Name: Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, Dec 2022

Course: Particle and Fluid Particle Processing
Program: B. Tech (Chemical Engineering)
Course Code: CHCE 3030

Semester: 5
Time: 03 hrs.
Max. Marks: 100

Instructions:

1. This is a **closed book** examination. Please write your answers with detailed information, wherever required.
2. In case of any missing data or information, make necessary assumptions with proper reason.
3. Make sure you have **Appendix-1,** and submitted along with your answer script.

SECTION A

S. No.		Marks	CO
Q 1	Provide one method for determining the (i) size, and (ii) shape of irregular shape particle.	2+2	**CO3**
Q 2	Name two size reduction equipment for (i) coarse material (ii) intermediate materials	4	**CO2**
Q 3	What is hindered settling? What is its importance?	4	**CO1**
Q 4	With the help of a diagram, illustrate the challenges that one might face while storing and transportation of particulate matters or powders. (Only labelled diagram will be enough)	4	**CO4**
Q 5	Give any two examples of nanotechnology that we can observed in nature.	4	**CO5**
	SECTION B		
Q 6	You are provided with 1 kg of powder (any material of your choice). Give at-least four methods (each) to characterize the (i) size and (ii) shape of the powdered particles.	10	**CO3**
Q 7	A particle of square shape having 3 mm × 3 mm face with a thickness of 2.3 mm falling in an oil. Compute the terminal settling velocity (V_t). Given data: Density of particle (ρ_p) = 3500 kg/m^3, Density of oil (ρ_f) = 800 kg/m^3, viscosity of oil (μ_p) = 0.1 poise, and acceleration due to gravity (g) = 9.8 m/s^2	10	**CO1**
Q 8	With the help of five (5) examples, elaborate in detail about the specific properties of nanoparticles or nanotechnology that have played important role in the improvement of modern human civilization.	10	**CO5**
Q 9	Using appropriate assumptions (with valid reasons), derive an expression for calculating the minimum fluidization velocity. You can use images and diagrams to elaborate your answers. **OR**	10 10	**CO5**

	Using appropriate assumptions (with valid reasons), derive an expression for calculating the pressure gradient for fluid flowing (***Re* = 1**) through a fixed packed bed of solid particles. You can use images and diagrams to elaborate your answers.		
	SECTION C		
Q 10	Powdered coal with following screen analysis is feed to a vibrating 48-mesh screen. The particle size distribution of feed, oversize, and undersize is shown in the **Table 2**. Determine (i) effectiveness of the screen, considering oversize as the desired product, (ii) ratio of quantity of oversize to feed, and (iii) List down 5 reasons due to which the effectiveness of an actual screen is never 100%. **OR** Powdered marble with following screen analysis is feed to a vibrating 65-mesh screen. The particle size distribution of feed, oversize, and undersize is shown in the **Table 2**. Determine (i) effectiveness of the screen, considering oversize as the desired product, (ii) ratio of quantity of oversize to feed, and (iii) List down any two difference between ideal screen and actual screen.	**10+5+ 5**	**CO3**
Q 11	A ball mill is fed with fresh feed (F) as 40×10^3 kg/h and the product (P) is screened using a screen of 208 µm aperture size. Oversize are recycled at a rate of 80×10^3 kg/h. Calculate the energy consumption of the ball mill for (i) open circuit as well as (ii) closed circuit grinding, and the (iii) Define work index (that should be used in solving this numerical) **Given data:** Work index = 12.74 kW hr/ton. The screen analysis data for feed, recycle (oversize) and desired product (undersize) is given in **Table 1** of **Appendix-1**.	**10+5+ 5**	**CO2**