PVP 23

Code: 23ME3402

II B.Tech - II Semester – Regular Examinations - MAY 2025

FLUID MECHANICS AND HYDRAULIC MACHINES

(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	Write applications of capillarity.	L1	CO1
b)	What is Cohesion.	L1	CO1
c)	Classify fluid flows.	L2	CO2
d)	List application of Bernoulli's equation.	L1	CO2
e)	Define boundary layer separation.	L1	CO3
f)	Give two examples in everyday life where formation of boundary layer is important.	L2	CO3
g)	Write about draft tube.	L1	CO4
h)	Classify hydraulic turbines.	L1	CO4
i)	Write about cavitation in pumps.	L2	CO5
j)	How do you select the type of turbine.	L1	CO5

PART – B

			BL	CO	Max. Marks
UNIT-I					
2	a)	The surface tension of water in contact with air is given as 0.0725 N/m. The pressure outside the droplet of water of diameter 0.02 mm is 100 kPa. Calculate the pressure within the droplet of water.	L3	CO1	5 M

	b)	Classify differential manometers and explain anyone of them.	L2	CO1	5 M
OR					
3	a)	In a stream of glycerin in motion, at a certain point the velocity gradient is 0.25 m/s. The mass density of fluid is 1270 kg/m^3 and kinematic viscosity is 6.3×10^{-4} m^2/s. Calculate shear stress at that point.	L3	CO1	5 M
	b)	A simple manometer (U-tube) containing mercury is connected to a pipe in which an oil of specific gravity 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 200 mm and height of oil in the left-limb from the centre of the pipe is 150 mm below.	L3	CO1	5 M
UNIT-II					
4	a)	A pipe line 300 m long has a slope of 1 in 100 and tapers from 1.2m diameter at the high end to 0.6m at the low end. The discharge through the pipe is 5.4 m^3 /min. If the pressure at the high end is 70 kPa, find the pressure at the low end. Neglect the losses.	L3	CO2	5 M
	b)	Derive the Bernoulli's equation from the Euler's equation.	L3	CO2	5 M
OR					
5	a)	Differentiate between the rotational and irrotational flows.	L2	CO2	5 M
	b)	The water is flowing through a tapering pipe having diameters 0.3 m and 0.15 m at inlet and outlet respectively. The discharge through the pipe is 0.04 m^3/sec. The inlet is	L3	CO2	5 M

		10 m above datum and outlet is 6 m above datum. Find the intensity of pressure at outlet if that at inlet is 400 kN/m^2.			
UNIT-III					
6	a)	Explain the different methods of preventing separation of boundary layers.	L2	CO3	5 M
	b)	A smooth plate 2 m wide and 2.5 m long is towed in oil (sp. gr. = 0.8) at a velocity of 1.5 m/s along its length. Find the thickness of boundary layer and shear stress at the trailing edge of the plate. Kinematic viscosity of oil is 10^{-4} m^2/s.	L3	CO3	5 M
OR					
7	a)	The velocity distribution in the boundary layer is $\frac{u}{U}=\frac{1.5y}{\delta}-\frac{y^2}{2\delta^2}$, where δ is the boundary layer thickness. Determine (i) displacement thickness (ii) Momentum thickness and (iii) Energy thickness.	L3	CO3	5 M
	b)	Differentiate stream lined body and bluff body.	L2	CO3	5 M
UNIT-IV					
8	a)	Find an expression for force exerted by a fluid jet on stationary flat plate.	L3	CO4	5 M
	b)	Explain the working of Francis turbine with neat diagram.	L2	CO4	5 M
OR					
9	a)	Differentiate between Impulse turbine and Reaction turbine.	L2	CO4	5 M
	b)	A 150 mm diameter jet moving at 30m/s impinges on a curved vane moving at 15m/s in the direction of the jet. The jet leaves the vanes at 60° with the direction of motion of the vanes. Calculate: (i) Force exerted by the jet in the direction of motion of vanes (ii) Work done by the jet per second.	L3	CO4	5 M

UNIT-V					
10	a)	Draw and discuss characteristic curves of centrifugal pump.	L4	CO5	5 M
	b)	A turbine is to operate under a head of 25 meters at 200 rpm. The discharge is 9 m^3/s. If the turbine efficiency is 90% determine: (i) specific speed of the turbine (ii) power generated (iii) performance under a head of 20 meters. Also state the type of the turbine.	L4	CO5	5 M
OR					
11	a)	A single-acting reciprocating pump, running at 50 rpm delivers 0.01 m^3/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine (i) the theoretical discharge of the pump, (ii) co-efficient of discharge and (iii) slip and the percentage slip of the pump.	L3	CO5	5 M
	b)	A centrifugal pump is to discharge 0.118 m^3/s at a speed of 1450 rpm against a head of 25 m. The impeller diameter at outlet is 250mm and its width at outlet is 50mm and Manometric efficiency is 75%. Determine vane angle at outer periphery of the impeller.	L3	CO5	5 M