

**2005 JAWAHARLAL NEHRU TECHNOLOGY UNIVERSITY**

II B.TECH I SEMESTER SUPPLYMENTARY EXAMINATIONS

**MECHANICS OF FLUIDS HYDRAULIC MACHINE**

(ELECTRICAL AND ELECTRONICS ENGINEERING)

MAY 2005

TIME: 3 HOUR  
MARK: 80

ANSWER ANY FIVE QUESTIONS ALL QUESTIONS CARRY EQUAL MARKS

MARK [ 5\*16=80 ]

1. (a) Distinguish between vaporization and boiling with reference to vapour pressure.
- (b) The volume of a fluid is reduced by 1% by increasing the pressure from 5 Pa to 125 Pa. Estimate the modulus of elasticity of the fluid for
- isothermal process
  - Isentropic process. Assume adiabatic index of 1.4.
2. (a) How would you find force on a submerged curved surface.
- (b) Determine the differential reading of an inverted U-tube manometer containing oil of specific gravity 0.8 as the manometric fluid, when connected across two pipes conveying liquids of specific gravities. 1.2 and 1.0 respectively and immiscible with the oil. Assume pressure in the two pipes be equal and are located at the same datum level.
3. (a) Show that if the flow is irrotational, velocity potential function must exist.
- (b) Do the velocity components:  $u=(2x+3y)$  and  $v=(3y-4x)$  represent a possible flow? Write down the continuity equation in cylindrical coordinates.
4. (a) Describe the functioning of a rotameter in flow measurement.
- (b) A closed tank partially filled with water to a depth of 1m has an orifice of diameter 1.5cm at its bottom. The pressure of air above the water surface is raised until the discharge becomes 2 liter/s through the orifice of coefficient of discharge 0.6 calculate the pressure of air.
5. (a) Explain the hydraulic gradient line and the total energy line.
- (b) A pipe of 0.6m diameter is 1.5km long. In order to augment the discharge, another pipe of the same diameter is introduced parallel to the first in the second-half of the length. Neglecting minor losses, find the increase in discharge if friction factor is 0.04. Assume a level difference of 30m at inlet and outlet of the pipe.
6. (a) Obtain the expressions for components of the force exerted, due to the impact of jet of fluid on a stationary curved vane.
- (b) A jet of water with a velocity  $U$  and jet area  $A$  strikes a flat plate normal to it. Determine the force of impingement, power developed and efficiency when the plate is
- at rest
  - permitted to move along the direction of the jet at a velocity  $u$ .
7. (a) Define
- Hydraulic efficiency
  - Mechanical efficiency and

iii. overall efficiency of a hydraulic turbine.

(b) Pelton wheel develops 7KW under a head of 240 meters with an overall efficiency of 83% when revolving at a speed of 200 RPM. Find the unit discharge, unit power and unit speed. Assume a peripheral coefficient of 0.46. If the head on the same turbine falls during summer season to 150m, find the discharge, power and speed

8. (a) Explain with a neat sketch the basic components of a centrifugal pump.

(b) A single stage centrifugal pump with impeller diameter of 30cm rotates at 2000 RPM and lifts 3m<sup>3</sup> of water per minute to a height of 30 meters, with an efficiency of 75%. Find the number of stages and the diameter of each impeller of a similar multistage pump to lift 5m<sup>3</sup> of water per minute a height of 200m when rotating at 1500 RPM.

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