BT-MRE-III(S)/12.17- 1725 Reg. No. | | | | | | | | |

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B.Tech. Degree III Semester Supplementary Examination in Marine Engineering December 2017

MRE 305 FLUID MECHANICS AND MACHINERY

(*Prior to 2013 Scheme*)

Time: 3 Hours Maximum Marks: 100

(5 × 20 = 100)

I. (a) Calculate the velocity gradient at distance of 0, 100, 150 mm from the boundary if the velocity profile is a parabola with the vertex 150 mm from the boundary, where the velocity is 1 m/s. Also calculate the shear stress at these points if the fluid has a viscosity of 0.804 N-s/m^2. (8)

(b) A solid cone floats in water with its apex downwards. Determine the least apex angle of cone for stable equilibrium. The specific gravity of the material of cone is 0.70. (12)

OR

II. (a) If in a model study the length ratio is $\frac{1}{40}$ and the velocity ratio is $\frac{1}{6.34}$; find the discharge in the model required for a design discharge of 10,000 m^3/s in the prototype. What duration of time in the model represent one day in the prototype? (8)

(b) The vertical side of a reservoir has a rectangular opening 2.75 m long and 1.2 m high. It is closed by a plate using 4 bolts placed at the corner of the opening. What would be the tension in the bolts if water stands to a height of 1.8 m above the top edge of the opening? (12)

III. (a) Explain Bernoulli's equation and its limitations. (8)

(b) A venturimeter is installed in a pipeline 30 cm in diameter. The throat-pipe diameter ratio is 1/3, water flows through the installation. The pressure in the pipe line is 137.7 kN/m^2 and the vaccum in the throat is 37.5 cm of mercury. If 4% of the differential head is lost between the gauges, find the flow in the pipe line. (12)

OR

IV. (a) Explain the various losses in pipe flow. (8)

(b) Two sharp ended pipes of diameter 50 mm and 100 mm respectively, each of length 100 meters are connected in parallel between two reservoirs which has a difference of level of 10 meters. If the coefficient of friction for each pipe is 0.32 = (4f), calculate the rate of flow for each pipe and also the diameter of a single pipe 100 meters long which would give the same discharge, if it were substituted for the original two pipes. (12)

V. (a) Prove that the velocity distribution in laminar flow through a circular pipe is parabolic and hence deduce that the average velocity is half the maximum velocity. (8)

(b) An oil having specific gravity of 0.9 flows at the rate of 11.3 liters per second through a horizontal pipe 7.5 cm in diameter. The pressure drop over 300 m length of the pipe is 412 kN/m^2. Assuming laminar flow, find the viscosity of the oil. Also establish that the flow through the pipe is laminar. (12)

OR

(P.T.O.)

VI. (a) Distinguish between forced vortex and free vortex. (8)

(b) A cylindrical drum has an opening in the centre of its bottom. During its filling with water the opening is pluged and after filling the plug is opened and the water is allowed to flow out. As the water depth is progressively decreased, a spiral flow which is distinctly visible on the liquid surface is setup, if the tangential velocity at a radial distance of 35 cm is found to be 25 cm/sec. Determine: (12)

(i) Velocity at a radial distance of 15 cm.
(ii) The velocity-law for the vortex.
(iii) The radial distance where velocity is equal to 50 cm/sec.

VII. (a) Write notes on impact of jet. (8)

(b) A jet of water moving at 12 m/s impinges on a concave shaped vane and is deflected though an angle of 120° when the vane is stationery. If the vane starts moving at 6 m/s, determine angle of the jet to avoid the shock at the inlet, assuming the vane to be symmetrical. (12)
Also calculate the velocity of the jet at the exit both in magnitude and direction and work done per unit mass of water per second. Relative velocity at the outlet is 0.9 of that of at the inlet due to friction of vane.

OR

VIII. (a) Distinguish between Impulse and Reaction Turbine. (8)

(b) Write notes on: (12)
(i) Speed regulation of turbine.
(ii) Draft tube.
(iii) Selection of turbines.

IX. A centrifugal pump works against a head of 8 m and pumps 1500 litters per second. It rotates at 180 rpm. Diameter of the impeller at the outlet is 1.3 m and the area at the outer periphery is 0.3 m^2. Assuming the ratio of the external to the internal diameter to be 2 and the vane angle at the out let is 30°, find: (20)
(i) Hydraulic efficiency of the pump.
(ii) Power required to run the pump.
(iii) Minimum starting speed.

OR

X. A single acting reciprocating pump discharges 0.018 m^3 of water per second when running at 60 rpm. Stroke length is 50 cm and the diameter of the piston is 22 cm. If the total lift is 15 m, find: (20)
(i) Theoretical discharge of the pump.
(ii) Slip and percentage slip.
(iii) Co-efficient of discharge.
(iv) Power required to run the pump.

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