



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FOURTH YEAR EXAMINATION FOR BACHELOR OF SCIENCE IN ELECTRICAL
AND ELECTRONICS ENGINEERING

SPECIAL/SUPPLEMENTARY EXAMINATION

EEE 406: MICROPROCESSOR SYSTEMS AND APPLICATIONS

DATE: 31/8/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS.

Answer **QUESTION ONE** and **any other TWO**.

QUESTION ONE (COMPULSORY) (30 MARKS)

- (a) Consider the following assembly program written in 8086 emulator which adds two byte numbers (DATA1 AND DATA2) and stores the result in SUM located at offset 0010H.

```
.MODEL SMALL
.STACK 64

.DATA
DATA1 DB 52H
DATA2 DB 29H
SUM DB ?

.CODE
MAIN PROC
    MOV AX, @DATA
    MOV DS, AX
    MOV AX, 0000H
    MOV AL, DATA1
    MOV BL, DATA2

    ADD AL, BL
    MOV SUM, AL

    MOV AX, 4C00H
    INT 21H

MAIN ENDP
END MAIN
```

Identify the values of all registers for each instruction as shown in Table 1 below.(10 marks)

Table 1. 8086 Registers Values

Instruction Register	1	2	3	...	N
AX					
BX					
DS					
CS					
IP					

- (b) In the real mode addressing, Identify the starting and ending memory addresses of segment located by the following segment register values:- (8 marks)
- DS = 1000H
 - SS = 2345H
 - CS = E000H
 - ES = AB0FH
- (c) What is wrong with the following instructions: (5 marks)
- ADD AL, AX
 - ADC CS, DS
 - INC [BX]
 - ADD [AX], [BX]
 - INC SS
- (d) Write a sequence of assembly instructions that divide the number in BL by the number in CL and then multiplies the result by 2. The final answer must be a 16-bit number stored in the DX register. (7 marks)

QUESTION TWO (20 MARKS)

- (a) Draw the block diagram of the 8086 microprocessor architecture. (5 marks)
- (b) Assume that DS = 4500, SS = 2000, BX = F000, SI = 3000 and AX = 2512. Show the exact physical memory location where AX is stored in each of the following. All values are in hex.
 MOV [BX+20], AX
 MOV [BX+SI], AX (5 marks)
- (c) Develop a short sequence of instructions that adds two thirty two bit numbers (FE432211H and D1234EF1H) with the sum appearing in BX-AX. (5 marks)

- (d) Data transfer in a microprocessor can be classified as Microprocessor controlled or Device Controlled like DMA. Microprocessor controlled data transfer can further be divided into two categories namely; Programmed I/O and Interrupt Driven I/O. Explain what you understand by Programmed I/O and Interrupt Driven I/O data transfer. (5 marks)

QUESTION THREE (20 MARKS)

- (a) What are the features of 80386? (5 marks)
- (b) Draw the interfacing diagram of 80286. (6 marks)
- (c) The original contents of AX, BL, word-sized memory location SUM, and carry flag CF are 1234H, ABH, 00CDH, and 0H, respectively. Describe the results of executing the following sequence of instructions:

ADD AX, [SUM]

ADC BL, 05H

INC WORD PTR [SUM] (6 marks)

- (d) What is an instruction pointer? (3 marks)

QUESTION FOUR (20 MARKS)

- (a) Differentiate between microprocessor and microcontroller? (4 marks)
- (b) What is REP prefix? Explain how it functions for string instructions? (3 marks)
- (c) A microcomputer is defined as a stand-alone system based on a microprocessor. A stand-alone system is one that is able to operate without additional equipment. Draw a block diagram of a simple microcomputer. (5 marks)
- (d) There are two types of microcomputers: the general purpose digital microcomputer and the embedded microcomputer. Explain the differences between two. (4 marks)
- (e) The microprocessor performs a large number of functions. List at least four of them. (4 marks)

QUESTION FIVE (20 MARKS)

- (a) Write an assembly program in 8086 where 32 8-bit numbers are stored in consecutive address with the first number at offset address 8100H. The program counts how many of these 32 numbers are equal to zero, and stores this count in the offset address 8200H. (7 marks)
- (b) There are some key things about Intel assembly language syntax. Kindly identify them. (6 marks)
- (c) Explain what Direct Memory Access is as well as the different DMA transfer combinations available in the 8086 microprocessor. (7 marks)