



## TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT OF BUILDING & CIVIL ENGINEERING  
**UNIVERSITY EXAMINATION FOR:**  
DIPLOMA IN BUILDING AND CIVIL ENGINEERING  
**ECV 2201: FLUID MECHANICS**  
**SERIES:** September 2018  
**TIME:** 2 HOURS

### **Instructions to Candidates**

You should have the following for this examination

-Answer Booklet, examination pass and student ID

-Pocket calculator

This paper consists of **FIVE** questions. Attempt any **THREE** questions

**Do not write on the question paper**

**Mobile Phones are NOT allowed inside the examination room**

### **QUESTION ONE**

(a) A certain oil has a specific gravity of 0.8. Determine the following in SI units

- i. Its unit weight
- ii. Its mass density
- iii. The weight of 2 litres of the oil
- iv. The volume of 1200 N of the liquid.

(Make any necessary assumption)

(10 Marks)



(b) State FOUR assumptions made deriving the Bernoulli's theorem.  
(4 Marks)

(c) Define the following terms and indicate typical SI units.  
i. Mass  
ii. Viscosity  
iii. Specific volume

(6 Marks)

## QUESTION TWO

(a) A differential manometer is connected to two points A and B of two pipes as shown in

Fig 2a. Pipe A contains a liquid of specific gravity 1.5 while pipe B contains a liquid of specific gravity 0.9. The pressure at A and B are  $P_A=9.81kN/m^2$  and  $P_B=147.15kN/m^2$  respectively. Determine the deflection  $h$

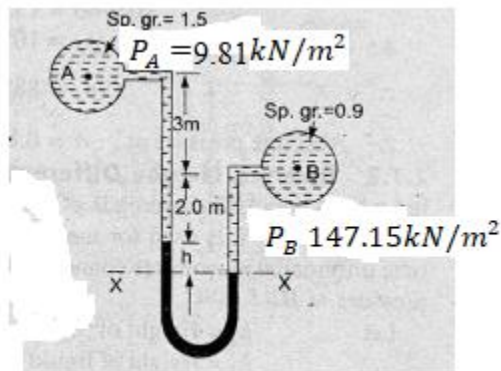


Fig 2a

(6 Marks)

(b) A rectangular plane surface 3 x 4 m lies in water as shown in fig 2b, determine:

- i) The total pressure on the plate (F)
- ii) The position of the centre of pressure ( $\bar{h}$ )

Note:  $I_{cc} = \frac{bd^3}{12}$  for a rectangular section.

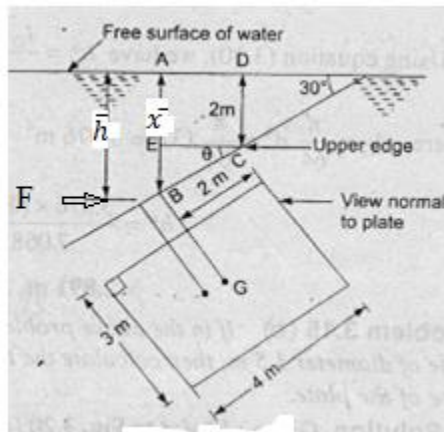


Fig 2b

(8 Marks)

c) For Define the following terms

- i. Atmospheric pressure
- ii. Absolute pressure
- iii. Gauge pressure

(6 Marks)

### QUESTION THREE

- a) A wooden block  $4\text{m} \times 1\text{m} \times 0.5\text{m}$  of specific gravity 0.75 is floating in water. Find the weight of concrete of specific gravity  $24\text{KN}/\text{m}^3$  that may be placed on the block to completely immerse the wooden block  
(5 Marks)
- b) Define the following types of flow in pipe flow.  
i. Laminar flow  
ii. Turbulent flow  
iii. uniform flow  
iv. Non uniform flow.  
(8 Marks)
- c) State Archimedes principle  
(3 Marks)
- d) Define the following terms  
i. Buoyancy  
ii. Centre of Buoyancy  
(4 Marks)

### QUESTION FOUR

- a) Water is flowing through a pipe of 100mm diameter under a pressure of  $196.2\text{kN}/\text{m}^2$  (gauge) and with a mean velocity of 3.0m/s. the pipe is 8m above datum. Determine the total head of the water at that cross section reckoned above datum  
(4Marks)
- b) Water discharges from a large tank through a sharp entry into a pipe of 50 mm diameter pipe which is 45 m long. It is then joined to a 75 mm pipe which is 30 m long which discharges into atmosphere, 6 m below the water level in the tank. The pipe expansion is sudden. Darcy's  $f=0.005$  for both pipes. Determine the discharge in l/s.  
(8 Marks)
- c) An orifice meter with an orifice diameter of 15cm is inserted in a pipe 30cm diameter. The pressure gauges fitted upstream and downstream of the orifice give readings of  $147.15\text{kN}/\text{m}^2$  and  $98.1\text{kN}/\text{m}^2$  respectively. the coefficient of discharge  $C_d = 0.6$ . Determine the discharge in litres per second.  
(8Marks)

## QUESTION FIVE

a) The head of water over an orifice of 100mm diameter is 10m. The water coming out of the orifice is collected in a circular tank of 1.5m diameter. The rise of water level in this tank is 1.0m in 25 seconds. The coordinates of a point on the jet, measured from the vena contracta are 4.3m horizontal and 0.5m vertical. Determine the following coefficients:

i.  $C_d$

ii.  $C_v$

iii.  $C_c$

(8 Marks)

b) State TWO advantages of a triangular weir over a rectangular weir.

(2 Marks)

c) Explain the difference between

I. A notch and a weir

II. A small and a large orifice.

(6

Marks)

d) Water is discharging through a circular orifice at a rate of 15lps under a head of 1.5m. If the coefficient of discharge,  $C_d = 0.6$ , determine the diameter of the orifice

(4 Marks)