



**KIBABII UNIVERSITY COLLEGE**

**(constituent college of MMUST)**

**UNIVERSITY EXAMINATIONS**

**2014/2015 ACADEMIC YEAR**

**THIRD YEAR FIRST SEMESTER EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE (COMPUTER SCIENCE)**

**COURSE CODE: CSC 353E**

**COURSE TITLE: Digital System Design**

**DATE 6<sup>TH</sup> MAY 2015**

**TIME: 3.00-5.00PM**

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**INSTRUCTIONS**

- Answer **QUESTION ONE** and attempt **ANY OTHER TWO** questions from the following five questions

### Question One ( 30 marks)

- a) Some of the common operations that digital designers wish to perform are listed below. ,  
For each, identify a common MSI device that could apply. 6 marks
- (b) For a Guillotine machine is an example of an interlock machine, for it to operate safely; it is required that the operator should press two switches that are apart using ,both hands while simultaneously pressing a foot switch. LED and Photodetector are so, aligned that in case he bends over into the path of the guillotine he obstructions , stopping the guillotine .
- (i) Define suitable logic expression for the safe operation of guillotine. 2 marks
- (ii) Use a universal gate to implement the operation 4 marks
- ( c) Compare the Mealy and Moore Machines 4 marks
- (d) Describe the basic building block of (state Machine) Chart 6 marks
- (e) Discuss the two types of control unit design 8 marks
- (f) Distinguish between combination and sequential circuits 2 marks

### Question Two 20 marks

Maintaining control over the bus sources, to assure only one talker at a time, is very much a concern of the designer of the bus. Illustrate the use of four control mechanisms, listed below for Bus access.

- i. multiplexer
- ii. OR gates
- iii. Open-collector gates
- iv. Three-state outputs.

### Question Three (20 marks)

- (a) Wafula has several standard logic gates and is thinking of constructing a circuit to add binary bits. Using a truth table and logic minimization and a schematic diagram illustrate how this can be done.  
8 marks
- (b) Illustrate how Wafula synthesis a ALU what of his solution in (a) Above 8 marks
- (c) When tries to increase the number of bits he realises that system is slowing down. Suggest a possible flaw and remedy to his design. 4 marks

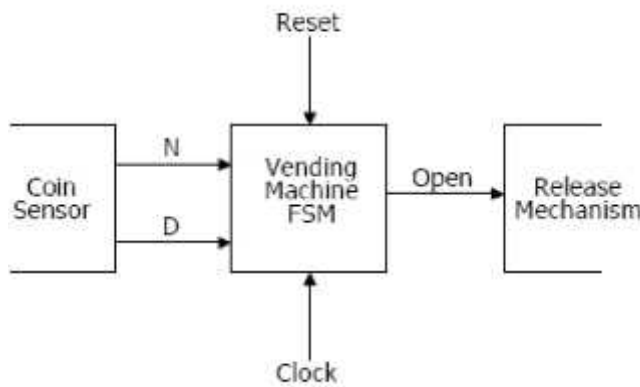
### Question Four (20 marks)

- (a) With aid of a circuit diagram and truth table illustrate the operation of 3 inputs TTL NAND gate. 4 marks

- (b) Illustrate any two problems associated with the totem pole output 4 marks
- (c) You have designed a digital system that has been implemented in Maji Moto Computing Ventures. However the system is faulty. Discuss techniques and tools that you could use troubleshooting the system 12 marks

**Question Five (20 marks)**

- (a) Figure 1 below shows a vending machine that releases an item after insertion of 15 cents. it has single slot, nickel, dime. Nickel has value of five cents while a dime has value of ten cent.



**Figure 1: Vending Machine**

- i. Provide an abstraction for the scenario involves probable input sequence, state diagram and assumption 4 marks
- ii. Minimise the number of states 3 marks
- iii. Uniquely encode states 2 marks

(b) Table 1 address map of various memory chips in digital system. Using the table

	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	
0000-03FF	0	0	0	0	0	0	Chip address									ROM1	
0400-07FF	0	0	0	0	0	1	Chip address									ROM2	
0800-0BFF	0	0	0	0	1	0	Chip address									ROM3	
0C00-0CFF	0	0	0	0	1	1	0	0	Chip address							RAM1	
0D00-0DFF	0	0	0	0	1	1	0	1	Chip address							RAM2	
0E00-0EFF	0	0	0	0	1	1	1	0	Chip address							RAM3	
0F00-0FFF	0	0	0	0	1	1	1	1	Chip address							RAM4	

To deduce the address lines to select:

- i) A valid memory address  
The address line A12 to A15 must be logical 0
- ii) RAM OR ROM  
When  $A_{10} = A_{11} = 1$  ram address otherwise ROM
- iii) A specific ROM device  
Specific rom device is determine by the address of A10 and A11
- iv) A specific RAM device  
RAM device by A9 and A8
- v) A location within a specific ROM  
A0 to A9
- vi) A location within a specific RAM A0 to A7

11 marks