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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, October/November - 2016
MECHANICS OF FLUIDS AND HYDRAULIC MACHINES
(Common to ME, MIE, MSNT)

Time: 3 Hours   Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Explain what is vapour pressure.   [2]
  b) Explain what is manometer. How is it classified?   [3]
  c) Distinguish Eularian and Lagrangian method of representing fluid motion.   [2]
  d) Describe assumptions and limitations of Bernoulli's theorem.   [3]
  e) What is meant by laminar and turbulent boundary layer?   [2]
  f) Distinguish between major and minor losses.   [3]
  g) What is difference between radial flow and axial flow in turbo machinery?   [2]
  h) Explain the geometric similarity in hydraulic machinery.   [3]
  i) What is slip?   [2]
  j) Differentiate positive displacement and rotodynamic pumps.   [3]

PART-B

(50 Marks)

2.a) State and explain Newton's law of viscosity with a neat sketch and give examples of its
      application.
  b) An oil film of thickness 1.5 mm is used for lubrication between a square plate of size
      0.9 m ×0.9 m and an inclined plane having an angle of inclination 20^0. The weight of the
      square plate is 392.4 N and it slides down the plane with a uniform velocity of 0.2 m/s.
      Find the dynamic viscosity of the oil.   [5+5]

                                          OR

3.a) Discuss the classification of fluids and give one example for each type of fluid.
  b) Calculate the capillary rise in a glass tube of 3.0 mm diameter when immersed vertically
      in (i) water, and (ii) mercury. Take surface tensions for mercury and water as 0.0725 N/m
      and 0.52 N/m respectively in contact with air. Specific gravity for mercury is given as
      13.6.   [5+5]

4.a) Name the different forces present in a fluid flow. For the Euler's equation of motion,
      which forces are taken into consideration?
  b) A pipe of diameter 30 cm carries water at a velocity of 20 m/sec. The pressures at the
      points A and B are given as 34.335 N/cm^2 and 29.43 N/cm^2 respectively. While the datum
      head at A and B are 25 m and 28 m, find the loss of head between A and B.   [5+5]

                                          OR

5.a) What is Euler's equation of motion. How will you obtain Bernoulli's equation from it?

b) A 45^0 reducing bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 40 cm and 20 cm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet of bend is 21.58 N/cm^2. The rate of flow of water is 500 litres/s. [5+5]

6.a) What do you understand by pipes in series, pipes in parallel and equivalent pipe?

b) A horizontal Venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water. The reading of differential manometer connected to inlet and throat is 10 cm of mercury. Determine the rate of flow. Take Cd = 0.98. [5+5]

OR

7.a) Explain the principle of Venturimeter with a neat sketch. Derive the expression for the rate of flow of fluid through it.

b) The rate of flow of water through a horizontal pipe is 0.3 m^3/s. The diameter of the pipe is suddenly enlarged from 250 mm to 500 mm. The pressure intensity in the smaller pipe is 13.734 N/cm^2. Determine: (i) loss of head due to sudden enlargement, (ii) pressure intensity in the large pipe and (iii) power lost due to enlargement. [5+5]

8.a) Define the term: impact of jets. Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.

b) A Pelton wheel has a mean bucket speed of 35 m/s with a jet of water flowing at the rate of 1 m^3/s under a head of 270 m. The buckets deflect the jet through an angle of 170^0. Calculate the power delivered to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98. [5+5]

OR

9.a) Find the expression for the force exerted by the jet on a flat vertical plate moving in the direction of the jet.

b) A Kaplan turbine runner is to be designed to develop 7357.5 kW S.P. The net available head is 10 m. Assume that the speed ratio as 1.8 and flow ratio 0.6. If the overall efficiency is 70% and diameter of the boss is 0.4 times the diameter of the runner, find the diameter of the runner, its speed and specific speed. [4+4]

10. A centrifugal pump is to discharge 0.12m^3/s at a speed of 1400 r.p.m. against a head of 30 m. The diameter and width of the impeller at outlet are 25 cm and 5 cm respectively. If the manometric efficiency is 75%, determine the vane angle at outlet. [8]

OR

11.a) What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal pump.

b) The internal and external diameters of the impeller of a centrifugal pump are 300 mm and 600 mm respectively. The pump is running at 1000 r.p.m. The vane angles at inlet and outlet are 20^0 and 30^0 respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. [4+4]

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