

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER- V (New) EXAMINATION – WINTER 2019****Subject Code: 2150502****Date: 02/12/2019****Subject Name: Mechanical Operation****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1**
- (a) Define sphericity. Prove that sphericity of sphere is unity. **03**
 - (b) Differentiate differential and cumulative analysis. **04**
 - (c) A roller crusher has rolls of 200 cm in diameter and 75 cm face width. The crushing roll surfaces are 1.25 cm apart at the narrowest point. The angle of nip 30° . The roll crusher operates at a speed of 150 rpm. They are used to crush a rock of specific gravity of 2.35. Calculate the maximum permissible size of feed and the maximum actual capacity in metric tons per hour, if the actual capacity is 15% of the theoretical. **07**
- Q.2**
- (a) What rotational speed in RPM would you recommend for a ball mill 1000 mm in diameter charged with 75 mm balls? **03**
 - (b) In a ball mill of diameter 2000 mm, 100 mm diameter steel balls are being used for grinding. Presently, for the material being ground, the mill is run at 15 rpm. At what speed will the mill have to be run if the 100 mm balls are replaced by 50 mm balls, all the other conditions remaining the same? **04**
 - (c) Explain the construction and working of a roller crusher with the help of a neat sketch and write the important equations for roll crusher. **07**
- OR**
- (c) A Blake jaw crusher is used for crushing limestone such that the average size of the particles is reduced from 50mm to 10 mm with energy consumption of 50 W·hr/metric ton. Calculate the energy consumption for crushing the same material from average size of 75mm to 20mm. Use Rittinger's law, Kick's law and Bond's law. **07**
- Q.3**
- (a) Explain use of Filter aid with a suitable example. **03**
 - (b) Derive the mathematical expression for constant pressure filtration. **04**
 - (c) With neat diagram explain construction and working of plate and frame filter press also state its advantages and limitations. **07**
- OR**
- Q.3**
- (a) Industrially filtration is carried at constant pressure drop and not at constant volume flow rate. Justify your answer. **03**
 - (b) Differentiate classifier and clarifier. **04**
 - (c) Explain construction and working of continuous rotary vacuum filter. **07**
- Q.4**
- (a) What is power number and its significance? **03**
 - (b) How vortex formation can be prevented in agitated vessel. **04**
 - (c) Explain Muller mixer in detail with neat sketch. **07**
- OR**
- Q.4**
- (a) What is swirling and what are its effect on liquid mixing. **03**
 - (b) Enlist different types of flow pattern induced in an Agitated vessel contains liquid. **04**
 - (c) List different types of industrial conveyers and explain any one in detail. **07**
- Q.5**
- (a) List different types of industrial conveyers. **03**
 - (b) Explain in detail the screw conveyor. **04**

- (c) With neat sketch, explain pneumatic conveying system with advantages and disadvantages. 07

OR

- Q.5** (a) Explain minimum fluidization velocity. **03**
(b) Differentiate between particulate fluidization and bubbling fluidization **04**
(c) A bed of ion-exchange beads 8 ft deep is to be backwashed with water to remove dirt. The particles have a density 1.24 g/cm^3 and an average size of 1.1 mm. What is the minimum fluidization velocity using water at 20°C , and what velocity is required to expand the bed by 25 percent? The beads are assumed to be spherical ($\Phi_s=1$), ϵ_M is taken as 0.40 and $\mu=0.01$ P and $\rho = 1 \text{ g/cm}^3$. Take exponent $m = 3.9$. **07**

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