

Code: 20CE3403

**II B.Tech - II Semester – Regular Examinations – JULY 2022**

**HYDRAULICS AND HYDRAULIC MACHINES  
(CIVIL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

---

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.  
2. All parts of Question must be answered in one place.

---

**UNIT – I**

1. a) Write the definition and mathematical expression of  
i) rotational and non-rotational flow ii) uniform and non-uniform flow, iii) steady and unsteady flow and iv) laminar and turbulent flow. 8 M
- b) In a rectangular channel of bed width 5m with a bed slope of 0.0001, uniform flow is taking place with a normal depth of 1.5m. Calculate the specific energy of flow assuming Chezy's constant as 40. Also find the minimum specific energy required for the flow and corresponding critical depth. 6 M
- OR
2. a) Draw the specific energy curve and derive the expression for critical depth and critical velocity. 7 M
- b) In a rectangular channel of width 24m and depth of flow 6m, the rate of flow of water is  $86.4 \text{ m}^3/\text{s}$ . If the bed slope of the channel is 1 in 4000. Find the slope of the free water surface. 7 M

## UNIT – II

3. a) Derive any two conditions for most economical trapezoidal channel section. 7 M
- b) Explain classifications of channel bottom slopes for Gradually Varied Flow in open channels. 7 M

OR

4. a) Derive the equation for loss of energy due to hydraulic jump. 7 M
- b) A sluice gate discharges water into horizontal channel with a velocity of 10m/s and depth of flow is 1m. Determine the depth of flow of water after the jump and consequent loss in total head. 7 M

## UNIT-III

5. a) Write the definition and applications of momentum principle. 7 M
- b) Obtain an expression for the force exerted by a jet of water on a fixed inclined plate in the direction of jet. 7 M

OR

6. a) Obtain an expression for the force exerted by a jet of water on a moving flat and inclined plate in the direction of jet, and also calculate the work done. 10 M
- b) A jet of water of diameter 50 mm moving with a velocity of 40 m/s, strikes a curved fixed symmetrical plate at the centre. Find the force exerted by the jet of water in the direction of the jet  $F_x$ , if the jet is deflected through an angle of  $120^\circ$  at the outlet of the curved plate. 4 M

### UNIT – IV

7. A pelton wheel is revolving at a speed of 190 r.p.m. and develops 5150.25 kw when working under a head of 220m with an overall efficiency of 80%. Determine unit speed, unit discharge and unit power. The speed ratio of turbine is given as 0.47. Find the speed, discharge and power when this turbine is working under a head of 140m. 14 M

OR

8. a) Define turbine and provide a detailed note on classifications of turbines, and briefly discuss about efficiencies of a turbine. 7 M
- b) Define cavitation and briefly explain its effects on hydraulic machines. 7 M

### UNIT – V

9. a) Define Centrifugal pump? Write a detailed note on work done by the centrifugal pump on water. 7 M
- b) Write the definitions of heads and efficiencies of centrifugal pumps. 7 M

OR

10. a) Provide a detailed note on multi-stage centrifugal pumps for (i) high heads and (ii) high discharges. 7 M
- b) Find the number of pumps required to take water from a deep well under a total head of 89m. All the pumps are identical and are running at 800 r.p.m. The specific speed of each pump is given as 25 while the rated capacity of each pump is  $0.16 \text{ m}^3/\text{s}$ . 7 M