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**University Examinations 2016/2017**

SECOND YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN FOOD SCIENCE AND NUTRITION

**AFT 3202: FOOD ENGINEERING**

**DATE: DECEMBER, 2016 TIME: 2 HOURS**

**INSTRUCTIONS: -** *Answer question* ***one*** *and any other* ***two*** *questions*

QUESTION ONE (30 MARKS)

1. Define the law of conservation of energy. (1 mark)
2. Briefly define or differentiate the following terms; (5 marks)
3. Thermal diffusivity
4. Emulsification
5. F-value
6. Wet and cryogenic milling
7. Pasteurisation and blanching
8. Differentiate between laminar and turbulent flow. (2 marks)
9. Calculate the rate of heat transfer through a wall with 2m wide and 2m length and 3mm thickness if the temperature on the two sides of the glass is 120C and 140C respectively and the thermal conductivity of the wall is 0.7W/m0C. The system is at steady state. (5 marks)
10. A student wanted to measure the thermal conductivity of a sample using line heat source method. Briefly explain the experiment. (3 marks)
11. Briefly discuss five methods of wet cleaning. (5 marks)
12. A student has a frozen piece of meat for an experiment. But realised he need to work with a fresh sample so he went and bought a fresh unfrozen meat sample. How would the specific heat capacity and thermal conductivity of the two samples compare? (3 marks)
13. A 200 kg of a food sample containing 40% moisture on a wet basis was dried down to 20% moisture at a constant rate of 0.05 kg m-2s-1. The critical moisture content is 15%. Calculate the batch time if the drying surface is 4 m2. (3 marks)
14. Differentiate between co-current and counter current plate heat exchanger. (3 marks)

**QUESTION TWO (15 MARKS)**

1. A food processing industry aims to build a cold store having an outer wall of concrete (105 mm thick) and an inner wall of timber (10 mm thick), with the space in between (100 mm ) filled with Styrofoam. If the inner wall temperature is 40C and the outer wall is maintained at the ambient air temperature of 250C, calculate the rate of heat penetration. (10 marks)
2. In a milk processing industry the following data was recorded during pasteurisation of milk at constant temperature. Determine the D-value. (4 marks)

|  |  |
| --- | --- |
| Time (min) | No. Of micro-organisms |
| 1 | 2x105 |
| 2 | 4x104 |
| 6 | 2x103 |

1. Discuss any three alternative methods to thermal processing that are used in food processing (6 marks)

**QUESTION THREE (15 MARKS)**

1. Discuss the two modes of heating of food by microwaves and highlight industrial applications of microwaves. (15 marks)
2. A moist food product contains 70% water. After drying, it is found that 70% of original water has been removed. Determine (a) mass of water removed per kilogram of moist food and (b) composition of dried food. (5 marks)

**QUESTION FOUR (20 MARKS)**

Discuss the principle of operation of the following methods or equipment mentioning one application of each; (20 marks)

1. Freeze drier
2. Bucket elevator
3. Disk bowl centrifuge
4. Roller sorters