B.Tech Odd Semester (CBCS) Exam., December—2016

AGRICULTURAL ENGINEERING

(5th Semester)

Course No. : AE–505

(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 angle of repose. With a neat figure, describe different methods for the measurement of angle of repose. 10

(b) The specific heats of bone dry grain and water were 0·45 and 1 kcal/kg °C respectively. Calculate the specific heat of the grain which has a moisture content of *(i)* 75% wb and *(ii)* 233% db. 5

2. *(a)* With the help of a neat figure, explain the following terms related to texture profile analysis of food products : 7½

(i) Hardness
(ii) Fracturability
(iii) Cohesiveness
(iv) Springiness
(v) Gumminess
(vi) Chewiness
(vii) Resilience

(b) What are various engineering properties of agricultural materials? Discuss any one of them in detail. 7½

UNIT—II

3. With neat sketch, discuss the following : 5×3=15

(a) Plate and frame filter

(b) Rotary filter

(c) Centrifugal filter

4. 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

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%

(iii) The outflow of blower contained 0·2% clean seed

(iv) The overflow of first 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? Derive an equation for rate of settling in tubular bowl centrifuge. 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) 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. 11

8. *(a)* Discuss the common types of the mechanical device for grain handling. Explain the principles influence the selection of a conveying system. 5

(b) A particle in free fall will reach a steady-state velocity is constant terminal velocity.

(i) What are different forces that will act on the particle in free fall?

(ii) Derive a general expression for terminal velocity. 7

(c) Explain different ways of size reduction of agricultural products. 3

UNIT—V

9. *(a)* A troughed belt 90 cm wide conforms to a set of three pulleys such that the belt incline is 18° to enable transport of paddy weighing 600 kg/m^3. The belt should have a clear margin of 5 cm on either side and the surcharge angle for paddy is measured to be 20°.

(i) Calculate the carrying capacity of belt while moving at 200 m/min.

(ii) What width of belt would be required to convey only half of the quantity of paddy calculated in *(i)* above, if other conditions remain unchanged? 7½

(b) Explain with a neat figure the constructional detail and working of bucket elevator for conveying of food material. 7½

10. *(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 rpm. 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. 7½

(b) What are the purposes of agitations of fluids? With the help of figures, describe different types of agitator used in food processing industries. 7½

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