INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

MAY/JUNE 2018 END SEMESTER EXAMINATION

B. Tech. (Marine Engineering)

Semester : IV

Fluid Mechanics-I (UG11T1405/ UG11T2405)

Date : 18-06-2018 Maximum Marks : 100

Time :3 Hours Pass Marks : 50

PART-A **(Marks: 3x10=30)**

(All questions are compulsory)

1.

(a) Distinguish between Newtonian and non-Newtonian fluids.

(b) How is the choice of repeating variable made in case of Buckingham's method?

(c) Define the terms in respect of floating body: stable, unstable and neutral equilibrium.

(d) How is total force and its location found out on the curved surface ?

(e) Define the terms:
i) Co-efficient of velocity, ii) Co-efficient of contraction and
iii) Co-efficient of discharge.

(f) State the assumptions made in Bernoulli's equation.

(g) What are different types of loss of head in fluid flow through pipeline?

(h) What is hydraulic radius? Why it is used in Chezy's formula.

(i) Draw the sketch of i) velocity distribution and ii) shear stress distribution across a section of a pipe when the flow is viscous.

(j) Define the terms with examples (i) Free vortex flow (ii) Forced vortex flow.

PART-B **(Marks :14 x 5=70)**

(Answer any five of the following)

2.

a) Describe Buckingham's π-theorem ? Why this theorem is considered superior to Rayleigh's method for dimensional analysis.

b) A cylinder containing water is subjected to constant angular rotation. Prove that the rise of liquid level at the ends is equal to fall of liquid level at the axis of rotation.

(Marks 7+7)

3.

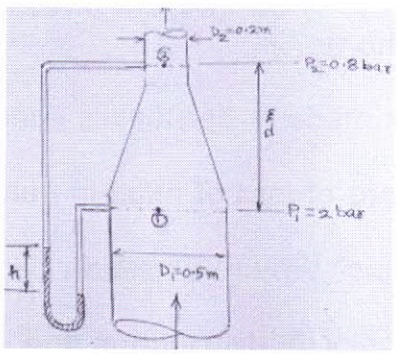
a) Obtain an expression of total pressure and centre of pressure force on a inclined plane surface immersed in liquid at angle θ from the free surface of water.

b) A ship 70 m long and 10 m broad has a displacement of 19620 KN. A weight of 343.35 KN is moved across the deck through a distance of 6 m. The ship is tilted through 6 degree. The moment of inertia of the ship at waterline about its fore and aft axis is 75% of M.O.I of the circumscribing rectangle. The center of buoyancy is 2.25 m below waterline. Find the metacentric height and position of center of gravity of ship. Sp. wt. of sea water is 10104 N/M^3.

(Marks- 6+8)

4. Calculate the flow rate of oil of specific gravity0.8 in the pipe line where D1=0.5 m and D2=0.2 m as shown in the figure. Also calculate the reading " **h**" shown by the differential manometer fitted to the pipe line. Differential manometer is filled with mercury of specific gravity 13.6. Pressure at inlet (1) and out let (2) of pipe are 2 bar and 0.8 bar respectively.

(Marks 7+7)



5.

a) Derive the condition for maximum power transmission through pipeline and also obtain the maximum efficiency of power transmission.

b) For the distribution main of a town water supply, a 25cm main is required. As pipes above 20 cm diameter are not available, it is decided to lay two parallel mains of same diameter. Find the diameter of the parallel mains.

(Marks 7+7)

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resistance of a Collar Bearing.

b) A collar bearing having internal and external diameter of 200mm and 400 mm, oil film thickness 0.2 mm and μ=0.8 poise, is taking the thrust of the shaft and overcoming viscous resistance when shaft rotates with 300 rpm. Find power consumed by the collar bearing. **(Marks 7+7)**

7. An open circular cylinder of 15 cm diameter and 100 cm long contains water upto a height of 70 cm. When the cylinder is rotated about its vertical axis at 59.05 rad/sec, the vertical depth of water at centre becomes zero. Find the difference in total pressure force i) at the bottom of cylinder and ii) at the sides of the cylinder due to above rotation. **(Marks 7+7)**

8.

a) Derive the Euler's equation of motion for steady and streamline flow of an ideal fluid and also obtain from its Bernoulli's equation.

b) A jet of water 10 cm in diameter strikes a flat plate with a velocity 25 m/s. The jet is inclined at an angle of 60° with the plate. If the plate is moving at 8 m/s away from the jet, determine the normal force on the plate and work done by the jet on the plate. **(Marks7+7)**
