

19 JAN 2023

Reg. No.

Question Paper Code

11646

**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022**

Fourth Semester

**Civil Engineering**

**20CEPC401 - APPLIED HYDRAULIC ENGINEERING**

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

**PART - A (10 × 2 = 20 Marks)**

Answer ALL Questions

- |  | <i>Marks,<br/>K-Level, CO</i> |
|--|-------------------------------|
| 1. Define critical velocity.                                     | 2,K2,CO2                      |
| 2. What is mean by most economical channel section?              | 2,K1,CO2                      |
| 3. What channel profiles are possible based on slope?            | 2,K1,CO3                      |
| 4. Define Gradually Varied Flow.                                 | 2,K2,CO3                      |
| 5. Mention the uses of formation of hydraulic jump in a channel. | 2,K2,CO4                      |
| 6. Define Surge.   | 2,K1,CO4                      |
| 7. Compare impulse turbine with reaction turbine.                | 2,K2,CO5                      |
| 8. Define Runway speed of a turbine.                             | 2,K1,CO5                      |
| 9. Draw the velocity triangle of a centrifugal pump.             | 2,K1,CO6                      |
| 10. When Negative slip will occur in a reciprocating pump?       | 2,K2,CO6                      |

**PART - B (5 × 13 = 65 Marks)**

Answer ALL Questions

11. a) Calculate the specific energy in a rectangular channel carrying  $15 \text{ m}^3/\text{s}$  with a velocity of  $1.5 \text{ m/s}$ . The width of channel is  $6 \text{ m}$ . Also calculate the alternate depth of flow for the same discharge. What will be the depth of flow at minimum specific energy? 13,K3,CO2
- OR**
- b) Derive the conditions for most economical trapezoidal channel section. 13,K2,CO2
12. a) Explain the types and characteristics of Gradually Varied Flow profiles. 13,K2,CO3
- OR**
- b) A river  $160 \text{ m}$  wide is having normal depth of flow at  $3 \text{ m}$ , has an average bed slope of  $0.0004$ . Estimate the length of GVF profile produced by a low dam which raises the water surface just upstream of it by  $2.5 \text{ m}$ . Take the roughness coefficient of bed material as  $0.025$ . 13,K2,CO3

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

**11646**



13. a) A rectangular channel having width 4m, carry a discharge of  $8.5 \text{ m}^3/\text{s}$ . The depth of flow before jump is 0.32 m. Estimate (i) sequent depth, (ii) energy loss, and (iii) efficiency of jump. 13,K3,CO4

**OR**

- b) (i) Write a short note about the classification of hydraulic jump. 8,K2,CO4  
(ii) Draw the various possible types of surges that can be generated in open channel flow. 5,K2,CO4

14. a) A Pelton wheel generates 8000kWatts under a net head of 130 m at a speed of 200 rpm. Assuming the coefficient of velocity for the nozzle as 0.98, speed ratio 0.465, jet diameter to the wheel diameter ratio as 1/9, hydraulic efficiency as 87% and mechanical efficiency as 75 %, determine the followings: (i) discharge required, (ii) diameter of wheel, (iii) diameter and number of jets required, and (iv) specific speed of the turbine. 13,K3,CO5

**OR**

- b) An axial flow reaction turbine generates 20 MWatts at 180 rpm under a head of 7.5 m. The generator efficiency is 96%, overall efficiency is 89%, hydraulic efficiency is 97%, the outer and hub diameter are 5 m and 2.3 m respectively. Find the vane and guide angles and mean diameter of the runner. 13,K3,CO5

15. a) Following data pertains to a centrifugal pump: Discharge is  $0.2 \text{ m}^3/\text{s}$ , manometric head is 34 m, revolution of vanes is 700 rpm, Impeller diameters at inlet is 300 mm and at outlet is 600 mm, flow area is constant having value of  $0.08 \text{ m}^2$  and angle of vane at exit is  $35^\circ$ . Compute (i) manometric efficiency (ii) vane angle at inlet, (iii) Loss of head at inlet of impeller when the discharge is reduced to 42% without changing the speed. 13,K3,CO6

**OR**

- b) (i) With a neat sketch, explain the construction and working principle of a reciprocating pump. 7,K2,CO6  
(ii) What is mean by indicator diagram? Draw the indicator diagram considering the effect of acceleration and friction in suction and delivery pipes. 6,K2,CO6

**PART - C (1 × 15 = 15 Marks)**

16. a) The bed width of a trapezoidal channel section is 8 m and side slope is 1 V : 1.5 H. If depth of flow in the channel is 2.75 m, determine the discharge using Manning's and Chezy's formula. Take Manning constant as 0.022 and Chezy constant as 43.2. 15,K2,CO1

**OR**

- b) (i) Find the rate of flow for a rectangular channel 7.5 m wide for uniform flow at a depth of 2.25 m. The channel is having bed slope as 1 in 1000. Take Chezy's constant  $C = 55$ . 8,K2,CO1  
(ii) Derive the expression for most economical rectangular channel. 7,K2,CO1