



2ND SEM. 2013/14

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**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 (2) HOURS

**INSTRUCTIONS : ANSWER QUESTION ONE (1) AND ANY OTHER
TWO (2) QUESTIONS.**

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THE CHIEF INVIGILATOR**

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 $0.07 \text{ W/m}^\circ\text{C}$ and that of the concrete is $0.5 \text{ W/m}^\circ\text{C}$. The system is at steady state. (20 Marks)
- (b) Air at 20°C and 60% relative humidity is heated to 90°C and then enters a continuous dryer in adiabatic operation. The air exits at 40°C . Calculate the inlet volumetric flow rate of air required to remove 20 kg of water/h from the product. (20 Marks)

[TOTAL MARKS = 40]

QUESTION 2

- (a) With the help of a sketch, describe a three-effect multiple evaporation system with a feed backward configuration. (10 Marks)
- (b) Classify unit operations depending on the nature of the transformation performed and give two examples for each class. (12 Marks)
- (c) Briefly explain the phenomena in free and forced convection heat transfer (8 Marks)

[TOTAL MARKS = 30]

QUESTION 3

- (a) Explain the following: (20 Marks)
- i. Boiling point elevation
 - ii. Adiabatic saturation process
 - iii. Dimensional consistency
 - iv. Refrigeration load
 - v. TDT curve
- (b) Explain what pressure-enthalpy chart is and its use. (10 Marks)

[TOTAL MARKS = 30]

QUESTION 4

- (a) Indicate the location of the slowest heating point in canned food by conduction and convection and explain why it happens so. **(10 Marks)**
- (b) The humidity ratio of a given air-water vapor mixture increases as the temperature of the mixture increases. Agree or disagree with this statement and justify your answer. **(10 Marks)**
- (c) Explain the mechanism mass transfer by molecular diffusion and convection. **(10 Marks)**

[TOTAL MARKS = 30]