

**2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY****III B.TECH I SEMESTER SUPPLEMENTARY EXAMINATIONS  
HYDRAULIC MACHINERY AND SYSTEMS  
(MECHANICAL ENGINEERING)**

/NAVEMBER 2005

TIME: 3 HOURS  
MAX MARKS: 80**Answer any FIVE Questions  
All Questions carry equal marks**

1. (a) Derive an expression for efficiency of propulsion of jet propelled boats when the inlet ports are located amid ships in force.

(b) A jet propelled boat moves at 32 kmph in a fresh water lake. There are 2 jets each of diameter 20 cm. The absolute velocity of the discharged jets is 25 kmph. Calculate the pump discharge force of propulsion, power input and efficiency of propulsion if the inlet orifices are located

i. amid ships and

ii. in bow.

[6+5+5]

2. A Francis turbine is working under a head of 100m and the discharge is 2m<sup>3</sup>/s. The velocity of flow, assumed constant through the runner is 16m/sec. The runner blade angle at inlet is 90°, the width of the blade at inlet is 0.15 times the diameter at inlet and the outlet diameter is 0.6 times the inlet diameter. Calculate the outlet angles of the guide and runner blades, wheel diameter and the hydraulic efficiency when the wheel is rotating at 500 rpm and the discharge are axial. (Assume that 10% of the flow area is blocked by the finite thickness of the blades) [16]

3. (a) What do you mean by the characteristic curves of a turbine?

(b) A turbine develops 10,000 HP under a head of 30 Metres at 120 rpm. Calculate the specific speed of the turbine and state the type of turbine? [10+6]

4. (a) Derive an expression for pressure head in the cylinder during suction stroke of a reciprocating pump with air vessel..

(b) A single acting reciprocating pump has a plunger diameter of 250 mm and stroke length of 450 mm. The suction pipe is 125 mm diameter and 12 m long with a suction lift of 3 metres. An air vessel is fitted to the suction pipe at a distance of 1.5 m from the cylinder and 10.5 m from the sump of water level. If the barometer reads 10.0 m of water and separation takes place at 2.5 m vacuum, find the speed at which the crank can operate without separation to occur. Take  $f = 0.01$  [10+6]

5. (a) What are the mechanical losses in the working of a centrifugal pump?

(b) The impeller of a centrifugal pump has outer diameter of 40 cm and inner diameter of 20 cm. The blade angle at outlet is  $30^\circ$ . The speed of the impeller is 1450 rpm. The velocity of flow at inlet and outlet is same at 2.2 m/sec. Find head developed if manometric efficiency is 75%, absolute velocity at outlet and blade angle at inlet. [10+6]

6. (a) What is the phenomenon of cavitation? Where will it occur in centrifugal pump?

(b) When will the kinematic similarity exist between model and prototype? [10+6]

7. (a) Describe with neat sketch the working of a hydraulic press.

(b) A hydraulic press has diameter of ram 200 mm and of plunger 40 mm. It is provided with a lever for applying force to the plunger. If the ratio of leverage is 10, determine the weight lifted by the press, when the force applied to the level is 100 N. [10+6]

8. Power is to be transmitted hydraulically to a distance of 8 km by means of a number of 10 cm pipes laid horizontally, for which the coefficient of friction may be taken as 0.03. The pressure at the accumulator is maintained constant at  $66.5 \text{ Kg/cm}^2$ . Determine the number of pipes required to ensure an efficiency of at least 92 percent when the power delivered is 220 h.p. [16]

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