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

CLASS: BTECH **SEMESTER: V/ADD**
BRANCH: CHEMICAL ENGINEERING **SESSION: MO/2025**

SUBJECT: CL343 FLUID-SOLID OPERATIONS

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)	Draw a properly resolved force diagram for a particle immersed in fluid.	[5]	1	2
Q.1(b)	For a cube of dimensions $1 \times 1 \times 1$ cm^3, show that $d_s/d_v \sim 1.11$.	[5]	1	3
Q. 2	Answer the following questions			
Q.2(a)	Perfectly cubic limestone particles were dumped by litterbugs in a clear but stagnant pool of water at normal temperature. Analysis of a sample of the particles shows a PSD in the range 140-190 μm and sp. gravity of 2.81. Estimate the terminal velocity and approximate settling time in a 5 m deep pool under the action of normal gravity.	[5]	2	3
Q.2(b)	Draw a curve of variation in rise velocity with bubble diameter using suitable assumptions and approximations.	[5]	2	4
Q. 3	Answer the following questions			
Q.3(a)	Derive expressions for the height of a fluidized bed (FB) operating in a regime for which the dense phase velocity matches the minimum fluidization velocity.	[5]	3	3
Q.3(b)	Show the ease of fluidizability with the help of Geldart's map for: FCC catalyst, cement powder, feed of circulating bed FBCC process, and feed of bubbling bed FBCC process. (FCC: FB catalytic cracking; FBCC: FB coal combustion)	[5]	3	3
Q. 4	Answer the following questions			
Q.4(a)	For FB combustion: (i) Draw the h – ε_s curve for riser zone of a circulating bed FBCC process; (ii) What method of separation of sand and residue is used in the Ebara FBI process? (iii) Indicate the methods of temperature control in a bubbling bed FBCC process on a simplified flow circuit diagram. (I: incineration)	[5]	4	3
Q.4(b)	Draw flow diagrams of the first and second generation FCC process with emphasis on the loop configurations.	[5]	4	3
Q. 5	Answer the following questions			
Q.5(a)	Chief Technologist of Goldbar has assigned you to separate gold dust onsite from a ton of excavated ores. Provide an algorithm for the approach you might follow and also show a process flow diagram / important components of hardware using properly labeled sketch(es).	[5]	5	4
Q.5(b)	A peculiarly grooved plate was discovered during archeological excavations in a remote place. As a renowned expert in ancient technologies, how would you examine the probable use of the plate to help the excavations onsite?	[5]	5	4

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