Fluid Machinery
(ME-306, MAY 2007)

Time: 3 Hrs
Max Marks: 60

Note: Section A is compulsory. Attempt any four questions from Section B and any two from Section C.

Section-A

1. a) Explain impulse momentum principle.
   b) Define over all efficiency of turbine.
   c) Sketch layout of a typical hydroelectric power plant and label it.
   d) Sketch different types of draft tubes.
   e) Define manometric head of a pump.
   f) Classify hydraulic pumps.
   g) Define "Net Positive Suction Head".
   h) Classify hydraulic turbines.
   i) Define degree of reaction.
   j) Define specific speed of a turbine.

Section-B

2. A Francis turbine works under a head of 25 m producing 3675 KW at 150 rpm. Determine the (a) unit power and unit speed of the turbine, (b) specific speed of the turbine and (c) power developed by this turbine if the speed is reduced to 100 rpm.
3. Explain the factors which decide the choice for a particular hydraulic turbine for a hydraulic power project.
4. Show that the work saved in overcoming friction in the pipelines by fitting air vessel is 84% for a single acting reciprocating pump and 39.2% for a double acting pump.
5. What is the difference between a hydraulic coupling and a hydraulic torque converter? Where are they used in practice?
6. Mention any two pumping devices which are non-conventional in practice. Sketch and describe the working of an air lift pump.

Section-C

7. A jet of water of 5 cm diameter impinges on a curved vane and is deflected through an angle of 175º. The vane moves in the same direction as that of the jet with a velocity of 35 m/sec. If the rate of flow is 170 liters/sec determine the component of force on the vane in the direction of motion. How much would be the power developed by the vane and what would be the vane efficiency? Neglect friction.
   How these parameters would change if instead of vane, there are vanes fitted to a wheel and are moving in the direction of jet with velocity of 35 m/sec.
8. Obtain relation for hydraulic efficiency of a Pelton wheel where the bucket deflects the water through (180º - θ). Proceed further to show that best bucket speed for maximum efficiency is equal to half that of the jet.
9. Show that the pressure rise in the impeller of a centrifugal pump, where friction and other losses in the pump are neglected, is given by
   $p_2 - p_1 = \rho (u_2^2 - u_1^2) / 2$
   Provided flow is radial at inlet, velocity of flow is constant through out and outlet angle of impeller vane is 45º.