TECHNICAL UNIVERSITY OF MOMBASA

School of Engineering and Technology

Department of Electrical and Electronic Engineering

UNIVERSITY EXAMINATION FOR:

Bachelor of Science in Electrical and Electronic Engineering

EEE 4407: Microprocessor II

END OF SEMESTER EXAMINATION

SERIES: MARCH 2025

TIME: 2 HOURS

DATE: Pick DateSelect MonthPick Year

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 any THREE Questions.

Do not write on the question paper.

Question ONE

a) Differentiate between a laptop computer system and a microcontroller system [4 marks]

b) Explain the difference between an assembler directive and an assembly instruction [4 marks]

c) Assuming that the following code has been executed.

```
movlw 2f
addlw 55
```

i) Specify the condition of the following three status flags: C; DC, Z

ii) The binary content of the working register

[7 marks]

d) Write an assembly language program to add the literal h'64' to the contents of File h'30' and store the result in File h'40'. State the highest sum this routine can be accomplish. [6 marks]

e) Suppose STATUS register has 0x10, determine which bank is selected [2 marks]

f) Explain the purpose of executing the following instructions:

```
movlw b'11110000'
movwf trisb
```

[3 marks]

g) Briefly detail the advantages and disadvantages of a modular approach to writing software, using subroutines to illustrate your answer. [4 marks]

Question TWO

a) Outline the process for the Intel 8085 non-vectored interrupt process [6 Marks]

b) Table Q2 (b) is an Intel 8085 assembly language program.

i) Determine the vector location for the second instruction in the program

ii) State the op code that will almost be found in this location

Table Q2 (b)

```
LXI H, 4000H
RST 5
MOV C, A
```

[2 Marks]

c) Intel 8085 microprocessor reads 100 bytes per second from a peripheral device. With the programmed input, determine the time is the CPU wasting. (Assume a 3-MHz clock). [6 Marks]

d) Fig Q2 (d) shows one of the techniques used for data transfer incorporating a microprocessor system. Write a program that transfers 256 bytes from addresses 8000H to 80FFH to a peripheral device using the handshaking. [6 Marks]

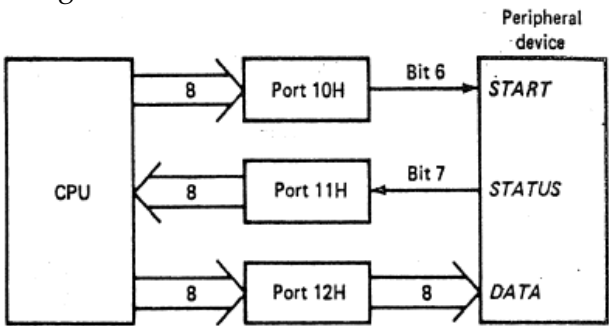

Figure Q2(d)

Question THREE

a) With the aid of a diagram and waveforms, explain an interrupt – driven input circuits that handshakes with port A of an Intel 8156 PIO [9 Marks]

b) The system clock in Figure Q3 (b) is connected to the TIMER IN input of the Intel 8156. The clock has a frequency of 3 MHz. Show a program segment to produce a continuous square wave with a frequency of 1 kHz. Include a start timer command, disable the port interrupts, make B and C output ports, and make A, an input port

[11 Marks]

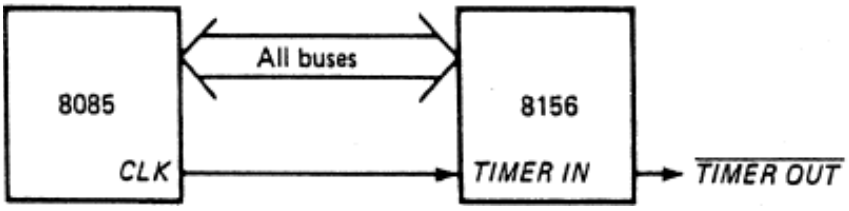

Figure Q3 (d)

Question FOUR

a)
(i) State any THREE advantages of subroutines in assembly language programming
(ii) State the THREE functions of an input/output interface circuit

[6 Marks]

b) With the aid of diagram explain the process of polled input/output operation.

[4 Marks]

c) State the role of the stack in PIC16F84 microcontroller as used during the execution of subroutines. [2 marks]

d) The following code has an infinite loop, explain why and provide a remedy.

```
        MOVLW   10
        MOVWF   PORTB
LOOP:   DECFSZ  PORTB, W
        GOTO    LOOP
```

[6 Marks]

Question FIVE

a) For the program Table Q5(a),
i) Determine the delay in the following loop if the clock period is 0.25μs
ii) Determine the number of memory locations required to store the program

Table Q5(a)

Label	Mnemonic	T-states
	LXI D, 22FF H	10
LOOP	DCX D	6
	XTHL	16
	XTHL	16
	NOP	4
	NOP	4
	MOV A, E	4
	JNZ LOOP	10/7

[5 Marks]

b)
i) Write a program that multiplies decimal 14 and 9 including a JZ instruction.
ii) Modify the program in (i) by using a JNZ instruction only.
iii) Hand-assemble the program in (ii) starting at address 3000H.
iv) Change the multiplication part of the program in (iii) into a subroutine memory located at starting at address FF06H.

v) Write a program that utilizes the subroutine to multiply any two 8-bit numbers.

[15 Marks]

8085A CPU INSTRUCTIONS IN OPERATION CODE SEQUENCE

Table 5-2

OP CODE	MNEMONIC		OP CODE	MNEMONIC		OP CODE	MNEMONIC		OP CODE	MNEMONIC		OP CODE	MNEMONIC		OP CODE	MNEMONIC		OP CODE	MNEMONIC	
00	NOP		28	DCX	H	56	MOV	D,M	81	ADD	C	AC	XRA	H	D7	RST	2			
01	LXI	B,D16	2C	INR	L	57	MOV	D,A	82	ADD	D	AD	XRA	L	D8	RC				
02	STAX	B	2D	DCR	L	58	MOV	E,B	83	ADD	E	AE	XRA	M	D9	–				
03	INX	B	2E	MVI	L,D8	59	MOV	E,C	84	ADD	H	AF	XRA	A	DA	JC	Adr			
04	INR	B	2F	CMA		5A	MOV	E,D	85	ADD	L	B0	ORA	B	DB	IN	D8			
05	DCR	B	30	SIM		5B	MOV	E,E	86	ADD	M	B1	ORA	C	DC	CC	Adr			
06	MVI	B,D8	31	LXI	SP,D16	5C	MOV	E,H	87	ADD	A	B2	ORA	D	DD	–				
07	RLC		32	STA	Adr	5D	MOV	E,L	88	ADC	B	B3	ORA	E	DE	SBI	D8			
08	–		33	INX	SP	5E	MOV	E,M	89	ADC	C	B4	ORA	H	DF	RST	3			
09	DAD	B	34	INR	M	5F	MOV	E,A	8A	ADC	D	B5	ORA	L	E0	RPO				
0A	LDAX	B	35	DCR	M	60	MOV	H,B	8B	ADC	E	B6	ORA	M	E1	POP	H			
0B	DCX	B	36	MVI	M,D8	61	MOV	H,C	8C	ADC	H	B7	ORA	A	E2	JPO	Adr			
0C	INR	C	37	STC		62	MOV	H,D	8D	ADC	L	B8	CMP	B	E3	XTHL				
0D	DCR	C	38	–		63	MOV	H,E	8E	ADC	M	B9	CMP	C	E4	CPO	Adr			
0E	MVI	C,D8	39	DAD	SP	64	MOV	H,H	8F	ADC	A	BA	CMP	D	E5	PUSH	H			
0F	RRC		3A	LDA	Adr	65	MOV	H,L	90	SUB	B	BB	CMP	E	E6	ANI	D8			
10	–		3B	DCX	SP	66	MOV	H,M	91	SUB	C	BC	CMP	H	E7	RST	4			
11	LXI	D,D16	3C	INR	A	67	MOV	H,A	92	SUB	D	BD	CMP	L	E8	RPE				
12	STAX	D	3D	DCR	A	68	MOV	L,B	93	SUB	E	BE	CMP	M	E9	PCHL				
13	INX	D	3E	MVI	A,D8	69	MOV	L,C	94	SUB	H	BF	CMP	A	EA	JPE	Adr			
14	INR	D	3F	CMC		6A	MOV	L,D	95	SUB	L	C0	RNZ		EB	XCHG				
15	DCR	D	40	MOV	B,B	6B	MOV	L,E	96	SUB	M	C1	POP	B	EC	CPE	Adr			
16	MVI	D,D8	41	MOV	B,C	6C	MOV	L,H	97	SUB	A	C2	JNZ	Adr	ED	–				
17	RAL		42	MOV	B,D	6D	MOV	L,L	98	SBB	B	C3	JMP	Adr	EE	XRI	D8			
18	–		43	MOV	B,E	6E	MOV	L,M	99	SBB	C	C4	CNZ	Adr	EF	RST	5			
19	DAD	D	44	MOV	B,H	6F	MOV	L,A	9A	SBB	D	C5	PUSH	B	F0	RP				
1A	LDAX	D	45	MOV	B,L	70	MOV	M,B	9B	SBB	E	C6	ADI	D8	F1	POP	PSW			
1B	DCX	D	46	MOV	B,M	71	MOV	M,C	9C	SBB	H	C7	RST	0	F2	JP	Adr			
1C	INR	E	47	MOV	B,A	72	MOV	M,D	9D	SBB	L	C8	RZ		F3	DI				
1D	DCR	E	48	MOV	C,B	73	MOV	M,E	9E	SBB	M	C9	RET	Adr	F4	CP	Adr			
1E	MVI	E,D8	49	MOV	C,C	74	MOV	M,H	9F	SBB	A	CA	JZ		F5	PUSH	PSW			
1F	RAR		4A	MOV	C,D	75	MOV	M,L	A0	ANA	B	CB	–		F6	ORI	D8			
20	RIM		4B	MOV	C,E	76	HLT		A1	ANA	C	CC	CZ	Adr	F7	RST	6			
21	LXI	H,D16	4C	MOV	C,H	77	MOV	M,A	A2	ANA	D	CD	CALL	Adr	F8	RM				
22	SHLD	Adr	4D	MOV	C,L	78	MOV	A,B	A3	ANA	E	CE	ACI	D8	F9	SPHL				
23	INX	H	4E	MOV	C,M	79	MOV	A,C	A4	ANA	H	CF	RST	1	FA	JM	Adr			
24	INR	H	4F	MOV	C,A	7A	MOV	A,D	A5	ANA	L	D0	RNC		FB	EI				
25	DCR	H	50	MOV	D,B	7B	MOV	A,E	A6	ANA	M	D1	POP	D	FC	CM	Adr			
26	MVI	H,D8	51	MOV	D,C	7C	MOV	A,H	A7	ANA	A	D2	JNC	Adr	FD	–				
27	DAA		52	MOV	D,D	7D	MOV	A,L	A8	XRA	B	D3	OUT	D8	FE	CPI	D8			
28	–		53	MOV	D,E	7E	MOV	A,M	A9	XRA	C	D4	CNC	Adr	FF	RST	7			
29	DAD	H	54	MOV	D,H	7F	MOV	A,A	AA	XRA	D	D5	PUSH	D						
2A	LHLD	Adr	55	MOV	D,L	80	ADD	B	AB	XRA	E	D6	SUI	D8						

D8 = constant, or logical/arithmetic expression that evaluates to an 8-bit data quantity.

D16 = constant, or logical/arithmetic expression that evaluates to a 16-bit data quantity.

Adr = 16-bit address.