INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

End Semester Examination Dec 2019/Jan 2020

B.Tech (Marine Engineering)

Semester -V

UG11T3504- Fluid Machines

Date: 16.12.2019 **Max Marks: 70**

Time: 3 Hours **Pass Marks: 35**

Part – A (compulsory)

Answer the following (10x2=20 Marks)

1. What is function of an impeller in a Centrifugal pump?
2. Give the function of volute casing and diffuser in centrifugal pump
3. What is a priming? Why is it required?
4. What is a slip in reciprocating pump?
5. What is an indicator diagram used for reciprocating pump?
6. What is an Air Vessel used for reciprocating pump?
7. Differentiate between the impulse turbine and reaction turbine.
8. Classify the various types of turbines.
9. Mention the types of similarities.
10. Distinguish between the model and prototype.

Part – B

Answer any 5 out of 7 questions (5 x 10= 50 marks)

11. The internal and external diameter of the impeller of a centrifugal pump are 300 mm and 600 mm respectively. The pump is running at 1000rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by impeller per unit weight of water. Sketch the velocity triangle. (10 Marks)

12. A centrifugal pump delivers water against a net head of 14.5 m and a design speed of 1000 r.p.m. against a head of 25 m. The Vanes are curved back to an angle of 30 °with the periphery. The impeller diameter is 300 mm and outlet width is 50 mm .Determine the discharge if manometric efficiency is 95 %. (10 Marks)

13. A single acting reciprocating pump running at 50 rpm, delivers 0.01 m^3/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine.

i) the theoretical discharge of the pump

ii) coefficient of discharge

iii) Slip

iv) the percentage slip of the pump.

(3+3+2+2=10 Marks)

14. A Pelton wheel is having a mean bucket diameter of 1m and is running at 100 r.p.m the net head on the Pelton wheel is 700m. If the side clearance angle is 15° and discharge through nozzle is 0.1 m^3/s, find

i. Power available at the nozzle.
ii. Hydraulic efficiency of the turbine. Take $C_v = 1$ (5+5=10 Marks)

15. An inward flow reaction turbine with an overall efficiency of 75% is required to produce 148.25 kW power. It is working under a head of 7.62 m. The peripheral velocity = 0.26 $\sqrt{2gH}$ and the radial velocity of flow at inlet is 0.96$\sqrt{2gH}$. The wheel runs at 150 r.p.m. and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine:

(i) The guide blade angle,
(ii) The wheel vane angle at inlet,
(iii) Diameter of the wheel at inlet, and
(iv) Width of the wheel at inlet (2+2+3+3=10 Marks)

16. Using Buckingham's π- theorem, show that the velocity through a circular orifice is given by $V = \sqrt{2gH}\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$, where H is the head causing flow, D is the diameter of the orifice, μ is co-efficient of viscosity, ρ is the mass density and g is the acceleration due to gravity. (10 Marks)

17. A ship 300m long moves in sea- water, whose density is 1030 kg/m^3, A1:100 model of this ship is to be tested in a wind tunnel around the model is 30m/s and the resistance of the model is 60N. Determine the velocity of ship in sea- water and also the resistance of the ship in sea – water. The density of air is given as 1.24 kg/m^3. Take the kinematic viscosity of sea – water and air as 0.012 strokes and 0.018 strokes respectively.
(10 Marks)