Paper Code: ME-011

Roll No.

B.Tech.
(SEM VI) EVEN SEMESTER EXAMINATION 2015-16
FLUID MACHINERY

[Time: 3 hrs.]   **[Max. Marks: 100]**

Note- Attempt All questions. All questions carry equal marks.

Q1. Attempt any **two** parts of the following: -   **[10x2= 20]**

(a) Draw layout of a hydroelectric power plant with pelton turbine, and explain effective head, various efficiencies and available power.

(b) A pelton wheel is working under a head of 45m and discharge is 0.8 m^3/s. The mean bucket speed is 14 m/s. Find overall efficiency and the shaft power produced if the jet is deflected by the blades through an angle of 165^0. Assume the coefficient of velocity = 0.99 and mechanical efficiency = 0.95. Draw inlet and outlet velocity triangles.

(c) A jet of water having a velocity of 40 m/s impinges without shock on a series of vanes moving at 12m/s. The jet is making an angle of 20^0 with the direction of motion of vane. Relative velocity at exit is 0.9 times relative velocity at entrance and absolute velocity of water at exit is normal to the direction of motion of the vanes. Find (i) vane angles at entrance and exit (ii) work done on the vanes per N of water and (iii) hydraulic efficiency.

Q2. Attempt any **two** parts of the following: -   **[10x2= 20]**

(a) What is the purpose of a draft tube in a reaction water turbine? Derive an expression for draft tube efficiency.

(b) A reaction turbine works at 450 rpm under a head of 115 m. The diameter of the inlet is 1.20 m and flow area is 0.40 m^2. At the inlet absolute and relative velocities make angles of 20^0 and 60^0 respectively with the tangential velocity. Determine (i) the runner power developed and (ii) hydraulic efficiency. Assume velocity of whirl at outlet to be zero.

(c) Discuss operating and constant efficiency characteristics curves of hydraulic turbines.

Q.3 Attempt any **two** parts of the following:-   **[10x2= 20]**

(a) Sketch and describe volute casing with guide vanes (diffuser type) of a centrifugal pump. What are its advantages over the volute type and vortex type casings?

(b) A centrifugal pump is to supply 100 lit/s of water at a speed of 1450 rpm against manometric head of 15 m. The impeller has an outer diameter of 25 Cm and with a width of 6 cm at the outlet. The manometric efficiency is 0.80. Estimate blade angle at the outlet and impeller power.

(c) Each impeller of a two stage centrifugal pump (with impellers in series) has an outer diameter of 400 m.m. and a width of 25 m.m. The discharge of pump is 0.06 m^3/s at a speed of 1000 rpm. The vane angle at the outlet is 30^0 . Assuming manometic efficiency of 80%, calculate manometric head developed by pump. What would be shaft power if overall efficiency is 80%.

Q.4 Attempt any **two** parts of the following:- **[10x2= 20]**

(a) Derive an expression for acceleration head in reciprocating pump. Show its effect on theoretical indicator diagram.

(b) Explain the term slip as used in reciprocating pump. Discuss why and when negative slip occurs.

(c) Following data relate to a single acting reciprocating pump:
Cylinder dia = 15 cm,   Stroke length = 20 cm.
Static suction head = 4.0 m,   dia of suction pipe = 7.5 cm.
Suction pipe length = 8.0 m.,   crank speed = 60 rpm.
Delivery pipe dia = 7.5 Cm,   length of delivery pipe = 30.0 m
Static delivery head = 25.0m,   friction factor 0.025
Air vessels are provided very near the cylinder on suction and delivery sides. Estimate power required to drive the pump by assuming pump efficiency of 80%.

Q.5 Briefly explain the principle & working of any **two** parts of following:- **[10x2= 20]**
(a) Hydraulic press
(b) Hydraulic Coupling
(c) Air lift pump.