CBCS SCHEME

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18CV43

Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Applied Hydraulics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What are the types of similarities? Explain with equations. **(06 Marks)**

b. What are the conditions of equilibrium of floating and submerged bodies? **(06 Marks)**

c. The pressure difference ΔP in a pipe of dia. D and length ℓ due to turbulent flow depends on the velocity v viscosity μ, density ρ and roughness k, using Buckingham π theorem obtain expression for ΔP. **(08 Marks)**

OR

2 a. Explain the dimensionsless numbers with equation. **(06 Marks)**

b. Derive the equation for metacentric height by analytical method. **(08 Marks)**

c. A solid cylinder of diameter 4.0m has a height of 3m. Find the meta – centric height of the cylinder when it is floating in water with its axis vertical. The sp.gr of the cylinder = 0.6. **(06 Marks)**

Module-2

3 a. Derive the equation for discharge through open channel by Cherys formula. **(06 Marks)**

b. Explain specific energy and specific energy curve with a neat sketch. **(08 Marks)**

c. A trapezoidal channel with side slope of 1:1 has to be designed to convey $10 m^3/s$ at a velocity of 2m/s so that the amount of concrete living for the need and sized in the minimum. Calculate area of living vertical for 1m length of canal. **(06 Marks)**

OR

4 a. For most economical trapezoidal channel, derive the condition for hydraulic mean depth. **(08 Marks)**

b. Explain critical depth, critical velocity and minimum specific energy with equations. **(06 Marks)**

c. The specific energy for a 5m rectangular channel is to be 4Nm/N. If the rate of flow of water through the channel is $20 m^3/s$, determine the alternate depth of flow. **(06 Marks)**

Module-3

5 a. Derive the expression for depth of hydraulic jump. **(08 Marks)**

b. Derive the equation for Gradually Varied Flow (GVF). **(06 Marks)**

c. A slice gate discharges water in to a horizontal rectangular channel with a velocity of 10m/s and depth of flow of 1m. Determine the depth of flow after the jump and consequent loss of tidal head. **(06 Marks)**

OR

6 a. Derive the expression for the length of back water curve. **(08 Marks)**

b. Explain back water curve and afflux. **(04 Marks)**

c. Find the scope of free water surface in a rectangular channel of width 20m having depth of flow 5m. The discharge through the channel is 50 m^3/s. The bed of channel is having a slope of 1 in 4000. Take C = 60. **(08 Marks)**

Module-4

7 a. Find the force exerted by a jet on stationary curved plate, when jet strikes the plate at one end tangentially when the plate is symmetrical. **(10 Marks)**

b. A jet of water having a velocity of 40 m/s strikes a curved vane which is moving with a velocity of 20 m/s. The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves at an angle of 90° to the direction of motion of vane at outlet. Draw the velocity triangles at inlet and outlet and determine the vane angle at inlet and outlet so that the water enters and leaves for vane without shock. **(10 Marks)**

OR

8 a. Explain efficiencies of turbine with equations. **(06 Marks)**

b. What are the parts of Pelton wheel? Explain with sketch. **(06 Marks)**

c. Determine the power given by the jet of water to the runner of a Pelton wheel which is having tangential velocity as 20 m/s. The net head on the turbine is 50 m and discharge through the jet water is 0.03 m^3/s, the side clearance angle is 15° and take $C_v = 0.975$. **(08 Marks)**

Module-5

9 a. Explain the main parts of radial flow reaction turbine with the sketches. **(08 Marks)**

b. Explain efficiency of centrifugal pumps. **(06 Marks)**

c. A conical draft tube having inlet and outlet diameter 1 m and 1.5 m discharges water at outlet with a velocity of 2.5 m/s. The total length of the draft tube is 6 m and 1.2 m of the length of draft tube is immersed in water. If the atmospheric pressure head is 10.3 m of water and cross of head due to friction inter draft tube is equal to 0.2 x velocity head at outlet of the tube. Find pressure head at inlet and efficiency of the draft tube. **(06 Marks)**

OR

10 a. What are the main parts of centrifugal pumps?. **(06 Marks)**

b. Explain draft tube theory and efficiency of draft tube. **(06 Marks)**

c. A single stage centrifugal pump with impeller diameter of 30 cm rotates at 2000 rpm and lift 3 m^3 of water per second to height of 30 m with an efficiency of 75%. Find the number of stages and diameter of each impeller of a similar multistage pump to lift $5 m^3$ of water per second to a height of 200 m, when rotating at 1500 rpm. **(08 Marks)**

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