

/ T.E. (Civil) / Sem - II / 'C' Scheme / Subj. - AH / Date - 13/11/2025  
8.11.2025

Max. Time: 3 hrs

Total Marks: 80

Q.P. Code: -10095136

**Note:** Question no. 1 is compulsory.

Solve any 3 questions out of remaining questions.

Assume suitable data, if required.

Draw neat sketches wherever required.

1. Solve any four questions out of following 20
- a. A turbine is to be operated under a head of 25 m at 200 rpm. The discharge is 9 cumec. If the efficiency is 90%, determine: (i) Specific speed of the turbine, and (ii) Power generated.
  - b. Write a short note on Hydraulic Ram
  - c. Explain Draft Tube theory and types of Draft Tube in Turbines
  - d. Derive the expression for force exerted by jet on a stationary vertical plate.
  - e. Explain the phenomenon of Cavitation in Pumps and NPSH
  - f. Write a short note on Surface profiles for open channel flow.
2. a. A Kaplan turbine develops a shaft power of 24650 kW at an average head of 39 meters. Assuming a speed ratio of 2, flow ratio of 0.6, diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 90%, calculate the diameter and speed of the turbine. 10
- b. A specific energy for a 3 m wide channel is to be 3 Nm/N. what would be the maximum possible discharge? 05
- c. A sewer pipe laid at a slope of 0.0001 flow half full conveys a discharge of 800 lps. Find the size of the pipe. Take Manning's coefficient  $N = 0.015$  05
3. a. A jet of water is moving 60 m/s and is deflected by a vane moving at 25 m/s in a direction at  $30^\circ$  to the direction of the jet. The water leaves the blades with no velocity component in the direction of motion of the vane. Determine the inlet and outlet angles of the vanes for no shock at entry or exit. Take the outlet velocity of water relative to the blades to be 0.85 of the relative velocity at entry. 10
- b. Derive the condition for most economical trapezoidal channel section. 10

4. a. The loss of energy head in a hydraulic jump is 4.25 m. The Froude number just before the jump is 7.50. Find (i) Discharge per meter width of channel (ii) The depths before and after the hydraulic jump (iii) Froude number after jump (iv) Percentage loss of energy head due to jump and (v) length of the jump. **10**
- b. The internal and external diameters of an outward flow reaction turbine are 1.80 m and 3 m respectively. The width of the wheel is 360 mm at inlet and outlet. The discharge through the turbine is  $8.68 \text{ m}^3/\text{s}$ . The turbine runs at 230 rpm and the head of the turbine is 54m. If the guide blade angle is  $8^\circ$  find the vane angles at inlet and outlet. Ignore thickness of the vanes. Assume that turbine discharges radially at outlet. **10**
5. a. Find the slope at which a circular sewer of 1.50 m diameter should be laid to provide the maximum velocity at a discharge of  $0.75 \text{ m}^3/\text{s}$ . Take  $N = 0.015$  **10**
- b. A jet of water having a velocity of 40 m/s impinges without shock on a series of vanes moving at 12 m/s. The jet is making an angle of  $20^\circ$  with the direction of motion of vane. Relative velocity at exit is 0.9 times the relative velocity at entrance and the absolute velocity of water at exit is normal to the direction of the motion of the vanes. Find (i) Vane angles at the entrance and exit, (ii) Work done on the vanes per N of water and (iii) Hydraulic efficiency. **10**
6. a. The inlet and outlet diameter of the impeller of a centrifugal pump are 150 mm and 450 mm respectively and the corresponding impeller widths are 40 mm and 18 mm. The vane angles at inlet and outlet are  $20^\circ$  and  $15^\circ$  respectively. The pump runs at 1800 rpm. Neglecting losses, determine (i) Discharge, (ii) The direction of the flow leaving the impeller, (iii) Head developed by the impeller, (iv) Power of the pump, and (v) Pressure rise through the impeller. **10**
- b. A pelton wheel working under a head of 35 m is supplied with  $0.75 \text{ m}^3/\text{s}$  of water, the mean bucket speed being 12 m/s. the buckets deflect the jet by  $160^\circ$  when stationary. The coefficient of velocity is 0.98. Find the power developed and the hydraulic efficiency. Neglect friction of the bucket. **10**