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Total number of printed pages – 2

B. Tech
BEME 2209

Third Semester Regular Examination – 2014

FLUID MECHANICS AND MACHINES

BRANCH(S) : BIOTECH, ENV, PLASTIC

QUESTION CODE : H 394

Full Marks – 70

Time – 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.

The figures in the right-hand margin indicate marks.

1. Answer the following questions :

2 × 10

- (a) Define compressibility.
- (b) Differentiate Newtonian and Non-Newtonian fluids.
- (c) What do you understand by hydrostatic law ?
- (d) Explain the “total pressure” and ‘centre of pressure’.
- (e) Define the term: meta centre and centre of buoyancy.
- (f) Distinguish rotational and irrotational flow.
- (g) What is difference between pitot tube and pitot static tube ?
- (h) Define weir and end contraction of weir.
- (i) Differentiate the turbine and pump.
- (j) Write the working principle of hydraulic intensifier.

2. (a) A plane 0.0254 mm distant from a fixed plate, moves at 0.61 m/sec and requires a force of 20 N/m² to maintain this speed. Determine the dynamic viscosity of the fluid between the plates. 5

(b) An open tank contains water upto a depth of 1.5 m and above it an oil of sp. Gravity 0.8 for a depth of 2 m. Find the pressure intensity at the interface of two liquids and at the bottom of the tank. 5

3. (a) Two pressure points in a water pipe are connected to a manometer which has the form of a inverted U tube. The space above the water in the two limbs of the manometer is filled with toluene of specific gravity 0.875. If the difference of level of water column in the two limbs is equal to 0.12 m. What is the corresponding difference of pressure ? 5

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- (b) A circular opening 3m diameter in a vertical side of a tank is closed by a disc of 3 m diameter which can rotate about a horizontal diameter. Calculate the force on the disc and the torque required to maintain the disc in equilibrium in the vertical position when the head of water above the horizontal diameter is 6 m. 5
4. Show that a cylindrical buoy of 1m diameter and 2 m height weighing 7.848 kN will not float vertically in sea water of density 1030 kg/m^3 . Find the force necessary in a vertical chain attached to the centre of base of the buoy that will keep it vertical. 10
5. (a) The inlet and throat diameter of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm^2 while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow, assume that 4% of the differential head is lost between the inlet and throat. Find the value of C_d for the venturimeter. 5
- (b) An orifice in the side of a large tank is rectangular in shape 1.2 m wide and 0.7 m deep. The water level on one side of orifice is 1.2 m above the top edge and the water level on other side of orifice is 0.25 m below the top edge. Calculate the discharge if $C_d = 0.62$. 5
6. (a) The pressure intensity of water supplied to an intensifier is 20 N/cm^2 while the pressure intensity of water leaving the intensifier is 100 N/cm^2 . The external diameter of the sliding cylinder is 20 cm. Find the diameter of the fixed ram of the intensifier. 5
- (b) A pelton wheel is having a mean bucket diameter of 1m and is running at 1000 r.p.m. The net head on pelton wheel is 700 m. If the side clearance angle is 15° and discharge through nozzle is $0.1 \text{ m}^3/\text{s}$, find : (i) power available at the nozzle and (ii) Hydraulic efficiency of the turbine. 5
7. A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000rpm works against a total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5 m/s . The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine : vane angle at inlet, work done by impeller on outer per second and manometric efficiency. 10
8. Write short notes on any two : 5×2
- (a) Differential equation of continuity
- (b) Draft tube
- (c) Hydraulic crane.