UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME   :   BACHELOR OF SCIENCE IN FOOD SCIENCE, NUTRITION AND TECHNOLOGY YEAR II

COURSE CODE   :   FNS201

TITLE OF PAPER   :   PRINCIPLES OF FOOD ENGINEERING

TIME ALLOWED   :   TWO (2) 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) Calculate the rate of heat transfer through a composite wall of a cold store made of concrete lined with an insulation layer with 6 m^2 surface area. The insulation and concrete have thickness of 10 cm and 15 cm, respectively. The temperature on the two sides of the composite wall is 10 °C and 25 °C. The thermal conductivity of the insulator is 0.07 W/m°C and that of the concrete is 0.5 W/m°C. The system is at steady state.

(15 Marks)

(b) Air with 25 °C dry bulb temperature and 10 g water/kg dry air at 1 atm was heated to 40°C dry bulb temperature. The heated air passed through a dryer, picking up moisture adiabatically, and left the dryer at 80% relative humidity. Show the process on a psychrometric chart and determine the properties of the heated air and the air leaving the dryer.

(15 Marks)

(c) Mango juice with 8% solid is flowing through a pipe at a rate of 40 kg/min. To adjust for the required solids, mango powder is added. At what rate would the powder be added to increase the solids content to 22%.

(10 Marks)

[TOTAL MARKS = 40]

QUESTION 2

(a) Write short notes on the following:
   I.   Newtonian fluids
   II.   Cooling load
   III. Survivor curve
   IV.   Coefficient of Performance

(4×5 = 20 Marks)

(b) Describe the factors that influence the rate of heat transfer by conduction.   (10 Marks)

[TOTAL MARKS = 30]

QUESTION 3

(a) Describe changes in he properties of moist air during heating and cooling phenomena using a psychrometric chart.
(10 Marks)

(b) Describe the different phases of growth of bacteria.
(12 Marks)

(c) Name the components of a refrigeration system and describe what happens in any two of them.
(8 Marks)

[TOTAL MARKS = 30]

QUESTION 4

(a) Explain a three effect backward feed multiple evaporation system with the help of a sketch.
(10 Marks)

(b) Explain the constant and falling rate drying periods.
(10 Marks)

(c) Describe steady and unsteady state systems.
(10 Marks)

[TOTAL MARKS = 30]

Carrier
A United Technologies Company

PSYCHROMETRIC CHART
NORMAL TEMPERATURES
SI METRIC UNITS
Barometric Pressure 101.325 kPa
SEA LEVEL

PSYCHROMETRIC CHART
HIGH TEMPERATURES
SI METRIC UNITS
Barometric Pressure 101.325 kPa
SEA LEVEL