B. Tech Degree III Semester Examination in Marine Engineering, November 2009

MRE 305 FLUID MECHANICS AND MACHINERY

Time: 3 Hours Maximum Marks: 100

I. (a) Explain in brief:
(i) Viscosity of fluid
(ii) Surface tension
(iii) Capillary rise (10)

(b) Discuss geometrical and dynamical similarity and its applications. (10)

OR

II. (a) Explain Newtonian and Non Newtonian fluids. (5)

(b) A circular tank 4m in diameter and 10m long rests with its axis horizontal on the bottom of a canal in which the depth of water is 10m. Calculate the depth of the center of pressure on each of the flat surface and the resultant hydrostatic force acting on the tank. (15)

III. (a) Discuss in brief:
(i) Stream function
(ii) Burnaulli's equation and its limitations (10)

(b) Water flows out of a tank through a small orifice on a vertical wall under a constant head of 2 meters. The orifice diameter is 2cm. The water jet issuing out of the orifice drops downward due to the action of gravity. It is seen that the vertical fall is 10cm, for a horizontal displacement of 85cm from the Vena-contracta. Calculate,
(i) Coff. of velocity
(ii) Discharge per unit time of $C_c = 0.62$ (10)

OR

IV. (a) Derive Darcy-Weisbach equation. (10)

(b) In a city water supply system, water flowing through a pipe line 30 cm in diameter. The pipe diameter is suddenly reduced to 20cm. Estimate the discharge through the pipe if the difference in pressure across the sudden contraction is 5 KPa. (10)

V. (a) Explain variation of resistance coefficient with Reynold's number. (8)

(b) Glycerine (Sp. Gravity 1.26, viscosity 0.9 Pa-S) is pumped at the rate of 20 litters/s through a straight pipe, diameter 100mm, 45m long and inclined upwards at 15° to the horizontal. The gauge pressure at inlet is 590 kPa. Calculate the gauge pressure at the outlet end and the average shear stress at the wall. (12)

OR

VI. (a) Discuss two dimensional flow theory. (8)

(b) A closed cylindrical vessel 16cm internal diameter and 1m height, contains water upto a height of 75cm from the bottom determine (i) Height of paraboloid, if the vessel is rotated at 450 rpm about its axis (ii) speed at which the water just touches the top lid of the vessel. (12)

VII. (a) Explain momentum equation applied to a control volume. (8)

(b) A jet of water of diameter 6cm moving with a velocity of 25 m/s strikes a flat plate, inclined at 40° to the axis of the jet. Find the normal force on the plate when it is moving with a velocity of 15 m/s in the direction of the jet and away from it. Also calculate the power and the efficiency of the system. (12)

(Turn Over)

OR

VIII. (a) Differentiate between impulse turbine and reaction turbine. (8)

(b) Calculate the number of jets required for a pelton wheel to develop 10,000 KW under a head of 370m when running at 500 rpm. Ratio of the wheel diameter to the jet diameter is 12. Assume suitable values of coefficient of velocity, speed ratio and the overall efficiency. (12)

IX. (a) Explain classification of centrifugal pumps. (8)

(b) A centrifugal pump discharges 0.13 m^3/s when running at a speed of 1450 rpm. Head developed is 30m. Impeller diameter and width at the outlet are 30cm and 5cm respectively. Hydraulic efficiency is 77%. Find the vane angles at the outlet periphery of the impeller. (12)

OR

X. (a) With a neat sketch explain a theoretical indicator diagram of reciprocating pump. Show the effect of friction and acceleration on it. (8)

(b) A single acting reciprocating pump raises water to a height of 20m through a delivery pipe which is 35m long and 14cm in diameter. Diameter and stroke of the piston are 25cm and 40cm respectively. Cavitation occurs at 2.5m of water absolute. Find the speed at which the pump can run without cavitation to occur on the delivery side if

(i) the pipe rises first vertically and then runs horizontally,

(ii) the pipe runs first horizontally and then vertically upwards. (12)

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