Register No : ____________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

Third Semester

Agricultural Engineering

AI3303 - Fluid Mechanics and Pumps

Regulations – 2021

Duration: 3 Hrs *Maximum: 100 Marks*

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

Q.No	*Questions*	*BTL*	*CO*	*Marks*
1.	Define specific gravity.	L1	1	2
2.	State Pascal's law with one application.	L2	1	2
3.	Define Reynolds number in fluid mechanics.	L1	2	2
4.	Differentiate between Total Energy Line (TEL) and Hydraulic Grade Line (HGL).	L2	2	2
5.	List the significance of the Moody diagram in analyzing pipe flow.	L1	3	2
6.	Differentiate between distorted and undistorted models in similitude studies.	L2	3	2
7.	State two differences between uniform flow and non-uniform flow in open channels.	L2	4	2
8.	Write the condition for a hydraulically efficient rectangular channel section.	L1	4	2
9.	Recall why priming is necessary in a centrifugal pump before starting.	L1	5	2
10.	Classify pumps into positive displacement and dynamic types.	L2	5	2

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

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	Apply the principles of fluid statics and explain how stability of floating bodies is ensured in ships and submarines. Draw neat sketches to illustrate metacentric height and discuss how it affects the stability of floating structures.	L3	1	16
		Or			
	b	A cubical tank has sides of 1.5 m. It contains water in the lower 0.6m depth. The upper remaining part is filled with oil of relative density 0.9. Calculate for one vertical side of the tank (i) the pressure force and (ii) position of the centre of pressure.	L3	1	16
12.	a	Apply the control volume approach to derive the Bernoulli's equation along a streamline. Discuss the assumptions involved and explain with examples how Bernoulli's principle is applied in practical devices such as a venturi meter or an orifice meter.	L3	2	16
		Or			

	b	The velocity potential function for a two-dimensional incompressible flow is given by: $\phi (x, y) = y^2 - x^2$. 1. Develop an expression for the stream function $\psi (x, y)$ corresponding to this flow. 2. Using the stream function, determine the flow rate per unit depth between the streamlines passing through the points (0, 1) and (1, 0). (Assume two-dimensional, incompressible, irrotational flow. The flow rate per unit depth between two streamlines ψ_1 and ψ_2 is $\lvert\psi_2 - \psi_1\rvert$).	L3	2	16
13.	a	Explain laminar and turbulent flow in a circular pipe with a neat sketch. Describe Reynolds experiment and its significance in determining flow regimes.	L2	3	16
		Or			
	b	Explain the Darcy–Weisbach equation for pipe flow and the use of the Moody diagram. Illustrate the total energy line and hydraulic grade line with sketches.	L2	3	16
14.	a	Apply Chezy's and Manning's equations to determine flow characteristics in uniform and non-uniform open channels. Illustrate your answer with neat sketches.	L3	4	16
		Or			
	b	It is required to convey $10 m^3 / s$ of water at a mean velocity of 1.25 m/s. Calculate the dimensions of the most efficient section of the channel whose shape is (a) rectangular (b) triangular (c) trapezoidal.	L3	4	16
15.	a	A centrifugal pump has an impeller 0.5m outer diameter and when running at 600 rpm discharges 8000 litres/minute against a head of 8.5 m. The water enters the impeller without whirl and shock. The inner diameter is 0.25 m and the vanes are set back at the outlet at an angle of 45° to the periphery. The area of flow is constant from inlet to outlet of the impeller and is $0.06 m^2$. Determine the (a) vane angle at the inlet (b) monomeric efficiency of the pump and (c) speed at which the pump commences to work.	L3	5	16
		Or			
	b	Construct and working principle of centrifugal pump with neat diagram. Discuss how Net Positive Suction Head (NPSH) and cavitation influence pump operation in real applications.	L3	5	16