UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME	:	BACHELOR OF SCIENCE IN FOOD SCIENCE, NUTRITION AND TECHNOLOGY YEAR IV
COURSE CODE	:	FSNT 410
TITLE OF PAPER	:	PROCESS CONTROL AND AUTOMATION
TIME ALLOWED	:	TWO (2) HOURS
INSTRUCTIONS	:	ANSWER QUESTION ONE (1) AND ANY OTHER TWO (2) QUESTIONS.

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182

QUESTION 1 (COMPULSORY)

(a) Mango juice is concentrated in a single effect evaporator. The concentration of solids in the product is continuously measured using an online sensor to make sure the concentration is within required limit which is 43%. The concentration of the feed is 13% solids. Heat is supplied using steam using pipe controlled by valve equipped with a plunger.

i. With the help of a sketch (block diagram) describe how control is achieved by automatic closed-loop control structure. **(10 Marks)**

ii. For the above operation identify:
   1. The controlled variable
   2. Manipulated variable
   3. Set point
   4. Actuator
   5. Final control element

(10 Marks)

(b) Describe the criteria used in designing a control loop. **(10 Marks)**

(c) Describe primary and secondary transducers and give one example for each. **(10 Marks)**

[TOTAL MARKS = 40]

QUESTION 2

(a) Write short notes on the following:
   i. Filled thermal systems
   ii. Block diagrams
   iii. Robustness
   iv. Manipulated variables

(b) Indicate what anemometers are used for in a food processing operation and explain their working principle. **(10 Marks)**

[TOTAL MARKS = 30]

QUESTION 3

(a) Indicate the purpose and discuss the working principle of vibration method to measure level. **(10 Marks)**

(b) Name the stages of E-nose signal processing and pattern recognition and describe **one (1)** of them further. **(10 Marks)**

(c) Name the types of electrical pressure transducers and discuss one further. **(10 Marks)**

[TOTAL MARKS = 30]

QUESTION 4

(a) Discuss sequential control using an appropriate example. **(15 Marks)**

(b) Explain how Positive-Displacement flow meters measure flow. **(15 Marks)**

[TOTAL MARKS = 30]