INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

END SEMESTER EXAMINATION June-July 2019

B.Tech (Marine Engineering)

Semester: IV

FLUIDS MECHANICS-I

(UG11T3405)

Date: 03-07-2019 **Maximum Marks: 100**

Time: 3 Hrs **Pass Marks: 50**

PART A

Question 1 is compulsory.

1 (10*3=30 Marks)

a) Why does the viscosity of a gases increases with the increase in temperature while that of a liquid decreases with increases in temperature?

b) Define the term Jet Propulsion and state the efficiency of propulsion if the tank is fitted with an orifice and 'V' is the absolute velocity of jet coming out of orifice , 'u' is velocity of tank.

c) What do you understand by the term ,'Total Pressure' and 'Centre of Pressure'?

d) Define the terms 'Buoyancy' and 'Centre of buoyancy'.

e) State the Bernoulli's Equation and list the assumptions which are made while deriving the Bernoulli's Equation.

f) What is Kinetic Energy Correction Factor?

g) Explain in brief Hydraulic Gradient lines and Total Energy Lines.

h) What do you understand by the terms: Major energy losses and minor energy losses in pipes.

i) State the different methods of determining the coefficient of viscosity of a liquid. What do you understand by the term Reynold's number?

j) Define the terms vortex flow, forced vortex flow and free vortex flow.

PART B (5*14 = 70 Marks)

Answer any 5 questions from Question No. 2 to 8.

2

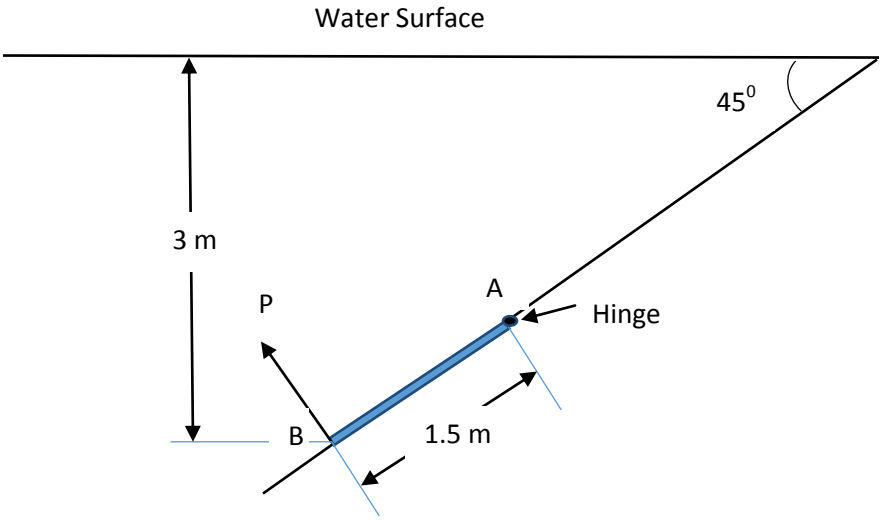
a) Calculate the velocity gradient at distance of 0, 100, 150 mm from the boundary if the velocity profile is a parabola i.e $u=Ay^2+By+C$ with the vertex 150 mm from the boundary, where the velocity is 1 m/s. Also calculate the shear stresses at these points if the fluid has a viscosity of 0.804 N-s/m^2 (7 marks)

b) Prove that the rate of increase of pressure in a vertically downward direction must be equal to the specific weight of the fluid at that point. (7 marks)

3

a) Prove that the centre of pressure of a completely vertical submerged plane surface is always below the centre of gravity of the submerged plane surface. (7 marks)

b) An inclined rectangular gate of width 5m and depth 1.5 m is installed to control the discharge of water as shown in figure 1. The end A is hinged. Determine the force normal to the gate applied at B to open it.



(7 marks)

Figure 1

4

a) For steady flow of an incompressible fluid derive an expression of Bernoulli's theorem from first principle. (7 marks)

b) A Venturimeter has its axis vertical, the inlet and throat diameters being 150 mm and 75 mm respectively. The throat is 225 mm above inlet. Petrol of specific gravity 0.78 flows up through the meter at a rate of 0.029 m^3/s. Assume coefficient of discharge of the venturimeter as 0.96. Find the pressure difference between the inlet and the throat. (7 marks)

5

a) Show that the loss of head due to sudden expansion in pipe line is a function of velocity head. (7 Marks)

b) Three pipes of diameters 300 mm , 200 mm and 400 mm and lengths 450 m , 255 m and 315 m respectively are connected in series. The difference in water surface level in two tanks is 18 m. Determine the rate of flow of water if coefficient of friction are 0.0075, 0.0078 and 0.0072 respectively considering;

i) Minor and Major losses and

ii) Neglecting minor losses. (7 marks)

6

a) Water at 15^0 C flows between two large parallel plates at a distance of 1.6 mm apart. Determine a) Maximum Velocity b) The pressure drop per unit length and c) The shear stress at the walls of the plate if the average velocity is 0.2 m/s. The viscosity of water at 15^0C is given as 0.001 poise. (7 marks)

b) What power is required per kilometer of a line to overcome the viscous resistance to the flow of glycerine through a horizontal pipe of diameter 100mm at the rate of 10 lit/s? Take dynamic viscosity of oil as 8.0 poise and kinematic viscosity as 6.0 stokes. (7 marks)

7

a) A vessel, cylindrical in a shape and closed at the top and bottom, contains water upto a height of 80 cm . The diameter of the vessel is 20 cm and length of vessel

120cm . The vessel is rotated at a speed of 400 rpm about its vertical axis. Find i) the height of paraboloid formed , ii) the speed of rotation (in rpm) of the vessel , when axial depth of water is zero. (7 marks)

b) Water flows radially between the two flanges at the end of a 0.15 m diameter pipe as shown in figure 2 Neglecting losses , if the pressure head at A is -0.3m . find the pressure head at B and flow in m^3/s.

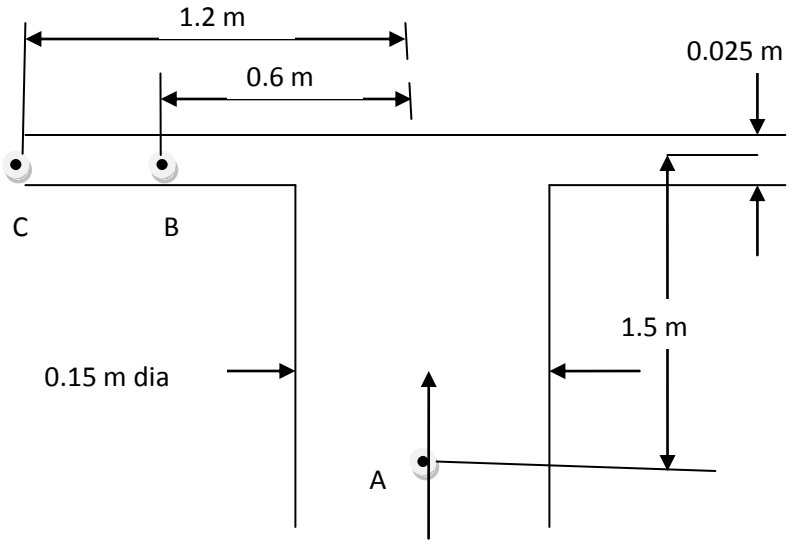


Figure 2 (7 marks)

8

a) A jet of water from a nozzle is deflected through 60^0 from its original direction by a curved plate which it enters tangentially without shock with a velocity of 30 m/s and leaves with a mean velocity of 25m/s. If the discharge from the nozzle is 0.8 kg/s, calculate the magnitude and direction of the resultant force on the vane, if the vane is stationary. (7 marks)

b) Obtain an expression for the force exerted by a jet of water on a moving inclined flat plate in the direction of the jet , if 'θ' is the angle between the jet and plate as shown in figure 3.

(7 marks)

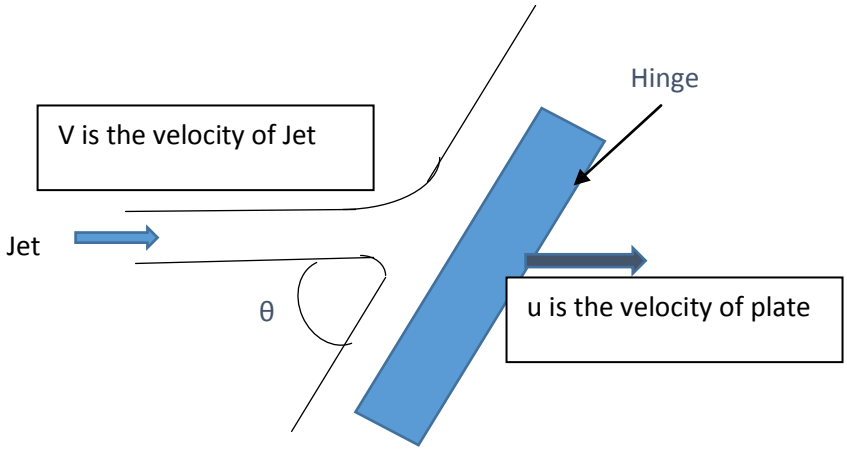


Figure 3.

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