ECH302

MECANICAL OPERATION

Time: 2 Hours **Max. Marks: 50**

Note:

- Attempt all questions.
- Marks and number of question to be attempted from the section is mentioned before each section.

1. Attempt any **four** parts of the following: [4X3.5]
   a. Define unit operation and also write types of mechanical operations.
   b. A sand mixture is screened through a standard 10 mesh screen. The mass fraction of the oversize material in feed, overflow and underflow are found to be 0.38, 0.79 and 0.22. What is the screen effectiveness based on oversize.
   c. The energy required per unit mass to grind hematite particles from very large size to 80μm is 14.3 kWh/ton. What is the energy required per ton to grind the same material from very large size to 40μm using Bond's law?
   d. What is the critical rotational speed in rev/sec is of a ball mill 1.2m in diameter charged with 70mm diameter balls?
   e. Define sphericity. Find out the sphericity of a particle cubical in shape.
   f. What is Flotation? What are the agents and equipment used for Flotation?

2. Attempt any **four** parts of the following: [4X3]
   a. What is sedimentation? Explain Batch Sedimentation Test.
   b. Explain the working and construction of a cyclone separator briefly?
   c. Explain the construction and working of fluid energy mill.
   d. What is filtering Aid? What is the important characteristic of filter medium for its selection?
   e. Write short notes on different weighing equipments used.
   f. What are Elutriators? What is their application?

3. Attempt any **two** parts of the following: [2X6]
   a. Screen analysis for a sample of crushed quartz is given. Density of the particles is 0.00265 g/mm^3, volume shape factor is 0.8 and sphericity is 0.571. for a material between 4 mesh and 200 mesh particle size, calculate i) specific surface area per unit mass ii) no of particles per unit mass iii) volume mean diameter

Mesh	Screen opening (mm)	Mass fraction retained
4	4.699	0
8	2.362	0.15
20	0.833	0.36
48	0.295	0.22
150	0.104	0.15
200	0.074	0.05
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   b. Explain the following (i) bag filters (ii) impingement separator (iii) Electrostatic Precipitator.
   c. Explain the following (i) Grizzlies (ii) Vibrating Screen (iii) Trommels

4. Attempt any **two** parts of the following: [2X6]
   a. In a constant pressure drop filtration of a slurry containing 20 kg/m^3 of $CaCO_3$ in water, 1 Lit of filtrate is collected in 41.3 sec and 2 Lit of filtrate is collected in 108.3 sec. Filter area is 0.09m^2 and viscosity of filtrate is 0.001 kg/ms. What is the specific cake resistance if the pressure drop is 10^4 N/m^2.
   b. Discuss the various laws of crushing with their formula.
   c. Discuss the utility of piles, hoppers and silos.