Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026

Third Semester

Mechanical Engineering

UMETL24303 - FLUID MECHANICS AND MACHINERY

Regulations - 2024

Duration : 3 Hrs *Maximum : 100 Marks*

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

Q.No	*Questions*	*BTL*	*CO*	*Marks*
1.	State Newton's law of Viscosity.	L1	1	2
2.	Determine the specific mass and specific volume of 10 Liters of a liquid that weighs 70 N.	L3	1	2
3.	Mention the significance of Moody's diagram.	L2	2	2
4.	Differentiate between T.E.L. and H.G.L.	L2	2	2
5.	Obtain the dimensions of relative density and specific weight.	L2	3	2
6.	List the types of similarities.	L1	3	2
7.	Classify turbines according to flow.	L1	4	2
8.	Mention the role of the draft tube in turbine operation.	L1	4	2
9.	How does cavitation occur in a centrifugal pump?	L2	5	2
10.	Define the slip of a reciprocating pump. When does the negative slip occur?	L1	5	2

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

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	Explain the pressure measurement using a simple U-tube manometer with a neat diagram.	L1	1	8
		ii	Calculate the capillary rise in a glass tube of 4 mm diameter, when immersed in (a) water and (b) mercury. The temperature of the liquid is 20 °C, and the values of the surface tension of water and mercury at 20 °C in contact with air are 0.073575 N/m and 0.465 N/m, respectively. The angle of contact for water is zero, whereas for mercury, it is 130°. The density of water at 20 °C is equal to 998 kg/m^3.	L3	1	8
			Or			
	b	i	Derive the Bernoulli's equation from Euler's equation of motion.	L1	1	8
		ii	Water flows at the rate of 200 litres per second upwards through a tapered vertical pipe. The diameter at the bottom is 24 cm, and at the top 20 cm, and the length is 500 cm. The pressure at the bottom is 8 bar, and the pressure at the topside is 7.3 bar. Determine the head loss through the pipe.	L3	1	8

12.	a	i	Derive the Darcy-Weisbach equation for loss of head due to friction.	L2	2	8
		ii	A horizontal pipe of diameter 500 mm is suddenly contracted to a diameter of 250 mm. The pressure intensities in the large and smaller pipes are given as 13.734 N/cm² and 11.772 N/cm², respectively. Find the loss of head due to contraction if Cc=0.62. Also, determine the rate of flow of water.	L4	2	8
			Or			
	b	i	Explain the boundary layer development in the pipe flow and indicate the various regimes of flow.	L2	2	8
		ii	For the velocity profile in the laminar boundary layer, $$\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$$ Find the thickness of the boundary layer and shear stress, 1.5 m from the leading edge of a plate. The plate is 2 m long and 1.4 m wide, and is placed in water, which is moving with a velocity of 200 mm /sec. Find the total drag force on the plate if μ for water is 0.01 poise.	L4	2	8
13.	a		Using Buckingham's Π theorem, show that the velocity through a circular orifice is given by $V=\sqrt{2gH}\,\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$, where H is the head causing flow, D is the diameter of the orifice, μ is the coefficient of viscosity, ρ is the mass density, and g is the acceleration due to gravity.	L3	3	16
			Or			
	b		A pipe of diameter 1.5 m is required to transport an oil of specific gravity 0.9 and viscosity 3×10^{-2} poise at the rate of 3000 liters/sec. Tests were conducted on a 15 cm diameter pipe using water at 20°C. Find the velocity and rate of flow in the model. Viscosity of water at 20°C = 0.01 poise.	L3	3	16
14.	a		A Pelton wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 700 lps under a head of 30 m. The buckets deflect the jet through an angle of 160°. Identify the power given by the water to A Pelton wheel that has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 700 lps under a head of 30 m. The buckets deflect the jet through an angle of 160°. Find out the power given by the water to the runner.	L3	4	16
			Or			
	b		A hub diameter of a Kaplan turbine, working under a head of 12 m, is 0.35 times the diameter of the runner. The turbine is running at 100 rpm. If the vane angle of the runner at the outlet is 15° and the flow ratio is 0.6, determine (i) the diameter of the runner, (ii) the diameter of the boss, and (iii) the discharge through the runner. Take the velocity of whirl at the outlet as zero.	L3	4	16
15.	a	i	With a neat sketch, explain the working principle of a centrifugal pump.	L2	5	8
		ii	The impeller of a centrifugal pump having external and internal diameters of 500 mm and 250 mm, respectively, a width at outlet of 50 mm, and running at 1200 rpm, works against a head of 48 m. The velocity of flow through the impeller is constant and equal to 3.0 m/s. The vanes are set back at an angle of 40° at the outlet. Determine the inlet vane angle and manometric efficiency.	L3	5	8
			Or			

b	i	Explain the working of a double-acting reciprocating pump with a neat sketch.	L2	5	8
	ii	A single-acting reciprocating pump running at 60 rpm delivers 0.02 m^3/s of water. The diameter of the piston is 250 mm, and the stroke length is 450 mm. Determine 1) theoretical discharge of the pump, 2) coefficient of discharge, 3) slip of the pump, and 4) Percentage slip of the pump.	L3	5	8