

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: BTECH
BRANCH: CIVIL ENGINEERING**

**SEMESTER: III
SESSION: MO/2025**

SUBJECT: CE24203 FLUID MECHANICS

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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	CO	BL
Q.1(a) Derive the expression for total pressure on a vertical plane submerged in a fluid. Find out the location for center of pressure.	[5] 1	K2
Q.1(b) A solid cube of side 0.5 m is hung from a spring balance. The balance reads 3000 N when the cube is in air, and 1774 N when the cube is fully submerged in water. Using Archimedes' principle, determine the density and specific gravity of the cube's material. The same cube is fully submerged in an unknown liquid, and the spring balance now reads 2200 N. Using Archimedes' principle, determine the density and specific gravity of the liquid.	[5] 1	K3
Q.2(a) Derive the Bernoulli's equation from the first principle. Explain the terms pressure head, velocity head, and datum head in Bernoulli's equation.	[5] 2	K2
Q.2(b) Derive an expression for general three-dimensional continuity equation. From the results, find out the expression of continuity equation for one dimensional incompressible flow.	[5] 2	K2
Q.3(a) Derive the expression and draw the shear stress and velocity distribution profiles for fully developed laminar flow through circular pipe.	[5] 3	K2
Q.3(b) Water flows at 250 l/s through a 300 mm-diameter pipe that contains a 135° bend. If the fluid pressure is 39.24 N/cm ² , determine the magnitude and direction of the resultant force acting on the bend.	[5] 3	K3
Q.4(a) A rectangular channel 4 m wide has depth of water 1.5 m. The slope of the bed of the channel is 1 in 1000 and value of Chezy's constant (C)=55. It is desired to increase the discharge to a maximum by changing the dimensions of the section for constant area of cross section, slope of the bed and roughness of the same channel. Find the new dimensions of the channel and increase in discharge.	[5] 4	K3
Q.4(b) Define specific energy, draw specific energy curve and then find the expression for critical depth and critical velocity.	[5] 4	K2
Q.5(a) Differentiate between Francis turbine and Pelton turbine. Define cavitation and state the condition for its occurring.	[5] 5	K2
Q.5(b) The diameters of an impeller of a centrifugal pump at inlet and outlet are 30 cm and 60 cm respectively. Determine the minimum starting speed of the pump if it works against a head of 30 m.	[5] 5	K3

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