A **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code: U4106

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

Fourth Semester

Civil Engineering

21UCE406- APPLIED HYDRAULIC ENGINEERING

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer All Questions

PART A - (10 x 1 = 10 Marks)

1. A rectangular open channel carries a discharge of 15 m^3/s when the depth of flow is 1.5 m and the bed slope is 1: 1440.What will be the discharge through the channel at the same depth if the slope would have been 1:1000? CO2 - App

   (a) 21.6 m^3/s (b) 18 m^3/s (c) 14.4 m^3/s (d) 12.5 m^3/s

2. The maximum velocity through a circular channel takes place when depth of flow is equal to CO1 - U

   (a) 0.95 times the diameter (b 0.5 times the diameter

   (c) 0.81 times the diameter (d) 0 .75 times the diameter

3. A person standing on the bank of a canal drops a stone on the water surface. He notices that the disturbance on the water surface in not traveling up-stream. This is because the flow in the canal is CO1 - U

   (a) sub-critical (b) super-critical (c) steady (d) uniform

4. If the value of rate of change of specific energy is 7.79×10-4 m and Sf = 0.00013, calculate the value of bed slope CO2 - App

   (a) 1 in 1000 (b) 1 in 1100 (c) 1 in 1200 (d) 1 in 1300

5. The sequent-depth ratio in a hydraulic jump formed in a horizontal rectangular channel is 16.48. The Froude number of the supercritical stream is CO4-Ana

   (a) 8.0 (b) 4.0 (c) 20.0 (d) 12.0

6. Development of surges in the open channel is CO1 - U

(a) gradually varied flow (b) Rapidly varied flow

(c) steady flow (d) normal flow

7. A pelton wheel operates at 630 rpm taking $3m^3/s$ of water under a head of 256m with a speed ration of 0.48.What is the diameter of the impeller? CO2 - App

(a) 0.90m (b) 1.03 m (c) 1.42 m (d) 1.80 m

8. The speed of an imaginary turbine, identical with the given turbine, which will develop a unit power under a unit head, is known as CO1 - U

(a) normal speed (b) unit speed (c) specific speed (d) none of these

9. The Maximum permissible suction lift for centrifugal pump in practice (at sea level and at 30^oC) is CO4-Ana

(a) 12 m (b) 10 m (c) 6m (d) 3m

10. A centrifugal pump discharge 260 litres of water per second when runner at 600 rpm.The impeller diameter at the outlet is 80 cm.It develops a head of 15.3 m. What is the approximate minimum starting speed? CO2 - App

(a) 425 rpm (b) 450 rpm (c) 475 rpm (d) 500 rpm

PART – B (5 x 2= 10 Marks)

11. What are the factors affecting Manning's roughness coefficient CO1 - U

12. State the assumptions made in the derivation of dynamic equation of gradually varied flow. CO1 - U

13. What are surges in open channel flow? State the types? CO1 - U

14. Draw typical velocity triangles for inlet and outlet of Pelton Wheel CO1 - U

15. Define the term negative slip. How it occurs CO1 - U

PART – C (5 x 16= 80 Marks)

16. (a) Find the velocity of flow and rate of flow of water through a rectangular channel of 6m wide and 3m deep, when it's running full. The channel is having bed slope as 1 in 2000.Take c=55 CO2 App (16)

Or

(b) Water flows at rate of $20m^3$/sec in a rectangular channel 14 m wide at a velocity of 1.8 m/sec. Determine the specific energy of flowing water, critical velocity ad minimum specific energy .Corresponding to the discharge ,the Froude number and state whether the flow is sub critical or super critical CO2 App (16)

17. (a) The normal depth of flow of, in a rectangular channel 2m wide ,is 1.2m.The bed slope of the channel is 0.0006 and manning's roughness coefficient n=0.015.Find the critical depth .At a certain section of the same channel the depth is 0.90 while at a second section the depth is 0.85.Find the distance b/w two sections. Also find the whether the second section is located downstream or upstream with respect to the first section. CO4 Ana (16)

Or

(b) A short reach of a 2 m wide rectangular open channel has its bed level rising in the direction of flow at a slope of 1 in 10000. It carries a discharge of 4 m^3/s and its Manning's roughness coefficient is 0.01. The flow in this reach is gradually varying. At a certain section in this reach, the depth of flow was measured as 0.5 m. Determine The rate of change of the water depth with distance, dy/dx, at this section. (Take g = 10 m/s^2) CO4 Ana (16)

18. (a) The water's depth changes from 0.5 meters to 0.7 meters during an experiment on a hydraulic leap in a rectangular open channel that is 0.8 meters wide. Enumerate the head loss resulting from the development of hydraulic jumps and the discharge in the channel. CO3 App (16)

Or

(b) When there is a hydraulic jump in a rectangular channel, the energy loss is 4 meters and the fe number prior to the jump is 30.Calculate the depth of flow , and flow rate. CO3 App (16)

19. (a) A Pelton wheel is to be designed for the following specifications. Power = 735.75 kW S.P. Head = 200m, Speed = 800 r.p.m. η_0 =0.86 and jet diameter is not to exceed one-tenth the wheel diameter. Determine
i). Wheel diameter ii). The number of jets required and iii). Diameter of the jet. Take C_v = 0.98 and speed ratio = 0.45 CO3 App (16)

Or

(b) A Kaplan turbine is to be designed to develop 20000KW .The net available head is 35m.The speed ratio is 2 and the flow ratio is 0.6.The overall efficiency is 86% and diameter of the boss is one - third the diameter of the runner .Determine the diameter of the runner, speed, and specific speed of the turbine. CO3 App (16)

20.	(a)	In an industry, it is expected to transfer high pressure liquid from chamber to another in high velocity. Suggest a suitable pump system and discuss about its principles, working with neat sketch.	CO1 U	(16)
		Or		
	(b)	What is difference between Pump head & Discharge Pressure? How to Convert discharge pressure into head?	CO1 U	(16)