TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MEDICAL ENGINEERING

EHL 2205: MEASUREMENT SYSTEM

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 15 May 2016

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

Question ONE

a) Distinguish between the following terms as applied in measurement systems;
    (i)   Accuracy and precision
    (ii)   Repeatability and reproducibility

(4mks)

b) The output of an LVDT transducer is connected to a 5v voltmeter through an amplifier with a gain of 250. The voltmeter scale has 100 divisions and the scale can be read up to $\frac{1}{5}th$ of a division. An output of 2mv appears across the terminals of the LVDT, when core is displaced through a distance of 0.5mm. determine;

    i)   Sensitivity of LVDT
    ii) Sensitivity of the entire system
    iii) The resolution of the instrument.

(10mks)

c) A single manometer is connected to a pipe containing a liquid of specific gravity of 0.9 as shown in Fig 1. Given that $h_2 and h_1$ are 40cm and 20cm respectively. Find the pressure in the pipe if the area of the reservoir is 100times the area of the tube for manometer reading. The specific gravity of mercury is 13.6
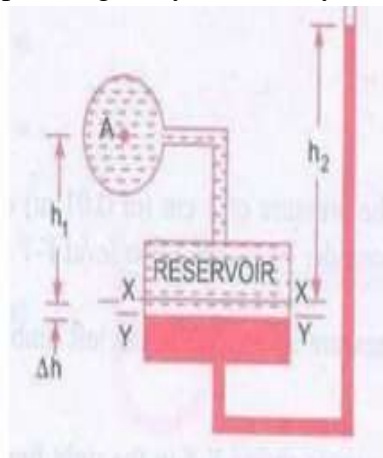

Fig 1.

(10mks)

d) A platinum resistance thermometer has a resistance of 138.5Ω at 100^0C. If it's resistance increases to 281Ω when it is in contact with hot gas, determine the temperature of the gas. The resistance can be taken as 100Ω at 0^0C. Take the temperature coefficient of platinum as 0.0039   **(6mks)**

Question TWO

a) State any three advantages of electromagnetic flow meter over turbine flow meters.

(3mks)

b) With an aid of a diagram describe the operation of hot wire anemometer flow meter.

(9mks)

c) Water is flowing through a tapered pipe having diameters 15cm and 5cm at the large and small end respectively. Determine ;

      i)   Rate of discharge in litres per second at the small end.

      ii)   The velocity head. Take the velocity of water at the large end to be 2.5m/s.

(8mks)

Question THREE

a) State the four corrective measures that can be taken to minimize environmental errors.

(4mks)

(b) A barium titanate piezo electric pick up has dimensions of 6mm× 6mm×1.5mm and a voltage sensitivity of 0.012V/N. Relative permittivity of the barium titanate is 1400 and the modulus of elasticity is 1200×10^{10} N/m^2. Determine;

    i)   The output voltage
    ii) Charge sensitivity
    iii) Strain
    iv) Charge generated
    v) Capacitance of the pick up if the force applied to the pickup is 10N.

(10mks)

c)   With an aid of a diagram describe the operation of linear variable differential transformer transducer   **(6mks)**

Question FOUR

a) The figure shown in Fig 2 is a measurement system.

    i)   Name the measurement system
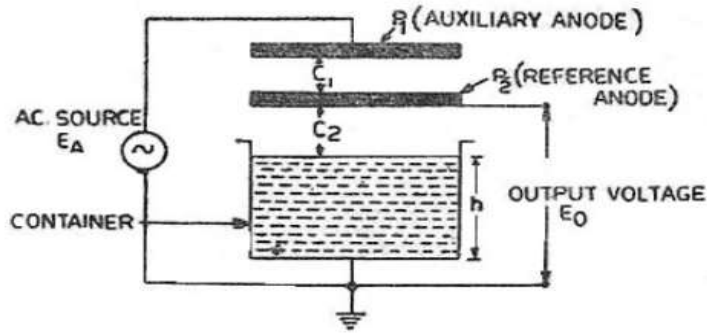   ii) Describe the principle of operation of the system.

(6mks)

Fig 2.

b) With the aid of a diagram describe operation of a float type level measurement method
(**8mks**)

c) A strain gauge with a gauge factor of 2 is fastened to a metallic member subjected to a stress of 1000kg/cm^2 . The modulus of elasticity of the metal is 2×10^6kg/cm^2. Determine;

i) The percentage change of the resistance of the strain gauge

ii) Poisson's ratio (6mks)

Question FIVE

.a) i) State the three advantages of platinum application in resistance thermometer.

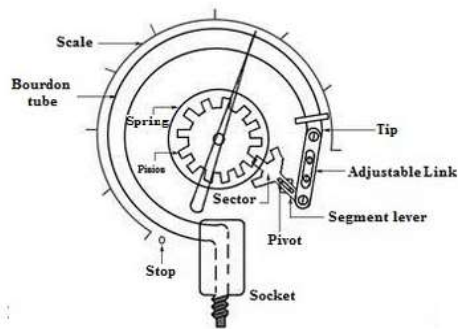ii) Fig 3 below shows a bourdon tube gauge for pressure measurement. Describe its Principle of operation. (**8mks**)

Fig 3.

b) With aid of a diagram of pitot flow meter, describe its operation. (**8mks**)

c) State any four characteristics of an ideal transducer. (**4mks**)