

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2022****Subject Code:3161410****Date:08/06/2022****Subject Name:Storage Engineering****Time:10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1**
- (a) What is cooling load? **03**
- (b) What are important aspects to be considered during design and construction of Storage Structure **04**
- (c) Discuss in detail the different types of modern food grain storage structure **07**
- Q.2**
- (a) What is angle of internal friction? **03**
- (b) What is the need for controlled atmosphere storage? **04**
- (c) Design a bag storage structures for storing 300 tonnes of paddy. Assume reasonable data wherever necessary. **07**

**OR**

- (c) Calculate the total cooling load from the following information: **07**

Mass of Potato to be stored: 1500 Mt

Loading rate: 4% of the total storage capacity/day

Product temperature at the time of loading = 20 °C

Outside Dry Bulb Temperature: 40 °C

Out Side RH: 50%

Inside Dry Bulb Temperature: 2 °C

Inside RH: 95%

Volume of cold room: 20.8 m x 16.625 m x 14.0 m

Density of air: 1.12 kg/m<sup>3</sup>

Air change factor, z = 2.65

Enthalpy of air at 40 °C DBT and 50% RH= 105 kJ/kg

Enthalpy of air at 2 °C DBT and 95% RH= 15 kJ/kg

Specific heat of potato: 3.6 kJ/kg K

Heat of Respiration of potato =  $0.0325 \frac{\text{kJ}}{\text{kg.h}}$ 

3 number of occupants each working in cold storage for 10 hours/day

10 lamp of 18 W each lighting for 2 hours/day in cold storage room

- Q.3**
- (a) What is passive MAP? **03**
- (b) What are advantages of aeration? **04**
- (c) A storage structure having smooth wall used for storing rice has diameter of 2.5 m and height 25 m. The characteristics of stored rice are as follows: **07**

Minimum bulk density : 720 kg/m<sup>3</sup>Maximum bulk density: 830 kg/m<sup>3</sup>Minimum angle of internal friction ( $\phi$ ): 25°

Maximum angle of internal friction: 30°

Minimum angle of friction on smooth wall ( $\phi'$ ): 18°

Angle of repose: 25°

Calculate the load on the bottom, and the lateral pressure thrust at 10 m.

**OR**

- Q.3** (a) Write five general arrangements and considerations for design of cold storage. **03**  
(b) Differentiate between shallow and deep bins. **04**  
(c) Classify different storage structure on the basis of **07**  
    a. Duration of Storage  
    b. Size or Scale of Storage

- Q.4** (a) What are ripening chambers? **03**  
(b) Write about count and weigh method for estimating storage loss. Mention its **04**  
    two shortcomings also.  
(c) Discuss the effect of temperature and moisture on stored grains. **07**

**OR**

- Q.4** (a) Calculate the refrigeration load due to the heat of respiration of spinach at a **03**  
    constant temperature of  $3.33^{\circ}\text{C}$ . Given  $a = 65.6 \text{ mW/kg}$  and  $b = 0.131^{\circ}\text{C}^{-1}$ .  
(b) What are apparatus used to remove carbon dioxide from storage atmosphere. **04**  
(c) Describe the normal and subnormal gas regimes in controlled atmosphere **07**  
    storage. Also mention the permissible value of gases in CAS.

- Q.5** (a) What is hermetic storage technology? **03**  
(b) Write a short note on respiration of grains during storage. **04**  
(c) What are different types of traditional storage structure used in India. Discuss **07**  
    the improved version of one of them.

**OR**

- Q.5** (a) Write five rat control measures in storage. **03**  
(b) Discuss the basic design components of aeration system. **04**  
(c) Explain with diagram air movement and migration of moisture inside storage **07**  
    bin in summer season.

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