INDIAN MARITIME UNIVERSITY
(Central University, Government of India)

May/June 2016 End Semester Examinations
B.Tech. (Marine Engineering)

Fourth Semester – Fluids Mechanics - I - (UG11 T1405/ T2405)

Date : 17.06.2016 **Max. Marks: 100**
Time: 3 Hrs **Pass Marks : 50**

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

1) a) Distinguish between manometers and mechanical gauges.
b) State Bernoulli's theorem and give example of its applications.
c) What do you understand by the terms: Major energy loss and minor energy losses in pipes?
d) Define the terms: Kinetic Energy Correction factor and Momentum Correction Factor.
e) Define the terms: "Viscous Flow' and Laminar Flow
f) State Newton's law of Viscosity. Describe variation of Viscosity with temperature for Liquid and Gases.
g) What are the conditions of equilibrium of a floating body and a submerged body?
h) What do you understand by 'Total' pressure' and 'Centre of Pressure'?
i) What is Vena – Contracta? Explain Theoretical velocity of flow through an orifice.
j) Derive the expression $Cd = Cv \times Cc$

Part-B **(14 x 5 =70 Marks)**
Answer any Five Questions

2) A 30 x 15 cm Venturimeter is provided in a vertical pipeline carrying oil of sp. gr. 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the Venturimeter is 30 cm. The differential U-tube mercury manometer shows a gauge deflection of 25 cm. Calculate 1) the discharge of oil and 2) the pressure difference between the entrance section and the throat section. Take Cd=0.98 and sp.gr. of mercury as 13.6. (14)

3) a) Derive the Hagen Poiseuille Formula for drop of pressure in viscous flow.

b) The external and internal diameters of a Collar bearing are 20 cm and 15 cm respectively. Between the collar surface and the bearing, an oil film thickness 0.025cm and of viscosity 0.9 poise is maintained. Find the torque and the H.P. loss in overcoming the viscous resistance of the oil when the shaft is running at 250 rpm. (6+8)

4) a) Deduce the expression for the force on the inclined plane moving in the direction of the jet and also work done per second by the jet on the plate.

b) A jet of water of diameter 10 cm strikes a flat plate normally with a velocity of 15 m/sec. The plate is moving with a velocity of 6m/sec in the direction of the jet. Find the force exerted by the jet on the plate and work done by the jet on the plate. (8+6)

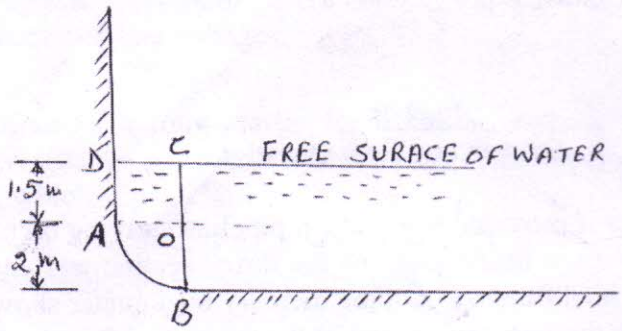
5) a) Derive the expression for the horse power absorbed to overcome the viscous resistance in a journal bearing.

b) A shaft of 100 mm diameter rotates at 60 r.p.m. , in a 200 mm long bearing. Taking that the two surfaces are uniformly separated by a distance of 0.5 mm and taking linear velocity distribution in the lubricating oil having dynamic viscosity of 4 centpoises, find the horse power absorbed in the bearing. (8+6)

6) a) A plate 0.025 mm distant from a fixed plate, moves at 60 cm/sec and requires a force of 2N per unit area i.e. 2 N/m^2 to maintain this speed. Determine the fluid Viscosity between the plates.

b) The resisting force R of a Supersonic plane during flight can be considered as dependent upon the length of aircraft – l, velocity V, air viscosity μ, air density ρ and bulk modulus of air K. Express the functional relationship between these variables and the resisting force. (7+ 7)

7) a) Compute the horizontal and vertical components of the total force acting on a curved surface AB, which is in the form of a quadrant of a circle of radius 2 m as shown in fig. Take the width of the gate as unity.



(b) Determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water in such a way that the centre of the plate is 3 m below the free surface of water. Find the position of centre of pressure also. (7+7)

8) (a) Prove that in case of forced vortex, the rise of liquid level at the ends is equal to the fall of liquid at the axis of rotation.

(b) An open circular cylinder of 15 cm diameter and 100 cm long contains water upto a height of 80 cm. Find the maximum speed at which the cylinder is to be rotated about its vertical axis so that no water spills. (7+7)

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