



**TECHNICAL UNIVERSITY OF MOMBASA**

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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

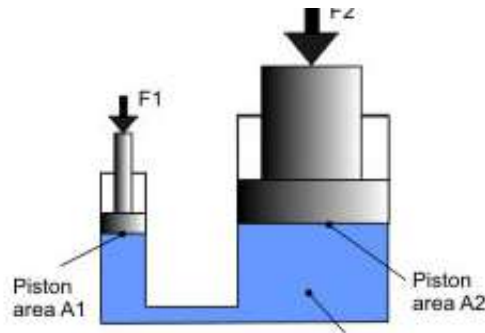
This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

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### Question ONE

- a.) State the four characteristics of an ideal transducer. **(4mks)**
- b) The output of an LVDT transducer is connected to a 20v voltmeter through an amplifier with a gain of 100. The voltmeter scale has 100 divisions and the scale can be read up to  $\frac{1}{10}$ th of a division. An output of 4mv appears across the terminals of the LVDT, when core is displaced through a distance of 0.8mm. Determine;
- Sensitivity of LVDT
  - Sensitivity of the entire system
  - The resolution of the instrument.
- (10mks)**
- c) An hydraulic press Ram of 30cm diameter and a plunger of 4.5cm diameter is used for lifting heavy loads as shown in Fig 1. Determine the weight lifted by the hydraulic press when the force applied at the plunger is 500N.



**Fig 1.**

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

**(10mks)**

### Question TWO

- a.) State the three assumptions made when taking measurements using venturi flow meters. **(3mks)**
- b) With an aid of a diagram describe the operation of electromagnetic 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 three categories of systematic errors.

**(3mks)**

(b) A capacitive transducer uses two quartz diaphragms of area  $600\text{mm}^2$ . Separated by a distance of 2.5mm. A pressure of  $8 \times 10^5 \text{N/m}^2$ , when applied to the top of the diaphragm, causes a deflection of 0.5mm. The capacitance is  $400 \times 10^{-12} \text{F}$  when no Pressure is applied to the diaphragm. Determine the value of capacitance after the Application of pressure of  $8 \times 10^5 \text{N/m}^2$ .

**(10mks)**

- (c) With an of a diagram describe the operation of linear variable differential transformer transducer

**( 7mks )**

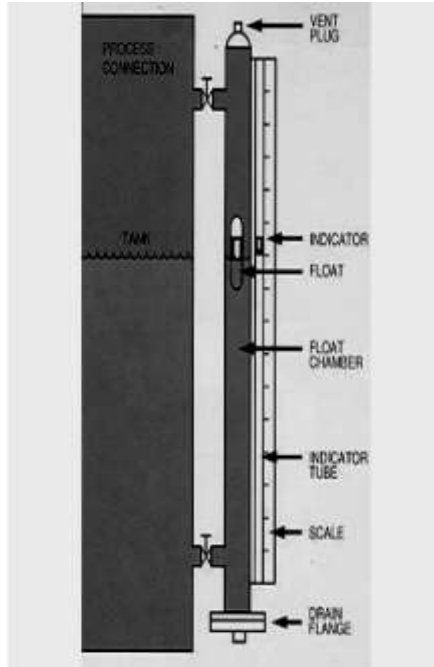
### **Question FOUR**

- a) Fig 2 below is a level measurement system.

(i)Name the level measurement system

(ii) Describe the principle of operation of the system.

**(6mks)**



**Fig 2.**

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

c) State the six characteristics possessed by wire strain gauges for excellent measurement applications.

**(6mks)**

### **Question FIVE**

a) State the three advantages of platinum application in resistance thermometer. **(3mks)**

b) A single column manometer is connected to a pipe containing a liquid of specific gravity of 0.9 as shown in Fig 3. Given that  $h_2$  and  $h_1$  are 40cm and 20cm respectively, determine 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.

**(10mks)**



**Fig 3.**

c) With aid of a diagram of a hot wire anemometer flow meter, describe its operation.

**(7mks)**