B.TECH/CHE/3RD SEM/CHEN 2101 (BACKLOG)/2019

MECHANICAL OPERATION (CHEN 2101)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and <u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A (Multiple Choice Type Questions)

- 1. Choose the correct alternative for the following: $10 \times 1 = 10$
 - (i) The Cyclone separator is generally used for
 (a) gas solid separation
 (b) solid liquid separation
 (c) liquid liquid separation
 (d) gas liquid separation.
 - (ii) Which product is used as a collector?
 (a) Alum
 (b) Petroleum
 (c) Xanthates
 (d) Copper.
 - (iii) For uniform sphere ϵ varies from (a) 0.1 to 10 (b) 1 to 100 (c) 0.5 to 0.95 (d) 5 to 50.
 - (iv) Which one is a hydraulic classifier?
 (a) Cyclone separator
 (b) Colloid mill
 (c) Screw mixer
 (d) Spitzkasten.
 - (v) Which of the following gives the crushing energy required to create new surface?
 (a) Taggart's rule
 (b) Kick's law
 (c) Rittenger's aw
 (d) Bond's law.

(b) Is screen

(d) MS screen.

- (vi) 200 mesh screen is the basis for(a) Tyler screen(c) BSS screen
- (vii) Ultrafine grinder is an example of
 (a) Hydraulic classifier
 (b) Fluid energy mill
 (c) Clarifier
 (d) Mixing unit.
- (viii) Which of the following states that the terminal settling velocity ut varies with dp05?
 (a) Newton's law
 (b) Kick's law
 (c) Fick's law
 (d) Fourier's law.

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- (ix) Apron is most suitable for
 (a) handling lumpy and heavy material
 (b) mixing plastic mass
 (c) segregating coarse particle
 (d) collecting pure air.
- (x) Power number is related with(a) tank height(c) impeller number

(b) impeller rotational speed(d) power consumption.

Group – B

- 2. (a) Explain the working principle of dense phase pressure system.
 - (b) Write short note on fluidized bed dryer.
 - (c) Why pneumatic conveyor is better than mechanical conveyor?

5 + 4 + 3 = 12

- 3. (a) Define sphericity. What are the utilities of screening?
 - (b) Calculate the volume surface mean diameter for the following particulate solid:

Size of screen	-800 + 400	-400 + 200	-200 + 100	-100 + 50	Pan
opening (µ)					
Mass of particle	30	40.5	70	80	55
in range (g)					

(2+2)+8=12

Group - C

- 4. (a) Derive Kick's law and Bond's law from the generalized crushing law.
 - (b) What are the limitations of Kick's law and Rittenrger's law?
 - (c) What are the laws of comminution?

6 + 4 + 2 = 12

- 5. (a) A pair of rolls takes a feed equivalent to spheres of 10 cm in diameter and crushes them to spheres of 3 cm in diameter. If $\mu = 0.29$, what will be the diameter of the rolls?
 - (b) Define work index.
 - (c) Write short note on fluid energy mill.

6 + 2 + 4 = 12

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Group – D

- 6. (a) State the Kynch theory.
 - (b) Explain the working principle of cyclone separator and continuous thickener.
 - (c) State the significance of power number, Froude number, Reynolds number in connection with agitation operation.

2 + (3 + 3) + 4 = 12

7. (a) A tank is 1.83 m in diameter; the turbine is 0.58 m in diameter and is positioned 0.51 m from the bottom of the tank. The tank is filled to depth of 1.74 m with a solution of 60% caustic soda which has a viscosity of 12 cp and density of 1.8 gm/cm³. The turbine is operated at 90 rpm. What will be the power consumption for the operation of the baffled mixer? Data are as given in table:

NRE	10000	60000	80000
φ	5.9	6.5	7.0

- (b) Derive the expression for terminal velocity of a rigid spherical particle through a stagnant fluid.
- (c) What is lamella clarifier?

5 + 5 + 2 = 12

Group – E

- 8. (a) Derive the expression for incompressible cake.
 - (b) What is filter aids.
 - (c) Explain the froth floatation method with help of neat sketch.
 - (d) Which types of material are used as filter media? Name any two commercial filter media.

4 + 2 + 4 + 2 = 12

- 9. (a) Discuss the working principle and operation theory of rotary drum filter with help of neat flow diagram.
 - (b) What is plate and frame filter press?

10 + 2 = 12