

B. TECH
(SEM-III) THEORY EXAMINATION 2019-20
MECHANICAL OPERATION

*Time: 3 Hours**Total Marks: 100***Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

a.	Describe the term Cake resistance.
b.	Differentiate between Bond's and Kick's law.
c.	Differentiate between free settling and hindered settling.
d.	Classify types of filtration on different basis.
e.	Differentiate between unit operation and unit process with example of each.
f.	Explain the difference between silo and hopper.
g.	Describe the term Filtration.
h.	Define capacity and explain how it affects the effectiveness of a screen.
i.	What is communiton? Discuss the major classification of size reduction equipment.
j.	What is fluidization? Explain its types and application.

SECTION B**2. Attempt any three of the following:****10x3=30**

a.	Calculate specific surface area of the particles sample from the distribution data given below. The particle density of the sample may be taken as 2760 kg/m ³																		
	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Particle size, μm</td> <td>212-150</td> <td>150-106</td> <td>106-90</td> <td>90-75</td> <td>75-63</td> <td>63-56</td> <td>56-38</td> <td>38-0</td> </tr> <tr> <td>Weight fraction</td> <td>.05</td> <td>0.12</td> <td>0.18</td> <td>0.23</td> <td>0.14</td> <td>0.12</td> <td>0.1</td> <td>0.06</td> </tr> </table>	Particle size, μm	212-150	150-106	106-90	90-75	75-63	63-56	56-38	38-0	Weight fraction	.05	0.12	0.18	0.23	0.14	0.12	0.1	0.06
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b.	State Rittingers and kicks law. And using them solve the following numerical: A material is crushed in a Blake jaw crusher and the average size of particles is reduced from 10cm to 2.6cm with the consumption of energy at a rate of 37watt-hr/m-ton. What will be the consumption of energy necessary to crush same material of average size of 16cm to an average size of 6cm? Do the calculations using rittingers and kicks law?																		
c.	Describe the construction and working of ball mill. Derive the expression for the critical speed of the ball mill.																		
d.	A plate and frame press filtering slurry give a total of 8m ³ of filtrate in 1800 sec and 11m ³ of filtrate in 3600 sec. When filtration was stopped estimate the washing time in sec if 3 m ³ of wash water is used. The resistance of the cloth can be neglected and the constant pressure is used throughout the process.																		
e.	Write short note on following: <ul style="list-style-type: none"> i. Decantation ii. Elutriation iii. Fluid Energy Mill 																		

SECTION C

3. Attempt any *one* part of the following: 10x1=10

a.	Explain the construction and working of rotary drum filter.
b.	Discuss in detail with diagram the principle, operation of belt and apron conveying of solids.

4. Attempt any *one* part of the following: 10x1=10

a.	Explain the one dimensional motion of particles through a fluid in gravitational and centrifugal field.
b.	Derive an expression for calculating power consumption in an agitated vessel and write the applications in agitation.

5. Attempt any *one* part of the following: 10x1=10

a.	<p>i) A pair of roll is to take a feed equivalent to sphere 38mm in diameter and crush them to sphere having a diameter of 12.7mm. If the co-efficient of friction is 0.29, what should be the diameter of rolls?</p> <p>ii) What is the power required to crush 100 ton/hr of limestone if 80% of feed passes 2 inch screen and 80% of product through a 1/8 inch screen. (work index=12.74)</p>
b.	Derive the Ergun's equation for pressure drop for fluidisation.

6. Attempt any *one* part of the following: 10x1=10

a.	Explain the construction and working of plate and frame filter press.
b.	A filter press contains 20 frames each of 0.6m by 0.6m inside dimensions. The frames are 0.025m thick. The press is equipped with 1 and 3 button plates for washing. The volume of wash water used is 10% of the filtrate per cycle. The time required for filtering at constant pressure is 2 hours by which time the frames are full. Washing is done at the same pressure as filtering and viscosity of wash water is nearly the same as that of filtrate. What is the time for washing? There is 0.05m ³ of final cake per m ³ of filtrate. Neglect the filter medium resistance.

7. Attempt any *one* part of the following: 10x1=10

a.	<p>The screen analysis of the particle is as given below. Density is 2650 kg/m³ (.00265g/m m³), shape factor=0.8, sphericity= 0.571. Calculate A_w, N_w, D_v, D_s, D_w</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Mesh no</th> <th>D_{pi}</th> <th>X_i</th> </tr> </thead> <tbody> <tr> <td>8</td> <td>2.362</td> <td>.1250</td> </tr> <tr> <td>10</td> <td>1.651</td> <td>.3207</td> </tr> <tr> <td>14</td> <td>1.168</td> <td>.2570</td> </tr> <tr> <td>35</td> <td>.417</td> <td>.0210</td> </tr> <tr> <td>48</td> <td>.295</td> <td>.0102</td> </tr> <tr> <td>65</td> <td>.208</td> <td>.0077</td> </tr> <tr> <td>100</td> <td>.147</td> <td>.0058</td> </tr> <tr> <td>200</td> <td>.074</td> <td>.0031</td> </tr> <tr> <td>pan</td> <td>-----</td> <td>.0075</td> </tr> </tbody> </table>	Mesh no	D _{pi}	X _i	8	2.362	.1250	10	1.651	.3207	14	1.168	.2570	35	.417	.0210	48	.295	.0102	65	.208	.0077	100	.147	.0058	200	.074	.0031	pan	-----	.0075
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b.	What is terminal velocity? Derive the equation for terminal velocity for laminar flow.																														