



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

THE DEGREE IN BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

TMC 4214 : FLUID MECHANICS I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

DATE: Pick Date Sep 2018

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 any **THREE** questions.

Do not write on the question paper.

Question ONE

a) Define the following terms

- i. Specific weight
- ii. Viscosity
- iii. Density
- iv. Specific gravity
- v. Surface tension
- vi. Specific volume

(6 Marks)

b) State the Newton's law of viscosity

(2marks)

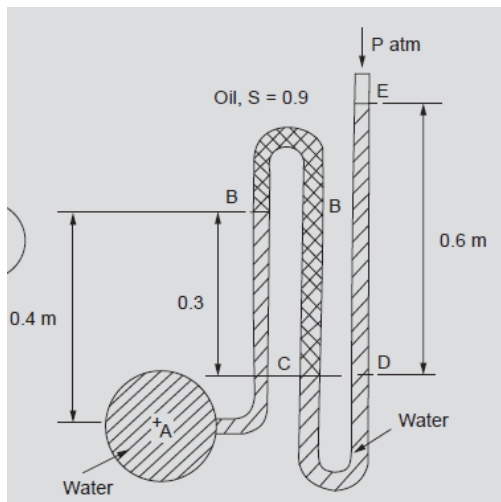
c) A Container of glycerin has a mass of 1200 kg and a volume of 0.952m². Find the following.

- i. Weight of the glycerin
- ii. specific weight

- iii. Density
 - iv. Specific gravity with aspect to water (use $g=9.81$) (6marks)
- d) A plate 0.05 mm distant from a fixed plate moves at 1.2 m/s and requires a force of 2.2 N/m² to maintain this speed. Find the viscosity of the fluid between the plates. (3marks)
- e) A plate of area 1.5×10^6 is pulled with a speed of 0.4m/s relative to another to another plate located at a distance of 0.15mm from it .Find the force and power required to maintain this speed ,if the fluid separating them is having viscosity as 1 poise (0.1Ns/m²) (4 marks)

Question TWO

- a) Explain the following terms
- i. Absolute pressure
 - ii. Gauge pressure
 - iii. Vacuum pressure
- (3marks)
- b) A multiple U-tube manometer is fitted to a pipe with centre at A as shown in Fig 1.Determine the pressure at A.



- (4 marks)
- c) Explain the capillarity Phenomenon (2 marks)
- d) Derive the expression for height of capillary rise (5marks)
- e) A U-tube is made up of two capillaries of 1mm and 2 mm respectively. The tube is held vertically and is partially filled with liquid of surface tension 0.05 N/m zero contact angle. Calculate the density of the liquid if the estimated difference in the level of two menisci is 1.25cm (6 marks)

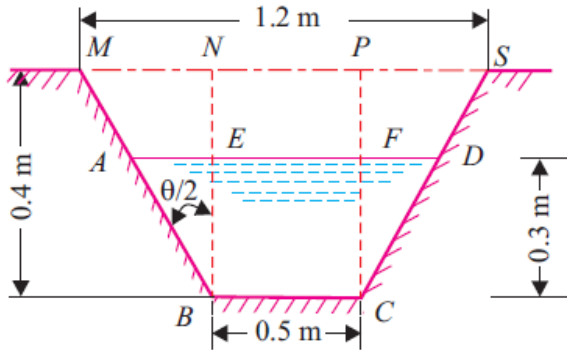
Question THREE

a) Describe the following devices used for measuring the rate of flow

- i. Notch
- ii. Weir
- iii. Orifice

(3marks)

b) Find the discharge through a trapezoidal notch which is 1.2 m wide at the top and 0.50 m at the bottom and is 0.4 m in height. The head of water on the notch is 0.3 m. Assume C_d for rectangular portion = 0.62, while for triangular portion = 0.60.



(6 marks)

c) Find the discharge through a trapezoidal channel of width 8 m and side slope of 1 horizontal to 3 vertical. The depth of flow of water is 2.4 m and value of chezy's constant $C=50$. The slope of the bed of the channel is given 1 in 4000.

d) Define the following terms

- i. Total pressure
- ii. Centre of pressure

(2marks)

e) An Isoscales triangular plate of base 3m and height 3m is immersed vertically in a specific gravity 0.8. The base of the plate coincides with the free surface of the Oil. Calculate

- i. Total pressure on the plate
- ii. Centre of pressure

(4marks)

Question FOUR

a) Describe Ven-contracta

(2marks)

b) Define the following co-efficients

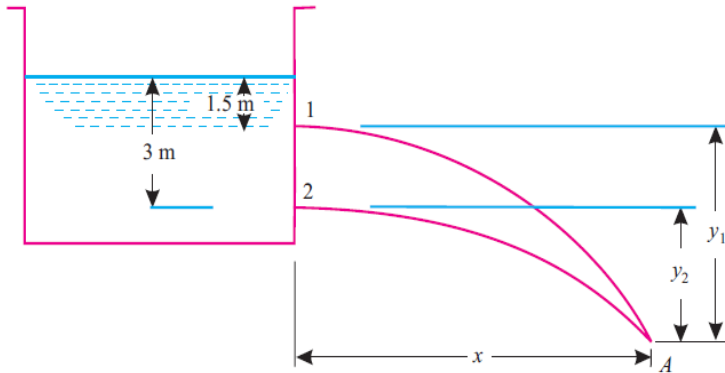
- i. Co-efficient of velocity

ii. Co-efficient of contraction

iii. Co-efficient of discharge

(6 marks)

- c) A tank has two identical orifices in one of its vertical sides, The upper orifice is 1.5 m below the water surface and the lower one is 3 m below the water surface as shown in Fig. 2. Find the point, at which the two jets will intersect, if the co-efficient of velocity is 0.92 for both the orifices.



(6 marks)

- d) Define the following losses in pipe

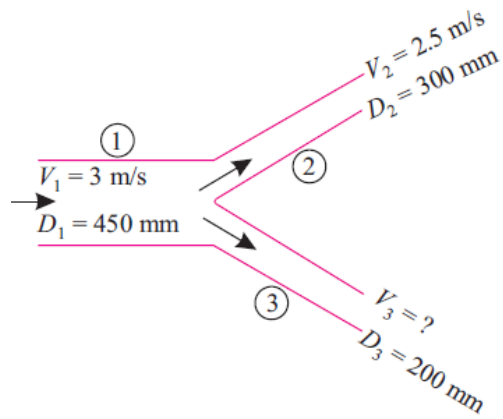
i. Major Loses

ii. Minor Loses

(6 marks)

Question FIVE

- a) A pipe (1) 450 mm in diameter branches into two pipes (2 and 3) of diameters 300 mm and 200 mm respectively as shown in Fig. 3 If the average velocity in 450 mm diameter pipe is 3 m/s find:
- Discharge through 450 mm diameter pipe;
 - Velocity in 200 mm diameter pipe if the average velocity in 300 mm pipe is 2.5 m/s.



(5 marks)

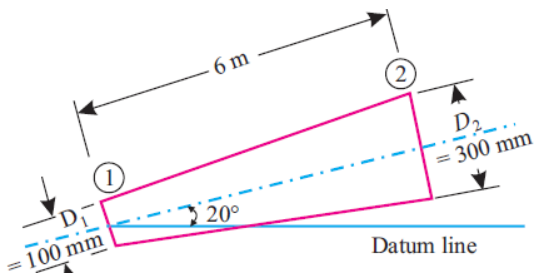
b) Describe a ventrimeter

(4 marks)

c) Describe a pitot tube

(4 marks)

d) A 6m long pipe is inclined at an angle of 20° with the horizontal. The smaller section of the pipe which is at lower level is of 100 mm diameter and the larger section of the pipe is of 300 mm diameter as shown in Fig.3. If the pipe is uniformly tapering and the velocity of water at the smaller section is 1.8 m/s, determine the difference of pressures between the two sections.



(4marks)

e) A pitot tube being used to determine the velocity of flow of water in a closed conduit indicates a difference between water level in the pitot tube and in the piezometer of 48 mm. What is the of flow

(3 marks)