

--	--	--	--	--	--	--	--

***B.Tech. Degree III Semester Examination in
Marine Engineering December 2016***

**MRE 1305 FLUID MECHANICS AND MACHINERY
(2013 Scheme)**

Time : 3 Hours

Maximum Marks : 100

(5 × 20 = 100)

- I. (a) A piston 796 mm diameter and 200 mm long works in a cylinder of 800 mm diameter. If the annular space is filled with a lubricant of viscosity 5 cP, calculate the speed of descent of piston in vertical position. The weight of the piston and axial load are 9.8 N. (8)
- (b) A square surface 3 m × 3 m lies in a vertical plane. Determine the position of the centre of pressure and the total force on the square, when its upper edge is (i) in water surface (ii) 15 m below water surface. (12)

OR

- II. (a) Define the term 'Metacentric Height' and derive an expression for the same in a floating body. (8)
- (b) A model of sub-marine is scale down $\frac{1}{20}$ of the proto type and is to be tested in a wind tunnel. The speed of the proto type at which to estimate the drag is 8 m/s. What should be the free stream velocity of the air? What should be the ratio of the drag between the model and the prototype? (12)
- III. (a) Write notes on stream function and velocity potential function. (8)
- (b) A venturimeter is to be fitted in a 150 mm diameter pipe line horizontally at a section where the pressure is 100 kN/m². If the maximum flow of water in the pipe is 150 liters/sec, find the diameter of the throat so that the pressure at the throat does not fall below 75 kN/m² (vacuum). Assume that 3% of the differential head is lost between the inlet and the throat. (12)

OR

- IV. (a) Derive Darcy – Weisbach formula. (8)
- (b) Two pipes of diameter 40 cm and 20 cm are each of 300 m long. When the pipes are connected in series and discharge through pipe line is 0.10 m³/sec, find the loss of head incurred. What would be the loss of head in the system to pass the same total discharge when the pipes are connected in parallel? Take $f = 0.0075$ for each pipe. (12)
- V. (a) Write notes on variation of coefficient of resistance with Reynolds Number. (8)
- (b) An oil having viscosity of 0.143 Ns/m² and specific gravity of 0.9 flows through a pipe 2.5 cm diameter and 300 cm long, at 1/10 of the critical velocity for which Reynolds number is 2500. Find:
(i) The velocity of flow through pipe.
(ii) The head in metres of oil across the pipe length required to maintain the flow. (12)

OR

(P.T.O.)

- VI. Write notes on : (20)
- (i) Couette flow
 - (ii) Critical velocity.
 - (iii) Two dimensional flow theory.
 - (iv) Forced and free vortex.

- VII. (a) Obtain an expansion for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet. (8)
- (b) How will you decide the number of buckets for a Pelton turbine? (6)
- (c) What is speed ratio? What are its theoretical and actual values? (6)

OR

- VIII. (a) Differentiate between reaction turbine and impulse turbine. (8)
- (b) The following data relates to a Pelton turbine that generates 4000 kW under a net head of 300 m. (12)
- | | |
|-------------------------|---------------|
| Speed ratio | : 0.45 |
| Jet ratio | : 12 |
| Angle of jet deflection | : 165° |
| C_v | : 0.97 |
| η_o | : 86 % |
| Generator efficiency | : 96 % |
| Friction loss of bucket | : 10% |

Determine :

- (i) Diameter of the jet.
- (ii) Tangential force exerted by the jet on the bucket.
- (iii) Mean diameter of runner
- (iv) Synchronous speed.

- IX. (a) Describe the classification of centrifugal pumps. (8)
- (b) A two-stage centrifugal pump delivers 100 liters of water per second, when running at 1000 r.p.m. Its impellers are 50 cm in diameter and 2.5 cm wide at the out let. Vanes are curved back at an angle of 30° and area due to blade thickness is 10% of the total area. Taking overall efficiency as 80% and manometric efficiency as 88%, determine : (12)
- (i) Head generated.
 - (ii) Power consumed.

OR

- X. (a) What is an indicator diagram? What is its importance in reciprocating pump? How does the acceleration head and pipe friction affect the indicator diagram? (8)
- (b) A single acting reciprocating pump has a piston diameter of 12 cm and stroke of 22 cm. Diameter and length of the suction pipe are 5 cm and 6.5 m, while that of delivery pipe are 4 cm and 20 m respectively. Sump water level is 4 m below and the delivery tank is 16 m above the centre line of the pump. (12)

If separation is to occur at 7.8 m below the atmosphere pressure head, determine the maximum speed at which the pump can be operated without separation.