CBCS SCHEME

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15CV43

Fourth Semester B.E. Degree Examination, Feb./Mar. 2022
Applied Hydraulics

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain Rayleigh's method with an example. **(03 Marks)**

b. Define : i) Center of Buoyancy ii) Metacenter. How these are used to identify the equilibrium condition of floating bodies? **(05 Marks)**

c. Water is flow through a pipe of diameter 30cm at a velocity of 4m/s. Find the velocity of oil flowing in another pipe of diameter 10cm, if the condition of dynamic similarity is satisfied between the two pipes. The viscosity of water and oil is given as 0.01 poise and 0.25 poise. The Sp.gr of oil = 0.8. **(08 Marks)**

OR

2 a. What is meant by Dimensionally Homogenous equation? Explain with an example. **(04 Marks)**

b. The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid , angular velocity w , dynamic diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters. **(12 Marks)**

Module-2

3 a. Derive Manning's equation from first principles. **(08 Marks)**

b. The depth of flow of water, at a certain section of a rectangular channel of 2m wide, is 0.3m. The discharge through the channel is $1.5 m^3/s$. Determine whether a hydraulic jump will occur and if so, find the height and loss of energy per kg of water. **(08 Marks)**

OR

4 a. Draw a neat sketch of Specific energy curve and write the expression for Critical depth , Critical velocity and Minimum specific energy in terms of Critical depth. **(08 Marks)**

b. A trapezoidal channel has side slopes of 1horizontal to 2 vertical and the slope of the bed is 1 in 1500. The area of the section is $40m^2$. Find the dimension of the section if it is most economical. Determine the discharge of the most economical section if C = 50. **(08 Marks)**

Module-3

5 a. Derive an expression for depth of hydraulic jump in terms of upstream Froude Number. **(08 Marks)**

b. A rectangular channel 7.5m wide has a uniform depth of flow of 2.0m and has a bed slope of 1 in 3000. If due to Weir constructed at the downstream end of the channel , water surface at a section is raised by 0.75m, determine the water surface slope with respect to horizontal at this section. Assume Manning's n = 0.02. **(08 Marks)**

OR

6 a. Write a note on Classification of flow in Channels. **(06 Marks)**

b. Derive Dynamic equation of Gradually varied flow. **(10 Marks)**

Module-4

7 a. Derive an expression for the Force exerted by jet on stationary curved vane striking at the centre. **(06 Marks)**

b. A Pelton wheel is to be designed for a head of 60m when running at 200 r.p.m. The Pelton wheel develops 95.6475 KW shaft power. The velocity of the buckets = 0.45 times the velocity of the Jet , Overall efficiency = 0.85 and Co-efficient of the velocity is equal to 0.98. **(10 Marks)**

OR

8 a. Draw a neat sketch of a layout of hydroelectric power plant and explain the function of each component. **(06 Marks)**

b. A jet of water having a velocity of 20m/s strikes a curved vane, which is moving with a velocity of 10m/s. The jet makes an angle of 20° with the direction of motion of vane at inlet and leaves an angle of 130° at the direction of motion of vane an outlet. Calculate

i) Vane angles , so that the water enters and leaves the vane without shock.

ii) Work done per second per unit weight of water striking the vane per second. **(10 Marks)**

Module-5

9 a. Draw the velocity triangle for a Reaction turbine and name all the components of the triangle. **(06 Marks)**

b. A reaction turbine works at 450 r.p.m. Under a head of 120meters. Its diameter at inlet is 120cm and the flow area is $0.4m^2$. The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Determine

i) The discharge ii) Power developed and iii) Hydraulic efficiency. **(10 Marks)**

OR

10 a. Define Draft Tube. Draw the neat sketches of types of draft tubes. **(08 Marks)**

b. The internal and external diameters of the impeller of a centrifugal pump are 200mm and 400mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radically and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. **(08 Marks)**

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