



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
DEPARTMENT OF MEDICAL ENGINEERING

DIPLOMA IN MEDICAL ENGINEERING
(DME Y2 S2)

EHL 2205
MEASUREMENT

SPECIAL/SUPPLEMENTARY EXAMINATIONS

SERIES: JULY, 2014
TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

- This paper consists of **FIVE** questions..
- Attempt Question **ONE** and any other **TWO** questions.

This paper consists of 4 **PRINTED** pages
QUESTION ONE (COMPULSORY)

(a) Differentiate between:

- (i) Repeatability and Reproducibility
 - (ii) Resolution and Threshold
 - (iii)** Accuracy and precision
- (6 marks)**

(b) (i) State the general differential equation describing the dynamic response of a second order measuring instrument and use it to express the following.

Static sensitivity
Undamped natural frequency
Damping ratio

(ii) Sketch the instrument response for the cases of

heavy damping
Critical damping

(III) Light damping and state which of these is the usual target when a second order instrument is being designed. **(12 marks)**

(c) With the aid of labeled diagrams, explain the principle of operation of the following transducers.

- (i) Bourdon tube
- (ii)** Bellows
- (iii)** Diaphragm **(12 marks)**

QUESTION TWO

(i) State the hydrostatic law

(ii) By considering a small fluid element, prove the hydrostatic law. **(8 marks)**

Draw and describe the following characteristics of a thermistor:

- (i) Resistance- temperature
- (ii) Voltage – current, indicating the desired temperature variations
- (iii)** Current-time, indicating the desired voltage variations **(12 marks)**

QUESTION THREE

- (a) Define the following terms as applied in measurement

Thermal lag

Resistivity

Temperature coefficient

(6 marks)

- (b) (i) Explain why thermal lag might be less for a thermocouple than for a resistance thermometer

- (ii) A relay coil takes a current of 0.12A at 20° when connected to a 60 v d.c supply.

(I) Calculate the rise in temperature if the relay now it takes a current of 0.1 A at the same supply, given that resistivity ($\propto \frac{1}{\rho}$) of relay coil = 0.0043 per °c at 0°c.

(II) Convert the calculated value in I. from celcius to Fahrenheit (14 marks)

QUESTION FOUR

- (a) Using a suitable diagram, explain both the constructional features and principle of operation of an Electromagnetic flow meter.

- (b) Discuss **FOUR** reasons why a.c excitation is preferred to a d.c excitation in electromagnetic flow meters.

- (c) State **TWO** advantages and **TWO** limitations for an electromagnetic flow meter. (20 marks)

QUESTION FIVE

(a) Define the following terms as used in pressure measurement.

- (i) Absolute pressure
- (ii) Gauge pressure

(4 marks)

(b) The pressure intensity at a point in a fluid is given as 3.924 N/M^2 . Find the corresponding height of fluid when the fluid is

- (i) Pure water
- (ii) Oil of specific gravity 0.9

(4 marks)

(c) (i) Using a labeled diagram explain the principle of operation of a Resistive Method of level measurement.

- (ii) State **TWO** advantages and **TWO** disadvantages of Resistive Method of liquid level measurement.

(12 marks)