UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAM	:	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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QUESTION 1 [COMPULSORY]

(a) A particulate food is dried using fluidized bed dryer by blowing hot air through perforated floor of the dryer. A motor drives the blower at the required speed to regulate the hot air flow rate. A control loop is in place to attain the right moisture content of the product by measuring the temperature of the exhaust air.

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

ii. For the drying system identify:
   1. The controlled variable
   2. Manipulated variable
   3. Actuator
   4. Final control element

(8 Mark)

(b) Discuss the advantages of feed-forward control strategy and give an example food processing operation (unit) where such a control strategy could be used. **(12 Marks)**

(c) Mention **five (5)** factors to be considered while selecting transducers based on their handling. **(10 Marks)**

[TOTAL MARKS = 40]

QUESTION 2

(a) Explain the following; **(15 Marks)**
   i. Robustness
   ii. Tuning
   iii. Settling time
   iv. Disturbances
   v. Set point

(b) Explain how bimetallic strip thermometer works and suggest how it could be used (integrated) in a food processing operation for automation and control **15 Marks)**

[TOTAL MARKS = 30]

QUESTION 3

(a) Explain how time-of-flight method is used to measure level. **(10 Marks)**

(b) Describe the working principle of capacitor pressure-sensing transducer and give an example of food processing operation where this transducer can be used. **(10 Marks)**

(c) Briefly state the reasons for automation. **(10 Marks)**

[TOTAL MARKS = 30]

QUESTION 4

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

(b) Describe the operation of a proportional control and outline its advantages over on-off control. **(15 Marks)**

[TOTAL MARKS = 30]