BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: B.TECH **SEMESTER: III**
BRANCH: CIVIL **SESSION : MO/2019**

SUBJECT : CE203 FLUID MECHANICS

TIME: 2:00 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 25.
2. Candidates may attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.

Q1 (a) What is viscosity? State the Newton's law of viscosity. [2]

Q1 (b) The velocity distribution over a plate is given by $u = (2/3)\, y - y^2$ in which u is the velocity in m/s at a distance of y m above the plate. Find the distance in meters above the plate at which the shear stress is zero. Take μ = 6 poise. [3]

Q2 (a) Define capillarity. Obtain expression for capillary rise and capillary fall in a glass tube. [2]

Q2 (b) Two plates are placed at a distance of 0.15 mm apart. The lower plate is fixed while the upper plate having surface area 1 m^2 is pulled at 0.3 m/s. Find the force and power required to maintain this speed, if the fluid separating them is having viscosity 1.5 poise. [3]

Q3 (a) Derive the expression for pressure variation in a fluid at rest. [2]

Q3 (b) What are the gauge pressure and absolute pressure at a point 3 m below the free surface of a liquid having a density of 1.53×10^3 kg/m^3 if the atmospheric pressure is equivalent to 750 mm of mercury? The specific gravity of mercury is 13.6 and density of water is 1000 kg/m^3. [3]

Q4 (a) A block of wood of specific gravity 0.7 floats in water. Determine the meta-centric height of the block if it's size is 2 m × 1 m × 0.8 m. [2]

Q4 (b) A circular plate 3 m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4 m and 1.5 m respectively. Determine the total pressure on one face of the plate and position of the center of pressure. [3]

Q5 (a) Derive Euler's equation of motion. [2]

Q5 (b) In a 45° bend a rectangular air duct of 1 m^2 cross-sectional area is gradually reduced to 0.5 m^2 area. Find the magnitude and direction of the force required to hold the duct in position if the velocity of flow at the 1 m^2 section is 10 m/s, and pressure is 2.943 N/cm^2. Take density of air as 1.16 kg/m^3. [3]

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