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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2016
MECHANICS OF FLUIDS AND HYDRAULIC MACHINES
(Automobile Engineering)

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) What do you mean by dimensions and units? [2]
 b) List out different fluid properties along with their significance. [3]
 c) What do you mean by rotational and irrotational flows? [2]
 d) Distinguish between fluid Kinematics and Fluid Dynamics. [3]
 e) Distinguish between Orifice meter and venture meter. [2]
 f) What are laminar and turbulent boundry layers? [3]
 g) Differentiate pump and turbine. [2]
 h) What is geometric similarity? [3]
 i) How do you distinguish centrifugal and reciprocating pumps? [2]
 j) What is indicator diagram? What is its significance? [3]

PART - B
(50 Marks)

2.a) Explain Newtonian and Non-Newtonian fluids, vapour pressure, and compressibility.
 b) A piston 796 mm diameter and 200 mm long works in a cylinder of 800 mm diameter. If the annual space is filled with lubrication oil of viscosity 5 cp (centi-poise), calculate the speed of descent of the piston in vertical position. The weight of the piston and axial load are 9.81 N. [5+5]

OR

3.a) What is the difference between U-tube differential manometers and inverted U- tube differential manometers. Where are they used?
 b) An open tank contains water up to a depth of 1.5 m and above it an oil of sp.gr.0.8 for a depth of 2 m. Find the pressure intensity: (i) at the interface of the two liquids, and (ii) at the bottom of the tank. [5+5]

4.a) Derive Bernoulli's equation for the flow of an incompressible frictionless fluid from consideration of momentum.
 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]

OR

5.a) What is the difference between momentum equation and impulse momentum equation.
 b) A 30 cm diameter pipe carries water under a head of 15 metres with a velocity of 4 m/s. If the axis of the pipe turns through 45^0, find the magnitude and direction of the resultant force at the bend. [5+5]

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

b) The rate of flow of water through a horizontal pipe is 0.3 m³/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/cm². 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]

OR

7.a) What is a pitot-tube. How will you determine the velocity at any point with the help of pitot-tube.

b) A 30 cm × 15 cm venturimeter is inserted in a vertical pipe carrying water, flowing in the upward direction. A differential mercury-manometer connected to the inlet and throat gives a reading of 30 cm. Find the discharge. Take $C_d = 0.98$. [5+5]

8.a) Define and explain hydraulic efficiency, mechanical efficiency and overall efficiency of a turbine.

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. [5+5]

OR

9.a) Draw a net sketch of a Pelton wheel installation and briefly indicate the functions of each component.

b) A double jet Pelton wheel develops 1200 MHP with an overall efficiency of 82% under a head of 60 m. The speed ratio = 0.46, jet ratio = 12, and the nozzle coefficient = 0.97. Find the jet diameter, wheel diameter and wheel speed in rpm. [5+5]

10.a) What precautions are to be taken while starting and closing the pump.

b) A centrifugal pump delivers 300 lps of water against a head of 5 m when running at 510 rpm. At what speed should a geometrically similar pump run when delivering 150 lps at a head of 10m. Determine the ratio of linear dimensions of the pump. [5+5]

OR

11.a) Discuss the conditions under which cavitation and negative slip occur and state why air vessels are used in reciprocating pumps.

b) A centrifugal pump is required to deliver 300 lit of water per second against a head of 14 m. If the vanes of the impeller are radial at outlet and the velocity of flow is constant equal to 2m/sec, find the proportions of the pump. Assume manometric efficiency as 75% and the ratio of breadth to diameter at outlet as 0.1. [5+5]

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