GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

B. Tech (Fourth Semester - Regular) Examinations, April – 2025

23BMEPC24001 – Fluid Mechanics and Hydraulic Machines

(Mechanical Engineering)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions
(The figures in the right hand margin indicate marks)

PART – A (2 x 5 = 10 Marks)

	Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a.	If the specific gravity of a liquid is 0.85, determine its mass density and specific weight.	CO1	K2
b.	State Bernoulli's equation with the assumption.	CO2	K1
c.	Define stream function and velocity potential function.	CO3	K1
d.	What is the function of a draft tube in reaction turbines?	CO5	K1
e.	Define slip and percentage slip in reciprocating pumps.	CO6	K1

PART – B (10 x 5 = 50 Marks)

	Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a.	Find the kinematic viscosity of an oil having density 981 kg/m^3. The shear stress at a point in oil is 0.2452 N/m^2 and velocity gradient at that point is 0.2 per second.	5	CO1	K3
b.	A pressure gauge reads 350 kPa in a water pipeline. Determine the pressure head in meters of water and also find the absolute pressure if atmospheric pressure is 101.3 kPa.	5	CO1	K3
	(OR)			
c.	A block of wood of specific gravity 0.7 floats in water. Determine the metacentric height of the block if its size is 2m * 1m* 0.8m.	5	CO1	K3
d.	Find an expression for the force exerted and center of pressure for a completely submerged vertical plane surface.	5	CO1	K2
3.a.	A Venturimeter is installed in a horizontal pipeline carrying water. The diameters of the inlet and throat are 300 mm and 150 mm respectively. The differential manometer shows a reading of 200 mm of mercury. Find the discharge. (Take: g=9.81 m/s^2 g=9.81m/s^2, ρ_{Hg}=13.6×1000 kg/m^3, ρ_{Hg} =13.6×1000kg/m^3)	5	CO2	K3
b.	Explain the concept of hydraulic gradient line (HGL) and total energy line (TEL) with diagrams.	5	CO4	K3
	(OR)			
c.	A main pipe is divided into two parallel pipes which again forms one pipe. First parallel pipe is of 1000m long with 0.8 m diameter and second pipe is 1000m long with 0.6 m diameter. Coefficient of friction is 0.005. Rate of flow is 2 m^3/s. Find the rate of flow for individual parallel pipe.	5	CO4	K3

d.	An Orifice meter diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter gives readings of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. Co-efficient of discharge for Orifice meter is given as 0.6. find the discharge of water through pipe.	5	CO2	K3
4.a.	Explain velocity potential function and stream function and flow net.	5	CO3	K2
b.	The diameters of a pipe at the sections 1 and 2 are 10 cm and 15 cm respectively. Find the discharge through the pipe if the velocity of water flowing thorough the pipe at section 1 is 5 m/s. Determine also the velocity at section 2.	5	CO4	K3
	(OR)			
c.	Water is flowing through a pipe with varying cross-section. The diameters at inlet and outlet are 30 cm and 20 cm respectively. If the velocity at inlet is 3 m/s, find the velocity at outlet.	5	CO4	K3
d.	A two-dimensional velocity field is given by: $u=3x-4y$, $v=4x+3y$ Check whether the flow is rotational or irrotational.	5	CO3	K4
5.a.	A jet of water with velocity 25 m/s and diameter 5 cm strikes a stationary flat plate perpendicular to its axis. Calculate the force exerted by the jet on the plate. (Take: $\rho=1000\ kg/m^3$, $\rho=1000kg/m^3$)	5	CO5	K3
b.	Draw the velocity triangles for a Francis turbine and derive the expression for work done per unit weight of water.	5	CO5	K4
	(OR)			
c.	A Pelton wheel turbine running at 250 rpm under a head of 200 m develops 10000 kW. Coefficient of velocity of the nozzle= 0.98, Hydraulic efficiency =87%, Mechanical efficiency = 75%, Speed ratio = 0.45, Wheel diameter / jet diameter = 10. Determine: i. Flow rate required, ii. Wheel diameter, iii. Diameter of jet, iv. Number of jet, v. Specific speed	10	CO5	K3
6.a.	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 the inlet and outlet are 20^0 and 30^0 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.	5	CO6	K3
b.	Explain the working of a reciprocating pump and derive an expression for the work done per cycle. Define slip and its significance.	5	CO6	K2
	(OR)			
c.	A single acting reciprocating pump has its piston diameter 15cm and stroke of 30cm. it discharges 300 liters of water per minute at 60 rpm. The suction and delivery heads are 5m and 15m respectively. Find the theoretical discharge, Coefficient of the discharge and percentage of slip of the pump. How much HP will be required to drive the pump with its efficiency is 70%.	5	CO6	K3
d.	Write short notes on: Hydraulic Accumulator	5	CO6	K2

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