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B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fourth Semester

Civil Engineering

CE 8403 — APPLIED HYDRAULIC ENGINEERING

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

1. Missing data if any may suitably be assumed
2. Draw sketches whenever necessary.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Difference between laminar flow and turbulent flow.
2. Mention the condition for best hydraulic section for a rectangular channel.
3. Define 'critical flow'.
4. What is called 'afflux' in gradually varied flow?
5. Define Froude's number and Euler's number
6. Mention the cause for a 'Hydraulic Jump'.
7. Differentiate impulse and reaction turbines.
8. Draw a simple sketch of a pelton wheel.
9. What is meant by Negative slip?
10. State the purpose of an Air vessel in a pump.

PART B — (5 × 13 = 65 marks)

11. (a) The discharge of water through a rectangular channel of width 8m, is 15 m³/sec. when the depth of flow is 1.2m, calculate
- (i) Specific Energy of flowing water (5)
 - (ii) Critical depth and critical velocity (4)
 - (iii) Minimum Specific Energy (4)

Or

- (b) Derive a relation for Chezy's equation for a Uniform flow. (13)
12. (a) Determine the length of the backwater curve caused by an afflux of 2.0 m in a rectangular section of width 40 m and depth 2.5 m. The slope of the bed is given as 1 in 11000. (13)
- Take Manning's N = 0.03

Or

- (b) (i) State the various assumptions to be made while deriving equations for a gradually varied flow. (7)
- (ii) How drop down curve can be obtained? Explain with equations. (6)
13. (a) Derive an expression for the length of Hydraulic jump under rapidly varied flow conditions. (13)

Or

- (b) A sluice gate discharges water into a horizontal rectangular channel with a velocity of 10m/s and depth of flow of 1 m. Determine the depth of flow after the jump and consequent loss in total head. (13)
14. (a) A Kaplan Turbine develops 24000 kW power at an average head of 39 m. By 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, speed and specific speed of the turbine. (13)

Or

- (b) Explain the working of reaction turbine along with its components with a neat sketch. (13)
15. (a) A centrifugal pump having an outer diameter equal to two times the inner diameter and running at 1000 rpm. works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500mm and the width at outlet is 50 mm, determine:
- (i) Vane angle at outlet (5)
 - (ii) Work done by impeller on water per second (4)
 - (iii) Manometric Efficiency (4)

Or

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- (b) (i) Explain the working mechanism of a reciprocating pump with a neat sketch. (7)
- (ii) Bring out the effect of acceleration in suction and delivery pipes on indicator diagram. (6)

PART C — (1 × 15 = 15 marks)

16. (a) Elaborate on the following:
- (i) Conditions for a most economical section for a trapezoidal channel (6)
- (ii) Characteristic curves for turbines (9)

Or

- (b) (i) A rectangular channel of width 4 m is having a bed slope of 1 in 1500. Find the maximum discharge through the channel. Take value of $C = 50$. (6)
- (ii) Explain the conditions for super critical and sub critical flow (9)

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