

**UNIVERSITY OF SWAZILAND  
FACULTY OF SCIENCE  
DEPARTMENT OF ELECTRONIC ENGINEERING**

**MAIN EXAMINATION MAY 2008**

**TITLE OF PAPER: INDUSTRIAL ELECTRONICS**

**COURSE CODE: EIN520**

**TIME ALLOWED: THREE HOURS**

**INSTRUCTIONS:**

1. Answer question **one** (1) and any other three questions.
2. Each question carries 25 marks.
3. Marks for different sections are shown in the right-hand margin.

This paper has 6 pages including this page.

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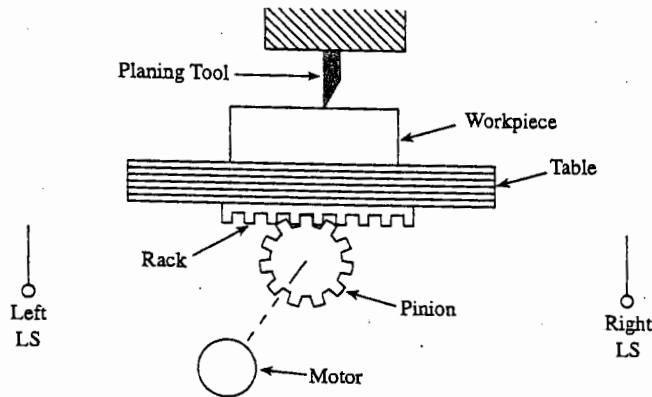
**Question 1**

- a) In developing a program for Programmable Logic Controllers, a systematic design technique involves same steps regardless of whatever type of a programming language one may chose to use. List five step you would follow to develop a program. [ 10 marks]
- b) How do you tell the differences between HMI and SCADA applications. [ 10 marks]
- c) Under what condition can SCADA not be used and why? [ 5 marks]

**Question 2**

A physical appearance of an oscillating planer is shown in Figure 2. When a workpiece is mounted on the table and an “in position” contact closes. The operator pushes the start push button switch to start the planer, then the table moves back and forth by a reversing motor while the planing tool remains stationary. When the table moves to the extreme right, it contacts the right limit switch “Right LS”, which signals the control circuit to reverse the motor and run to the left; when it moves to the extreme left it contacts left limit switch “Left LS” which signals the control circuit to run the motor to the right. This operation continues until the operator is satisfied that the planing is complete, the stop switch is then pushed to stop the table.

Draw a control circuit of this oscillating planer when implemented with negative edge-triggered clocked RS flip-flops. [ 25 marks ]



**Figure 2**

**Question 3**

A pulse-width modulation giving out an output with a period of 30ms at 50% duty cycle is required to control a small motor.

Design a 555 timer oscillator with a 12 V supply that can be part of this PWM [25 marks]

#### **Question 4**

A temperature transducer gives an output of  $10 \text{ mV/}^\circ\text{C}$ . If the transducer is to be used to measure temperature which ranges from  $10^\circ\text{C}$  to  $120^\circ\text{C}$  then

- a) Show that an 8-bit A/D converter with a 5 volts full scale input can not be used to produce a  $1^\circ\text{C}$  resolution.
- b) Provide a solution for implementing this transducer with the specified A/D convertor.

[25 marks]

**Question 5**

In signal transmission, voltage can vary from point to point in a circuit loop, but it is impossible for current to vary within a loop.

- (a) Draw a circuit showing current as a signal-transmission variable. Label all the variables and parameters. [10 marks]
- (b) Draw a simple circuit for converting current back to voltage. [ 5 marks]
- (c) Name and explain five functions commonly performed by op amps? [10marks]