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University Examinations 2013/2014

THIRD YEAR, FIRST SEMESTER EXAMINATIONS FOR DEGREE OF BACHELOR OF
SCIENCE IN FOOD SCIENCE AND NUTRITION

AFS 2316: FOOD ENGINEERING

DATE: APRIL 2014

TIME: 2 HOURS

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

QUESTION ONE – (30 MARKS)

- (a) What do you understand by the law of conservation of energy and mass? (2 Marks)
- (b) Briefly define or discuss these terms as encountered in food engineering.
- (i) Specific heat capacity
 - (ii) D-value
 - (iii) Reverse osmosis
 - (iv) Rising film evaporator
 - (v) Laminar flow (5 Marks)
- (c) Dry foods heat poorly in a microwave oven. Briefly discuss. (3 Marks)
- (d) What is the quantity of heat required to raise the temperature of 20 litres of milk from 22°C to 78°C . Take mean heat capacity of milk to be $4.0\text{KJ kg}^{-1}\text{K}^{-1}$. (3 Marks)
- (e) Briefly discuss the principle of a fluidized bed drier. (3 Marks)
- (f) A student was carrying out an experiment and obtained the following data. Calculate D-value during cooking of a food sample at constant temperature.

Time (min)	Number of Micro-organisms
0	2×10^5
3	4.3×10^4
6.5	6.32×10^3
8	2.0×10^3

(3 Marks)

- (g) Discuss one application of size reduction in liquid food product suggesting the equipment you would employ. (3 Marks)
- (h) Briefly discuss the principle of pulsed electric fields as a non-thermal food preservation method. (3 Marks)
- (i) Calculate 'g' in a centrifuge that can spin at 2000 rev/min with a maximum radius of 20cm. (3 Marks)
- (j) Why are consumers opting for minimally processed food product? (2 Marks)

QUESTION TWO – (20 MARKS)

- (a) A cook observed that when equal amount of cooking oil and water are subjected to the same amount of head, oil heats faster, discuss. (4 Marks)
- (b) A cold storage wall ($3 \times 6 \mu\text{m}$) is constructed of 15cm thick concrete (thermal conductivity is $1.37 \text{ W/m}^\circ\text{C}$) insulation must be provided to maintain a heat transfer rate through the wall at or below $0.05 \text{ W/m}^\circ\text{C}$. Calculate the required thickness of the insulation. The outside surface temperature of the wall is 38°C and the inside wall temperature is 5°C . (10 Marks)
- (c) A cook bought two frozen samples A and B. After thawing process, there were large pools of blood under sample A compared to B. Discuss. (3 Marks)
- (d) Discuss the principle of ultrasound in food preservation. (3 Marks)

QUESTION THREE – (20 MARKS)

- (a) Discuss four non-thermal food processing technologies highlighting the principles. (8 Marks)
- (b) How much sugar must be added to 300kg of aqueous sugar solution in order to increase the concentration from 20 to 60 %. (4 Marks)
- (c) Food sample was ground from an average size of $500 \mu\text{m}$ in diameter to an average size in diameter of $100 \mu\text{m}$. The net energy consumption was 0.6 kW/h per tonne. What would be the net energy consumption for reducing the particles to $20 \mu\text{m}$ diameter product;
 - (i) According to Rettinger's law (3 Marks)
 - (ii) According to Kick's law (3 Marks)
- (d) Surface hardening is a problem encountered in drying. Discuss steps you would take to minimize chances of surface hardening. (2 Marks)

QUESTION FOUR – (20 MARKS)

- (a) Discuss the principles by which microwave oven heat food. (8 Marks)
- (b) Discuss four application of emulsification in food industry. (8 Marks)
- (c) 1000kg of a juice stream contained 10% weight of suspended pulp which are separated in a vacuum filter to produce clear juice and wet solids containing 20% moisture. How much of clean juice and wet solid is produced. (4 Marks)