

INDIAN MARITIME UNIVERSITY
Time Bound Assignment September/October 2020
B Tech (ME) Arrear Examinations
Fluid Mechanics-I
UG11T1405 / UG11T2405

Date: 28/09/2020
Time: 3 Hrs

Maximum Marks: 70
Pass Marks: 35

PART-A (compulsory)
(Answer the following (10x2=20 Marks))

1. What are the types of similarity between model and prototype?
2. Define viscosity. How does viscosity behave with variation of temperature in respect of liquid and gas.
3. Explain conditions for stable, unstable & neutral equilibrium of floating body.
4. Define Meta centre and metacentric height.
5. Why length of converging part of the Venturimeter is shorter than diverging part?
6. What are the assumptions of Bernoulli's equation of motion? Write the modified form of Bernoulli's equation for real fluid.
7. Write the equations of force and work done when force is exerted by a jet on stationary flat vertical plate.
8. Which dimension of a pipe is used to define a standard pipe size and why?
9. Draw the profile of velocity and shear stress distribution of viscous flow at a section between two plates.
10. Define the radial flow of fluid. In radial flow, what is Barlow's curve?

PART-B

Answer any 5 out of 7 questions. (Marks :5 x 10=50)

11.a) Explain Rayleigh's method of dimensional analysis. Why Buckingham's π -theorem is considered superior to Rayleigh's method for dimensional analysis.

b) Find the expression for the power P , developed by a pump when P depends upon the head H , discharge Q and specific weight w of the fluid.

(Marks 5+5)

12.a) An annular plate 3 m external diameter and 1.5 m internal diameter is immersed in water with its greatest and least depths below water surface as 3.6 m and 1.2 m respectively. Determine the total pressure and the position of the center of pressure on one face of the plate.

b) A battle ship weighs 127.53 MN. On filling the ship's boats on one side with water weighing 588.6 KN and its mean distance from the centre of the ship being 10 m, the angle of displacement of the plumb line is $2^{\circ}16'$. Determine the meta-centric height.

(Marks 5+5)

13.a) Find experimentally C_c , C_v , C_d and area at vena-contracta of water jet.

b) A horizontal Venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of sp.gr. 0.8. The discharge of oil through Venturimeter is 60 litres/sec. Find the reading of the oil-mercury differential manometer.

(Marks 5 +5)

14a) Derive an expression for loss of head due to sudden enlargement of pipe.

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.

(Marks 5+5)

15) A pipe line of length 2000 m is used for power transmission. If 110.3625 KW power is to be transmitted through the pipe in which water having a pressure of 490.5 N/cm^2 at inlet is flowing. Find the diameter of the pipe and efficiency of transmission if the pressure drop over the length of pipe is 186.39 N/cm^2 . Take coefficient of friction $f=0.0065$. Also find the diameter of pipe corresponding to the maximum efficiency of transmission. **(Marks 4+2+4)**

16.a) Derive equations of torque and power due to viscous resistance in Collar bearing.

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. **(Marks 5+5)**

17.a) Derive equation of motion of forced vortex flow and from its equation, prove that top surface of vortex motion is paraboloid.

b) 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 at the bottom of cylinder. **(Marks 5+5)**

* * * * *