2ND SEMESTER 2011/2012

UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAMINATION PAPER

PROGRAM	:	**BACHELOR OF SCIENCE IN FOOD SCIENCE, NUTRITION AND TECHNOLOGY YEAR II**
COURSE CODE	:	**FSNT 205**
TITLE OF PAPER	:	**PRINCIPLES OF FOOD ENGINEERING**
TIME ALLOWED	:	**TWO HOURS**
INSTRUCTIONS	:	**ANSWER QUESTION ONE (1) AND ANY OTHER TWO (2) QUESTIONS. ILLUSTRATE YOUR ANSWERS WITH DIAGRAMS WHERE NEEDED**

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QUESTION 1 [COMPULSORY]

a. A food is thermally treated in equipment whose processing temperature is 135°C. If the initial microbial load is 10 CFU/container and it is desired to reduce it to 10^{-6} CFU/container, calculate the processing time. The target microorganism for this thermal process has a decimal reduction time of 3 min for a reference temperature of 121°C, and to reduce the treatment time to the tenth part it is required to increase the temperature by 10°C. ($j_h = 2$, $f_h = 20$).

(15 Marks)

b. Mango juice flowing through a pipe at a rate of 50 kg/min is sweetened by adding concentrated sugar solution (20 % sugar) to the pipe line at constant rate. At what rate would the concentrated sugar solution be added to provide 5% sugar in the product?

(10 Marks)

c. The wall of a refrigerator of 4 m^2 surface area consists of two metal sheets with insulation in between. The temperature of the inner wall surface is 5 °C and that of the outer surface is 20 °C. The thermal conductivity of the metal wall is 16 W/ m°C and that of the insulation is 0.017 W/m °C. If the thickness of each metal sheet is 2 mm, calculate the thickness of the insulation that is required so that the heat transferred to the refrigerator through the wall is 10 W/m^2.

(15 Marks)

[TOTAL MARKS = 40]

QUESTION 2

a Draw a block diagram for continuous counter current multi stage extraction system and write the following mass balance equations.

i. The global mass balance.
ii. The mass balance between the first stage and an intermediate stage, i.
iii. General equation /expression relating all the streams.

(10 Marks)

b Make a comparative discussion of gravitational settling and centrifugation separation. (6 Marks)

c Give a brief account on the hysteresis phenomena in food materials. (6 Marks)

d. Outline the objectives of mixing and size reduction in solid and liquid foods. (8 marks)

[TOTAL MARKS = 30]

QUESTION 3

a. Discuss the advantages of multiple effect evaporation over single effect evaporation system. (8 Marks)
b. Explain the mass transfer phenomena in the constant and falling rate drying period (8 Marks)
c. Discuss the different phases in microbial growth. (6 Marks)
d. Describe the different stages in solid liquid extraction. (8 Marks)

[TOTAL MARKS = 30]

QUESTION 4

a. Explain steady and unsteady state system. (8 Marks)
b. With the help of graph, explain the constant rate and constant pressure filtration systems. (8Marks)
c. Explain the convective heat transfer phenomena in canned food. (6 Marks)
d. Describe the different types of membrane designs. (8 Marks)

[TOTAL MARKS = 30]