Registration No : | | | | | | | | | | |

Total number of pages : 02 **B.Tech**
PCE3I103

3rd Semester Regular/ Back Examination 2018–19
MECHANICAL OPERATION
BRANCH : CHEM
Time : 3 Hours
Max Marks : 100
Q.CODE : E656

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.

The figures in the right-hand margin indicate marks.
Assume suitable notations and any missing data wherever necessary.
Answer all parts of a question at a place.

Part – I

Q1 **Short Answer Type Questions (Answer All 10)** **(10 × 2)**

a) How to increase the solid-flow rate out of bins?
b) What should be the criteria for the selection of size-reduction equipments?
c) Discuss the parameters which constitute the basis for mechanical separations.
d) Give the common standards followed for screen designation.
e) What is elutriation?
f) What are the materials used in the fabrication of bag filters?
g) What specific advantages are obtained in a pipe conveyor?
h) Why are baffles used in liquid mixers?
i) What is the function of a binder?
j) What are coagulant and flocculants?

Part – II

Focused-Short Answer Type Questions(Answer Any EIGHT out of TWELVE)

Q2 **Answer the following questions :** **(6 × 8)**

a) Write briefly about the pressure developed by solid particles in bins or silos.
b) Why do we require more and more power to grind smaller and smaller particles?
c) Discuss in detail the various separation processes.
d) What are the applications of the floatation technique?
e) Explain briefly the laboratory batch sedimentation test with a neat diagram.
f) Discuss the theory of vibrational separation.
g) Define filtration and state the factors affecting the rate of filtration.
h) Find the terminal settling velocity of 25 % by volume of sand particles in a fluid having hindered settling velocity of 4.5 μm/s. The Richardson–Zaki index is 4.4.
i) Discuss the construction and working of a venturi scrubber.
j) Discuss the construction and working of a bucket elevator.
k) How is mixing index related to mixing time?
l) Why is the closed circuit grinding generally chosen over open-circuit grinding method? Draw a neat diagram of a closed circuit grinding system.

Part – III

Long Answer Type Questions (Answer Any TWO out of FOUR)

Q3 Threetonnes of galena is to be reduced to fine powder by passing through a crusher and a grinder in succession, drawing power from the same drive. Screen analysis of feed, product from the crusher, and product from the grinder indicated surface areas of 5, 120, and 1000 m^2/kg respectively. If the power required by the drive to run the crusher–grinder assembly is 20 kW and efficiency of the crusher is 20 %, find the efficiency of the grinder. Rittinger's number of galena = 90 m^2/kJ. **(16)**

Q4 Forty tonne/h of calcite of 6 cm size is fed to a gyratory crusher. Screen analysis from the crusher shows a surface area of product of 62 m^2/kg. The crushed material is then subjected to fine reduction in a hammer mill. Mill product analysis indicates a surface area of 750 m^2/kg. Rittinger's number for calcite is 80 cm^2/kg.cm. Efficiency of the grinder is only 15 %. The crusher and grinder are driven on the same shaft whose transmission efficiency is 80 %. If 500hp is fed at the other end of the shaft, compute the efficiency of the crusher.Data: Density of calcite = 2.7 g/cc andSpecific surface ratio for feed = 3.0. **(16)**

Q5 A plate-and-frame filter press with negligible filter medium resistance is being used to filter a sample of water slurry of fixed composition. Tests indicate that, during 3.2 hour of continuous operation at a constant pressure drop of 1.5 kg/cm^2, 9000 litres of filtrate is delivered. The operation carried out at a pressure drop of 0.5 kg/cm^2 for the above duration produced 4500litres of filtrate. The unit is to be operated at a constant pressure drop of 1.1 kg/cm^2 during filtration and washing. The cake is to be washed with 300litres of wash water at the end of 2 hour a of continuous operation. If reverse thorough washing is used, estimate the time required for washing in hour. **(16)**

Q6 Explain the particle sedimentation theory (with proper assumptions); the forces acting on a settling particle; four regions of settling according to the Reynolds number; and the equation for the settling ratio. **(16)**