

**Code No: 154AZ****JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B. Tech II Year II Semester Examinations, March - 2022****FLUID MECHANICS AND HYDRAULIC MACHINES****(Mechanical Engineering)****Time: 3 Hours****Max. Marks: 75**

**Answer any five questions**  
**All questions carry equal marks**

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- 1.a) What is capillarity? Derive an expression for height of a capillary rise.  
b) What is the difference between cohesion and adhesion?  
c) Determine the minimum size of glass tube that can be used to measure water level, if the capillary rise in the tube is not to exceed 0.25 mm. Take surface tension of water in contact with air as 0.0735 N/m. [5+5+5]
- 2.a) Derive an expression for capillary fall.  
b) Calculate the capillary rise in a glass tube 2.5 mm diameter when immersed vertically in: i) water ii) mercury. Take surface tension = 0.00725 N/m for water surface tension = 0.52 N/m for mercury in contact with air. The specific gravity of mercury is given as 13.6 and angle of contact =  $130^\circ$ . [7+8]
- 3.a) State the momentum equation. How will you apply momentum equation for determining the force exerted by a flowing liquid on a pipe bend?  
b) A  $45^\circ$  reducing bend is connected in a pipe line, the diameter at the inlet and outlet of the bend being 600 mm and 300 mm respectively. Find the force exerted by the water on the bend if the intensity of pressure at inlet to bend is  $8.829 \text{ N/cm}^2$  and rate of flow of water is 600 litres/s. [7+8]
4. Explain the uniform flow with source and sink. Obtain expressions for stream and velocity potential functions. [15]
5. Explain the principle working of a: a) Orifice meter b) pitot tube and c) rotameter. [5+5+5]
- 6.a) Show the governing mechanism of a Pelton wheel turbine with a neat sketch and explain how it works.  
b) A Pelton wheel has a mean bucket speed of 10 meters per second with a jet of water flowing at the rate of 700 litres/s under a head of 30 meters. The buckets deflect the jet through an angle of  $160^\circ$ . Calculate the power given by water to the runner and hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98. [7+8]

- 7.a) Briefly explain about governing of turbine.
- b) A turbine operates under a head of 25 m and 200 r.p.m. The discharge is 9 cumecs. If the efficiency is 90%, determine the performance of the turbine under a head of 20 meters. [7+8]
- 8.a) Define cavitation, Effects of cavitation.
- b) A double-acting reciprocating piston pump is pumping water (diameter of the piston 250 mm, diameter of piston rod which is on one side of piston 50 mm, piston stroke 380 mm). The suction and discharge heads are 4.5 m and 18.6 m respectively. Find the work done by the piston during outward stroke. Would the work done change for the inward stroke? [5+10]

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