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University Examinations 2012/2013

THIRD YEAR, FIRST SEMSTER, EXAMINANATIONS FOR DEGREE OF FOOD SCIENCE AND NUTRITION

AFS 2316: FOOD ENGINEERING

DATE: AUGUST 2013 **TIME: 2 HOURS**

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

QUESTION ONE – (30 MARKS)

a) Define the law of conservation of energy and mass (1 Mark)
b) What is the mode of heat transfer during baking (1 Mark)

c) Name the main component in foods that influence thermal conductivity? And how does the thermal conductivity of frozen foods and unfrozen food compare? (3 Marks)

d) During microwaving of food it is not advisable to use metallic utensils. Discuss (3 Marks)

e) Explain the cause surface of hardening in dried foods. (3 Marks)

f) Calculate the quality of heat required to raise the temperature of 10Kg of orange juice from 20^{o}c to 70^{o}c? The mean heat capacity of orange juice is 3.8 $KJ/Kg^{-1}k^{-1}$ (3 Marks)

g) How much dry sugar must be added in 200kg of aqueous sugar solution in order to increase the concentration from 20 to 50%. (4 Marks)

h) Discuss the principle of operation of:
   i. Microwave oven (5 Marks)
   ii. Reverse osmosis (5 Marks)

e) Briefly discuss factors to consider when choosing an equipment for size reduction.

(4 Marks)

QUESTION TWO– (20 MARKS)

a) A student had two samples of foods A and B. Both foods were subjected to the same amount of heat on a hot plate. Food A heated faster to higher temperature than B. Discuss what could be the cause, (3 Marks)

b) A cold room has a wall comprising of 3 components; 10cm of brick to the outside, 7cm of concrete and 8cm of cork. The inside temperature of the stone is -15^{o}c and the outside surface temperature of the wall is 20^{o}C thermal conductivity of brick concrete and cork are 0.69, 0.76 and 0.043 $JM^{-1}S^{-1o}c^{-1}$

i. Calculate the rate of heat transfer through the wall

ii. Calculate the temperature at the interfaces between the concrete and cork layers, and the brick and concrete walls. (17Marks)

QUESTION THREE – (20 MARKS)

a) Frozen meat was thawed in a refrigerator for 10 hours. After the thawing process there were pools of blood on the refrigerator shelf. Discuss (4 Marks)

b) A drier at 100^{o}C was used to dry food containing 75% water to a moisture content of 10% the initial temperature of food was 200^{o}C. Calculate the quantity of heat energy required per unit weight of the original material to dry under atmospheric pressure Latent heat of vaporization of water at 100^{o}C and at standard atmospheric pressure is 2257 $KJ^{-1}Kg^{-1}$ and that heat capacity of food is 3.8 KJ $kg^{-1o}c^{-1}$ and that of water is 4.2 KJ/Kg^{o}C. Also calculate the energy requirement per kg of water removed. (8 Marks)

QUESTION FOUR – (20 MARKS)

a) Differentiate between pasteurization and sterilization. (4 Marks)

b) Differentiate between D- value and Z-value (4 Marks)

c) The following data was recorded during cooking of a food sample at constant temperature. Calculate the decimal reduction time. (4 Marks)

Time (min)	Number of micro-organisms
1	2.0×10^{5}
2.0	4.31×10^{4}
4.5	6.32×10^{3}
6.0	2.0×10^{3}
7.5	6.32×10^{2}

d) Discuss the mechanism of operation of a refrigerator (8 Marks)