



III B.Tech I Sem Regular End Examination, December 2022

Hydraulics and Hydraulic Machinery

(Civil)

Time: 3 Hours.**Max. Marks: 70**

Note: 1. Question paper consists: Part-A and Part-B.

2. In Part – A, answer all questions which carries 20 marks.

3. In Part – B, answer any one question from each unit.

Each question carries 10 marks and may have a, b as sub questions.

PART- A**(10*2 Marks = 20 Marks)**

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|-------|--|----|-----|-----|
| 1. a) | Compare steady flow and unsteady flow | 2M | C01 | BL2 |
| b) | Write down Mannings formulae and Chezy' formulae | 2M | C01 | BL1 |
| c) | Distinguish between gradually varied flow and rapidly varied flow | 2M | C02 | BL2 |
| d) | What is hydraulic jump | 2M | C02 | BL1 |
| e) | Water is flowing through a pipe at the end of which a nozzle is fitted. The diameter of the nozzle is 150 mm and the head of water at the center nozzle is 150m. Find the force exerted by the jet of water on affixed vertical plate. The co-efficient of velocity is given as 0.90 | 2M | C03 | BL3 |
| f) | Find the force exerted by a jet of water of diameter 150 mm on a stationary flat plate, when the jet strikes the plate normally with a velocity of 35 m/s | 2M | C03 | BL3 |
| g) | Draw a Pelton wheel. | 2M | C04 | BL1 |
| h) | What is specific speed and its use? | 2M | C04 | BL1 |
| i) | Infer monomeric efficiency | 2M | C05 | BL1 |
| j) | Explain utilization factor and capacity factor | 2M | C05 | BL4 |

PART- B**(10*5 Marks = 50 Marks)**

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|-----------|--|----|-----|-----|
| 2. a) | Distinguish between: (i) Uniform flow and non-uniform flow, (ii) Steady and unsteady flow | 5M | C01 | BL2 |
| b) | Distinguish between: (i) Laminar and turbulent flow and (ii) Critical, sub-critical and super-critical flow in a open channel. | 5M | C01 | BL2 |
| OR | | | | |
| 3. a) | Prove that for the trapezoidal channel of most economical section: Half of top width = Length of one of the sloping sides | 5M | C01 | BL3 |
| b) | Derive the expression for most economical rectangular channel. | 5M | C01 | BL6 |

- 4 a) Build an expression for critical depth and critical velocity 5M C02 BL3
 b) Illustrate the condition for maximum discharge for a given value of specific energy. 5M C02 BL2
- OR**
- 5 a) Show that in a rectangular channel: Critical depth is two-third of specific energy. 5M C02 BL3
 b) Show that in a rectangular channel: Froude number at critical depth is unity. 5M C02 BL3
- 6 What do you mean by repeating variables? How are the repeating variables selected for dimensional analysis? 10M C03 BL1
- OR**
- 7 a) Show that for a curved radial vane, the work done per second is given by, $\rho a V_1 [V_{w1} u_1 \pm V_{w2} u_2]$ 5M C03 BL2
 b) A jet of water of diameter 150 mm strikes a flat plate normally with a velocity of 12 m/s. The plate is moving with a velocity of 6m/s in the direction of the jet and away from the jet. Determine: (i) the force exerted by the jet on the plate, (ii) work done by the jet on the plate per second, (iii) power of the jet, and (iv) efficiency of the jet. 5M C03 BL5
- 8 Develop an expression for the work done per second by water on the runner of a Pelton wheel. Hence derive an expression for maximum efficiency of the Pelton wheel giving the relationship between the jet speed and bucket speed. 10M C04 BL6
- OR**
- 9 Distinguish between: (a) The impulse and reaction turbines, (b) Radial and axial flow turbines, (c) Inward and outward radial flow turbine, and (d) Kaplan and propeller turbines. 10M C04 BL4
- 10 a) Define cavitation. What are the effects of cavitation? Give the necessary precautions against cavitation. 5M C05 BL1
 b) Draw and discuss the operating characteristics of a centrifugal pump. 5M C05 BL6
- OR**
- 11 a) What is the difference between single-stage and multistage pumps? Explain multistage pump with (a) impellers in parallel, and (b) impellers in series 5M C05 BL5
 b) A centrifugal pump is to discharge 0.12m^3 at a speed of 1400 r.p.m. against a head of 30m. The diameter and width of the impeller at outlet are 25 cm and 5 cm respectively. If the manometric efficiency is 75%, determine the vane angle at outlet. 5M C05 BL5

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