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

CLASS: BTECH **SEMESTER : III**
BRANCH: CHEMICAL ENGG. **SESSION : MO/2022**

SUBJECT: CL203 FLUID MECHANICS

TIME: 3:00 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.

Q.1(a) Write short note on the various types of forces exist on fluid elements? [2]

Q.1(b) State and derive Pascal's Law. [4]

Q.1(c) The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the lift limb is connected to a pipe in which a fluid of specific gravity 0.85 is flowing. The centre of the pipe is 14 cm below the level of mercury in the right limb. Evaluate the pressure of fluid flowing in the pipe if the difference of mercury level in the two limbs is 22 cm. [4]

Q.2(a) Define "laminar flow" and "turbulent flow". Explain the nature and quantification of turbulence. [2]

Q.2(b) Sketch stress versus strain diagram for Newtonian and Non-Newtonian fluid with example. [3]

Q.2(c) Discuss the following flow visualization with a neat diagram: [5]

i. Timeline
ii. Pathline
iii. Streakline
iv. Streamline

Q.3(a) Define Fanning Friction Factor, what is the relationship between friction factor and Reynolds number in laminar and turbulent flow. [2]

Q.3(b) Discuss the application of Bernoulli's equation for measuring the velocity of fluid flowing in the pipe. Explain the principle of orificemeter and derive the equation of velocity in terms of the cross sectional area of the pipe. [3]

Q.3(c) A pump draws a solution, specific gravity 1.84 from a storage tank through a 3 in schedule 40 steel pipe (cross-sectional area = 0.0513 ft^2). The efficiency of the pump is 60 percent. The velocity in the suction line is 3 ft/sec. The pump discharge through a 2 in schedule 40 steel pipe (cross-sectional area = 0.0233 ft^2) to an overhead tank. The end of the discharge pipe is 50 ft above the level of the solution in the feed tank. Friction losses in the entire piping system are 10 ft lb_f/lb. What pressure must the pump develop? [5]

Q.4(a) What do you understand by the term "Fluidized bed"? [2]

Q.4(b) Discuss the various flow patterns in agitated vessel? [3]

Q.4(c) A truck having a projected area of 6.5 m^2 travelling at 70 km/hour has a total resistance of 2000 N. Of this 20 % is due to rolling friction and 10 % is due to surface friction. The rest is due to form drag. Calculate the co-efficient of form drag. Take density of air = 1.25 kg/m^3. [5]

Q.5(a) Describe head capacity, power & efficiency curve of a centrifugal pump. What is cavitation and NPSH of a pump? [3]

Q.5(b) Compare centrifugal pump and positive displacement pump. [3]

Q.5(c) Water flows through a venturimeter which has a diameter at the inlet of 1.2 m and a diameter of 0.5 m at the throat. The difference in pressure between the main and the throat is measured by a differential mercury gauge, which shows a deflection of 5.1 cm. Find the discharge through the meter and also calculate the velocity of water at the throat. Take the coefficient of discharge of the meter as 0.98. [4]

:::::23/11/2022:::::E