

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)

B.Tech. II Year II Semester Regular & Supplementary Examinations March/April-2026
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 | Define specific volume. | CO1 | L1 | 2M |
| | b | Explain the term Dynamic Viscosity. | CO1 | L2 | 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 | List the methods of dimensional analysis. | CO4 | L1 | 2M |
| | g | Define the terms, Unit Speed and Unit Head. | CO5 | L1 | 2M |
| | h | Explain about Hydraulic Efficiency and Mechanical Efficiency. | CO5 | L2 | 2M |
| | i | Differentiate between Radial and axial flow turbine. | CO6 | L2 | 2M |
| | j | Define cavitation and water hammer. | CO6 | L1 | 2M |

PART-B

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

UNIT-I

- | | | | | | |
|---|---|--|-----|----|----|
| 2 | a | List out different types of manometers. Explain about piezometer in detail. | CO1 | L1 | 4M |
| | b | An inverted U – tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30cm. When an oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective center lines of the pipes) are found to be same and equal to 35 cm. Determine the difference of pressure between the pipes. | CO1 | L3 | 6M |

OR

- | | | | | | |
|---|---|--|-----|----|----|
| 3 | a | Define buoyancy and Meta Centre. | CO1 | L1 | 3M |
| | 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 | 7M |

UNIT-II

- | | | | | | |
|---|---|--|-----|----|----|
| 4 | a | Define the following terms: Velocity potential function, stream function and flow net. | CO2 | L1 | 4M |
| | b | Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE. | CO2 | L2 | 6M |

OR

- | | | | | | |
|---|---|---|-----|----|----|
| 5 | a | State the momentum equation. How will you apply momentum equation for determining the force exerted by a flowing liquid on a pipe bend? | CO2 | L5 | 4M |
| | b | A 45° reducing bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 600mm and 300mm respectively. find the force exerted by water on the bend if the intensity of pressure at inlet of bend is 8.829N/cm ² and rate of flow of water is 600 litres/S. | CO2 | L2 | 6M |

UNIT-III

- | | | | | | |
|---|--|---|-----|----|-----|
| 6 | | A thin plate is moving in still atmospheric air at a velocity of 5m/s. the length of the plate is 0.6m and width 0.5 m. calculate (i) the thickness of the boundary layer at the end of the plate and (ii) drag force on one side of the plate. Take density of air as 1.24kg/m ³ and kinetic viscosity 0.15 stokes. | CO3 | L3 | 10M |
|---|--|---|-----|----|-----|

OR

- | | | | | | |
|---|---|--|-----|----|----|
| 7 | a | State Buckingham's pi (π)-theorem. Why this theorem is considered superior over the Rayleigh's method for dimensional analysis. | CO4 | L1 | 5M |
| | b | The time period (t) of a pendulum depends upon the length (L) of the pendulum and acceleration due to gravity(g). derive the expression for time period. | CO4 | L6 | 5M |

UNIT-IV

- | | | | | | |
|---|---|---|-----|----|----|
| 8 | a | Derive the equation for force exerted by a jet on stationary inclined flat plate | CO5 | L6 | 5M |
| | b | A jet of water of diameter 50 mm strikes a fixed plate in such a way that the angle between the plate and the Jet is 30°. The force exerted in the direction of the jet is 1471.5 N. Determine the rate of flow of water. | CO5 | L5 | 5M |

OR

- | | | | | | |
|---|--|---|-----|----|-----|
| 9 | | A Kaplan turbine runner is to be designed to develop 9100KW. The net available head is 5.6 m, If the speed ratio =2.09, Flow ratio =0.68, overall efficiency=86% & diameter of the boss is 1/3 the diameter of the runner. Find the diameter of the runner and its speed and the specific speed of the turbine. | CO5 | L2 | 10M |
|---|--|---|-----|----|-----|

UNIT-V

- | | | | | | |
|----|---|---|-----|----|----|
| 10 | a | Describe the governing mechanisms employed in hydraulic turbines. How do these mechanisms regulate the speed and output of the turbine? | CO6 | L5 | 5M |
| | b | Define and explain hydraulic efficiency, mechanical efficiency and overall efficiency. | CO6 | L2 | 5M |

OR

- | | | | | | |
|----|--|---|-----|----|-----|
| 11 | | 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 40° 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 |
|----|--|---|-----|----|-----|

*** END ***