junctions are of three types: (9 marks)
- (i) Name the three types
 - (ii) Describe each type
 - (iii) Give the application of each type
- (9 marks)
- c) State TWO advantages and TWO disadvantages of venture tube over orifice plate. (5 marks)

Question Five

- a) Define the following terms:
- (i) Conduction
 - (ii) Convection
 - (iii) Radiation
- (3 marks)
- b) State TWO advantages and TWO disadvantages of Alcohol as a thermometric fluid (4 marks)
- c) With the aid of a well labeled diagram, explain the principle of operation of a bimetallic thermometer. (8 marks)
- d) A venture tube of throat diameter 5cm has a discharge coefficient of 0.98 and with a flow rate of $10\text{dm}^3/\text{s}$, and pressure differential is 12.5KPa. Determine the flow rate when an orifice of 5cm is used in the same pipe given that the discharge coefficient is 0.60 and same pressure differential. (5 marks)