

R09

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, May - 2016

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

(Common to ME, MIE)

Time: 3 hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

- 1.a) The velocity distribution for flow over a flat plate is given by $u=1.5y-y^{1.5}$ where u is the point velocity in metre per second at a distance y metre above the plate. Find the shear stress at $y = 9\text{cm}$. Assume dynamic viscosity as 8 poise.
- b) Write short notes on manometers. [8+7]
- 2.a) A conical tube is fixed vertically with its smaller end upwards. The velocity of flow down the tube is 4.5 m/s at the upper end and 1.5 m/s at the lower end. The tube is 1.5 m long and the pressure head at the upper end is 3.1 m of the liquid. The loss in the tube expressed as a head is $(0.2(v_1-v_2)^2)/2g$ where v_1 and v_2 are the velocities at the upper and lower ends respectively. What is the pressure head at the lower end?
- b) Define stream line, path line, streak line and stream tube. [8+7]
- 3.a) A turbine operating under a total fall of 36 m is supplied water through 90 m long 0.2 m diameter pipe. If the flow rate is such that 9.5 m of head is lost in friction in the pipe, what will be the power delivered to the turbine. Take $f = 0.022$.
- b) What is the use of Pitot tube? Also explain the principle behind it. [7+8]
- 4.a) Define boundary layer and explain the fundamental causes of its existence. Also discuss the various methods of controlling the boundary layer.
- b) A thin plate is moving in still atmospheric air at a velocity of 5 m/s. The length of the plate is 0.6 m and width 0.5 m. Calculate the thickness of the boundary layer at the end of the plate and drag force on one side of the plate. Take density of air as 1.24 kg/m^3 and kinematic viscosity 0.15 stokes. [8+7]
5. A 50 mm diameter jet having a discharge of 50 lps impinges without shock on a series of vanes which move in the same direction as the jet at 10 m/s. The shape of each vane is such that if stationary it would deflect the jet through an angle of 135° . Due to frictional resistance the relative velocity at outlet is 0.85 of that at inlet. Determine the magnitude and direction of the resultant force on vanes, the work done on the vanes and the efficiency of the system. [15]

6.a) Two jets strike the buckets of a Pelton wheel which is having shaft power as 15450 kW. The diameter of each jet is given as 200 mm. If the net head on the turbine is 400 m, find the overall efficiency of the turbine. Take $C_v = 1.0$.

b) What is draft-tube theory? Explain with a sketch. [8+7]

7.a) Derive the expressions for unit speed, unit discharge and unit power.

b) Explain Thomas cavitation factor. [8+7]

8.a) How does a single acting reciprocating pump works?

b) The diameters of an impeller of a centrifugal pump at inlet and outlet are 30 cm and 60 cm respectively. Determine the minimum starting speed of the pump if it works against a head of 30 m. [8+7]

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