INDIAN MARITIME UNIVERSITY
(A Central University, Govt. of India)

B.Tech. (Marine Engineering) - Semester IV
December 2015 End Semester Examinations

Fluids Mechanics - I
Subject Code: UG11T2405/ UG11T1405

Time: 3 hrs | Max Marks: 100
Date: 23.12.2015 | Pass Marks: 50

Part-A **(10 x 3 Marks=30 Marks)**

Compulsory Question

1. Compulsory short answer questions:

   a) Explain Newton's Law of Viscosity
   b) What do you mean by fundamental units, derived units?
   c) Define the terms: stable, unstable and neutral equilibrium.
   d) Derive the relation between: i) Co-efficient of velocity, ii) Co-efficient of contraction and iii) Co-efficient of discharge.
   e) State Bernoulli's theorem. Also write the assumptions made in the derivation of Bernoulli's equation.
   f) Explain the terms: i) Pipes in parallel, ii) Pipes in series and iii) Equivalent pipe.
   g) Explain the terms: (i) Hydraulic Gradient Line (ii) Total Energy Line.
   h) What is the difference between dynamic viscosity and kinematic viscosity? State their units of measurements.
   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 **(5 x14 Marks = 70Marks)**

Answer any Five of the followings.

2. 1: 50 model of an ocean tanker is dragged through fresh water at 1.5 m/s with a total measured drag of 10 N. The frictional drag co-efficient f for model and prototype are 0.03 and 0.002 respectively in the equation, $Rf = f . A . V^2$; The wetted surface are of the model is 20 m^2. Determine the total drag on the prototype and the power required to drive the prototype. Take density of sea water and fresh water as 1024 kg/m^3 and 1000 kg/m^3 respectively. (14 Marks)

3. Each gate of lock is 6 m high and 5 m wide is supported on one side by two hinges, each 0.5 m from the top and from the bottom. The angle between the gates in closed position is 120 degree. If the depths of water on the two sides are 5 and 1.25 m respectively, find the magnitude and position of the resultant water pressure on each gate, the magnitude of reaction between the gates and the magnitude and directions of the reactions at hinges. Assume the reaction between the gates to be in the same horizontal plane as that of the resultant water pressure sketches of the top view and of the end view of the lock must be shown. (14 Marks)

4. A Cubical Tank has sides of 1.5 m. It contains water for the lower 0.6 m depth. The upper remaining part is filled with oil. Specific gravity of oil is 0.9. Calculate for one vertical side of the Tank : (a) Total pressure force (b) Depth of centre of pressure force. (14 Marks)

5. a) Obtain the expression for the discharge through a Venturimeter.
   b) A 30cm x 15 cm Venturimeter is inserted in a vertical pipe carrying water, flowing in upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 20 cm. Find the discharge. Take Cd=0.96. (7 + 7 Marks)

6. The rate of flow of water through a horizontal pipe is 0.25 m3/sec. The diameter of the pipe is suddenly enlarged from 20 cm to 40 cm. The pressure intensity in the smaller pipe is 11.772 N/cm2. Determine a) loss of head due to sudden enlargement b) pressure intensity in the large pipe and c) power loss due to enlargement. (14 Marks)

7. a) Deduce an expression for the power absorbed in overcoming viscous resistance of a Collar Bearing.
   b) The external and internal diameters of a collar bearing are 200 mm and 150 mm respectively. Between the collar surface and the bearings, an oil film of thickness 0.25 mm and of viscosity 0.9 poise is maintained. Find the torque and the power lost in overcoming the viscous resistance of the oil when the shaft is running at 250 rpm. (7+7 Marks)

8. A closed vertical cylinder 400 mm in diameter and 500 mm high is filled with oil of relative density 0.9 to a depth of 340 mm, the remaining volume containing air at atmospheric pressure. The cylinder revolves about its vertical axis at such a speed that the oil just begins to uncover the base. Calculate (a) the speed of rotation for this condition and (b) the upward force on the top cover. (14 Marks)

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