EME011

(Following Roll No. to be filled by candidate)

Roll No. 1 3 0 4 3 4 0 0 0 9

B TECH
SIXTH SEMESTER EXAMINATION 2015-2016
EME011
FLUID MACHINERY

Time: 3 Hours **Max. Marks: 100**

Note:

- Attempt all questions.
- All questions are equal marks.
- All symbols have usual meaning.

1. Attempt **any four parts** from the followings. [4X5]
   a. What is meant by the eye of the impeller? For what type of service is the multistage pump adapted?
   b. List four reasons why a pump may have a reduced capacity, a reduced pressure, or a failure to deliver water?
   c. How the capacity of a reciprocating pump is calculated. Compare theoretical lift and actual lift.
   d. Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet. Also write the assumption made in the expression.
   e. What is cavitation? How it can be avoided in reaction turbine.
   f. Describe briefly the function of various components of pelton turbine with neat sketch.

2. Attempt **any two parts** from the followings. [2X10]
   a. A Pelton turbine develops 8 MW under a head of 130 m at a speed of 200 rev/min. The following are the particulars of Pelton wheel.
      - Coefficient of velocity (Cv) 0.98
      - Speed ratio 0.46
      - Jet diameter 1/9 of diameter of the wheel
      - Overall efficiency 87%

      Determine: the flow required, the diameter of the wheel, the diameter of the jet, the number of jets and the number of buckets.
   b. An axial flow turbine operates under a head of 21.8 m and develops 21 MW when running at 140 rpm. The tip diameter is 4.5 m and hub diameter is 2.0 m. The hydraulic efficiency is 94%. Determine inlet and exit angles of blades, and mean diameter if the overall efficiency is 88%.
   c. An inward flow turbine with radial discharge has an overall efficiency of 80% and develops 150 kw. The head is 8 m and the peripheral velocity at inlet is $0.96\sqrt{2gH}$ and flow velocity is $0.36\sqrt{2gH}$. The runner speed is 150 rev/min; the hydraulic efficiency is 85%.
      Determine:
      (a) Velocity of whirl at inlet

(b) Diameter of the wheel at inlet
(c) Flow rate
(d) Guide vane angle

3. Attempt **any two parts** from the followings. [2X10]
   a. What are the basic criteria of selection of a turbine at a particular place. Define specific speed of a turbine? Derive an expression for the specific speed. What is the significance of the specific speed?
   b. Define the term suction head, delivery head, static head and manometric head. Obtain an expression for the minimum speed for starting of a centrifugal pump.
   c. Discuss the main and operating characteristics of a centrifugal pump. A centrifugal pump having an impeller of outer diameter 350 mm rotates at 1050 rpm. The vanes are radial at exit and are 70 mm wide. The velocity of radial flow through the impeller is 3 m/s. The velocity in the suction pipe and delivery pipe are 2.5 m/s and 1.5 m/s respectively. Neglecting frictional losses, determine the height through which pump lifts and the house power of the pump.

4. Attempt **any two parts** of the followings. [2X10]
   a. What is negative slip in a reciprocating pump? Explain with the help of neat sketch the function of air vessels in a reciprocating pump.
   b. Explain in brief how and when separation of flow takes place in a reciprocating pump. Discuss the preventive measures usually adopted for effective reduction of separation in such type of pumps.
   c. The cylinder of a single acting reciprocating pump is 125 mm in diameter and 250 mm in stroke. The pump is running at 40 rpm and discharge water at a height of 15m. the diameter and length of the delivery pipe are 100 mm and 30 m respectively. If a large vessel is fitted in the delivery pipe at a distance of 1.5 m from the center of the pump, find the pressure head in the cylinder: (i) at the beginning of the delivery stroke, and (ii) In the middle of the delivery of the stroke. Take the efficiency of friction is 0.01.

5. Attempt **any two parts** from the followings. [2X10]
   a. What is a difference between fluid coupling and fluid torque convertor? Explain the torque convertor with neat sketch.
   b. Explain with neat sketch the construction and working of air lift pump. An accumulator is loaded with 40 kN weight. The ram has a diameter of 300 mm and stroke of 6m. Its fraction is 5%. The accumulator takes 2 minutes to fall through its full stroke. Find the total work supplied and power delivered to the hydraulic application by the accumulator, when 7.5 lps is being delivered by a pump while the accumulator descents with the stated velocity.
   c. With the help of neat sketch explain the working of hydraulic crane. A hydraulic crane has a diameter of 22 cm and ratio between movement of load and the ram is 10:1. The liquid is supplied to the jigger at a pressure of 5 MPa and the mechanism has a mechanical efficiency of 55%. Determine (i) the load lifted by the crane, and (ii) the quantity of liquid used when the load is raised through 8m height.