

Solid Fluid Mechanical Operation

Q.P. Code : 573400

32

(3 Hours)

[Total Marks : 80

- N.B. : (1) Question No.1 is compulsory.
 (2) Solve any three from the remaining questions.
 (3) Assume suitable data if required.

1. Answer the following questions :

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- (a) What are the various ways of representing the particle size distribution? Explain.
 (b) Write a note on effect of flocculation on Sedimentation.
 (c) State and Explain laws of crushing.
 (d) Discuss gas solid fluidization.

2. (a) Derive Ergun's equation.

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(b) In fluidization discuss the effect of fluid velocity on pressure gradient and pressure drop.

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3. (a) Calculate the minimum area of thickner and also evaluate the diameter with a circular basin to treat $0.1 \text{ m}^3/\text{s}$ of slurry of a solid concentration of 150 Kg/m^3 .
 The results of batch setting are as follows :

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Solid concentration (Kg/m^3)	Setting velocity ($\mu\text{m/s}$)
100	148
200	91
400	33.25
600	14.50
800	7.38
1000	4.2
1100	3.27

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

(b) How batch test of sedimentation is used to design thickners ?

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[TURN OVER



4. (a) Discuss in detail constant rate & constant pressure filtration. 10
 (b) A plate and frame press is filtering a slurry gives a total volume of 8m^3 of filtration in 1800 seconds and 11m^3 in 3600 seconds, when filtration was stopped. Estimate the washing time in seconds if 3m^3 of wash water was used. The resistance of cloth can be neglected and constant pressure is used throughout. 10
5. (a) Crushing roll 1 m in diameter are set so that the crushing surfaces are 15mm apart and angle of nip is 31° . What is the maximum size of the particle which should be fed to the rolls ? If the actual capacity is 10% of the theoretical. Calculate the through put in kg/s when running at 3.0Hz, the working face of the rolls is 0.4m long and feed weighs 2500kg/m^3 . 10
 (b) The performance of the solid mixer has been assessed by calculating variance occurring in weight fractions of a component among selection of sample withdrawn from mixture. The quality was tested at intervals of 320 seconds and the results are 10

Sample Variance	0.025	0.006	0.015	0.019
Mixing time (sec)	30	60	90	150

If the component analyzed is estimated to represent 20% of the mixture by weight and each sample removed contained 100 particles. Comment on quality of the mixture produced & present the data in graphical form showing variation & mixing index with time.

6. Write short note on :- 20
- (a) Cyclone Separator
 - (b) Ribbon Blender
 - (c) Solid Conveying equipment
 - (d) Ball mill.
