

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION MO2022)

CLASS: IMSC  
BRANCH: Chemical

SEMESTER : IX  
SESSION : MO/2022

SUBJECT: FT513 GRAIN STORAGE TECHNOLOGY

TIME: 03 Hours

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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- Q.1(a) Define specific surface area of a grain sample. Briefly discuss its importance in grain storage. 2 CO1  
BL1
- Q.1(b) Discuss the effects of following properties on the storage of grain: i) Humid volume, ii) Thermal conductivity, iii) Angle of internal friction. (Attempt any two) 4 CO1  
BL2
- Q.1(c) Particle size distributions of a sample grains are given by: 4 CO1  
BL3
- |                                 |    |    |    |    |
|---------------------------------|----|----|----|----|
| Number of grains                | 5  | 25 | 50 | 20 |
| Particle size ( $\mu\text{m}$ ) | 40 | 30 | 20 | 10 |
- Determine the Sauter mean diameter of the sample.
- Q.2(a) Briefly explain and locate various regions of drying of a food material in the rate of drying curve with the diagram. 4 CO2  
BL2
- Q.2(b) Draw the schematic diagram of a countercurrent tunnel dryer with its different parts. 3 CO2  
BL2
- Q.2(c) A food material is to be dried from the initial moisture content 70% (wet basis) to the critical moisture content 40% (wet basis). The constant drying rate is  $0.2 \text{ kg H}_2\text{O}/(\text{m}^2 \cdot \text{S})$ . Calculate the drying time (s) to complete the constant rate period. Given: Surface area of the food product =  $0.02 \text{ m}^2$ , initial mass of the wet solid is 1 kg. 3 CO2  
BL3
- Q.3(a) Explain the moisture migration in a grain-filled bin in summer season. Show a diagram. 4 CO3  
BL2
- Q.3(b) Wheat grain of bulk density  $625 \text{ kg/m}^3$  is loaded in a circular concrete silo of 4 m internal diameter and a clear height of 12 m. The angle of internal friction of wheat is  $25^\circ$ . The angle of friction between wheat and bin wall is  $30^\circ$ . Applying Janssen formula, i) calculate the maximum lateral pressure at the bottom of bin section. ii) Compare the calculation with Rankine's formula, iii) Calculate the average pressure with Rankine's formula. 6 CO3  
BL3
- Q.4(a) Explain the hermetic storage with an example. 3 CO4  
BL2
- Q.4(b) Explain the advantages and drawbacks of a metal silo. 3 CO4  
BL2
- Q.4(c) Determine the dimensions of a rectangular warehouse to store 1000 ton of rice in bags in 6 separate lots. The length should be approximately twice the width. The specific volume of rice is  $1.6 \text{ m}^3/\text{ton}$ . Each lot should measure  $4 \text{ m} \times 10 \text{ m}$ . Determine the feasibility of the design. 4 CO4  
BL4
- Q.5(a) Write a short note on funnel flow bin. 2 CO5  
BL1
- Q.5(b) Demonstrate various storage fungi and their mycotoxins with the poisoning effects. 3 CO5  
BL2
- Q.5(c) Briefly describe different chemical methods for grain protection. Mention their names with doses and drawbacks. 5 CO5  
BL2

::::24/11/2022::::E