

CBCS SCHEME



15MT42

Fourth Semester B.E. Degree Examination, July/August 2021
Fluid Mechanics and Machines

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Define following properties of fluids:
 - i) Viscosity
 - ii) Surface tension
 - iii) Vapor pressure
 - iv) Cavitation

(08 Marks)
- b. State and prove Pascal's law.

(04 Marks)
- c. A manometer is used to measure the pressure of a gas in a tank. The fluid used has a specific gravity of 0.85, and the manometer column height is 55cm. If the local atmospheric pressure is 96kPa, determine the absolute pressure within the tank.

(04 Marks)
- 2 a. Define:
 - i) Hydrostatic law
 - ii) Atmospheric pressure
 - iii) Gauge pressure
 - iv) Centre of pressure.

(06 Marks)
- b. A heavy car plunges into a lake during an accident and lands at the bottom of the lake on its wheels. The door is 1.2m height and 1m wide, and the top edge of the door is 8m below the free surface of the water. Determine the hydrostatic force on the door and the location of the pressure center.

(10 Marks)
- 3 a. List and explain types of fluid flow.

(06 Marks)
- b. Derive continuity equation in 3D Cartesian coordinate.

(06 Marks)
- c. The velocity potential function is given by an expression $\phi = \frac{-xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$. Find the velocity components in x and y direction.

(04 Marks)
- 4 a. Obtain Bernoulli equation from deriving Euler's equation of motion.

(08 Marks)
- b. Water is flowing through a pipe having diameter 300mm and 200mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525N/cm² and the pressure at the upper end is 9.81N/cm². Determine the difference in datum head if the rate of flow through pipe is 40 lit/s.

(08 Marks)
- 5 a. Define Similitude. Explain types of similarities.

(08 Marks)
- b. The efficiency η of a fan depends on density ρ dynamic viscosity μ of the fluid, angular velocity w , diameter D of the rotor and the discharge Q . express η in terms of dimensionless parameters.

(08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 6 a. Explain parts of venturimeter. Derive an expression for actual discharge through venturimeter. (10 Marks)
- b. An orifice meter with orifice diameter 10cm is inserted in a pipe of 20cm diameter. The pressure gage fitted upstream and down stream of the orifice meter gives reading of 19.62N/cm^2 and 9.81N/cm^2 respectively. Coefficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe. (06 Marks)
- 7 a. Define turbomachines. Explain principle components of turbomachines with suitable diagram. (08 Marks)
- b. Distinguish between positive displacement machine and turbomachines. (08 Marks)
- 8 a. Derive alternate form of Euler turbine equation. (06 Marks)
- b. Define degree of reaction and utilization factor. Obtain an expression relating degree of reaction and utilization factor. (10 Marks)
- 9 a. Explain classification of hydraulic turbines. (04 Marks)
- b. Explain constructional features of Francis turbine. (04 Marks)
- c. Derive an expression for maximum efficiency of Pelton wheel turbine. (08 Marks)
- 10 a. Derive an expression for maximum blade efficiency of impulse turbine in the form $\eta_{b.\text{max}} = \cos^2 \alpha_1$ [notations with their usual meanings]. (08 Marks)
- b. What is compounding? List and explain methods of compounding. (08 Marks)

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