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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : FOOD TECHNOLOGY UNIT PROCESS II
COURSE CODE : BWD 30103
PROGRAMME CODE : BWD
EXAMINATION DATE : DECEMBER 2019 / JANUARY 2020
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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- Q1** (a) Discuss the Steady-State Diffusion of gases and liquids through solids. (10 marks)
- (b) **Figure Q1(b)** shows Psychrometric chart for normal temperatures. An air flows at $1800 \text{ m}^3\text{h}^{-1}$ with initial conditions of 18°C and 50% RH is to be used in an air dryer. It is heated to 140°C and passed over a set of trays in a shelf dryer, leaving at 60% RH (enthalpy = 160 kJkg^{-1} , wet-bulb temperature = 48°C and humidity = 0.045 kgkg^{-1}). It is then reheated to 140°C and passed over another set of trays, leaving at 60% RH again (enthalpy = 268 kJkg^{-1} and humidity = 0.082 kgkg^{-1}). Estimate the energy necessary to heat the air and the quantity of water removed per hour. (10 marks)
- Q2** (a) Determine the thermal resistance constant (z) and thermal death time (F) if 99.99% reduction in microbial population would be equivalent to 0.001 minutes of decimal reduction time (D) of a particular microorganism (*Geobacillus stearothermophilus*) as shown by **Figure Q2(a)**. (10 marks)
- (b) Thermal processing is vital in food production. During this process, variations in temperature can affect processing times and it demonstrates how time-temperature relationships impact the degree of destruction of contaminating microorganisms. Distinguish between Decimal Reduction Time and Thermal Death Time values that are crucial in specialized calculations pertaining to thermal processing. (10 marks)
- Q3** (a) 15 tonnes of fish are frozen per day from an initial temperature of 10°C to a final temperature of -8°C using a stream of cold air. Estimate the maximum capacity of the refrigeration plant required by assuming that the maximum rate of heat extraction from the product is twice the average rate. If the heat-transfer coefficient from the air to the evaporator coils, which form the heat exchanger between the air and the boiling refrigerant, is $22 \text{ Jm}^{-2}\text{s}^{-1}\text{C}^{-1}$, calculate the surface area of evaporator coil required if the logarithmic mean temperature drop across the coil is 12°C . (specific heat of fish = $3.18 \text{ kJkg}^{-1}\text{C}^{-1}$ above freezing and $1.67 \text{ kJkg}^{-1}\text{C}^{-1}$ below freezing, and latent heat = 276 kJkg^{-1}) (10 marks)
- (b) Differentiate between chilling and freezing of pineapple fruit. (10 marks)

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- Q4** Pineapple jam processing facilities require a constant supply of fresh pineapples, and it is important that the pineapple processing line constantly operates at maximum capacity. If the processing chain has broken and interrupted, it can waste money and time, jeopardize product quality and introduce safety hazards on the production floor. To prevent this issue, the ultimate key to success is designing a plant that is well-designed.
- (a) Consider the main factors used in proposing plant location for pineapple jam processing. (10 marks)
- (b) Correlate the elements that can be a guide for well-designed new pineapple jam processing plant. (10 marks)
- Q5** Bread & Butter Bakery is planning to buy ovens for their bakery. Ovens are used for cooking, baking, roasting and browning. They operate either on LPG or electricity. There are various oven models such as rack with the option of rotating or steady racks, deck and tunnel depicting their shape and working style.
- (a) As a food technologist, help them to do a survey of ovens based on **FIVE (5)** factors of operational characteristics for selecting bakeries food processing equipment. (10 marks)
- (b) Two types of baking ovens design are used in food processing, which is natural convection and forced circulation. Analyze the usage of these baking ovens design for baking bread processing. (10 marks)

- END OF QUESTIONS -

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SEMESTER/SESSION : SEM I/2019/2020
COURSE NAME : FOOD PACKAGING TECHNOLOGY

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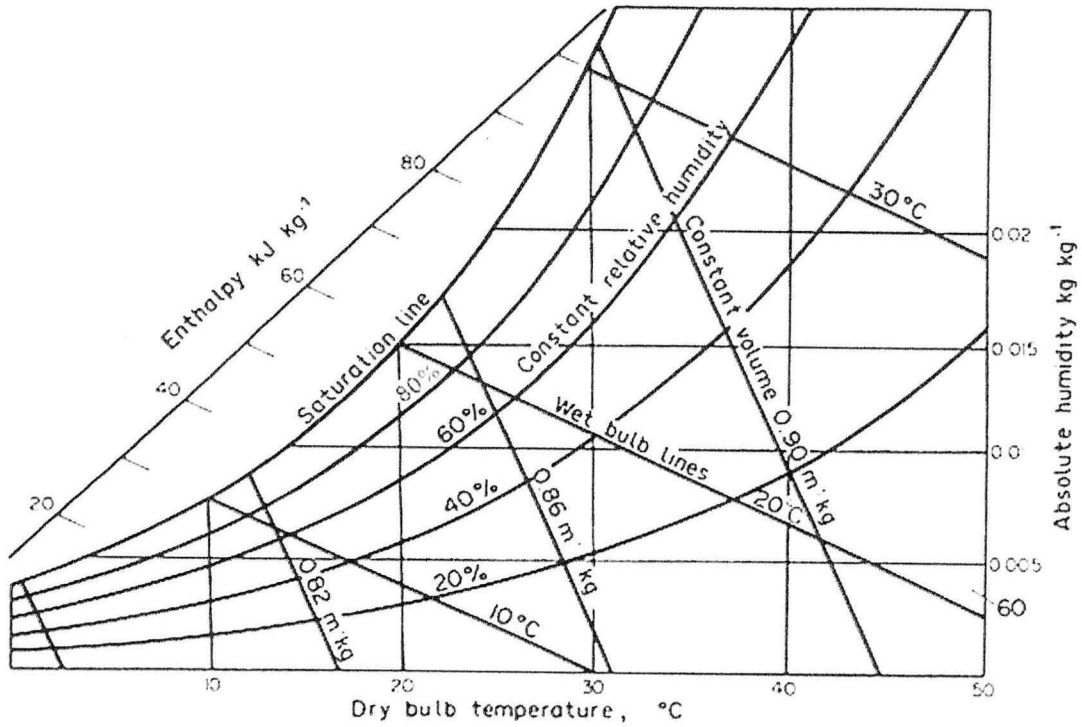


Figure Q1(b): Psychrometric chart for normal temperatures.

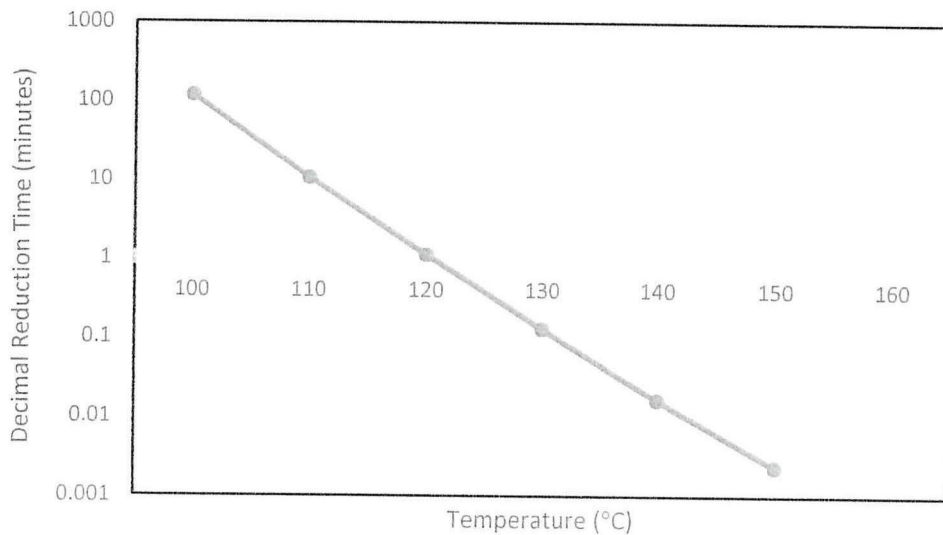


Figure Q2(a): Plot of Decimal Reduction Time versus Temperature for *Geobacillus stearothermophilus*.

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