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B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Civil Engineering

CE 6403 : APPLIED HYDRAULIC ENGINEERING

(Regulations 2013)

(Common to PTCE 6403 – Applied Hydraulic Engineering for B.E. (Part-Time) Fourth Semester – Civil Engineering – Regulations 2014)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Define open-channel flow.
2. How mean velocity is calculated in open channel flow ?
3. Draw the M_2 profile with an practical example.
4. What are the uses of hydraulic jump ?
5. Write down the application of channel transitions.
6. Define positive surge and give a practical example.
7. A jet of water 40 mm diameter with a velocity 30 m/s, strikes a stationary plate at its normal direction. Determine the force exerted by the jet.
8. What is meant by reaction turbine ? State an example.
9. Define Slip of reciprocating pump. When does the negative slip occur ?
10. List out the various components of a centrifugal pump.

PART – B **(5×13=65 Marks)**

11. a) An irrigation channel of trapezoidal section having side slope 1.5H : IV is to carry a flow of $10 m^3/s$ on a slope of 1 in 5000. The channel is to be lined for which the Manning's n = 0.012. Find the dimensions of the most economical section of the channel.

(OR)

b) Derive the geometrical properties of a most economical triangular channel section.

12. a) Derive the dynamic equation for gradually varied flow stating the assumptions made.

(OR)

b) A rectangular channel 10 m wide carries a discharge of 30 m^3/s. It is laid at a slope of 0.0001. Compute the back water profile created by a dam which backs up the water to a depth of 3.5 m immediately behind the dam. Use direct step method for computation.

13. a) i) What is a hydraulic jump ? List the assumptions made in the analysis of hydraulic jump. Explain its classification.

ii) In a hydraulic jump occuring in a rectangular channel of 3 m width, the discharge is 7.8 m^3/s and depth before the jump is 0.28 m. Estimate

(i) sequent depth (ii) the energy loss in the jump.

(OR)

b) i) A spillway discharges a flood flow at a rate of 7.75 cumecs/m width. At the downstream horizontal apron the depth of flow was found to be 0.5 m. What tail water depth is needed to form a hydraulic jump ? If a jump is formed, find its length, type, head loss and energy loss as a percentage of the initial energy.

ii) Discuss the types of surges briefly.

14. a) i) A jet of water 75 mm diameter with a velocity of 20 m/s strikes normally a flat smooth plate. Determine the force exerted on the plate if,

1) The plate is at rest.

2) The plate is moving in the same direction as the jet with a velocity of 6 m/s. Also determine the work done per unit time on the plate.

ii) A jet of water of diameter 100 mm moving with a velocity of 30 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, if the jet is deflected through an angle of 120° at the oulet of the curved plate.

(OR)

b) i) Distinguish between impulse and reaction turbines.

ii) A pelton wheel is required to develop 8825 kW when working under a head of 300 m the speed of the pelton wheel is 540 r.p.m. the coefficient of velocity is 0.98 and the speed ratio is 0.46. Assuming jet ratio as 10 and overall efficiency as 84% determine.

1) The number of jets.

2) The diameter of the wheel.

3) The quantity of water required.

15. a) A centrifugal pump has the following characteristics
Outer diameter of impeller = 800 mm
Width of impeller vanes at outlet = 100 mm
Angle of impeller vanes at outlet = 40°
The impeller runs at 550 rpm and delivers 0.98 m^3/s under an effective head of 35 m. A 500 kW motor is used to drive the pump. Determine the monometric, mechanical and overall efficiencies of the pump. Assume water enters the impeller vanes radically at inlet.

(OR)

b) A double-acting reciprocating pump, running at 40 rpm, is discharging 1 m^3/s water. The pump has a stroke length of 400 mm. The diameter of the piston is 200 mm. The delivery and suction head are 20 m and 5 m respectively. Find the slip of the pump and power required to drive the pump.

PART – C **(1×15=15 Marks)**

16. a) A trapezoidal channel has side slopes of 1.5H : 1 V and is required to discharge 15 m^3/s with a bed slope of 1 in 1500. If unlined the value of Chezy C = 50. If lined with concrete its value is 70. If the cost of excavation per m^3 is six times the cost per m^2 of lining. Determine whetjer the lined or unlined channel would cheaper ? The section can be assumed to be hydraulically efficient. **(15)**

(OR)

b) A 2 m wide rectangular channel, 2 km long carries a steady flow of 4.6 m^3/s at a depth of 1.15 m. The sides of the channel are 2 m high. If the flow is suddenly stopped by the closure of gate at the downstream end, will the water spill over the sides of the channel ? If there is no spillage, what minimum time interval must elapse before the arrival of the surge at the upstream end ? **(15)**