MICROPROCESSOR & MICROCONTROLLER
(ELEC 3202)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Stack Pointer in 8085 microprocessor is an
(a) 8 bit register (b) 16 bit register
(c) 32 bit register (d) 4 bit register

(ii) The first machine cycle of an instruction is always
(a) Memory read cycle (b) An opcode fetch cycle
(c) I/O read cycle (d) Memory write cycle

(iii) What will be the value of accumulator in Intel 8085 microprocessor after execution of the following instructions?
MVI A, 59H
ADI 05H
DAA
(a) 5EH (b) 64H (c) 01H (d) 46H

(iv) Which interrupt will be enabled after execution of the following instructions in Intel 8085 microprocessor?
MVI A, 0EH
SIM
(a) RST6.5 (b) RST5.5 (c) RST7.5 (d) INTR

(v) How many pins are there in Port A of 8255A PPI?
(a) 8 (b) 16 (c) 4 (d) 2

(vi) For an I/O operation, Port B of 8255A can be used for the following modes:
(a) only mode 0 (b) either mode 0 or mode 1
(c) only mode 2 (d) any of mode 0, mode 1, mode 2

(vii) In 8051 microcontroller range of bit addressable area in internal RAM is
(a) 20H-2FH (b) 00H-7FH (c) 80H-FFH (d) 00H-FFH

(viii) Which of the following instructions will give an error in an 8051 microcontroller?
(a) MOV A, DPTR (b) MOV A, R0
(c) MOV R1, DPL (d) MOV R2, A

(ix) Which two bits are supposed to be analysed / tested for unity value (1) in SCON for the reception of byte in mode 1 serial communication?
(a) RI & TI (b) RI & REN (c) REN & RB8 (d) TI & RB8

(x) How many data lines are there in a 16*2 alphanumeric LCD?
(a) 1 (b) 4 (c) 8 (d) 16.

Fill in the blanks with the correct word

(xi) The number of T states required to execute MOV A, B is _____.

(xii) The instruction of 8085 microprocessor which rotates the bits of the accumulator contents left by one position through carry flag is _____.

(xiii) The BSR control word 00000010 will reset bit _____.

(xiv) The address range of SFR register bank in 8051 microcontroller is _____.

(xv) The instruction to store F4 H data into accumulator of 8051 microcontroller using immediate addressing mode is _____.

Group - B

2. (a) Sketch and explain the timing diagram of the instruction MVI A, 45^{H}.
[(CO1)(Understand/LOCQ)]

(b) Explain the role of the following registers related to 8085 microcontroller:
(i) Accumulator, (ii) Program counter, and (iii) Instruction register.
[(CO1)(Apply/IOCQ)]

(c) Evaluate the time required by the 8085 microprocessor to execute the instruction STA $FFF9^{H}$. Consider a crystal frequency of 6 MHz. *[(CO1)(Evaluate/HOCQ)]*

4 + 5 + 3 = 12

3. (a) Define the following instructions related to Intel 8085 microprocessor:
(i) STA D001H (ii) POP B *[(CO1)(Remember/LOCQ)]*

(b) Identify the status of (i) Sign, (ii) Zero, (iii) Auxiliary Carry, (iv) Carry, (v) Parity flags and (vi) Accumulator contents after execution of the following program for Intel 8085 microprocessor.

```
MVI A, 6AH
ADI 9BH
HLT
```
[(CO1)(Apply/IOCQ)]

(c) Suppose two 8-bit BCD numbers are already stored in memory locations F001H and F002H. Develop an Assembly Language Program for an 8085 microprocessor to subtract the smaller BCD number (stored in memory location F001H) from larger BCD number (stored in memory location F002H) and store the result in memory location E100H. *[(CO1)(Create/HOCQ)]*

4 + 4 + 4 = 12

Group - C

4. (a) State the difference between I/O mapped I/O and memory mapped I/O. *[(CO2)(Remember/LOCQ)]*

   (b) Develop an interfacing circuit between an 8 KB EPROM and the 8085 microprocessor employing a NAND gate address decoder. Ensure that the chip is assigned a starting address of $A000^{H}$. *[(CO2)(Analyse/IOCQ)]*

   (c) Create an assembly language program to configure the interrupt mask, enabling RST 5.5 and RST 7.5, and disabling RST 6.5. Additionally, determine the initial content of the accumulator. *[(CO2)(Create/HOCQ)]*

4 + 5 + 3 = 12

5. (a) What will be the control words for 8255A in BSR mode to set bit PC6 and bit PC7 and reset bit PC3 ? *[(CO2)(Remembering/LOCQ)]*

   (b) Explain the control word format of 8255A for I/O mode. *[(CO2)(Evaluate/HOCQ)]*

   (c) Develop an assembly language program for Intel 8085 microprocessor to generate a triangular wave using 8255A. Assume that the address of the control register is 83H and the output device is connected with port B of 8255A and also assume the address of port B is 81H. *[(CO2)(Apply/IOCQ)]*

3 + 4 + 5 = 12

Group - D

6. (a) What are the basic building blocks of 8051 microcontroller? What are its features? *[(CO3)(Remember/LOCQ)]*

   (b) Elaborate bit addressable area within the first 128 bytes of internal RAM. *[(CO3)(Analyse/IOCQ)]*

   (c) Discuss the role of $\overline{\text{PSEN}}$ signal in 8051 microcontroller. *[(CO3)(Evaluate/HOCQ)]*

4 + 5 + 3 = 12

7. (a) Explain the following 8051 microcontroller instructions:
   (i) ADD A, # 23H
   (ii) SJMP rel-addr
   (iii) MOV A, @R0 *[(CO3)(Understand/LOCQ)]*

   (b) Construct an 8051 based assembly language program to generate a square wave of 75% duty cycle of frequency 2 kHz through the pin P1.2 while considering the crystal frequency as 11.0592 MHz. *[(CO3)(Apply/IOCQ)]*

   (c) Conclude the status of CY, OV and AC flags of the 8051 microcontroller, after execution of the following set of instructions.

```
MOV R4, #0D9H
MOV A, # 48H
ADD A, R4
```

[(CO3)(Create/HOCQ)]

4 + 5 + 3 = 12

Group - E

8. (a) Explain the role of each bit of SCON register in the context of serial communication. *[(CO4)(Understand/LOCQ)]*

   (b) Write an Assembly Language Program for the 8051 microcontroller to transmit ten consecutive bytes of data using '9600, N, 8, 1' protocol. Consider a crystal frequency of 11.0592 MHz. *[(CO4)(Apply/IOCQ)]*

   (c) Evaluate the Baud rate of serial data transfer when the crystal frequency is 16 MHz, and value loaded into the TH1 register is (i) $F2^H$, (ii) $F7^H$. *[(CO4)(Evaluate/HOCQ)]*

4 + 5 + 3 = 12

9. (a) Design the interfacing circuit of 8051 microcontroller with 16×2 LCD. *[(CO4)(Create/HOCQ)]*

   (b) Explain the above circuit in detail. *[(CO4)(Understand/LOCQ)]*

   (c) Develop the Assembly Language Program to display 'ELEC' in the LCD of above circuit. *[(CO4)(Apply/IOCQ)]*

3 + 3 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	31.25	41.67	27.08

Course Outcome (CO):

After the completion of the course students will be able to

- CO1: Explain the architecture of 8085 microprocessor and apply the concept of instruction sets to write assembly language program.
- CO2: Acquire knowledge of 8085 interrupt structure and interface read/write and read-only memories, input & output devices with microprocessor.
- CO3: Analyze the internal architecture of 8051 microcontroller and apply the concept of instruction sets to write assembly language program.
- CO4: Understand the interfacing of internal and external program and data memory, different peripheral devices with 8051 microcontroller.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*