Reg. No.															

Question Paper Code	12996

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Fourth Semester

Civil Engineering

20CEPC401 – APPLIED HYRAULIC ENGINEERING

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	What is the primary difference between pipe flow and open channel flow? (a) Pipe flow is influenced by gravity, while open channel flow is not. (b) Open channel flow has a free surface exposed to atmospheric pressure, while pipe flow is fully enclosed. (c) Pipe flow is always turbulent, while open channel flow is always laminar. (d) Open channel flow does not depend on fluid properties, while pipe flow does.	1	K1	CO1
2.	What are the three types of flow classification based on Froude number in open channels? (a) Steady, unsteady, and periodic (b) Subcritical, supercritical, and critical (c) Laminar, turbulent, and transitional (d) Uniform, non-uniform, and varied	1	K1	CO1
3.	The velocity distribution in open channel flow is generally which of the following?. (a) Uniform across the cross-section (b) Maximum near the channel bed (c) Maximum near the free surface (d) Independent of the channel shape	1	K1	CO1
4.	What does “best hydraulic section” mean in the context of open channel flow? (a) A section that provides maximum discharge for a given cross-sectional area. (b) A section that minimizes head loss. (c) A section with uniform velocity distribution. (d) A section that has maximum velocity.	1	K1	CO2
5.	Specific energy in an open channel flow is defined as the: (a)Total energy per unit width of the channel (b)Total energy at the channel bottom (c) Energy per unit weight of water relative to the channel bed (d) Energy due to friction loss	1	K1	CO2
6.	The point of minimum specific energy for a given discharge in an open channel flow corresponds to which flow condition? (a)Subcritical flow (b) Supercritical flow (c) Critical flow (d)Rapidly varied flow	1	K1	CO2
7.	What does "gradually varied flow" mean in open channel hydraulics? (a) Flow where the depth changes abruptly along the channel. (b) Flow where the depth changes slowly along the length of the channel. (c) Flow with constant velocity throughout the channel length. (d) Flow that is uniform across any cross-section.	1	K1	CO3
8.	A hydraulic curve represents which of the following in open channel flow? (a) The change in water surface profile over a length of the channel (b) The velocity distribution in a channel cross-section (c) The discharge rate along the channel. (d) The critical depth for a given flow rate	1	K1	CO3
9.	What type of slope is characterized by a slope greater than the critical slope in open channel flow? (a) Mild slope (b) Critical slope (c) Steep slope (d) Adverse slope	1	K1	CO3

10.	A hydraulic jump typically occurs when: (a) Flow changes from subcritical to supercritical. (b) Flow changes from supercritical to subcritical. (c) Flow is uniform throughout the channel. (d) Flow is critical throughout the channel.	*1*	*K1*	*CO4*
11.	What is the main purpose of a hydraulic jump in engineering applications? (a) To increase flow velocity (b) To dissipate excess energy in open channel flow (c) To minimize head loss in pipelines (d) To create subcritical flow upstream	*1*	*K1*	*CO4*
12.	Positive surges in open channel flow are characterized by: (a) A sudden rise in the water surface level moving downstream. (b) A sudden drop in the water surface level moving downstream. (c) An oscillating water surface. (d) A transition from laminar to turbulent flow	*1*	*K1*	*CO4*
13.	What is the primary distinction between impulse and reaction turbines? (a) Impulse turbines operate underwater, while reaction turbines do not. (b) Impulse turbines convert pressure energy entirely to kinetic energy before entering the turbine, while reaction turbines do not. (c) Reaction turbines use air as a working fluid, while impulse turbines use water. (d) Impulse turbines operate at high specific speeds, while reaction turbines operate at low specific speeds.	*1*	*K1*	*CO5*
14.	Which of the following turbines is classified as an impulse turbine? (a) Kaplan turbine (b) Francis turbine (c) Pelton wheel (d) Propeller turbine	*1*	*K1*	*CO5*
15.	What is the purpose of a draft tube in a reaction turbine? (a) To increase the kinetic energy of water (b) To discharge water directly into the atmosphere (c) To convert kinetic energy into pressure energy and reduce exit velocity (d) To prevent cavitation at the turbine exit	*1*	*K1*	*CO5*
16.	Which type of turbine is generally used for low head and high flow rate applications? (a) Pelton wheel (b) Francis turbine (c) Kaplan turbine (d) Impulse turbine	*1*	*K1*	*CO5*
17.	Centrifugal pumps are typically used for which of the following applications? (a) High-pressure, low-flow applications (b) Low-pressure, high-flow applications (c) High-flow, high-pressure applications (d) Low-flow, high-accuracy applications	*1*	*K1*	*CO6*
18.	An air vessel in a reciprocating pump contributes to work savings by: (a) Increasing the friction in the pump system (b) Reducing the pressure fluctuations and energy loss (c) Allowing air to enter the suction line (d) Increasing the power output of the pump	*1*	*K1*	*CO6*
19.	In reciprocating pumps, what does "negative slip" mean? (a) When the actual discharge is less than the theoretical discharge (b) When the pump operates in reverse (c) When the actual discharge is greater than the theoretical discharge (d) When the pump loses prime	*1*	*K1*	*CO6*
20.	Why are multistage centrifugal pumps used? (a) To achieve a higher discharge flow rate (b) To operate without cavitation (c) To increase the discharge pressure or head (d) To decrease energy consumption	*1*	*K1*	*CO6*

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21.	Define Open Channel with example.	*2*	*K1*	*CO1*
22.	List out the various types of flow in open channels?	*2*	*K1*	*CO1*
23.	What is meant the most economical section of a channel? What are the conditions for rectangular channel of the best section?	*2*	*K1*	*CO2*
24.	Explain the terms Specific Energy and Critical depth and Critical velocity.	*2*	*K2*	*CO2*
25.	Define gradually varied flow.	*2*	*K1*	*CO3*

26.	Distinguish between draw down and back water curve.	2	K2	CO3
27.	What are the classifications of hydraulic jump?	2	K1	CO4
28.	What is meant by surge?	2	K1	CO4
29.	Describe the impulse turbine with example.	2	K2	CO5
30.	What is meant by manometric head with regard to a centrifugal pump?	2	K1	CO6

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

31.	a)	Derive an expression for the discharge through a channel by Chezy's formula.	10	K2	CO1
		OR			
	b)	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.	10	K2	CO1
32.	a)	Prove that half of the top width of a most economical trapezoidal section is equal to the length of the one of the side slopes and derive the hydraulic mean depth as half of the depth of the flow.	10	K2	CO2
		OR			
	b)	A 3m wide rectangular channel conveys $12m^3$ of water at a depth of 2m. Find out (i) Specific energy of flowing fluid. (ii) Critical depth, critical velocity and the minimum specific energy. (iii) Froude number and state whether the flow is sub-critical or supercritical.	10	K2	CO2
33.	a)	Derive the dynamic equation for the Gradually Varied Flow and state clearly the assumptions in analysis of GVF.	10	K2	CO3
		OR			
	b)	Determine the length of the backwater curve in a rectangular channel width of 4m depth of water at upstream side 2m and downstream side 3m discharge of channel is 15 m^3/s. Take i_b=1/2000 & i_e=0.000031.	10	K2	CO3
34.	a)	Derive the expression for depth of hydraulic jump.	10	K2	CO4
		OR			
	b)	The depth of flow of water at a certain section of rectangular channel 5m wide is 0.6m. The discharge through a channel is 15 m^3 /s. if hydraulic jump take place on the downstream side. Find the depth of flow after jump, height of the hydraulic jump and loss of energy per kg of water.	10	K2	CO4
35.	a)	Explain briefly about the various efficiencies of hydraulic turbines.	10	K2	CO5
		OR			
	b)	A Pelton wheel is to be designed for the following specification: (i) Shaft Power = 11,772 kW (ii) Head = 380 meters (iii)Speed = 750 rpm (iv)Overall efficiency = 86% (v) Jet diameter= not to exceed 1/6th of the wheel diameter. Determine: (i) Wheel diameter (ii) Diameter of the jet (iii)Number of jets required Take C_v=0.985 and speed ratio K_{u1}=0.45	10	K2	CO5
36.	a)	Explain the working principle of centrifugal pump with its advantages.	10	K2	CO6
		OR			

b) A single acting reciprocating pump, running at 60 rpm delivers 0.53 m^3/s. The diameter of the piston is 200mm and stroke length 300mm. Determine the theoretical discharge, coefficient of discharge, percentage of slip of the pump. *10 K2 CO6*