(Please write your Exam Roll No.) Exam Roll No. 40818003416

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH.] MAY-JUNE-2018

Paper Code: ETCE-206 **Subject: Hydraulics & Hydraulic Machines**

Time: 3 Hours **Maximum Marks: 75**

Note: Attempt five questions in all including Q.No 1 which is compulsory. Select one question from each unit. Make necessary assumptions and clearly state them.

Q1 (a) Give conditions and draw a diagram for the Boundary layer separation. **(5x5=25)**
(b) Write a short note on Magnus Effect.
(c) Explain the concept of Equivalent pipe.
(d) Draw a neat and labeled diagram for the Hydro-electric plant.
(e) Differentiate between Centrifugal pump and reciprocating pump.

UNIT-I

Q2 (a) An oil having viscosity of 7 poise and specific gravity 0.85 flows through a horizontal 50 mm diameter pipe with a pressure drop of 18 KN/m² per meter of pipe length. Determine (i) Flow rate of oil and the center line velocity. (ii) total friction drag over 100 meter length of pipe and the power required to maintain the flow (iii) Velocity and shear stress at 8 mm from the wall. **(6.5)**
(b) Derive an expression for Kinetic Energy Correction Factor for Laminar flow in a circular pipe. **(6)**

Q3 (a) Explain the velocity distribution in the boundary layer and express the same for a flat plate.
Use momentum integral equation to develop an expression for boundary layer thickness, wall shear stress and skin friction coefficient, dag force on one side of the plate and the drag coefficient in terms of Reynolds number. **(6.5)**
(b) Describe the various methods for control of separation of boundary layer. **(6)**

UNIT-II

Q4 (a) A pipe line 60 cm diameter and 5 kg long, connects two reservoirs whose constant difference of level is 15 m. A branch pipe taken from a point distant 2 km from the reservoir. A leads to a third reservoir C. A regulating valve on this branch helps to control the quantity of water entering the reservoir C. Determine the rate of flow of water to reservoir B when (i) no water is discharged to reservoir C, (ii) The quantity of water discharged to reservoir C is 125 litres per sec. Consider only frictional losses. Take coefficient of friction 0.001. **(7.5)**
(b) For the given pipes in series as shown in figure A, draw hydraulic gradient line and total energy line. Take a coefficient of friction as 0.01. Consider all the minor losses. **(5)**

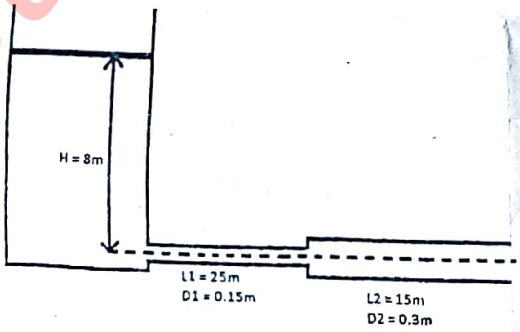

Figure A

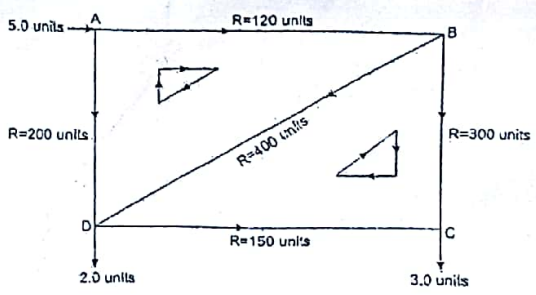

Figure B

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Q5 (a) A pipe network with two loops is shown Figure B. Determine the flow in each pipe. **(7.5)**

(b) Explain how the drag coefficient changes with (i) Surface roughness (ii) Turbulence level. Also explain why golf balls are designed to have dented surface. **(5)**

UNIT-III

Q6 (a) A pelton wheel of 1.2 m mean bucket diameter works under a head of 650 m. The jet deflection is 165°C and its relative velocity is reduced over the bucket by 15% due to friction. If the water used to leave the bucket without any whirl, find (i) the rotational speed of the wheel, (ii) ratio of bucket speed to jet velocity, (iii) impulsive force and the power developed by the wheel, (iv) Available water power and the power input to the buckets, (v) efficiency of the wheel. Take C_V=0.97. **(7.5)**

(b) Explain the governing mechanism for Francis Turbine with diagram **(5)**

Q7 In an inward flow reaction turbine having vertical shaft, water enters the runner from the guide vanes at an angle of 155 °C with the runner blade angle at entry being 100°. Both these angles are measured from the tangent at runner periphery drawn in the direction of runner rotation. The flow velocity through the runner is constant; water enters the draft tube from the runner without whirl and the discharge from the draft tube into the tail race takes place with a velocity of 2.5 m/sec. The runner has the dimensions of 40 cm external diameter and 3.8 cm inlet width. The turbine works with a net head of 35 m and the loss of head in the turbine due to fluid resistance is 4 m of the water. Draw the vector diagrams and calculate: (i) speed of the runner, (ii) runner blade angle at point on the outlet edge where the radius of rotation is 9cm, (iii) power generated by the turbine and its specific speed, (iv) inlet diameter of the draft tube. **(12.5)**

UNIT-IV

Q8 (a) Explain the different efficiencies of centrifugal pump. **(4.5)**

(b) A centrifugal pump having an overall efficiency of 72%, delivers 0.03 m^3/sec of water to a height of 20 m through a 10 cm diameter pipe 80 m long. Taking friction coefficient 0.01, calculate the power required to run the pump. **(8)**

Q9 (a) What do you understand by Cavitation? What is Thomas cavitation factor, what is its significance for turbines? **(5)**

(b) A single acting reciprocating pump has a stroke length of 15 cm, the suction pipe is 7 m long and the ratio of suction pipe diameter to the plunger diameter is ¾. The water level in the sump is 2.5 m below the axis pump cylinder and the pipe connecting the pump and the pump cylinder is 7.5 cm diameter. If the crank is running at 75rpm determine the pressure head on the piston at beginning and at the end of suction stroke. Take friction coefficient 0.01. **(7.5)**

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