

**FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI**  
**SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY**  
**DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY**  
**2009/2010 HARMATTAN SEMESTER EXAMINATIONS**

TIME ALLOWED: 3 hours

**FST 303: FOOD PROCESSING FUNDAMENTALS**

**INSTRUCTIONS** - Answer five (5) questions with at least one (1) question from each section. Answer each section in a separate booklet.

**SECTION A**

**QUESTION 1**

- (a) What are the benefits of heat processing of food  
 (b) Briefly explain why the determination of each of the following is critical to thermal process design (i) pH of food; (ii) cold point; (iii) inoculated pack studies  
 (c)

Process time(s)	Process temp °C	Lethal rate
50	99.4	-
60	106.0	-
70	115.0	-
80	119.2	-
90	120	-
100	125	-

The above data was obtained during canning operation. Given that Z-value 9.6°C and reference temperature 121°C, determine (i) the lethal rate for each process temperature  
 (ii) Compute the total lethality for the process.

**QUESTION 2**

- (a) What are the objectives of the following heat treatments  
 (i) Blanching (ii) Pasteurization (iii) Sterilization  
 (b) (i) What are the criteria for thermal process design  
 (ii) Outline the factors affecting the rate of heat penetration in canned foods.  
 (c) In a mechanical refrigeration system, the enthalpy at the beginning of evaporation is (H<sub>1</sub>) 300kJ/kg, at the end of evaporation (H<sub>2</sub>) 800kJ/kg, while at the end of compression (H<sub>3</sub>) 1030kJ/kg and the refrigerant load 25 tons (a ton is equivalent to 3.517kJ/s).  
 Compute (i) the refrigerant flow rate; (ii) Compressor power; (iii) C.O.P.

**QUESTION 3**

- a) What are the physical and chemical changes observed in frozen stored food  
 b) Describe (i) fluidized bed freezing method and (ii) cryogenic freezing method  
 c) 500kg of apples at ambient temperature 30°C is to be stored at -18°C. The freezing point of apple is -2°C, moisture content of apple is 75% specific heat capacity above freezing is given as; 0.0419m + 0.0084 (100 - m); latent heat of fusion 3.35m; specific heat below freezing 0.021m + 0.0084 (100 - m). Heat generated by workers in the cold room is 150kJ and heat from electric bulbs is 25kJ.  
 Compute (i) The heat load of the apple and (ii) The overall refrigeration load

## SECTION B

### QUESTION 4

- (a) What are the significance and scope of the psychrometric chart in drying of foods
- (b) Define (i) Absolute humidity (ii) Relative humidity  
(ii) Humid volume (iv) Dew point
- (c) Compare and contrast batch and continuous drying processes
- (d) An air stream at temperature (T) of 87.8°C having a humidity  $H = 0.030 \text{ kgH}_2\text{O/kgDA}$  is contacted in an adiabatic saturator with water. It is cooled and humidified to 90% saturation.  
Evaluate: (i) The final values of H and T at saturation 90%  
(ii) The values of H and T at 100% saturation.

### QUESTION 5

- (a) With the aid of a well-labeled profile (free-hand graph) explain the types of moisture involved in drying
- (b) Write short notes on any THREE of the following: (i) Foam-mat drying;  
(ii) Puff drying (iii) Short tube evaporators; (iv) Long tube evaporators
- (c) The initial moisture content of a food is 87% (wb) and the critical moisture content is 20% (wb). If the constant drying rate is  $0.2 \text{ kgH}_2\text{O/m}^2\text{s}$ , compute the time required for the product to begin the falling rate drying period. The product has a cube shape with 5-cm sides and the initial product density is  $950 \text{ kg/m}^3$

## SECTION C

### QUESTION 6

- (a) What is fermentation?
- (b) Give 3 classes of fermented foods with relevant examples.
- (c) Describe 3 objectives of fermentation as a method of food processing
- (d) Using relevant equations, mention and explain any 3 types of fermentation employed in food.

### QUESTION 7

- (a) Define the following terms (i) Radurization; (ii) Radicidation; (iii) Radappertization
- (b) Outline 3 advantages of cobalt 60 gamma sources
- (c) Briefly describe 4 areas where ionizing radiations have been employed in food preservation