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

CLASS: BE **SEMESTER: III**
BRANCH: CE/C&P **SESSION : MO/2018**

SUBJECT : CL3001 FLUID MECHANICS

TIME: 1.5 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

Q1 (a) Derive the fundamental equation of fluid statics. [2]
(b) Derive an expression for centre of pressure and total pressure for an inclined surface submerged in a fluid. [3]

Q2 (a) Write down the definitions of gauge pressure and absolute pressure. [2]
(b) Describe working of following pressure measuring devices: (i) Well type manometer (ii) Diaphragm gauge. [3]

Q3 (a) State any one dimensionless number related to fluid flow and explains their significance. [2]
(b) Derive Bernoulli's equation for flow through a straight pipe. Explain the significance of each term in above equation. Write the assumptions made while deriving the Bernoulli's equation. [3]

Q4 (a) Sketch stress versus strain diagram for Newtonian and Non-Newtonian fluid with examples. [2]
(b) A garden hose attached with a nozzle is used to fill a 10-gal bucket. The inner diameter of the hose is 2 cm, and it reduces to 0.8 cm at the nozzle exit. If it takes 50 s to fill the bucket with water, determine (a) the volume and mass flow rates of water through the hose, and (b) the average velocity of water at the nozzle exit. [3]

Q5 (a) Explain the concept of fluid-continuum. What is the advantage of assuming fluid-continuum concept? [2]
(b) Prove that the loss of head for the viscous flow through a circular pipe is given by $h_f = \frac{32\,\mu\,v\,L}{\gamma d^2}$, where μ, v, γ are viscosity, density, specific weight of fluid and L, d are length, diameter of circular pipe. [3]

Q6 (a) What is substantial derivative? [2]
(b) Water leaves the 25 mm diameter nozzle of a fire hose at a velocity of 25 m/s. What will be the reaction force at the nozzle which the fireman will need to counterbalance? [3]

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