Code No: 124DF

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, April/May - 2023
MECHANICS OF FLUIDS AND HYDRAULIC MACHINES
(Common to ME, MIE)

Time: 3 Hours   **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a) What is surface tension and write its expression.   [2]
  b) Define kinematic viscosity. How it varies with temperature?   [3]
  c) Differentiate between laminar and turbulent flow.   [2]
  d) Mention the properties of velocity potential function.   [3]
  e) Define Hydraulic gradient line and total energy line.   [2]
  f) What is meant by parallel pipe and write the governing equations.   [3]
  g) Define impact of jets.   [2]
  h) What are speed ratio and flow ratio?   [3]
  i) What is cavitation?   [2]
  j) Differentiate between positive and negative slip of a reciprocating pump. [3]

PART - B

(50 Marks)

2.a) Three liters of petrol weighs 23.7 N. Calculate mass density, specific weight and specific volume and specific gravity of petrol.
  b) Explain the phenomenon of capillarity. Obtain an expression for capillary rise of a liquid.
                                                                                 [5+5]

OR

3.a) What are the gauge pressure and absolute pressure at a point 3 m below the free surface of a liquid having a density of 1.53×10^3 kg/m^3 if the atmospheric pressure is equivalent to 750 mm of mercury? The specific gravity of mercury is 13.6 and density of water is 1000 kg/m^3.
  b) Enunciate Newton's law of viscosity. Explain the importance of viscosity in fluid motion.
                                                                                 [5+5]

4.a) A 30cm diameter pipe carries oil of specific gravity 0.8 at a velocity of 2m/s. At another section the diameter is 20cm. find the velocity at this section and also mass rate of flow of oil.
  b) What is Euler's equation of motion? How will you derive Bernoulli's equation from it?   [5+5]

OR

5.a) The stream function for an incompressible, two dimensional flow field is $\psi = ay - by^3$ where a and b are constants. Is this an Irrotational flow? Explain.

  b) Distinguish between the rotational and irrotational flow. Give one example each.   [5+5]

6.a) What is meant by boundary layer separation? What is the effect of pressure gradient on boundary layer separation?

  b) A 250 mm diameter pipe carries oil of specific gravity 0.9 at a velocity of 3 m/s. At another section the diameter is 200 mm. Find the velocity at this section and the mass rate of flow of oil.   [5+5]

OR

7.a) The rate of flow of water through a horizontal pipe is 350 lps. The diameter of the pipe is suddenly enlarged from 200mm to 500mm. The pressure intensity in the smaller pipe is 15 N^2/cm. Determine loss of head due to sudden enlargement and Pressure intensity in the larger pipe.

  b) Explain the terms: i) Pipes in parallel ii) Equivalent pipe iii) Equivalent size of pipe.   [5+5]

8.a) Obtain an expression for the force exerted by a jet of water in a fixed vertical plate In the direction of the jet.

  b) A nozzle of 50mm diameter delivers a stream of water at 20m/s perpendicular to a plate that moves away from the jet at 5m/s. Find the force on the plate and work done by jet.   [5+5]

OR

9.a) Differentiate between Impulse and reaction turbines and Radial and axial flow turbines.

  b) A turbine develops 9000kw when running at 10rpm. The head on the turbine is 30m. If the head on the turbine is reduced to 18m, determine the speed and power developed by the turbine.   [5+5]

10.a) Explain terms i) Manometric efficiency ii) Mechanical efficiency iii) overall efficiency of a centrifugal pump.

  b) Find the number of pumps required to take water from a deep well under a total head of 89m. All the pumps are identical and are running at 800rpm. The specific speed of each pump is given as 25 while the rated capacity of each pump is 0.16m^3/s.   [5+5]

OR

11.a) What is indicator diagram for a reciprocating pump? Prove the area of indicator diagram is proportional to the work done by reciprocating pump.

  b) A single acting reciprocating pump, running at 30rpm delivers 0.012m^3/s of water. The diameter of the piston is 25cm and stroke length 50cm. Determine the
  i) Theoretical discharge of pump
  ii) Coefficient of discharge.   [5+5]

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