



**K. K. Wagh Institute of Engineering Education & Research, Nashik**  
(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:IV
Class:SY	Program:B.Tech
Branch Code:MEC	Pattern:2023
Name of Course:Fluid Mechanics and Machines	Course Code:2305212
Max. Marks:60	Duration:2.30 Hrs.

**Instructions:** Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains \_\_\_\_ page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

**Marks CO**

**Question No. 1**

- 1a) Define the following properties of fluids: (6) CO1
- (a) Density
  - (b) Specific weight
  - (c) Specific volume
  - (d) Specific gravity

**Question No. 2**

- 2a) Differentiate between laminar and turbulent flow based on Reynolds number. (6) CO1, CO2, CO3  
Give two examples each of steady and unsteady flow from real life.

**Question No. 3**

- 3a) Explain the physical significance of each term in Bernoulli's equation with suitable examples. (8) CO2, CO3  
If the coefficient of discharge  $C_d$  of a Venturimeter decreases due to wear and tear, what happens to the calculated flow rate?

**OR**

- 3b) With a neat sketch, explain the principle of a Pitot tube. Derive the expression for measuring velocity using a Pitot tube. (8) CO2, CO3

In a Pitot tube, why is the difference between stagnation pressure and static pressure used to calculate velocity, instead of using only stagnation pressure?

- 3c) Sketch the venturimeter with neat labels. (8) CO3

A Venturimeter is installed in a horizontal pipe carrying water. The diameter at inlet and throat are 300 mm and 150 mm respectively. The differential manometer shows a reading of 0.25 m of mercury. Calculate the discharge through the pipe if the coefficient of discharge  $C_d=0.98$ .

(Take density of mercury = 13,600 kg/m<sup>3</sup>, density of water = 1000 kg/m<sup>3</sup>.)

**OR**

- 3d) An orifice meter with an orifice diameter of 150 mm is fitted in a pipe of 300 mm diameter. The pressure difference measured across the orifice is 50 kPa. Calculate the flow rate if the coefficient of discharge  $C_d=0.62$ . (8) CO3

**Question No. 4**

- 4a) Derive an expression for the velocity distribution for a viscous flow through a circular pipe. Sketch the velocity distribution across a section of pipe (8) CO4

**OR**

- 4b) Explain the concept of major and minor losses in pipe flow with suitable examples (8) CO4
- 4c) A crude oil of a viscosity of 0.9 poise and specific gravity of 0.8 is flowing through a horizontal circular pipe of diameter 80 mm and length of 15m. Calculate the difference of pressure at two ends of the pipe. If 50 kg of oil is collected in a tank in 15 seconds. (8) CO3, CO4

**OR**

- 4d) A main pipe divides into two branches in parallel and then rejoins. (8) CO4

Branch 1: Diameter = 100 mm, Length = 20 m

Branch 2: Diameter = 80 mm, Length = 25 m

Friction factor for both pipes = 0.02.

If total flow rate is 0.05 m<sup>3</sup>/s determine the flow distribution in the two branches.

**Question No. 5**

- 5a) Explain the concept of jet and write the types of jet impacts with diagrams. (8) CO5

A jet of water having a velocity of 30 m/s strikes a flat vane moving in the same direction at a velocity of 15 m/s. Calculate the force exerted by the jet and the work done per second by the jet on the vane. Take diameter of nozzle as 8 mm.

**OR**

- 5b) Differentiate between impulse and reaction machines with suitable examples. (8) CO5

A centrifugal pump delivers water at a flow rate of 0.05 m<sup>3</sup>/s against a total head of 25 m. If the input power is 15 kW, calculate the overall efficiency of the pump.

- 5c) What are the heads associated with a pump? Briefly explain. (8) CO5

**OR**

- 5d) Define the following efficiencies of a turbine: Hydraulic, Mechanical, and Overall efficiency. (8) CO5

Calculate the hydraulic efficiency associated with the following turbine:

Water power supplied to a turbine = 50 kW

Runner power (power developed by turbine blades) = 40 kW

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