

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)**

CLASS: BE
BRANCH: CEHM & CP

SEMESTER: III
SESSION : MO/2018

SUBJECT : CL3005 PROCESS CALCULATION AND MECHANICAL OPERATIONS IN CHEMICAL ENGG

TIME: 1.5 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The total marks of the questions are 30.
 2. Candidates may attempt for all 30 marks.
 3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. The missing data, if any, may be assumed suitably.
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- Q1 Pure water and pure ethyl alcohol are mixed to get a 100 kg of 60% (weight) alcohol solution. The densities (in kg/m³) of water, alcohol and the solution may be taken to be 998, 798 and 895 respectively at 293 K. Calculate the following: [5]
- i. How much volume of pure alcohol is needed?
 - ii. Molarity of alcohol in the solution
 - iii. Molality of alcohol in the solution
- Q2 The vapor pressure of benzene can be stated as [5]
- $$\ln(p^*) = 15.9008 - \frac{2788.51}{-52.36 + T}$$
- where p* is in mm Hg and T is in K. Determine the heat of vaporization of benzene at its normal boiling point (353.26 K).
- Q3 (a) Define sphericity (Φ) and volume shape factor (a)? Show that for spherical particle [2]
volume shape factor $a = \frac{\pi}{6}$?
- (b) Calculate sphericity of cylinder of dia 1 cm and height 3 cm? [3]
- Q4 (a) Name the different conveyors used in the industry? [2]
(b) Calculate volume-surface mean diameter for the following particulate material [3]
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|---------------------------------------|-----|-----|-----|----|----|
| Size range (μm) | 505 | 240 | 135 | 64 | 38 |
| Mass of the particles in the range, g | 30 | 35 | 65 | 70 | 55 |
- Q5 Classify the equipment's used for the size reduction and discuss their basic principles by selecting one from each section [5]
- Q6 (a) State the Rittinger's law of crushing and discuss about its limitations? [2]
(b) 270 kW of power is required to crush the 150 ton/h of material. If 80% of the feed passing through the 50 mm screen and 80% of the product passes through a 3 mm screen. Calculate the work index of the material. [3]

:::::: 12/90/2018 :::::