Enrolment No:

Course: CHEG 271(Particulate Technology) (End Semester Examination)

Programme: B.Tech CE+RP **Semester: IV(2017-18)**

Time: 03 hrs. **Max. Marks:100**

Instructions: Read all the below mentioned instructions carefully

1. **Write your Enrolment No. at the top of the question paper**
2. **Attempt all the parts of a Question at one place only**
3. **Make necessary assumptions.**

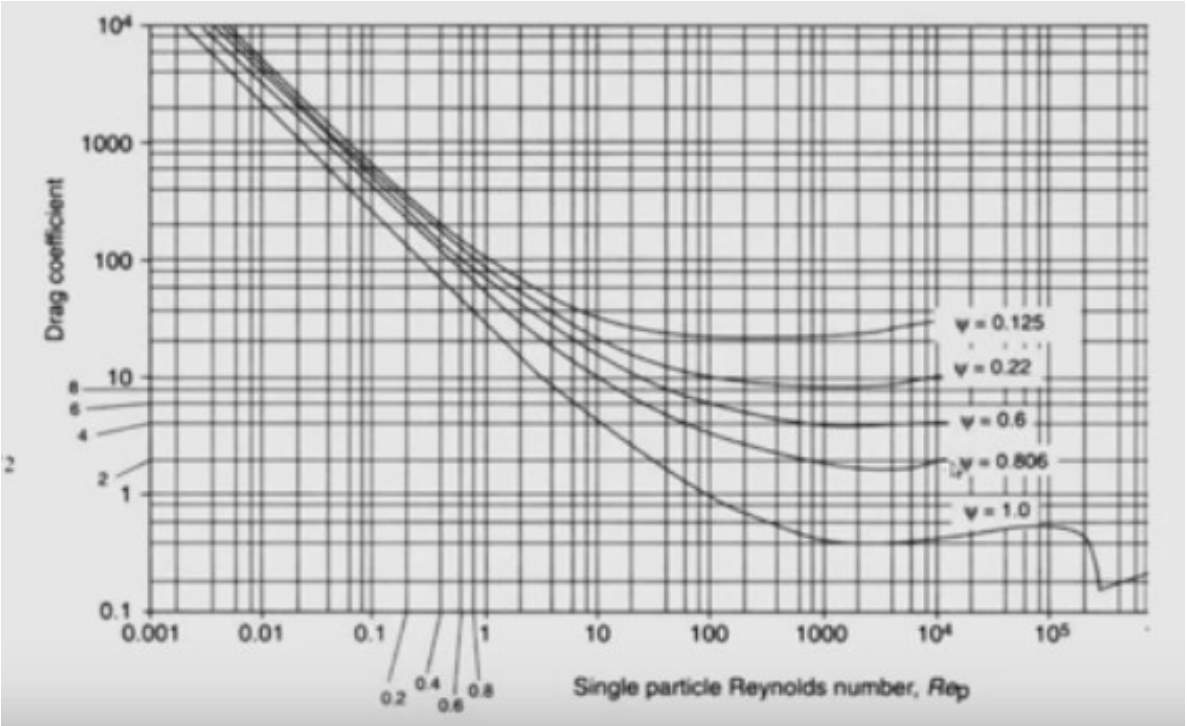
SECTION-A (Attempt all **FIVE** Questions**)**

1.	Consider a rigid solid sphere falling with a constant velocity in a fluid. The following data are known at the conditions of interest: viscosity of fluid= 0.1 Pa.s, density of the particle = 1180 kg/m^3 and density of the fluid =1000 kg/m^3. The diameter (in mm, rounded off to the decimal place) of the largest sphere that settles in stokes law region.	**[04]**	**CO1**
2.	A pair of rolls is to take a feed equivalent to spheres of 3 cm in diameter and crush them to spheres having 1 cm diameter. If the coefficient of friction is 0.29, what would be the diameter of the rolls?	**[04]**	**CO2**
3.	Calculate the mean size based on volume surface and specific surface area in cm^2/g of the cement sample from the size distribution data given below. It has a density of 3260 kg/m^3. The sphericity considered is 0.67.	**[04]**	**CO3**
4.	Explain the advantages and disadvantages of screw conveyors.	**[04]**	**CO4**
5.	Write the principles of cake filtration and the types of cake filtration and the factors that affect filtration.	**[04]**	**CO5**

Particle Size, μm	75-53	53-37	37-25	25-20	20-15	15-10	10-5	5-0
Weight fraction	0.05	0.12	0.18	0.23	0.14	0.12	0.1	0.06

SECTION B (Attempt all **FOUR** Questions)

6.	A Blake crusher of 60 cm by 40 cm with 10% efficiency is to be used to handle 72 ton/hr of a hard rock with specific gravity 3.5 in a cement plant. The surface area of the product is 7.1 m^2/kg. Rittinger's number is 0.0765 m^2/J. The crusher costs Rs.6 lakh. It operates on a 24 hr basis for 300 days per year and the maintenance, overhead and replacement costs amount to 50% of the power cost. Electricity power costs Rs 3.0 per kWh. If the annual depreciation cost is Rs 1 lakh, estimate the annual processing cost of the hard rock. Assume the feed surface area to be negligible as compared to that of the product.	**[10]**	**CO2**
7.	For geometrical similar baffled stirred tanks, the Power number is known remain constant at high Reynolds number. (a) Let P be the power supplied per unit volume of the fluid, N be the revolutions per	**[10]**	**CO4**

	second of the agitator, ρ the density of the fluid, μ the viscosity of the fluid, and D the diameter of the impeller. Then determine α,β,γ and d in the following equation. $P=N^{\alpha}\rho^{\beta}\mu^{\gamma}D^{d}$ (b) What is the effect of Froude number on P.		
8.	Derive the expression for the effectiveness of screen and clearly state the assumptions.	**[10]**	**CO3**
9.	a) With a neat sketch explain the working principle of hydrocyclone classifiers to classify particles in a liquid suspension, its merits and demerits. (Or) (b) A sludge filtered in a washing plate and frame filter press is of such nature that the filtration equation is $V^2=kt$ where V is the volume of filtrate obtained in time t, when the pressure is constant. 40 m3 of filtrate is produced in 10 hours. 4 m^3 of wash water is used for washing at the end of the filtration. Determine the washing time if washing rate is one third of filtration rate. If the filtration surface is doubled, remaining other conditions constant, how long it take to produce 25 m^3 of filtrate.	**[10]**	**CO1**
	SECTION C (Attempt all **Two Questions)**		
10.	(a) Derive Ergun equation for pressure drop in packed beds. **15M** (b) Calculate the pressure drop of air flowing at 30°C and 1 atm pressure through a bed of 1.25 cm diameter spheres at a rate of 60 kg/min. The bed is 125 cm diameter and 250 cm height. The porosity of the bed is 0.38. The viscosity of air is 0.0182 cp and the density is 0.001156 g/cc. **5M**	**[20]**	**CO5**
11.	(a) Particle of cylindrical in shape of 3 mm radius and 5 mm height are falling in oil. Compute the terminal settling velocity of a single particle. Also, compute terminal settling velocity of particles when they are filled in a glass cylinder of 30 mm diameter and the slurry contains 65% by weight solids. Density of particle is 3500 kg/m^3. Density of oil is 850 kg/m^3 and viscosity of oil is 0.13 poise.  	**[20]**	**CO1**

(Or)

(b) An aqueous slurry containing 1.2 percent by weight of solids (specific gravity =2.0) is to be clarified by continuous sedimentation. Feed to the thickener is 3600 m^3 per day and the underflow from the unit analyses 8 percent of solids. Specify the diameter of the thickener. A batch sedimentation test on the feed material gave the following information:

Time (min)	0	5	10	20	40	60	180	240	∞
Height of interface (cm)	31	21	10	3.2	2.2	2.1	2.0	1.96	1.94