CE 224 (R-20)

Total No. of Questions : 10] [Total No.of Pages : 02

II/IV B. Tech. DEGREE EXAMINATIONS, AUGUST - 2024

Second Semester

CIVIL ENGINEERING

HYDRAULICS & HYDRAULIC MACHINERY

Time : **Three Hours** Maximum : **70** Marks

Answer ONE question from each Unit. 5x14=70 M

All Questions carry equal marks.

UNIT - I

1. a) Explain how the reduction in the width of a channel affects the flow characteristics and under what circumstances might this occur ?

   b) Describe the Bazin equation and its significance in open channel flow. How does it differ from other flow equations ?

(OR)

2. a) A rectangular channel has a flow rate of 12 cubic meters per second and a channel slope of 0.005. Calculate the Manning's roughness coefficient (n) for this channel.

   b) What are channel transitions in open channel flow and why are they essential to study in hydraulic engineering ?

UNIT - II

3. a) Given a rectangular channel with a flow rate of 15 cubic meters per second and a flow velocity of 8 m/s before the hydraulic jump, calculate the depth of the jump and the velocity after the jump.

   b) How is the length of a hydraulic jump determined and what factors influence it ?

(OR)

4. a) Provide examples of practical applications where hydraulic jumps are encountered in engineering and environmental contexts.

   b) Describe the potential risks and impacts of positive surges in open channel flow.

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UNIT - III

5. a) An axial flow turbine has an efficiency of 85%. If the inlet velocity is 40 m/s, calculate the outlet velocity of the fluid.

   b) How does the direction and magnitude of the hydrodynamic force change when a jet strikes a curved vane compared to a flat vane ?

(OR)

6. a) Explain how the velocity triangles can be used to determine the direction and magnitude of the absolute and relative velocities of the fluid in a turbo machine.

   b) How can the angular momentum principle be used to analyze the behavior of turbo machinery under different operating conditions ?

UNIT - IV

7. a) Given a mixed flow turbine with a specific speed of 100, determine the runner diameter required to produce a power output of 500 kW when operating at a head of 30 meters.

   b) What factors influence the design of runner profiles in hydraulic turbines ?

(OR)

8. a) Explain the losses and efficiencies in centrifugal pumps. How are these factors used to assess the pump's performance ?

   b) Describe the operational characteristics of a Pelton turbine and a Francis turbine.

UNIT - V

9. a) Describe the main steps involved in applying Buckingham's Pi theorem to solve dimensional problems in hydraulics.

   b) Explain the significance of dimensionless numbers in hydraulic similitude. Provide examples of commonly used dimensionless numbers.

(OR)

10. a) What are the primary conditions that must be met to archieve geometric similarity between a model and its prototype ?

    b) Discuss the concept of the model scale factor and its relationship with the prototype scale factor.