MICROPROCESSOR & MICROCONTROLLER
(ELEC 3202)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

    (i)   When DCX H instruction is executed by Intel 8085 microprocessor
           (a) all flags will get affected   (b) no flag will get affected
           (c) only carry flag will get affected   (d) carry and zero flags will get affected.

    (ii)   Name of the 16 bit register(s) in 8085 microprocessor is/are
           (a) Stack pointer   (b) Program counter
           (c) Accumulator   (d) both (a) and (b).

    (iii) The number of address lines required for a 16KB EPROM chip is
           (a) 11   (b) 10   (c) 14   (d) 13.

    (iv)   XCHG instruction in INTEL 8085 microprocessor exchanges the contents of H-L
           register pair with which of the following register pairs?
           (a) PSW   (b) B-C   (c) D-E   (d) Stack Pointer.

    (v)   Which one is the call location of RST7.5 interrupt?
           (a) 003C$_H$ (b) 0036$_H$ (c) 0034$_H$ (d) 0024$_H$.

    (vi)   Which of the following instruction is not possible in Intel 8085 microprocessor?
           (a) POP D   (b) POP B   (c) POP 30H   (d) POP PSW.

    (vii) The register(s) that provides control and status information about counter in
           8051 microcontroller is
           (a) TCON & TMOD   (b) SCON   (c) IP   (d) IE.

    (viii) 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.

(ix) After power on reset, all port latches contain
(a) FF^H (b) 00^H (c) 07^H (d) 20^H.

(x) In 8051 microcontroller, the range of user area/scratchpad area of RAM is
(a) 00^H-7F^H (b) 20^H-2F^H (c) 00^H-FF^H (d) 30^H-7F^H.

Group- B

2. (a) Explain the function of the following related to INTEL 8085 microprocessor:
(i) $\overline{INTA}$, (ii) RESET OUT, (iii) IO/$\overline{M}$, (iv) $\overline{RD}$.   [(CO1)(Understanding/LOCQ)]
   (b) Sketch the timing diagram of the instruction 'MVI A, 42H' for Intel 8085 microprocessor.   [(CO1)(Apply/IOCQ)]
   (c) Evaluate the time required by the Intel 8085 microprocessor to execute the instruction 'STA 8050H' if the crystal frequency of the processor is 6MHz.
     [(CO1)(Evaluate/HOCQ)]
4 + 5 + 3 = 12

3. (a) Define the following instructions related to Intel 8085 microprocessor:
(i) LDA F205^H (ii) RRC.   [(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, AE^H
ANI 9F^H
HLT.   [(CO1)(Apply/IOCQ)]
   (c) Develop an assembly language program in Intel 8085 microprocessor to add ten 8 bit numbers (result may be 16 bit) and store the result in memory locations F001 (higher byte) and F000 (lower byte).   [(CO1)(Create/HOCQ)]
4 + 4 + 4 = 12

Group - C

4. (a) Illustrate the circuit that outputs RST 3 instruction opcode on acknowledging the interrupt.   [(CO2)(Understand/LOCQ)]
   (b) Develop an interfacing circuit for a 16K×8 bits IC with the 8085 using a NAND gate address decoder such that the starting address assigned to the chip is C000^H.   [(CO2)(Apply/IOCQ)]
   (c) Explain the software instructions DI.   [(CO2)(Evaluate/HOCQ)]
4 + 5 + 3 = 12

5. (a) What are the software interrupts and hardware interrupts supported by Intel 8085 microprocessor?   [(CO2)(Remembering/LOCQ)]
   (b) Develop an assembly language program for Intel 8085 microprocessor to generate a square wave.   [(CO2)(Apply/IOCQ)]
   (c) Explain the control word format of 8255A for I/O mode. [(CO3)(Evaluate/HOCQ)]
3 + 5 + 4 = 12

Group – D

6. (a) How many ports are available in 8051 for I/O purposes? What should be done to make a port an input port? Which I/O port of the 8051 does not have any alternative function and can be used solely for I/O? What is the content of Port 0 (P0) upon RESET of 8051? [(CO3)(Remember/LOCQ)]

(b) Analyze the internal RAM structure of Intel 8051 microcontroller.
[(CO3)(Analyze/IOCQ)]

(c) Discuss the function of the following signals related to 8051 microcontroller:
(i) $\overline{PSEN}$ (ii) $\overline{EA}$. [(CO3)(Create/HOCQ)]
4 + 5 + 3 =12

7. (a) Explain the following 8051 microcontroller instructions:
(i) ADDC A, # 2A^H
(ii) DA A
(iii) MOV A, R0. [(CO3)(Understand/LOCQ)]

(b) Construct an 8051 based assembly language program to generate a square wave of 50% duty cycle of frequency 1 kHz through the pin P1.0 while considering the crystal frequency as 11.0592 MHz. [(CO3)(Apply/IOCQ)]

(c) Conclude the status of CY, OV and AC flags of 8051 microcontroller, after execution of the following set of instructions.
MOV R0, # 20^H
MOV 20^H, # 5A^H
MOV A, # 49^H
ADD A, @ R0. [(CO3)(Create/HOCQ)]
4 + 5 + 3 = 12

Group - E

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

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

(c) Develop an Assembly Language Program to display 'HITK' in the LCD of the above circuit. [(CO4)(Apply/IOCQ)]
3 + 3 + 6 = 12

9. (a) Design the interfacing connection of 8051 microcontroller to a unipolar stepper motor. [(CO4)(Create/HOCQ)]

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

(c) Develop an Assembly Language Program to rotate that motor 90° in clockwise direction in 4 step sequence. Given: motor step angle = 2°.
[(CO4)(Apply/IOCQ)].
3 + 3 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	30.21	42.71	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