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
any 5 (five) from Group B to E, taking at least one 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 SUB B instruction is executed by Intel 8085 microprocessor,
         (a) all flags will be affected   (b) no flags will be affected
         (c) only carry flag will be affected (d) carry and zero flags will be affected.

   (ii) The "Stack Pointer" in 8085 microprocessor is a/an
         (a) 8 bit register   (b) 16 bit register (c) 32 bit register (d) 4 bit register.

   (iii) Which of the following instructions of the 8085 microprocessor will load 9876^H
         data in H-L register pair?
         (a) LHLD 9876^H (b) SHLD 9876^H (c) LXI H, 9876^H (d) LDA 9876^H.

   (iv) Which one of the following is used to store critical pieces of data during
         subroutines and interrupts?
         (a) Stack   (b) Queue   (c) Accumulator   (d) Data register.

   (v)   Which one of the following is the call location of RST6.5 interrupt?
         (a) $003C^H$ (b) 0036^H (c) 0034^H (d) 0024^H.

   (vi) If accumulator content is 16^H, after executing the instruction CPI 82^H what will
         be the status of carry flag (CY) and zero flag (Z)?
         (a) CY=1 & Z=1   (b) CY=0 & Z=0   (c) CY=0 & Z=1   (d) CY=1 & Z=0.

   (vii) The address range of SFRs in 8051 is
         (a) 00^H-77^H (b) 40^H-80^H (c) 80^H-$7F^H$ (d) 80^H-FF^H.

   (viii) The timers in mode 0 in 8051 microcontroller overflow when the register reaches
         (a) $1FFF^H$ (b) $FFFF^H$ (c) FF^H (d) $03FF^H$

   (ix) Which of the following instructions is invalid for an 8051 microcontroller?
         (a) MOV R0, R7   (b) MOV R0, A   (c) MOV 2,7   (d) MOV A, @R0.

   (x)   Embedded ROM size in 8051 microcontroller is
         (a) 2K bytes   (b) 4K bytes   (c) 8K bytes   (d) 64K bytes.

Group- B

2. (a) Explain the timing diagram of the instruction IN 80H related to the 8085 microprocessor. [(CO1)(Understanding/LOCQ)]
    (b) Sketch a neat diagram of bus structure of the 8085 microprocessor and explain it. [(CO1)(Apply/IOCQ)]
    (c) Evaluate the time required by the 8085 microprocessor to execute the instruction OUT D8 H. Consider a crystal frequency of 6 MHz. [(CO1)(Evaluate/HOCQ)]
    4 + 5 + 3 = 12

3. (a) Define the following instructions related to 8085 microprocessor:
    (i) PUSH B
    (ii) RLC. [(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 8085 microprocessor.
    MVI A, 2E^H
    ADI 71^H
    HLT. [(CO1)(Apply/IOCQ)]
    (c) Develop an Assembly Language Program for the 8085 microprocessor to multiply (by repeated addition method) two 8-bit numbers which are stored in memory locations F001 and F002, respectively. The result (which may be 16 bit or 8 bit) is to be stored in memory locations F100^H and F101^H. [(CO1)(Create/HOCQ)]
    4 + 4 + 4 = 12

Group - C

4. (a) Illustrate the accumulator bit pattern for execution of instruction RIM and explain the function of each bit. [(CO2)(Understand/LOCQ)]
    (b) Interface a 16 KB EPROM IC with the 8085 microprocessor 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 EI. [(CO2)(Evaluate/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 the address of the control register is 83^H and the output device is connected with port B of 8255A and also assume the address of port B is 81^H. [(CO2)(Apply/IOCQ)]
    3 + 4 + 5 = 12

Group - D

6. (a) Draw the bit pattern of the PSW register of the 8051 microcontroller and explain the function of each bit. [(CO3)(Understand/LOCQ)]
    (b) Analyze the architecture of the internal RAM of the 8051 microcontroller.
    [(CO3)(Analyze/IOCQ)]
    (c) Develop an assembly language program to toggle all the bits of port 1 continuously after some delay. Assume a suitable delay subroutine.
    [(CO3)(Create/HOCQ)]
    4 + 5 + 3 = 12

7. (a) Explain the following 8051 microcontroller instructions:
    (i)   ADD A, 25^H
    (ii) DIV AB
    (iii) MOV A, # 2B^H. [(CO3)(Understand/LOCQ)]
    (b) Construct an 8051 microcontroller based assembly language program to generate a square wave of 75% 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 the 8051 microcontroller, after execution of the following set of instructions.
    MOV R0, # 25^H
    MOV 25^H, # 0A5^H
    MOV A, # 33^H
    ADD A, @ R0. [(CO3)(Create/HOCQ)]
    4 + 5 + 3 = 12

Group - E

8. (a) Determine the value to be loaded in the TH1 register of timer 1 to obtain a baud rate of (i) 9600 bps and (ii) 1200 bps. Assume crystal frequency to be 11.0592 MHz, SMOD = 0. [(CO4)(Understand/LOCQ)]
    (b) Derive the BAUD rate equation for serial communication in context of mode 1 operation of UART and explain the role of SMOD bit. [(CO4)(Apply/IOCQ)]
    (c) Develop an Assembly Language Program for the 8051 microcontroller to receive bytes of data serially and put them in port 1 using '9600, N, 8, 1' protocol. Consider a crystal frequency of 11.0592 MHz. [(CO4)(Create/HOCQ)]
    4 + 5 + 3 = 12

9. (a) Design the interfacing connection of 8051 microcontroller with DAC0808.
    [(CO4)(Create/HOCQ)]
    (b) Explain the above circuit in detail. [(CO4)(Understand/LOCQ)]
    (c) Develop an Assembly Language Program to generate a staircase waveform of 5 steps in the above circuit. [(CO4)(Apply/IOCQ)]
    3 + 3 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	31	42	27

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.