

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur (GIET University)



B. Tech (Fourth Semester – Regular/Supplementary) Examinations, April 2026
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. Write the Continuity equation for Compressible and Incompressible fluid. | CO2 | K1 |
| b. Define stream function and velocity potential function. | CO2 | K1 |
| c. Differentiate between Laminar flow and Turbulence flow. | CO4 | K2 |
| d. What is the function of a draft tube in reaction turbines? | CO5 | K2 |
| e. Explain the concept of Net Positive Suction Head (NPSH) and its significance in the operation of a centrifugal pump. | CO6 | K2 |

PART – B**(10 x 5 = 50 Marks)**Answer **ALL** the questions

- | | Marks | CO # | Blooms Level |
|---|-------|------|--------------|
| 2. a. Two large parallel plates are placed 1 mm apart. The space between them is filled with a fluid. The lower plate is stationary, while the upper plate moves with a uniform velocity of 1 m/s. If the shear stress developed in the fluid is 2 N/m ² , determine the dynamic viscosity of the fluid. | 5 | CO1 | K3 |
| b. A vertical rectangular plate of width 2 m and height 3 m is fully submerged in water such that its top edge is 1 m below the free surface of water. Determine the total hydrostatic force acting on the plate, and the position of center of pressure from the free surface. | 5 | CO1 | K3 |

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| c. A soap bubble is formed when inside pressure is 5.2N/mm ² more than the atmospheric pressure. If the surface tension is 0.0126 N/mm, find the diameter of the bubble formed. | 5 | CO1 | K3 |
| d. A solid cylinder of diameter 5m has a height of 5m. Find the Metacentric height of the cylinder if the specific gravity of the material of cylinder is 0.7 and it is floating in water with the axis vertical. State whether the equilibrium is stable or unstable. | 5 | CO1 | K3 |
| 3.a. Write short notes on | 10 | CO3 | K2 |
| a. Steady and Unsteady flow | | | |
| b. Uniform and Non- Uniform flow | | | |
| c. Rotational and Irrotational flow | | | |
| d. Laminar flow and Turbulence flow | | | |
| e. 1D,2D and 3D flow | | | |

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| b. The water is flowing through a pipe having diameter 20 cm and 10 cm at section 1 and 2. The rate of flow through the pipe is 35 lit /Sec. the section – 1 is 6m above datum and section – 2 is 4m above datum. If the pressure at section – 1 is 39.24N/cm ² find intensity of pressure at section-2. | 5 | CO3 | K3 |
| d. An Orifice meter with orifice diameter 15cm is inserted in a pipe of 30cm diameter. The pressure difference measured by a mercury – oil differential manometer on the two sides of the Orifice meter gives a reading of 50 cm of | 5 | CO3 | K3 |

Mercury. Find the flow rate of oil of sp. gravity 0.9 and the coefficient of discharge is 0.64.

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| 4.a. | A pipe of 20cm diameter and 2000 m long connects two tanks having difference of water level of 20m. Determine the discharge through the pipe. If an additional pipe of diameter 20 cm and 1200 m long is attached to the last 1200 m length of the existing pipe, find the increase in discharge if $f = 0.015$. Neglect minor losses. | 5 | CO4 | K3 |
| b. | Water flows through a horizontal pipe having three different diameters. The diameters at sections A, B, and C are 300 mm, 200 mm, and 150 mm respectively. If the velocity of flow at section A is 2 m/s, determine: Velocity of water at section B, Velocity of water at section C. | 5 | CO2 | K3 |

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| c. | Water flows through a horizontal pipe which reduces in diameter from 300 mm to 150 mm. If the velocity of water in the larger pipe is 2 m/s, determine the velocity of water in the smaller pipe. | 5 | CO2 | K3 |
| d. | Determine the rate of flow of water through a pipe of diameter 20 cm and length 50 m when one end of the pipe is connected to a tank and the other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4 m above the center of the pipe. Consider all minor losses and take $f = 0.009$ in the formula: | 5 | CO4 | K3 |

$$h_f = \frac{4fLV^2}{d \times 2g}$$

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|-------|---|----|-----|----|
| 5. a. | 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 |
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| b. | A hydraulic turbine develops 880 kW under a head of 20 m and gives an efficiency of 90%. Calculate the specific speed of the turbine. Calculate the power generated if the head is reduced to 15 m. Assume $N = 400$ rpm. | 5 | CO5 | K3 |
| c. | A Kaplan turbine develops 9000kwatt under a net head of 7.5m. Mechanical efficiency of the wheel is 86%. The speed ratio based on the outer diameter is 2.2 and the flow ratio is 0.66. Diameter of the boss is 0.35 times the external diameter of the wheel. Determine the diameter of the runner and the specific speed of the runner. | 5 | CO5 | K3 |
| 6.a. | A single acting reciprocating pump has its piston diameter 15cm and stroke of 30cm. it discharges 300 litres 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%. | 10 | CO6 | K3 |

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| b. | Explain the working principle of centrifugal pump with a neat sketch. | 5 | CO6 | K2 |
| c. | Write short notes on: Hydraulic Accumulator | 5 | CO6 | K2 |

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