INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

End Semester Examinations December 2018

B. Tech (Marine Engineering)

Semester-V

FLUID MECHANICS-II (UG11T2504)

Date: 03-01-2019 Max Marks: 100

Time: 3 Hrs Pass Marks: 50

PART – A

All questions are compulsory (10 x 3 = 30 Marks)

1.

a. Why are backward facing impeller vanes preferred for centrifugal pump?

b. Why are the maximum speed and minimum speed of centrifugal pump limited?

c. Find out Manometric head of centrifugal pump by various methods.

d. What is cavitation? When does it occur in reciprocating pump?

e. What do you mean by negative slip? When it occurs?

f. What type of hydraulic brake is used in Pelton wheel?

g. What are the basic differences between Francis Turbine and Pelton wheel?

h. Why draft tube is used for hydraulic turbine?

i. Explain the terms –Geometric, Kinematic and Dynamic similarities?

j. Define the terms unit power, unit speed and unit discharge with reference to hydraulic turbine.

PART-B

Answer **any five** of the following questions

(14x5=70 Marks)

2. a)A centrifugal pump runs at 625 rpm and delivers 0.85 m^3/s under the effective head of 29 m. The outer diameter of impeller is 750 mm, width of impeller vane at outlet is 135 mm. A 525 kw motor is used and water enters impeller vanes radially at inlet. Compute the manometric, mechanical and overall efficiencies if the angle of impeller is 45 degree at outlet. (9)

b) Derive the fundamental equation of centrifugal pump where work done per unit weight = $h_e = \frac{v_2^2 - v_1^2}{2g} + \frac{u_2^2 - u_1^2}{2g} + \frac{v_{r1}^2 - v_{r2}^2}{2g}$ (5)

3.The diameter and width of a centrifugal pump impeller are 50 cm and 2.5 cm. The pump runs at 1200 rpm. The suction head is 6 m and delivery head is 40 m. The frictional drop in suction is 2 m and in the delivery 8 m. The blade angle at outlet is 30 degree. The manometric efficiency is 80% and overall efficiency is 75 %. Determine

(a) the power required to drive the pump. Also calculate

(b) the pressure at the suction and

(c) the pressure at delivery side of the pump. (4+5+5)

4.A Francis turbine working under a head of 40 m has wheel diameter of 1.0 m at the entrance and 0.5 m at exit. The vane angle at the entrance is 90 degree and guide blade angle is 15 degree. The water at exit leaves vane without shock and without any tangential velocity. Velocity of flow in the runner is constant. Neglecting the effect of draft tube and losses in the guide and runner passages, determine

(a) the speed of wheel in revolution per minute and
(b) vane angle at exit. (8+6)

5.a)A Pelton wheel is supplied with water at the rate of 900 litres/sec with mean bucket speed of 15 m/s. The Pelton wheel is working under a head of 50 m. Determine the power produced by the turbine and overall efficiency if the bucket deflects the jet through an angle of 140 degree. Consider mechanical efficiency 85% and assume velocity coefficient 0.98. (7)

b)A Pelton wheel is working under a head of 550 m and produces power 10000 KW at 450 rpm. If the overall efficiency of the wheel is 85%,determine the following: (Assume coefficient of velocity, Cv as 0.98 and speed ratio as 0.45)

i) Discharge of the turbine
ii) Diameter of the wheel
iii) Diameter of the nozzle (7)

6. By using Air Vessel, work is saved by eliminating the work lost in friction during the acceleration and deceleration of the fluid. Prove that percentage of work done saved per stroke for
(a) single acting pump is 84.8% and
(b) the same for double acting pump is 39.2%. (10+4)

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. (4)

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. (10)

8.a) A turbine develops power 150 KW at 250 rpm under a head of 20 m. Determine the scale ratio and speed of the similar machine which will generate 750 KW when working under a head of 30 m. (7)

b) From model testing analysis, the performance of a large centrifugal pump is required to be analyzed from a scale model of one-third the diameter. The large pump is required to pump against 20.0 m head. The model absorbs 10 KW when pumping under the test head of 7.0 m at its maximum speed of 3500 rpm. What will be its working speed, the power required to derive it, and the ratio of quantities discharged by the large pump and the model? (7)