Code No: 124DF

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2019
MECHANICS OF FLUIDS AND HYDRAULIC MACHINES
(Common to ME, MIE)

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) Define specific volume and specific density of a fluid. [2]
b) Differentiate between absolute and gauge pressure. [3]
c) List the general characteristics of laminar flow. [2]
d) Give two examples of unsteady and non-uniform flow. [3]
e) What do you understand by the term major losses and minor losses? [2]
f) What is hydraulic gradient line? [3]
g) Define geometric similarities. [2]
h) What is water hammer? [3]
i) What are the main parts of reciprocating pumps? [2]
j) Define mechanical efficiency. [3]

PART – B

(50 Marks)

2.a) A piston of 2.5 kg having diameter and height 4 cm and 7 cm respectively is decelerating at rate of 1 m/s^2 in a hollow lubricated cylinder. The clearance between piston and hollow cylinder is 0.5 mm. Calculate the viscosity of the film when the velocity of piston is 8m/s.
b) What is meant by vapour pressure? Explain its importance in liquid flow systems. [5+5]

OR

3.a) What is difference between U-tube differential manometers and inverted U-tube differential manometers?
b) Air is introduced through a nozzle into a tank of water to form a stream of bubbles. If the bubbles are intended to have a diameter of 2 mm, calculate by how much the pressure of air at the nozzle must exceed that of surrounding water. Assume $\sigma = 72.7 \times 10^{-3}$ N/m. [5+5]

4.a) Define equation of continuity. Obtain the expression for continuity equation for a three-dimensional flow.
b) Define stream line, streak line and path line. Derive mathematical expression for each of these lines. [5+5]

OR

5.a) What is Euler's equation of motion? How will you obtain Bernoulli's equation from it?
b) Explain momentum of equation and give its application on force on pipe bend. [5+5]

6.a) Two reservoirs whose water surface elevations differ by 100 m are connected by a 25 cm diameter pipe 3000 m long. Another pipe of the same diameter is laid parallel with the first pipe and connected to the middle one-third of its length. Calculate the percent increase in discharge. Assume f=0.01 for all pipes and neglect minor losses.

b) Explain clearly the concepts of displacement and momentum thickness of a boundary layer. [5+5]

OR

7.a) An orifice in one side of a large tank is rectangular in shape, 3 meters broad and 1 m deep. The water level on one side of the orifice is 4 meters above its top edge. The water level on the other side of the orifice is 0.5 meter below its top edge. Calculate the discharge through the orifice per second if $C_d = 0.63$.

b) What is venturimeter? Derive an expression for the discharge through a venturimeter. [5+5]

8.a) Find an expression for the efficiency of a series of moving curved vanes when a jet of water strikes vanes at one of its tips. Prove that maximum efficiency is when u = V and the value of maximum efficiency is 50%.

b) Explain water hammer with control measure. [5+5]

OR

9.a) What is the main difference between a Francis and propeller turbine? How are hydraulic losses minimized in propeller turbine?

b) How are work output and hydraulic efficiency calculated from velocity diagram? [5+5]

10.a) Discuss the classification of centrifugal pumps as per specific speed, working head and pump construction.

b) Explain the different types of pump characteristics. [5+5]

OR

11.a) Explain the working of reciprocating pump.

b) Find the slip of the reciprocating pump in percentage when a single-acting pump cylinder diameter is 0.3 m, stroke length 0.25m. The pump run at 45 rpm and actual discharge is 0.0128 m^3/sec. [5+5]

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