Code No: 114DF

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, November/December - 2015
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.

PART- A

[25 Marks]

1.a) Distinguish between Specific weight and Specific gravity. [2M]
b) Explain atmospheric, gauge and vacuum pressures. [3M]
c) Differentiate between kinematics and dynamics of fluid flow. [2M]
d) Describe surface and body forces considered in fluid dynamics. [3M]
e) List out major and minor losses in a pipe flow. [2M]
f) Explain TEL and HGL with the help of a sketch. [3M]
g) Explain under what circumstances, Pelton Wheel, Francis Turbine and Kaplan Turbines are preferred to. [2M]
h) Draw inlet and outlet velocity triangles when a jet strikes a moving curved vane tangentially at one end and leaving at the other end. [3M]
i) What is priming. [2M]
j) Distinguish between centrifugal pump and reciprocating pumps. [3M]

PART-B

[50 Marks]

2.a) Explain the surface tension and vapour pressure and discuss their role on flow.
b) Determine the intensity of shear of an oil having viscosity = 1.8 poise and is used for lubrication in the clearance between a 14 cm diameter shaft and its journal bearing. The clearance is 1.23mm and shaft rotates at 240 r.p.m. [5+5]

OR

3.a) Distinguish between U tube and differential manometers.
b) 12 m^3 of carbon tetrachloride reduces in volume by 0.15 percent when subjected to certain pressure increase. If the bulk modulus of the fluid is 1.1450 $10^6 N/m^2$, the original specific weight is 15,750 N/ m^3, calculate the increase in pressure and the final specific weight. [5+5]

4.a) Define the following:
i) Steady flow,
ii) Non-uniform flow,
iii) Laminar flow, and
iv) Two-dimensional flow.
b) The water is flowing through a taper pipe of length 50 m having diameters 40 cm at the upper end and 20 cm at the lower end, at the rate of 55 litres/s. The pipe has a slope of 1 in 40. Find the pressure at the lower end if the pressure at the higher level is 26 N/cm^2. [5+5]

OR

5.a) Derive Bernoulli's equation from Euler's equation of motion.

b) A 42° 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 20.00 kPa. The rate of flow of water is 550 litres/s. [5+5]

6.a) Derive an equation for head loss due to sudden expansion and sudden contraction.

b) An orifice-meter with orifice diameter 16 cm is inserted in a pipe of 34 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter give readings of 12.75 N/cm^2 and 10.00 N/cm^2 respectively. Find the rate of flow of water through the pipe in litres/s. Take $C_d = 0.6$. [5+5]

OR

7.a) What is meant by boundary layer? Explain with a neat sketch, development of boundary layer along a flat plate held parallel to uniform flow. Point out the salient features.

b) Differentiate between the characteristics of laminar and turbulent boundary layers. [5+5]

8. A jet of water having a velocity of 18 m/s strikes a curved vane which is moving with a velocity of 5 m/s. The vane is symmetrical and it so shaped that the jet is deflected through 100^0. Find the angle of the jet at inlet of the vane so that there is no shock. What is the absolute velocity of the jet at outlet in magnitude and direction and the work done per unit weight of water? Assume the vane to be smooth. [10]

OR

9.a) What do you mean by gross head, net head and efficiency of turbine. Explain the different types of efficiencies of a turbine.

b) A Pelton wheel has a mean bucket speed of 30 m/s with a jet of water flowing at the rate of 0.8 m^3/s under a head of 250 m. The buckets deflect the jet through an angle of 160°. Calculate the power delivered to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.85. [5+5]

10.a) Define a centrifugal pump. Explain the working of a single-stage centrifugal pump with sketches.

b) The internal and external diameters of the impeller of a centrifugal pump are 250 mm and 500 mm respectively. The pump is running at 1200 r.p.m. The vane angles at inlet and outlet are 25^0 and 35^0 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. [5+5]

OR

11.a) Explain the working of reciprocating pump. Also indicate various components.

b) Explain the method of selection of centrifugal pumps with the aid of characteristic curves. [5+5]

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