Code: 9A01308

R09

II B. Tech I Semester (R09) Supplementary Examinations, May 2012
FLUID MECHANICS & HYDRAULIC MACHINERY
(Electrical & Electronics Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1 (a) State and explain Newton's law of viscosity with a neat sketch and give examples of its application.
(b) In a stream of glycerin in motion, at a certain point the velocity gradient is 0.25 meter per sec per meter. The mass density of fluid is 1268.4 kg per cubic meter and kinematic viscosity is 6.30 ×10−4 square meter per second. Calculate the shear stress at the point.

2 (a) What is the difference between momentum equation and impulse momentum equation?
(b) A 30 cm diameter pipe carries water under a head of 15 meters with a velocity of 4 m/s. If the axis of the pipe turns through 45°, find the magnitude and direction of the resultant force at the bend.

3 (a) What do you mean by equivalent pipe? Obtain an expression for equivalent pipe.
(b) A pipe of diameter 300 mm and length 1000 m connects two reservoirs, having difference of water levels as 15 m. Determine the discharge through the pipe. If an additional pipe of diameter 300 mm and length 600 m is attached to the last 600 m length of the existing pipe, find the increase in the discharge. Take f = 0.02 and neglect minor losses.

4 (a) Prove that the force exerted by a jet of water on a fixed semi-circular plate in the direction of the jet, when the jet strikes at the center of the semi-circular plates is two times the force exerted by the jet on the fixed vertical plate.
(b) A jet of water of diameter 50 mm strikes a fixed plate in such way that the angle between the plate and the jet is 30^0. The force exerted in the direction of the jet is 1471.5 N. Determine the rate of flow of water.

5 (a) What do you mean by intake structure? What are the functions of it? Explain different types of intake structures with neat sketches.
(b) The average annual yield of a river at a dam site is 2000 ha-m. Assuming that the entire yield is available for power generation, estimate the water power potential. The average net head available is 52 m. Also estimate the available energy. Take efficiency of turbine as 80% and the efficiency of the generator as 90%.

6 An outward flow reaction turbine has internal and external diameters of the runner as 0.5 m and 1.0 m respectively. The guide blade angle is 15° and velocity of flow through the runner is constant and equal to 3 m/s. If the speed of the turbine is 250 r.p.m., head on turbine is 10 m and discharge at outlet is radial, determine : (i) The runner vane angles at inlet and outlet (ii) Work done by the water on the runner per second per unit weight of water striking per second and (iii) Hydraulic efficiency.

7 (a) Define the specific speed of a turbine. Derive an expression for the specific speed. What is the significance of the specific speed?
(b) An inward flow reaction turbine has external and internal diameters as 1.2 m and 0.6m respectively. The velocity of flow through the runner is constant and is equal to 1.8 m/s. Determine: (i) Discharge through the runner, and (ii) Width at outlet if the width at inlet = 200 mm.

8 (a) Define a centrifugal pump. Explain the working of a single-stage centrifugal pump with sketches.
(b) The internal and external diameters of the impeller of a centrifugal pump are 300 mm and 600 mm respectively. The pump is running at 1000 r.p.m. The vane angles at inlet and outlet are 200 and 300 respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.
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