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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: APRIL 2016**

**TIME: 2 HOURS**

**DATE: 15 May 2016**

**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)

- i) Relay
- ii) Contactor

(4mks)

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

- i) Ex-OR
- ii) NOR

(10mks)

c)i) Draw a ladder diagram to represent the operation of Fig 1.

ii) Deduce the truth table of Fig 1, hence name the logic gate which realizes the operation.

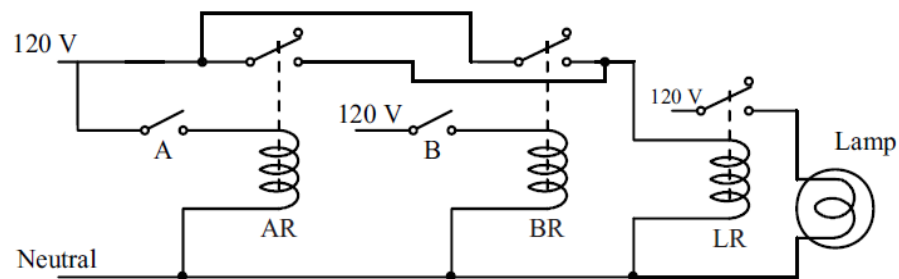


Fig 1.

(12mks)

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

(4mks)

## Question TWO

a) Draw ladder diagram of Fig 2, below.

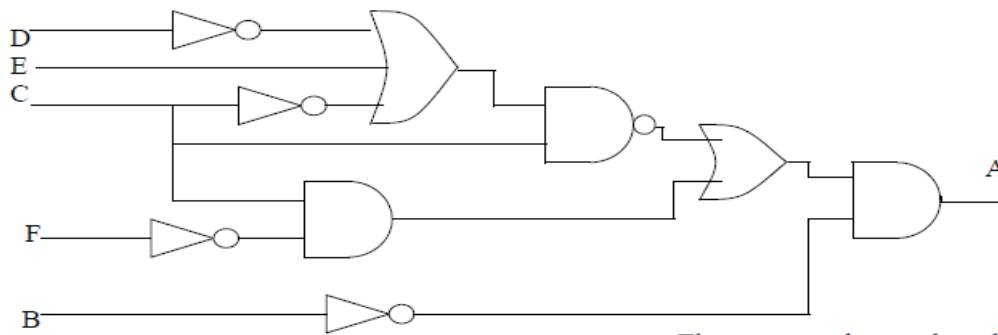


Fig 2.

(7mks)

b)i) With an aid of a ladder diagram describe the operation of a backed battery circuit.

(6mks)

ii) With an aid of a circuit diagram, describe the operation of a series current 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 a digital process controller.

(8mks)

c) With an aid of a canonical block diagram of a system, show that the primary feedback signal is given by  $\frac{B}{R} = \frac{GH}{1 \pm GH}$

(9mks)

## Question FOUR

a) i) State any four characteristics of a closed loop control system.

ii) A proportional controller with scale 0-10V, corresponds to 0 -100% output. If  $R_2 = 10K\Omega$  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 a computer Supervisory control for industrial processes. (10 marks)

## Question FIVE

a) Draw a block diagram of programmable logic controller hence describe the Function of each block. **(10 marks)**

b) Draw a ladder diagram for the instruction list program in Table 1.

**Table1.**

| ADDRESS | INSTRUCTION | DATA |
|---------|-------------|------|
| 0       | LOAD        | X400 |
| 1       | OR          | C461 |
| 2       | RESET       | C460 |
| 3       | K           | 6    |
| 4       | LOAD        | X401 |
| 5       | OUT         | C460 |
| 6       | LOAD        | C460 |
| 7       | OUT         | Y430 |
| 8       | LOAD        | X400 |
| 9       | OR          | C461 |
| 10      | RESET       | C461 |
| 11      | K           | 12   |
| 12      | LOAD        | X401 |
| 13      | AND         | C460 |
| 14      | OUT         | C461 |
| 15      | END         |      |

**(10mks)**