(3 Hours) **Total Marks : 80**

NB: 1) Question no.1 is compulsory
2) Attempt any three from remaining five questions.
3) Assume suitable data if required.
4) Figure to the right indicates full marks.

Q.1 A) Write short note on Free settling and hindered settling 5
B) Write short note on floatation. 5
C) Explain types of fluidization. 5
D) Explain mixing index for mixing of cohesive solids. 5

Q.2 A) A quartz mixture having analysis shown in table is screened through a standard 10 mesh screen. Calculate mass ratios of overflow and underflow of feed and overall effectiveness of screen 10

Mesh No.	Dp, mm	Mass retained in gms		
		Feed	Overflow	Underflow
4	4.699	0	0	--
6	3.327	25	49.7	--
8	2.362	125	251.3	0
10	1.651	320	294	58.5
14	1.168	260	84	115.5
20	0.833	155	15.4	75
28	0.589	55	7	24
35	0.417	20	--	9
65	0.208	20	--	6
Pan	--	20	--	12

B) A crusher is reducing limestone of crushing strength 70 MN/m^2 from 6 mm diameter size to product size of 0.1 mm diameter requires 9 KW. The same machine is used to crush dolomite at the same rate of output from 6 mm diameter size to product which contains of 20% with an average diameter of 0.25 mm, 60% with an average diameter of 0.125 mm and the balance having an average diameter of 0.085 mm. Estimate the power required to drive the crusher, assuming that the crushing strength of dolomite is 100 MN/m^2 and that crushing follows Rittinger's law. 10

Q.3 A) Constant pressure filtration and washing in leaf filter. An experimental press having an area of 0.0414 m^2 is used to filter an aqueous $BaCO_3$ slurry at constant pressure of 267 kPa. The filtration equation obtained was 10

$$t / V = 10.25 \times 10^6 V + 3.4 \times 10^3$$

Where t is in seconds, V in m^3. If the same slurry and conditions are used in a leaf press having an area of 6.97 m^2, how long will it take to obtain 1 m^3 of filtration?

B) Discuss in detail constant pressure and constant rate filtration. 10

Q.4 A) Derive the expression to estimate the size of smallest particle that can be separated from cyclone separator. 10

B) Calculate the minimum area and diameter of a thickener with a circular basin to treat 0.1 m^3/s of a slurry of solids concentration 150 kg/m^3 10

The result of batch settling test are as follows:

Solid concentration (kg/m^3)	100	200	300	400	500	600	700	800	900	1000	1100
Settling velocity (µm/s)	148	91	55.33	33.25	21.40	14.50	10.29	7.38	5.56	4.20	3.27

A value of 1290 kg/m^3 for underflow concentration was selected from a retention time test. Estimate the underflow volumetric flow rate assuming total separation of all solids and that a clear overflow is obtained.

Q.5 A) Calculate the operating speed of the ball mill from the following data: 8

(i) Diameter of ball mill = 500 mm

(ii) Diameter of ball = 50 mm

Operating speed of ball mill is 35% of critical speed.

B) Differentiate between ideal screen and actual screen. 4

C) Derive the expression for minimum fluidization velocity. 8

Q.6) Write short note on (Any four) 20

i) Muller mixer

ii) Screw conveyer

iii) Belt conveyer

iv) Electrostatic precipitator

v) Filter aids

vi) Flotation cell