

**B.Tech Odd Semester (CBCS) Exam.,
December—2017**

AGRICULTURAL ENGINEERING

(5th Semester)

Course No. : AE-505 (C)

(Mechanical Operation in Food Processing)

Full Marks : 75

Pass Marks : 30

Time : 3 hours

- Note :*
1. Attempt **one** question from each Unit.
 2. Begin each answer in a new page.
 3. Answer parts of a question at a place.
 4. Assume reasonable data wherever required.
 5. The figures in the margin indicate full marks for the questions.

UNIT—I

1. (a) Define terminal velocity. Discuss the applications of terminal velocity in food processing. 5
- (b) Discuss the thermal properties of food material and their applications in food industry. 10

2. (a) Explain the applications of texture profile analysis of food material. 5
- (b) Define angle of repose. Describe the various methods for the determination of angle of repose with a neat figure. 10

UNIT—II

3. What do you mean by filtration? Discuss the basic theory of filtration. Establish a relationship between volume of filtrate and time of filtration at constant pressure. 15
4. With neat sketch diagram, discuss the following : 5×3=15
 - (a) Plate and frame filter
 - (b) Rotary filter
 - (c) Centrifugal filter

UNIT—III

5. (a) During the evaluation of an air screen grain cleaner with two screens, the following were observed :
 - (i) The impurities present in feed were 6.5%
 - (ii) The impurities present in clean grain were 0.5%

(3)

- (iii) The outflow of blower contained 0.2% clean seed
- (iv) The overflow of 1st screen contained 1% clean seed
- (v) The underflow contained 0.5% clean seed

Compute the cleaning efficiency of the cleaner. 5

- (b) What is centrifugation? Discuss the basic theory of centrifugation. Also derive an equation for rate of settling in centrifuges. 10

6. What do you mean by screening? What is ideal and actual screen? Derive an equation for effectiveness of screen. 15

UNIT—IV

7. (a) What is pneumatic conveyor? Explain the basic systems of pneumatic conveying. 4
- (b) Discuss belt conveyor in brief. The design of the belt conveyor system is based on certain parameters. Elaborate them. Write down the equation for the capacity of belt conveyor and describe trough angle with a neat sketch. 11

(4)

8. (a) Discuss the common types of the mechanical devices for grain handling. Explain the principles influenced the selection of a conveying system. 5
- (b) What is extrusion cooking? Draw the cross-section of screw and barrel of single-screw extruder. Also find out the net flow of an extruder. 10

UNIT—V

9. (a) A screw conveyor mounted on a 4 cm diameter shaft has screw pitch and diameter both equal to 30 cm. Estimate its actual capacity of conveying wheat weighing 850 kg/m^3 while operating at 150 r.p.m. Assume actual capacity as 50% of theoretical capacity. Also determine the horsepower requirement of motor for a screw length of 8 m, if the horsepower material factor for wheat is 0.4. $7\frac{1}{2}$
- (b) Discuss the factors that affect the capacity of belt, bucket and screw conveyors. $7\frac{1}{2}$
10. (a) In a bucket elevator for lifting paddy, each bucket is 25 cm long and a cross-section which is a section of circle having a radius of 15 cm and

(5)

subtending an angle of 81° at the center. The buckets are spaced 45 cm apart and the lift is 25 m. The head wheel diameter is of 60 cm. Calculate (i) belt speed for centrifugal discharge, (ii) capacity of the lifting paddy weighing 580 kg/m^3 and (iii) horsepower required assuming an overall efficiency of 85%. $7\frac{1}{2}$

(b) Describe the working principle of belt conveyor with the help of a neat figure. $7\frac{1}{2}$

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