Uva Wellassa University, Sri Lanka
End Semester Examination – July 2010
ENG 403-2 Industrial Automation

Time: Two (02) hours

Total 04 Questions
Answer **All** Questions

01)

I. Explain operation of the relay and its applications.

(10 marks)

II. Explain following terms for a relay

a) Normally open contact
b) Normally closed contact
c) Single pole single throw
d) Single pole double throw
e) Double pole double throw

(30 marks)

III. What are the factors that need to consider when selecting an appropriate relay for a particular application?

(10 marks)

IV. Explain importance of using permissive and interlock circuits in a relay control circuit.

(20 marks)

V. Draw and explain the ladder logic diagram for a single phase motor starter with interlocks, overload protection and forward, reverse control.

(30 marks)

02)

I. Explain why different sensors are needed to automate an industrial process.

(10 marks)

II. Define following terms for an industrial sensor.

a) Accuracy
b) Resolution
c) Repeatability
d) Range
e) Sensitivity
f) Linearity

(20 marks)

III. What are the applications and use of

a) Mechanical proximity sensor
b) Optical proximity sensor
c) Inductive proximity sensor
d) Capacitive proximity sensor

(30 marks)

IV. Explain which sensor is most appropriate for the following applications. Give reasons for you selection.

a) To count number of glass bottles passing on a conveyor belt
b) To detect cardboard boxes passing on a conveyor belt
c) To measure the water level in a water tank
d) To measure the speed of a DC motor
e) To detect unauthorized access to a room

(30 marks)

V. Explain difference between "Sinking output sensor" and "sourcing output sensor".

(10 marks)

03)

I. Explain advantages of Program Logic Controller (PLC) over relay control circuits.

(10 marks)

II. Using block diagram, explain main parts of a Program Logic Controller.

(20 marks)

III. Describe the basic step of operation of a PLC after it turns on.

(20 marks)

IV. Explain what will happen if the scan time of a PLC is greater than the time for an input pulse.

(10 marks)

V. For the following problem design a ladder logic circuit to use in a basic PLC. Use only input, output relays and timers.

Problem: A conveyor is run by switching on or off a motor. An operator is removing cardboard boxes running on the conveyor belt. An optical sensor is used to detect boxes. The conveyor belt should stop after 1.5 seconds optical sensor detected a box .After a delay of 2 seconds (After the operator removed the box) the conveyor will start again. The system must have a start and stop buttons and a light should be on when the system is active.

(40 marks)

04)

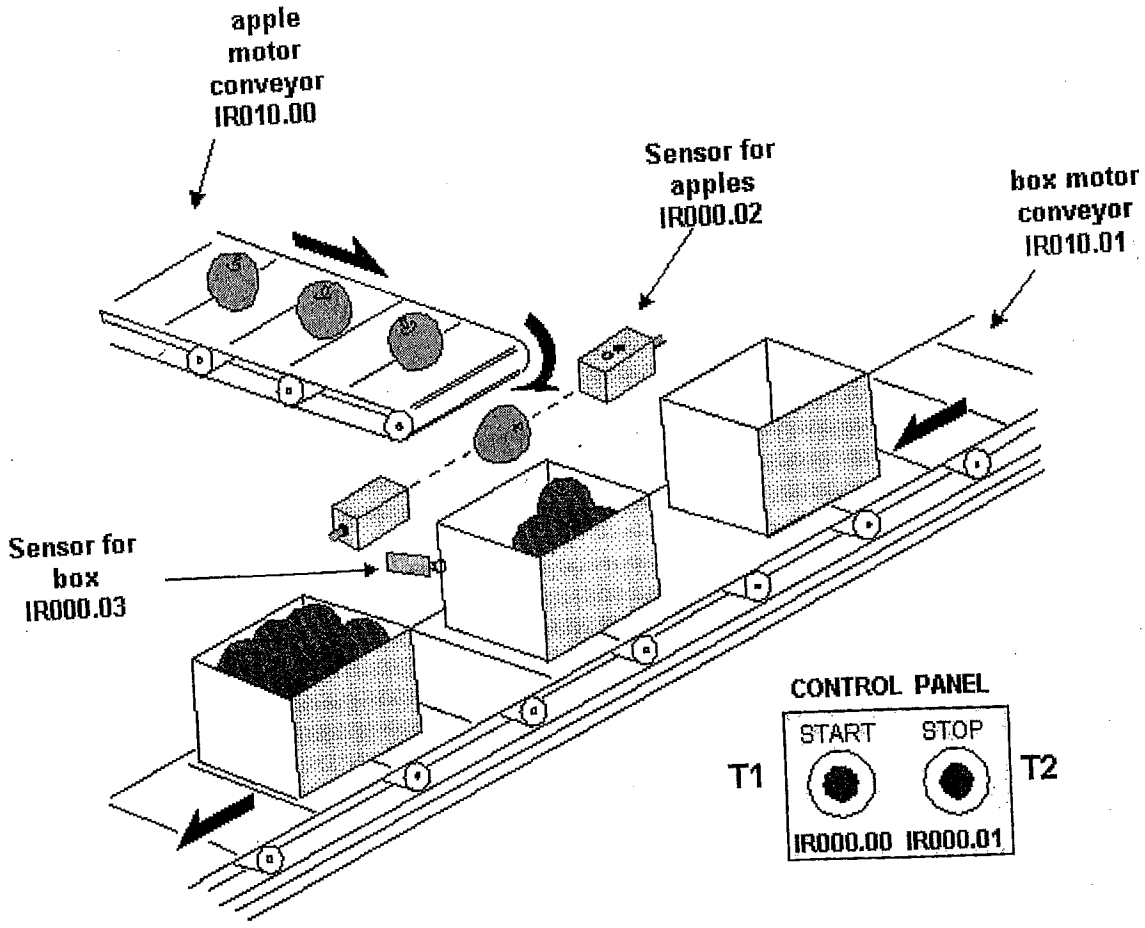
I. What are the main advantages of industrial process automation?

(10 marks)

II. What are the factors that need to consider when designing automation system for a process? How do you decide "whether to automate" or "not to automate" the process?

(20marks)

III. Design a ladder diagram to use in a basic PLC for the following automation problem.



Problem:

Above diagram describes an automated packaging system. By pushing START key, the motor of the conveyor for boxes is activated. The conveyor takes a box up to the limit switch, and the conveyor belt motor stops. When a box is detected, the conveyor with apples starts moving and starts to fill box with apple. An optical beam sensor is used to count number of apples that fill the box. When the box is filled with 10 apples the box starts to move again. By using the stop button complete process can be stopped.

(70marks)