

**IV B.Tech II Semester Supplementary Examinations, April/May 2005**  
**HYDRAULIC MACHINERY AND SYSTEMS**  
**( Common to Mechatronics and Production Engineering)**

Time: 3 hours

Max Marks: 70

Answer any FIVE Questions  
All Questions carry equal marks

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1. (a) Find an expression for the water propelling force and the work done per second on a tank which is provided with an orifice through which jet of water is coming out and the tank is free to move.  
(b) A jet of water 7.5 cm in diameter having velocity of 20 m/s strikes a series of the flat plates arranged around the periphery of a wheel such that each plate appears successively before the jet. If the plates are moving at a velocity of 5 m/s, compute the force exerted by the jet on the plate, the work done per second on the plate and the efficiency of the jet.
2. Sketch a Francis turbine and explain clearly its working principle. Under what circumstances will it be a good choice.
3. (a) One Pelton wheel develops 15MW power under a head of 360m at 450 rpm. What is its specific speed? What would be its normal speed and output under a head of 145m .  
(b) Explain what do you understand by unit speed, unit power and unit discharge of turbine.
4. (a) Derive an expression for the discharge of water into and from air vessel fitted to the delivery pipe of a single acting reciprocating pump.  
(b) A double acting reciprocating pump, running at 60 r.p.m has a plunger diameter of 250 mm and a stroke of 500mm. The delivery pipe is 100mm diameter and 50 m long. If the motion of the pump is simple harmonic, find the power required to overcome friction of the delivery pipe when no air vessel is fitted. Assume  $f = 0.01$
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 out let is same at 2.2 m/ sec. Find head developed if manometric efficiency is 75%, absolute velocity at out let and blade angle at inlet.
6. (a) What are the characteristic curves of centrifugal pumps ? Explain with neat diagrams.  
(b) Why do we maintain dynamic similarity between model and prototype?
7. (a) Differentiate between a fluid coupling and a torque converter.

- (b) State and draw the characteristic of fluid coupling and torque converter.
8. (a) A pipe 7.5 cm in diameter and 250 m long has a nozzle fitted at the discharge end. The total head at the inlet to the pipe is 40 m. Taking  $f=0.01$  for the pipe, determine the maximum power transmitted.
- (b) What is a gear pump and state the difference between an internal and an external type of such pump.

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