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B. M. S. College of Engineering, Bengaluru - 560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 19CH3DCMOP **Max Marks: 100**
Course: Mechanical Operations **Date: 14.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1. a) Define screen effectiveness. **03**

   b) A sand mixture was screened through a standard 12 mesh screen. The mass fraction of the oversize material in feed, overflow, and underflow were found to be 0.4, 0.8, and 0.2 respectively. Calculate the screen effectiveness based on the oversize materials. **05**

   c) Explain in detail gyratory screen shakers and vibrating screen shakers, along with neat diagrams. **12**

UNIT - II

2. a) List the primary size reduction equipment (crushers) and describe any two of them in detail, along with its functioning concept. **10**

   b) A sample of materials is crushed in a Blake jaw crusher such that average size of the particles is reduced from 50 mm to 10 mm with the energy consumption of 13 kW/(kg/s). Determine the consumption of energy to crush the same materials of 75 mm average size to an average size of 25 mm using Rittinger's and Kick's law. **10**

UNIT - III

3. a) Derive Ergun equation for estimating pressure drop across packed beds. **12**

   b) Explain the phenomena of fluidization with pressure variation. **08**

OR

4. a) Explain the followings: (i) Drag coefficient (ii) Particle Reynold no. (iii) Principle of cake filtration. **08**

   b) Laboratory filteration conducted at a constant pressure drop on a slurry of $CaCO_3$ in water gave the data as shown below. The filter area was 440 m^2, the mass of solids per unit volume of filtrate was 23.5 kg/m^3. Evaluate the α and R_m values. Pressure drop is 112 kPa and viscosity of water is 0.886 cP. **12**

Filtrate volume (L)	0.5	1.0	1.5	2.5	2.5	3.0	3.5	4.0
Time (s)	6.8	19.0	34.6	53.4	76.0	102.0	131.2	163.2

UNIT - IV

5. a) Explain the principle of cyclone separator with a figure and mention the applications. **10**

   b) Draw the industrial thickener diagram and explain working of it. **10**

OR

6. a) Define terminal settling velocity and derive its expression. **10**

   b) What is a batch settling test, and how can it be used to design a continuous thickener? **10**

UNIT - V

7. a) Explain in detail the working principle of Muller mixer and Screw mixer. **12**

   b) Write the various techniques used for separation of solids and explain any one in details. **08**

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