Code No. : **5186**

FACULTY OF ENGINEERING
B.E. 3/4 (Mech.) I Semester (Main) Examination, December 2011
HYDRAULIC MACHINERY AND SYSTEMS

Time: 3 Hours] [Max. Marks: 75

Note : *Answer **all** questions from Part **A**. Answer **any five** questions from Part **B**.*

PART – A **(25 Marks)**

1. A jet of water is directed through a nozzle of 5 cm diameter against a fixed flat plate held normal to the jet. The force exerted on the plate if the flow through the jet is 100 lit/sec is given by

   a) 5093 N b) 5092 N c) 5302 N d) 5309 N **3**

2. A pelton turbine develops 500 kW under a net head of 30 m If the over all efficiency of the turbine is 0.83. The discharge the turbine in (m^3/s) is

   a) 2.50 b) 2.05
   c) 1.41 d) 1.04 **3**

3. The cavitation in turbine is caused by

   a) High velocity b) Low pressure
   c) High pressure d) Low barometric pressure **2**

4. A centrifugal pump requires 6.5 kW power when running at 1440 rpm and delivering a total head of 15 m. The head developed when the pump runs at 1000 rpm is given by

   a) 2.60 m b) 2.75 m c) 2.57 m d) 2.58 m **3**

5. Inlet angle of the centrifugal pump is designed to get

   a) Relative velocity vector in radial direction
   b) Absolute velocity in radial direction
   c) Velocity flow to be zero
   d) Peripheral velocity to be zero **2**

6. A single acting reciprocating pump running at 100 rpm delivers 12 lit/sec water. The diameter and stroke of the cylinder are 20 cm and 30 cm respectively. The coefficient of discharge of the pump is given by

   a) 0.674 b) 0.764 c) 0.476 d) 0.647 **3**

7. The absolute pressure head in terms of meter of water to avoid the separation should be greater than
   a) 2.5 m b) 5 m c) 7.52 m d) 10.33 m 2

8. For high discharge and low head such as irrigation, the type of pump preferred is
   a) Centrifugal pump b) Reciprocating pump
   c) Propeller pump d) Gear pump 2

9. A hydraulic crane receives water 0.3 m^3 at a pressure of 10 bar for lifting a weight of 15 kN through a height of 15 m. The efficiency of the crane is given by
   a) 75% b) 76% c) 75.5% d) 76.5% 3

10. The function of the hydraulic accumulator is
    a) To store KE of the working fluid b) To store P.E. of the working fluid
    c) To store PE of the liquid d) All of the above 2

PART – B **(5×10= 50 Marks)**

11. A jet of water with a velocity of 40 m/s coming out of a nozzle of 7.5 cm diameter strikes to a fixed blade tangentially at one end at an angle of 30° to the horizontal. The jet leaves the blade tangentially making angle of 25° to the horizontal. Find the force exerted on the plate in horizontal and vertical directions.

12. A Pelton wheel is to be designed to develop 12 MW at 800 RPM when head available is 400 m. The given data is $n_o = 0.85$, $C_V = 0.97$ and $\phi = \frac{U}{V_1} = 0.45$ and $d \not> \frac{D}{5}$. Find wheel and jet diameters and number of jets required. Consider n_o of the system as 85%.

13. The internal and external diameters of the impeller of a centrifugal pump are 0.5 m and 1 m respectively. The vane angles at inlet and outlet are 30° and 45° respectively. If the impeller is running at 1200 rpm and flow of water through the pump is 0.2 m^3/s. Find the minimum power required to run the pump. Assume the velocity of flow is constant through the impeller of the pump.

14. Describe the principle and working of a reciprocating pipe. Draw an indicator diagram, considering the effect of acceleration and friction is suction and delivery pipes.

15. Derive the angular momentum equation for hydraulic machines and hence explain the classification of the hydraulic machines.

16. Explain the working principle of hydraulic torque converter.

17. What are the functions of air vessel in a reciprocating pump ? And why is the speed low in a reciprocating pump ?