INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)

May/June 2015 End Semester Examinations

SEMESTER-V, B.Tech. (MARINE ENGINEERING)

FLUID MECHANICS– II (T1504)

Date : 15.06.2015 **Maximum Marks: 100**
Time: 3 Hrs **Pass Marks : 50**

PART – A (3 x10 = 30 Marks)
(Compulsory Questions)

1. a) Define the terms: i) Model ii) Prototype iii) Model analysis.

   b) Define slip, percentage slip and negative slip of a Reciprocating pump.

   c) What is the purpose of use an air vessel for Reciprocating pump?

   d) Why is a reciprocating pump not coupled directly to the motor? Discuss the reason in details.

   e) What is Net Positive Suction Head (NPSH)?

   f) Explain the terms of manometric, mechanical and overall efficiencies of a centrifugal pump.

   g) What is priming? Why is it necessary for Centrifugal pump?

   h) What is a Draft-tube? What are its functions?

   i) Differentiate between the Impulse and Reaction turbines.

   h) Define the terms for turbine:
   i) Unit Speed, ii) Unit Discharge and iii) Unit Power.

PART – B (5 x14 = 70 Marks)
(Answer any five of the following)

2. a) Obtain an expression for Unit Speed, Unit Discharge and Unit Power for a turbine.

   b) A pump running at 1450 rpm with impeller diameter of 20 cm is geometrically similar to a pump with 30 cm impeller diameter running at 950 rpm. The discharge of the larger pump at the maximum efficiency was 200 litres/sec at a total head of 25 m. Determine the discharge rate and the head of the smaller pump at the maximum efficiency conditions. Also determine the ratio of power required.

   (6+8=14)

3. a) Draw an indicator diagram, considering the effect of acceleration and friction in suction and delivery pipes.

   b) A single acting reciprocating pump has piston of diameter 150 mm and stroke length of 250 mm. The piston makes 50 double strokes per minute. The suction and delivery heads are 5 m and 15 m respectively.
   Find a) discharge capacity of pump in litres per minute
   b) force required to work the piston during the suction and delivery strokes if the efficiency of suction and delivery strokes are 60 % and 75 % respectively
   c) power required to operate the pump. **(5+9=14)**

4. A double acting reciprocating pump has a bore of 0.2 m and stroke of 0.4 m. The suction pipe has a diameter of 0.1 m and is fitted with an air vessel. Find the rate of flow into or from the air vessel when the crank makes angles of 30^o, 90^o and 120^o with inner dead centre. Determine also the crank angles at which there is no flow to or from the air vessel. Take the speed as 120 r.p.m. and assume that the plunger has simple harmonic motion. **(14)**

5. A centrifugal pump operates against a manometric head of 30 m with a manometric efficiency of 75 %. The pressure rise through the impeller is 65% of the total head developed by the pump. The radial velocity of flow, which is constant, is 3 m/sec. The outer diameter of impeller is 400 mm and the width at outlet is 15 mm. The blades at inlet are curved back ward at 60 degree to the wheel tangent.
   Calculate i) the speed of pump (ii) blade angle at outlet. (iii)Diameter of impeller at inlet (iv) the discharge in litres per minute. **(14)**

6. A centrifugal pump lifts water under a static head of 36 m of water of which 4 m is suction lift. The suction and delivery pipes are both 150mm in diameter. The head loss in the suction pipe is 1.3 m and in the delivery pipe 7.0 m. The impeller is 380 mm in diameter and 25mm wide at the mouth and it revolves at 1200 rpm. Its exit blade angle is 35 degree. If manometric efficiency is 82%, find the discharge and the pressure at the suction and delivery branches of the pump.
   (14)

7. a) Prove that the hydraulic efficiency of Pelton wheel is maximum when the bucket speed is equal to half the velocity of the jet.
   b) An inward flow reaction turbine has external and internal diameters as 1 m and 0.5m respectively. The velocity of flow through the runner is constant and is Equal to 1.5 m/sec. Determine (i) Discharge through the runner and
   (ii) width of turbine at outlet if the width of the turbine at inlet is 200 mm.
   (6+ 8 = 14)

8. Pelton wheel has a mean bucket speed of 12 m/sec and is supplied with water at a rate of 750 litres per second under a head of 35 m. If the bucket deflects the jet through an angle of 160 degree, find the power developed by the turbine and its hydraulic efficiency. Take the co-efficient of velocity as 0.98. Neglect friction in the bucket. Also determine the overall efficiency of the turbine if its mechanical efficiency is 80%. **(14)**

****