Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025

Fourth Semester

Civil Engineering

CE3401 - Applied Hydraulics Engineering

Regulations - 2021

Duration : 3 Hrs ***Maximum : 100 Marks***

PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q.No	Questions	BLT	CO	Marks
1.	State the properties of open channel flow.	L1	1	2
2.	Discuss the significance of velocity distribution in open channel flow.	L2	1	2
3.	What is the direct step method used for profile determination?	L2	2	2
4.	Define the term "hydraulic slope" in the context of open channel flow.	L1	2	2
5.	Write the momentum equation for rapidly varied flow.	L1	3	2
6.	What is a positive surge in open channel flow?	L2	3	2
7.	What is Cavitation in turbines?	L2	4	2
8.	What is a Draft Tube?	L1	4	2
9.	Explain the variations in indicator diagrams with the change in speed and load.	L1	5	2
10.	What is negative slip in reciprocating pumps?	L2	5	2

PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

Q.No			Questions	BLT	CO	Marks
11.	a	i	Define pipe flow and open channel flow. Discuss the key differences between the two, with Illustrations.	L2	1	8
		ii	Explain sub-critical, super-critical, and critical flow with respect to the Froude number.	L2	1	8
			Or			
	b	i	Derive and explain Chezy's equation and Manning's equation. Discuss their applications in steady uniform flow.	L2	1	10
		ii	Explain the concepts of specific energy and specific force in open channel flow.	L2	1	6
12.	a	i	Explain how to determine the water surface profile using numerical methods.	L4	2	8
		ii	In an open channel, the hydraulic grade line (HGL) is located 1 meter above the channel bed. The flow rate is 20 m^3/s, and the channel has a slope of 0.001. Determine how the flow profile and water surface will be affected by the location of the HGL.	L4	2	8
			Or			

	b	i	Discuss the effects of varying channel grades on the flow profile using the Standard Step Method.	L4	2	10
		ii	A flow of 15 m^3/s in a channel with a bed slope of 0.001 starts encountering an abrupt grade change to a steeper slope of 0.0025. How does the water surface profile change, and what kind of flow (subcritical, supercritical) can be expected downstream of the grade change?	L4	2	6
13.	a	i	A flow with a discharge of 15 m^3/s and a flow depth of 2 m undergoes a hydraulic jump. The flow depth after the jump is 1.2 m. Calculate the energy dissipation due to the hydraulic jump.	L3	3	8
		ii	Derive the equation for energy dissipation in hydraulic jumps and explain the significance of energy loss.	L3	3	8
			Or			
	b	i	Calculate the effects of a positive surge in a river with a discharge of 25 m^3/s, where the water depth before the surge is 1.2 m and the velocity is 4 m/s. After the surge, the depth increases to 2.5 m. Calculate the velocity after the surge using the energy equations.	L3	3	8
		ii	A dam releases water with a steady flow rate of 50 m^3/s. However, a surge occurs and causes the water velocity to decrease from 4 m/s to 2.5 m/s. If the channel's cross-sectional area before the surge is 5 m^2, calculate the change in water depth and discuss the implications of a positive surge in a hydraulic system.	L3	3	8
14.	a	i	Explain the working of an Impulse Turbine with the help of a neat diagram.	L2	4	8
		ii	What are the factors affecting the performance of a turbine? Explain.	L2	4	8
			Or			
	b	i	Explain the working of a Francis Turbine and its characteristics.	L2	4	8
		ii	A turbine has a design speed of 350 rpm, and its runaway speed is 500 rpm. If the load on the turbine is suddenly removed, calculate the percentage increase in speed from design to runaway speed.	L2	4	8
15.	a	i	Evaluate the Concept of NPSH in Centrifugal Pumps. Derive the Formula for NPSH Available and NPSH Required, and Discuss Their Importance in Pump Selection and Operation.	L5	5	10
		ii	A centrifugal pump is required to pump water to a height of 40 meters at a flow rate of 50 L/s. The total friction losses in the	L5	5	6

		system are 10 meters. Calculate the NPSH required for the pump, assuming that the vapor pressure of water is negligible. If the available NPSH at the pump's location is 5 meters, will cavitation occur? Justify your answer.			
		Or			
b	i	Evaluate the Function of Air Vessels in Reciprocating Pumps. How Do Air Vessels Contribute to Savings in Work Done and Improved Pump Performance?	L5	5	10
	ii	A reciprocating pump is displacing water at a rate of 20 L/min. The pump's suction stroke time is 10 seconds and its delivery stroke time is 9 seconds. Calculate the slip in the pump and explain its significance. What would happen to the slip if the pump were operated at a higher speed?	L5	5	6