



2ND SEM. 2012/13

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FSNT 410 (M)**

**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. ILLUSTRATE YOUR
ANSWERS WITH DIAGRAMS WHERE NEEDED**

**DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN GRANTED BY
THE CHIEF INVIGILATOR**

QUESTION 1 [COMPULSORY]

- (a) Milk is concentrated using an evaporator. Steam flowing through a pipe regulated by a valve is used as the heat source. The control objective is to secure the correct concentration of milk by controlling the dilute milk flow rate. With the help of a sketch (block diagram) describe how control is achieved by automatic feed-forward closed-loop control structure. **(10 Marks)**
- (b) Outline the objectives of process control. **(10 Marks)**
- (c) Discuss the advantages and disadvantages of feedback and feed-forward control strategies. **(10 Marks)**
- (d) Mention **five (5)** factors to be considered while selecting transducers based on their performance. **(10 Marks)**

[TOTAL MARKS = 40]

QUESTION 2

- (a) Explain the following; **(15 Marks)**
- i. Controlled variables
 - ii. Manipulated variables
 - iii. Uncontrolled variables
 - iv. Disturbances
 - v. Set point
- (b) Describe self generating and variable transducers and give two examples for each. **(10 Marks)**
- (c) Describe the function of an actuator and give a brief explanation on the different actuator types. **(5 Marks)**

[TOTAL MARKS = 30]

QUESTION 3

- (a) Explain the following; (10 Marks)
- i. Amplification
 - ii. Linearization
 - iii. Event-based sequential control
 - iv. Time-based sequential control
 - v. Proportional control
- (b) Describe the principles and unique features of infrared thermometry. (10 Marks)
- (c) Mention the types of control tuning and outline the purpose of control loop tuning. (10 Marks)

[TOTAL MARKS = 30]

QUESTION 4

- (a) List electrical level measurement techniques and describe any one in detail. (15 Marks)
- (b) Explain the role of actuators and final control elements and give an example in food processing industry. (15 Marks)

[TOTAL MARKS = 30]