INDIAN MARITIME UNIVERSITY
(A Central University, Govt. of India)

B.Tech.(Marine Engineering) - Semester V
December 2015 End Semester Examinations

Fluid Mechanics - II
Subject Code: UG11T2504/ UG11T1504

Time: 3 hrs | Max Marks: 100
Date: 17.12.2015 | Pass Marks: 50

Part-A (3x10=30 Marks)

Compulsory Questions

1. Compulsory short answer questions

a. How is the choice of repeating variable made in case of Buckingham's method?
b. List the dimensionless coefficients used in model testing of hydraulic turbines.
c. Define operating point and shut off head of centrifugal pump.
d. What are the advantages of installing air vessels in reciprocating pumps?
e. Explain why backward curved blades are more popularly used.
f. What is manometric head? How is it related to the internal losses of centrifugal pump?
g. What is cavitation? When does it occur in reciprocating pump?
h. Explain why the casing is of spiral shape with uniform change in area, in case of reaction turbines.
i. Define speed ratio in case of turbines and pumps.
j. State the difference between Pelton wheel and Francis turbines.

Part-B (5x14 = 70 Marks)

Answer any five of the followings.

2. A centrifugal pump lifts water against a static head of 40 m, of which 4 m is suction lift. The suction and delivery pipes are both 150mm diameter; the head loss in the suction pipe is 2.3 m and in the delivery pipe 7.4 m. The impeller is 420 mm diameter and 25mm wide at the mouth; it revolves at 1200 rpm and its effective valve angle at exit is 35 degree. If manometric efficiency is 82% and overall efficiency is 72 %; determine the discharge delivered by the pump and power required to drive the pump. Also find the pressure head indicated at the suction and delivery branches of the pump. (14 Marks)

3. a) Derive an expression of specific speed of centrifugal pump.
b) Find the power required to drive a centrifugal pump which delivers 0.04 m3/sec of water to a height of 20 m through a 15 cm diameter and 100 m long pipe line. The overall efficiency of the pump is 70% and friction factor f=0.06 for the pipeline. Assume inlet losses in suction pipe equal to 0.33 m. (4+10=14 Marks)

4. A Francis turbine works under a head of 120 m. The outer diameter and width are 2 m and 0.16 m. The inner diameter and width are 1.2 m and 0.27m. The flow of velocity at inlet is 8.1 m/sec. The whirl velocity at outlet is zero. The outlet blade angle is 16º. Assume hydraulic efficiency 90%. Determine (i) power developed, (ii) speed at inlet (iii) blade angle at inlet and (iv) guide blade angle at inlet. (14 Marks)

5. A 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 Marks)

6. A double acting reciprocating pump, running at 40 rpm, is discharging 1.0 m^3 of water per minute. The pump has a stroke of 400 mm. The diameter of the piston is 200mm. The delivery and suction head are 20 m and 5 m respectively. Find the percentage of slip of the pump and power required to drive the pump. (14 Marks)

7. a) Draw a complete indicator diagram of single acting Reciprocating pump and mark on it the effect of acceleration and friction in suction and delivery pipes.
   b) Derive the expression of rate of flow of liquid into and from the air vessel for single acting reciprocating pump and from that expression, find the crank angles at which there will be no flow into or from the air vessel.

(4 + 10 – 14 Marks)

8. A pump running at 1450 rpm with impeller diameter of 20cm is geometrically similar to a pump with 30 cm impeller diameter running at 950 rpm. The discharge of the large pump at the maximum efficiency was 200 litres/sec at a total head of 25 m. Determine the discharge and the head of the smaller pump at the maximum efficiency conditions. Also determine the ratio of power required. (14 Marks)

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