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## TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

DIPLOMA IN MEDICAL ENGINEERING

EEP 2350: PROGRAMMABLE LOGIC CONTROLLERS

END OF SEMESTER EXAMINATION

**SERIES:APRIL2016**

**TIME:2HOURS**

**DATE:15May2016**

**Instructions to Candidates**

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

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## Question ONE

a) Distinguish between the following control systems;

- (i) Open loop
- (ii) Closed loop

**(4mks)**

b) With an aid of a truth table and ladder diagrams describe the following logic functions.

- i) Ex-NOR
- ii) NAND

**(10mks)**

c) i) With the aid of a single line diagram, explain the operation a three phase a.c motor controlled by a direct on line starter having overload and remote start – stop button.

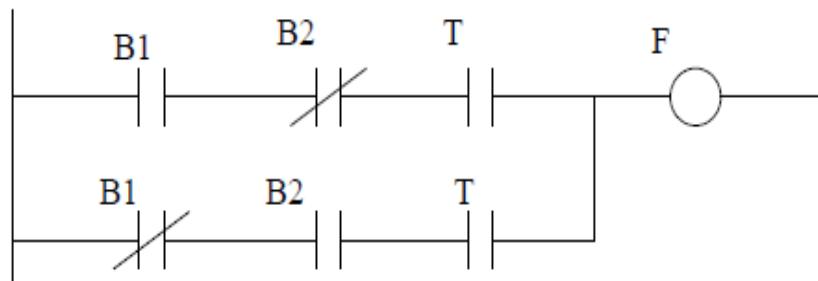
- ii) Implement the control circuit of c i) using ladder diagram. **(12mks)**

- iii) State the four advantages of programmable logic controller over a relay control panel.

**(4mks)**

## Question TWO

a) With the aid of the Fig 1 diagram, implement it's instruction list program



**Fig 1**

**(7mks)**

b) With an aid of a ladder diagram describe the operation of a latch circuit. **(6mks)**

c) With an aid of a circuit diagram, describe the operation of a series voltage regulator.

**(7mks)**

### **Question THREE**

- a) State any three rules that must be observed when carrying out ladder programming. **(3mks)**
- b) With the aid of a block diagram describe functions of each block of an analogue process control system. **(8mks)**
- c) Derive a minimized logic expression to control an a.c. servo motor whose operation depends on three input variables A, B and C. The conditions for the motor to operate are; any two inputs variables are present but not three. B is present. Implement its operation using logic gates hence realize its ladder diagram **(9mks)**

### **Question FOUR**

- a) i) State any four reasons for use of automatic control system.
- ii) A proportional controller with scale 0-10V, corresponds to 0 -100% output. If  $R_2 = 10\text{K}\Omega$  and full scale error range is 10V, find the values of  $V_0$  and  $R_1$  to support 20% proportional band about 50% zero error controller output. **(10mks)**
- b) With an aid of a block diagram describe the function of each block of direct digital control for industrial processes **(10mks)**

### **Question FIVE**

- a) i) State the four advantages of digital controllers **(4mks)**
- ii) Draw a circuit diagram to describe the operation of pulse width modulation Inverter. **(6mks)**
- b) Draw a block diagram of programmable logic controller hence describe the function of each block **(10mks)**