O.P.Code: 23ME0309	R23	H.T.No.									

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

B.Tech. II Year II Semester Regular Examinations July/August-2025

FLUID MECHANICS & HYDRAULIC MACHINES

(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 70**

PART-A

(Answer all the Questions **10 x 2 = 20** Marks)

1	a	Explain the term Dynamic Viscosity.	CO1	L2	2M
	b	Define the term centre of buoyancy.	CO1	L1	2M
	c	Differentiate between uniform flow and Non- uniform flow.	CO2	L4	2M
	d	What are the assumptions in Bernoulli's equation?	CO2	L1	2M
	e	What is boundary layer and boundary layer theory?	CO3	L3	2M
	f	State and apply the significance Buckingham's π theorem.	CO3	L5	2M
	g	State the basic principle involved in to calculate the force on vanes due to impact of jets.	CO5	L1	2M
	h	Differentiate between turbines and pumps.	CO5	L2	2M
	i	Explain about mechanical efficiency.	CO6	L2	2M
	j	Define specific speed of a pump.	CO6	L1	2M

PART-B

(Answer all Five Units **5 x 10 = 50** Marks)

UNIT-I

2	a	Explain the phenomenon of capillarity. Obtain an expression for capillary fall of a liquid.	CO1	L2	5M
	b	Calculate the capillary raise in a glass tube of 2.5mm diameter when immersed vertically water & mercury. Take surface tension is 0.0725N/m for water and 0.52N/m for mercury. The specific gravity of mercury is given 13.6 and angle of contact is 130^{o}.	CO1	L3	5M
		OR			
3	a	Define buoyancy and Meta Centre.	CO1	L1	5M
	b	A rectangular pontoon is 5m long, 3m wide and 1.20m high. the depth of immersion of the pontoon is 0.80m in sea water. if the centre of gravity is 0.6m above the bottom of the pontoon, determine the meta-centric height. the density of sea water=1025kg/m^3.	CO1	L5	5M

UNIT-II

4	a	Define rate of flow and derive continuity equation for one dimensional flow.	CO2	L6	5M
	b	A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s.	CO2	L3	5M
		OR			
5		What is Euler's equation of motion? How do you obtain Bernoulli's equation from it?	CO2	L6	10M

UNIT-III

6	Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate and $u = U$ at $y = \delta$, where δ = boundary layer thickness. Also calculate the value of δ^*/θ.	CO3	L2	10M
	OR			
7	The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft l, velocity V, air viscosity μ, air density ρ and bulk modulus of air K. Express the functional relationship between these variables and the resisting force.	CO4	L5	10M

UNIT-IV

8	A jet of water of diameter 7.5 cm strikes a curved plate at its center with a velocity of 20 m/sec. The curved plate is moving with a velocity of 8m/sec in the direction of the jet. The jet is deflected through an angle of 165 degree. Assuming the plate smooth find: i) Force exerted on the plate in the direction of jet, ii) power of the jet, iii) efficiency of the jet.	CO5	L2	10M
	OR			
9	A Pelton wheel is to be designed for a head of 60m when running at 200r.p.m. The Pelton wheel develops 95.6475 kW shaft power. The velocity of the buckets =0.45 times the velocity of the jet, overall efficiency=0.85 and co-efficient of the velocity=0.98.	CO5	L6	10M

UNIT-V

10	The centrifugal pump having outer diameter equal to two times inner diameter is running at 1000 rpm with working head of 40 m. Velocity of flow is constant and equal to 2.5m/s. The vanes are set back at an angle of 400 at outlet. If outer diameter of Impeller is 500mm and the width at outlet is 50mm. Then determine: (i) Vane angle at inlet, (ii) Work done by impeller on water per second, and (iii) Manometric efficiency.	CO6	L5	10M
	OR			
11	The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.	CO6	L5	10M

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