School of Engineering and Applied Science (SEAS), Ahmedabad University

Name: _____ Roll no.: _____

B. Tech. (Chemical): Semester III
Mechanical Operations: Mid Term Exam (Monsoon Sem.:2023-24); Marks: 30 M, Wt.: 30 %
September 18, 2023, Tuesday, 8.00 AM – 9.00 AM

Instructions:

1 All sections are compulsory.
2 Figures to right indicate full marks.
3 All acronyms carry their usual meaning.
4 Assume suitable data wherever necessary and specify it clearly in your answers.

Answer the Questions

Q-1 Particles of sphalerite (density = 4500 kg/m3) are settling under the force of gravity in CCl4 at 20 C (density = 1700 kg/m3). The diameter of the sphalerite particles is 0.2 mm. The volume fraction of CCl_4 is 0.25. Find the settling velocity of sphalerite particles if the sphalerite particles are to settle with hindered settling velocity. Viscosity of CCl4 is 0.00103 kg/ms (8 M)

Q-2: A mixture of solids consists of 25% of spherical, 30% of hemispherical, 15% cylindrical and 30% of cubical particles. The density of the sample is 2650 kg/m3. The diameter of the spherical particles is 2 mm, the diameter and height of cylindrical particles are 1.5 mm each, the diameter of the hemisphere is 0.65 mm and size of the cube is 0.3 mm each side. Calculate the sphericity of each of the shapes and find the specific area of the mixture of particles (10 M)

Q-3: Table salt is being fed to a vibrating screen at the rate of 90 kg/hr. The desired product is -30+20 mesh fraction. A 30 mesh and a 20 mesh scree are therefore used the feed being introduced on the 30 mesh screen. During the operation it was observed that the average proportion of oversize from 30 mesh screen to oversize from 20 mesh screen to undersize from 20 mesh screen is 2:1.75:1.2. Calculate the effectiveness of the screen if feed, oversize from 30 mesh screen, oversize from 20 mesh screen and undersize from 20 mesh screen mass fractions are 0.281, 0.076, 0.526 and 0.339 respectively (5 M)

Q-4: A packed bed consisting of uniform spherical particles with diameter of 3 mm and solid density of 4200 kg/m3 is fluidized by means of a liquid having viscosity of 1 mNs/m2 and density 1050 kg/m3. The void fraction in the bed is 0.48. Calculate the minimum fluidization velocity (v_{om}) and terminal settling velocity (u_t) based on the regime. Also find the ratio (u_t/v_{om}). (7 M)

All the best
