TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

HIGHER DIPLOMA IN BUILDING & CIVIL ENGINEERING (HDBC 12S)

EBC 3106: FLUID MECHANICS I

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: FEBRUARY 2013
TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

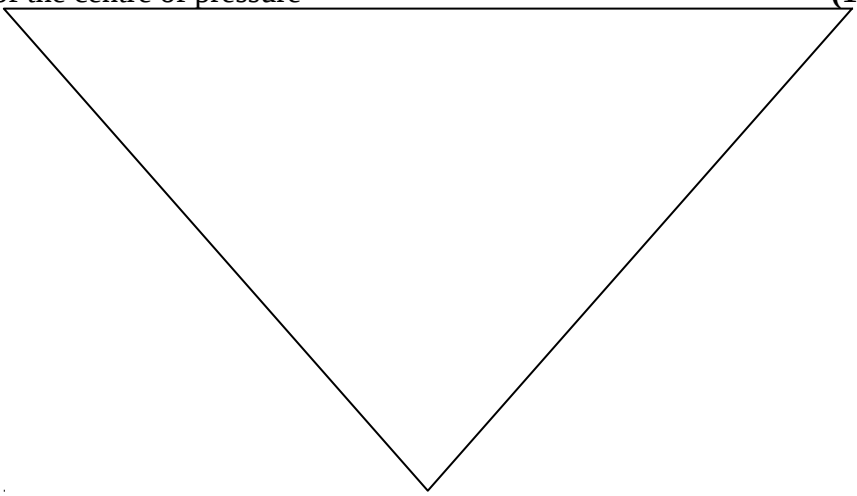
- *Answer Booklet*
- *Scientific Calculator*

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

Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One

a) A circular plate is 1.5m diameter is immersed in water as shown in figure 1. Determine:
- **(i)** The total pressure on one face of plate
- **(ii)** The position of the centre of pressure **(10 marks)**



b) Figure 2 shows a curved gate LM which is a quadrant of a circle 3m radius. If the width of the gate is 1m, determine:
- **(i)** The total pressure on the gate LM
- **(ii)** The angle that the total pressure makes with the horizontal **(10 marks)**

Figure 2

Question Two

a) Water is flowing through a pipe AB having diameters 600mm and 400mm at A & B respectively. The pressure at A is 350KN/m^2 and at B is 100KN/m^2. The rate of flow is 0.06m^3/s. Determine the difference in datum head at A and B. **(10 marks)**

b) Make a sketch of a pitot static tube and label all parts. **(6 marks)**

c) State:
- (i) **THREE** requirements of installation of a pitot tube
- **(ii)** **ONE** advantage of a pitot static tube over pitot tube **(4 marks)**

Question Three

a) A venturimeter with an inlet and throat diameters as 300mm and 150mm respectively is connected to a vertical pipe in which water flow occurs from bottom to top. The distance between the throat and inlet is 750mm. The mercury manometer connected to the throat and inlet reads a deflection of 0.22m. If Cd = 0.98, determine the discharge. **(8 marks)**

b) An orificemeter 150mm diameter with cd = 0.64 is fitted in a 300mm diameter pipe to measure the rate of flow of oil of specific gravity of 0.9. A differential mercury manometer connected to the meter reads a deflection of 0.5m. Determine the discharge. **(8 marks)**

c) State **FOUR** assumptions made in deriving Bernoulli's equation. **(4 marks)**

d) See queston on h

Question Four

(a) Sketch **THREE** types of external mouth pieces. **(6 marks)**

b) Differentiate between:
   (i) Small orifice and large orifice
   (ii) Small orifice and mouth piece **(8 marks)**

c) A large tank is fitted with a small orifice at the bottom which has an area of 930mm^2. The head causing flow is 3m. The jet issues horizontally and in a horizontal distance of 2.4m it falls by 0.53m. The actual discharge is measured as 430 litres in 1min 40 seconds. Determine:
   (i) Cc
   (ii) Cr
   (iii) Cd **(6 marks)**

Question Five

a) A circular tank 1m diameter in plan contains water up to a depth of 4m. The tank is fitted at the bottom with an orifice 40mm diameter with Cd = 0.6. Determine:
   (i) The time required to completely empty the tank
   (ii) The height of water above the bottom after 1 minute **(10 marks)**

b) A rectangular orifice 2m wide and 1m deep is fitted in the side of a large tank. The water level on the upstream side is 4m above top edge of orifice and the level downstream is 0.5m below top edge of orifice. If Cd = 0.25, determine the flow: **(10 marks)**