Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2024

Course: Particulate Technology — **Semester:** VII
Program: B. Tech (Chemical Engineering) — **Time:** 03 hrs.
Course Code: CHCE 2026 — **Max. Marks:** 100

Instructions: Please submit the **APPENDIX- 1** along with the answer script.

SECTION A

S. No.	Statement (s) of the question	Marks	CO
Q 1	What is flow separation? Draw a schematic diagram of a flow separation.	4	**CO1**
Q 2	What is closed circuit crushing? Draw the schematic diagram of a closed circuit crushing involving 2 crushers.	4	**CO2**
Q 3	**(a)** Define mesh and pitch of screens. **(b)** What does **TSS** stands for, w.r.t. to particle screening?	3 1	**CO3**
Q 4	What is shear-mixing mechanism?	4	**CO4**
Q 5	Give four examples of fluid flow through beds of solids.	4	**CO5**
	SECTION B		
Q 6	Differentiate (using table) between free settling and hindered settling of particles in a fluid.	10	**CO1**
Q 7	Derive the critical rotation speed (N_c) for a ball mill and calculate the critical speed in **revolution/minute**, of a ball mill with an internal diameter of 1200 mm loaded with balls of 70 mm diameter. **OR** Describe the working of any (**one)** comminution equipment for crushing a feed of intermediate size materials, along with a proper-labelled **diagram**.	10 10	**CO2**
Q 8	The screen analysis representing size distribution of particles is shown in **Fig. 1**. Using Gates-Gaudin-Schumann method, compute the particle size distribution of the particles (**for three sizes**) present in the pan.	10	**CO3**
Q 9	What is agglomeration? Explain the different stages of agglomeration of particulate matter with a schematic diagram. **OR** What are nanoparticles? Give five applications of nanoparticle *w.r.t.* its properties (mentioning the properties is compulsory).	10 10	**CO4**
	SECTION C		
Q 10	**(i)** Derive the expression of terminal settling velocity (V_t) of a particle falling in a fluid with very low Reynolds number.	**10**	**CO1**

	(ii) How does the size of a container (or vessel) affect the terminal settling velocity (V_t) of a particle? Give the expression for terminal settling velocity when the ratio of the size of particle **to** that of the size of container is significant. **OR** A cyclone separator is used to remove sand grains from an airstream at 150 ºC. If the cyclone body is 0.6 m in diameter and the average tangential velocity is 16 m/s, what is the radial near the walls for a particle of 20 μm in size? How much are these values greater than the terminal velocity in gravity settling? **Given data:** You can make use of **Fig. 2** and **3**. While, specific gravity of particles = 2.2.	**10** **20**	
Q 11	Derive Ergun equation for flow of liquid through packed bed. Mention all the assumptions wherever necessary.	**20**	**CO5**

APPENDIX- 1

This sheet (containing Fig. 1 - 3) needs to be submitted along with the answer script.	
Roll number:	**Name:**
Signature of the invigilator:	

Fig 1: Particle size distribution results of a screen analysis.

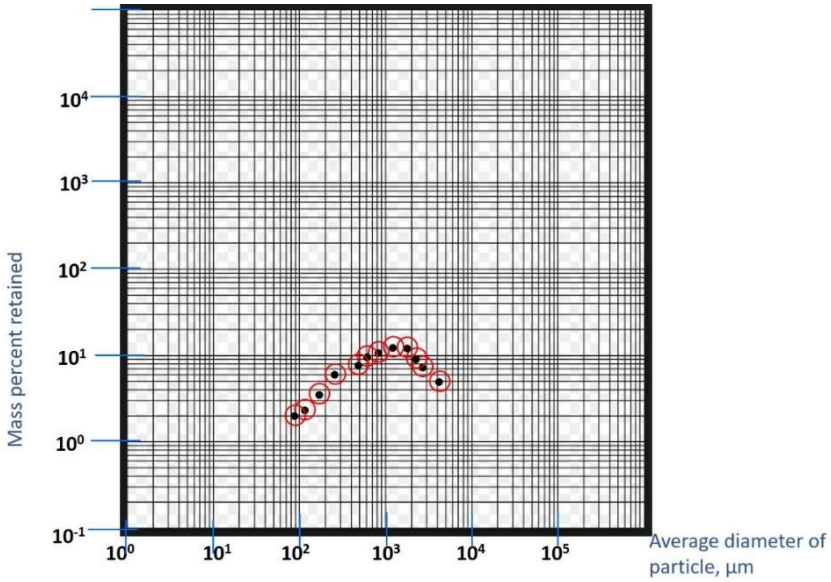
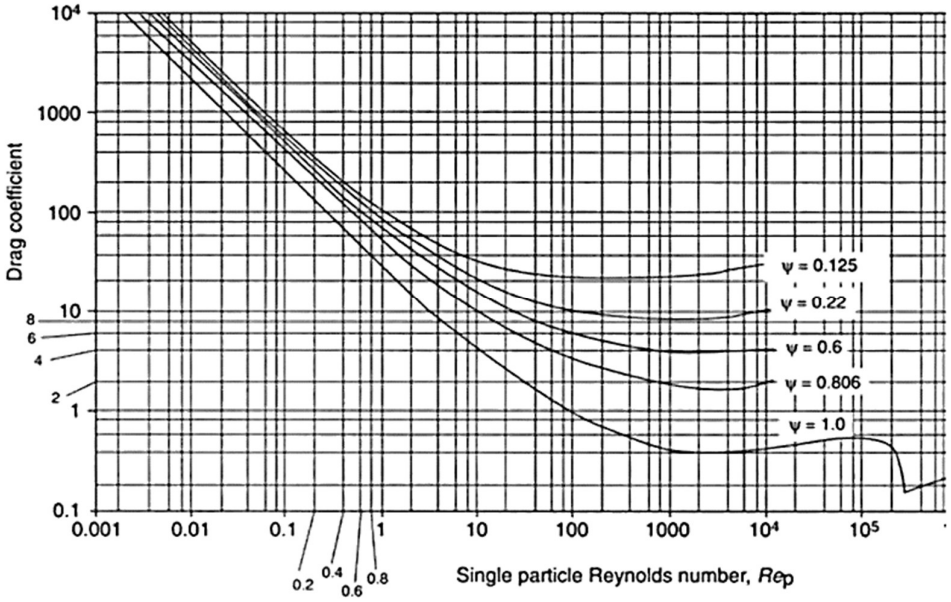


Fig 2: Plot for drag coefficient vs Reynolds number of single particle.



No.	Gas	X	Y
1	Acetic acid	7.7	14.3
2	Acetone	8.9	13.0
3	Acetylene	9.8	14.9
4	Air	11.0	20.0
5	Ammonia	8.4	16.0
6	Argon	10.5	22.4
7	Benzene	8.5	13.2
8	Bromine	8.9	19.2
9	Butene	9.2	13.7
10	Butylene	8.9	13.0
11	Carbon dioxide	9.5	18.7
12	Carbon disulfide	8.0	16.0
13	Carbon monoxide	11.0	20.0
14	Chlorine	9.0	18.4
15	Chloroform	8.9	15.7
16	Cyanogen	9.2	15.2
17	Cyclohexane	9.2	12.0
18	Ethane	9.1	14.5
19	Ethyl acetate	8.5	13.2
20	Ethyl alcohol	9.2	14.2
21	Ethyl chloride	8.5	15.6
22	Ethyl ether	8.9	13.0
23	Ethylene	9.5	15.1
24	Fluorine	7.3	23.8

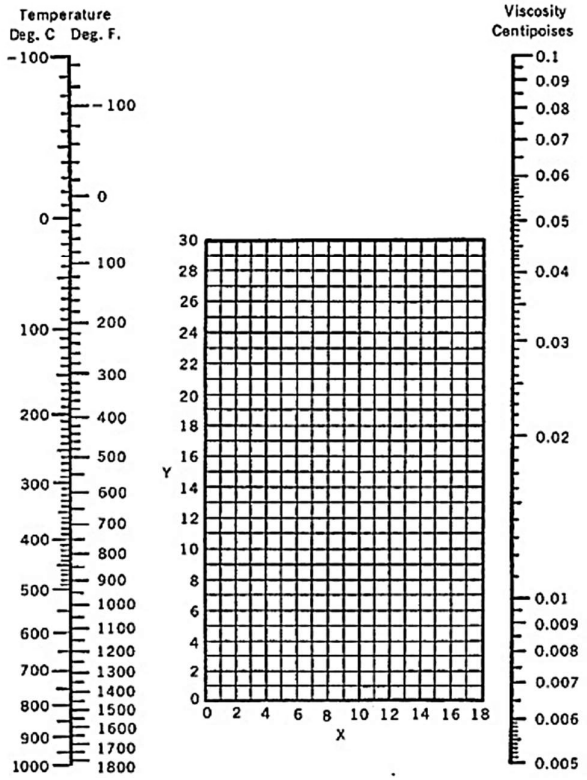


Fig. 3: Viscosity of gases.