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

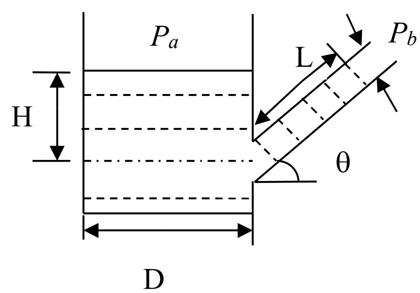
CLASS: BE **SEMESTER : III**
BRANCH: CE/C&P **SESSION : MO/18**

SUBJECT: CL3001 FLUID MECHANICS

TIME: 3:00 HRS. **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
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.

Q.1(a) Define Manometer and list out it's types. [2]
Q.1(b) State and Prove Pascal's Law. [4]
Q.1(c) An inclined manometer as shown in figure, has a vertical cylinder reservoir whose cross-sectional area is 35 times that of the tube. The fluid is ethylene glycol at 20°C. If θ = 20° and the fluid rises 25 cm above its zero-difference level, measured along the slanted tube, what is the actual pressure difference being measured? [6]



Q.2(a) What is continuum hypothesis? Is air a continuum? Does it always remain so? [2]
Q.2(b) Define viscosity. Write the dimensions and units (SI& CGS system) for the dynamic viscosity and kinematic viscosity. [4]
Q.2(c) Given the steady two-dimensional velocity distribution u = K x, v = - Ky, and w = 0 Where K is a positive constant, compute and plot the streamlines of the flow, including directions and give some possible interpretations of the pattern. [6]

Q.3(a) Show that f = 64 / Re. [2]
Q.3(b) Define and determine the value of kinetic energy correction factor for laminar flow in a pipe of circular cross-section. [4]
Q.3(c) Draw the neat sketch for the shear stress and velocity distribution for Newtonian fluid across a section of a circular pipe. Derive the expression for the Bernoulli's equation. State any two applications of Bernoulli's theorem. [6]

Q.4(a) Define drag and lift coefficients. [2]
Q.4(b) Plot and explain the variation of drag coefficient with particle Reynolds number for smooth spheres. [4]
Q.4(c) Air (ρ = 1.22 Kg/m^3, μ = 1.9 X 10^{-5} pa.s) is flowing in a fixed bed of a diameter 0.5 m and height 2.5 m. The bed is packed with spherical particles of diameter 10 mm. The void fraction is 0.38. The air mass flow rate is 0.5 kg/s. Calculate the pressure drop across the bed of particles. [6]

Q.5(a) An aeroplane files at Mach 0.8 in air at 15°C and 100kPa. Calculate the stagnation pressure and temperature. [5]
Q.5(b) Show that the flow velocity decreases in divergent nozzle for subsonic flow. [7]

Q.6(a) A rotameter designed to measure the flow rate of water is used to measure the flow rate of brine (specific gravity 1.15), without altering the scale. Would it more, or less? Justify. [2]
Q.6(b) Can a rotameter be used in a horizontal pipe line? If not, explain why? [4]
Q.6(c) Water flowing at 1.5 liters/sec in a 0.05 m diameter tube is metered by means of a simple orifice of diameter 0.025. If the coefficient of discharge is 0.62, what will be the reading on mercury under water manometer connected to the meter? [6]

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Q.7(a)	Define cavitation.	[2]
Q.7(b)	Define the term: suction head, delivery head, static head and manometric head.	[4]
Q.7(c)	Draw and label the different components of centrifugal pump.	[6]

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