THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering & Technology

DEPARTMENT OF CIVIL AND BUILDING ENGINEERING

HIGHER DIPLOMA IN ENGINEERING
DIPLOMA IN CIVIL ENGINEERING
(HD 09/DC09)

END OF COURSE EXAMINATIONS

APRIL/MAY 2010 SERIES

FLUID MECHANICS I

TIME: 2 HOURS

Instructions to Candidates

Answer question **ONE** and any other **TWO** Questions.

Question ONE

(a). Define the following terms stating their SI Units.

      (i).   Bulk modulus
      (ii).   Surface tension
      (iii).   Specific gravity
      (iv).   Unit weight   **(6 Marks)**

(b). In the arrangement shown in fig. 1, the pressure difference between A and B is 50KN/m². Calculate the difference in level x.   **(10 Marks)**
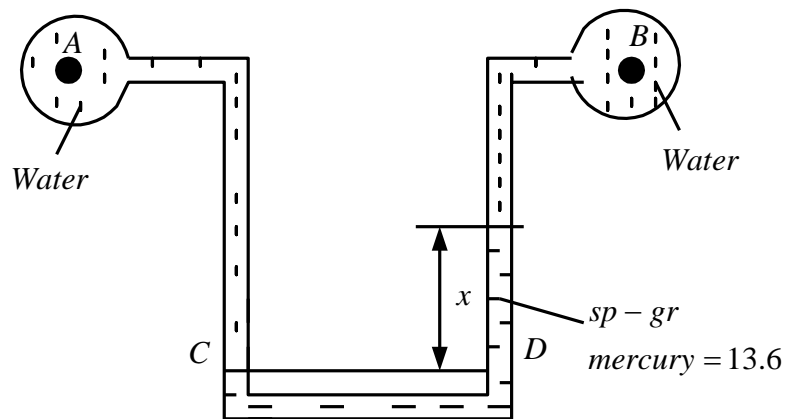
Fig. 1

(c). A flat rectangular plate 1 metre wide by 2m deep is immersed in water of density 1000kg/m³ as shown in fig. 2.

    Calculate the (i).   magnitude and   **(8 Marks)**

              (ii).   position of the force acting upon one side of the plate due to water pressure.   **(6 Marks)**
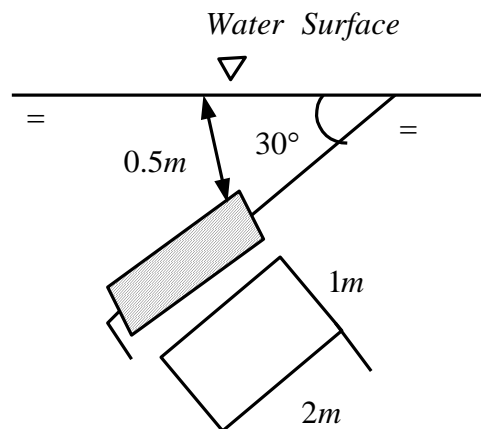
Fig. 2

Question TWO

(a).   Write the general expression of the Bernoulli's equation
        considering the losses and explain the symbols used.   **(5 Marks)**

(b).   Water is flowing through a 150mm diameter pipe under a pressure
        of $98.1 KN/m^2$. If the centre of the pipe is 20m, calculate the
        flow of the water in litres per second. If the total head relative
        to a datum plane 3m below the centre of the pipe is 20m, calculate
        the flow of the water in litres per second.   **(5 Marks)**

(c).   A jet of water 25mm in diameter and having a velocity of 8m/s
        strikes a flat plate. Calculate the force on the place.

        (i).   If it is stationery.   **(2 Marks)**

        (ii).   If it moves in the same direction as the jet at 3m/s.(2 Marks)

(d).   Define the following:

        (i).   Steady flow.   **(2 Marks)**
        (ii).   Non-uniform flow.   **(2 Marks)**
        (iii).   Laminar flow.   **(2 Marks)**

Question THREE

(a).   Sketch a pitot-static tube and show its construction features.**(9 Marks)**

(b).   State **TWO** installation conditions necessary for a pitot-static
        tube.   **(2 Marks)**

(c).   A pitot-static tube placed in the centre of a 200m diameter pipeline
        conveying water has one orifice facing upstream and the other
        perpendicular to it. If the pressure difference between the two
        offices is 38mm of water when the discharge through the pipe
        is $0.022 m^3/s$, calculate the meter coefficient.
        Take the mean velocity in the pipe as 0.83 of the central velocity.
        (9 Marks)

Question FOUR

(a).   Define the following:

        (i).   Small orifice   **(5 Marks)**
        (ii).   Large orifice   **(5 Marks)**

(b). A jet of water issues through an 25mm dia orifice whose $C_v = 0.98$ and $C_c = 0.62$. The jet drops a vertical distance of 1.0m in a horizontal distance of 2.65m. Determine:

(i). The head causing flow
(ii). The discharge

Question FIVE

(a). With the aid of a neat sketch, show the salient features of a venturimeter. **(5 Marks)**

(b). A venturi-meter has inlet and throat diameters of 300mm and 100mm respectively. When a particular water flow is passing through the meter, a 250mm difference is noted in the mercury levels of the differential manometer attached to the venturi tappings.
Calculate the rate of flow if the coefficient of discharge is 0.95.
(10 Marks)

(c). Calculate the quantity of flow through a 120°V-notch when the head of flow over the sill is 150mm and the coefficient of discharge is 0.62. **(5 Marks)**