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

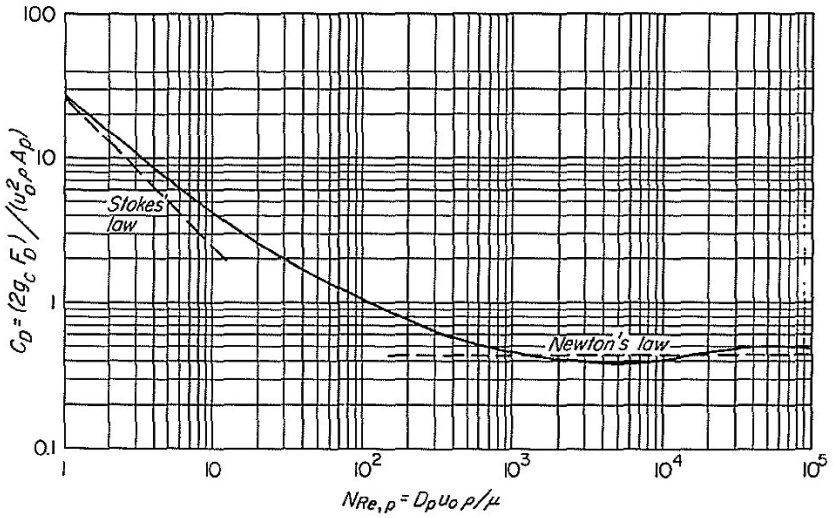
CLASS: BTECH **SEMESTER : V**
BRANCH: CHEMICAL ENGINEERING **SESSION : MO/2024**

SUBJECT: CL343 FLUID SOLID OPERATION

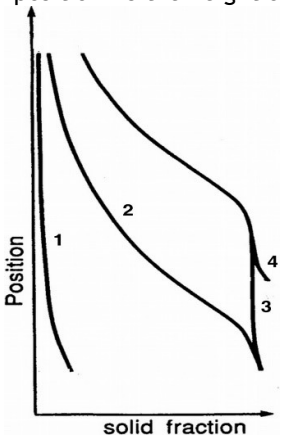
TIME: 3 Hours **FULL MARKS: 50**

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.

			CO	BL
Q.1(a)	Obtain an expression for the stagnation pressure of an incompressible fluid.	[5]	1	2
Q.1(b)	For a cube of side 1 cm, show that $d_v/d_s = 0.9$, where d_v is the diameter of a sphere having the same volume as the cube and d_s is the diameter of the sphere having same surface area as the cube.	[5]	1	3
Q.2(a)	Perfectly spherical limestone particles ($\rho_s = 2800$ kg/m^3) are being dumped in a stagnant pool of water at normal temperature. A prior sieve analysis suggests that the particles are in the size range 147-175 μm. If $\mu_{water} = 0.8$ cP and $\rho_{water} = 995$ kg/m^3, then estimate the terminal velocity of particles when a = 1g. (g = 9.81 m/s^2)	[5]	2	3
Q.2(b)	Under the same conditions as above, estimate the terminal settling velocity if a = 50g.	[5]	2	3



Q.3(a)	Derive expressions for the heights of fluidized bed during particulate and bubbling fluidization regimes.	[5]	3	3
Q.3(b)	Using the sketch given below, (i) identify the fluidization regimes 1-4, (ii) distinguish between curve 3 and 4, (iii) identify individual regions in curve 3. In the sketch, 'position' is the height of bed and 'solid fraction' is the fraction of solids.	[5]	3	3



PTO

Q.4(a)	Draw process diagrams for fluid coking and flexi-coking. Clearly highlight the difference between the process diagrams.	[5]	4	3
Q.4(b)	Answer the following questions: (i) What is the use of U-tubes in the second-generation FCC unit? (ii) Why preheating is required in FCC? (iii) What is the significance of bed 2 and bed 3 in the multi-stage gasification? (iv) What is the function of riser in a third-generation FCC unit? (v) What is the fluidization regime of regenerator in a third-generation FCC unit?	[5]	4	3
Q.5(a)	Which forces govern the interactions among particles and electrostatic forces in the electrostatic separation operations? Show how the minimum and maximum particle sizes are decided.	[5]	5	4
Q.5(b)	How the wetting characteristics decide the feasibility of flotation operation?	[5]	5	4

::::::25/11/2024::::::M