Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

V SEMESTER B. TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, NOVEMBER 2019

MICROCONTROLLER BASED SYSTEM DESIGN [ELE 3106]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: November 27, 2019** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Explain and differentiate CISC and RISC processor architecture considering 8051 (CISC) and ARM7 (RISC) as examples. ***(03)***

1B. Write single equivalent 8051 instruction for performing each of the following operations.

a)
```
MOV A, DPL
ADD A, #01H
MOV DPL, A
MOV A, DPH
ADDC A, #00H
MOV DPH, A
```

b)
```
MOV R2, A
MOV R4, 03H
MOV 03H, R2
MOV A, R4
```

c)
```
MOV A, P1
MOV C, ACC.6
JNC THERE
```

d)
```
XRL A, 25H
JNZ next
```

(03)

1C. Explain the following as applicable to 8051 instructions

a) Direct addressing mode
b) Register addressing mode
c) Indirect addressing mode
d) Immediate addressing mode

Use relevant 8051 instruction for logical OR operation, for each of these modes and illustrate with an example. ***(04)***

2A. The marks scored by 60 students in Microcontroller LAB exam is stored in external RAM location starting from 3000H. Write an 8051 ALP to display the count of students with grades 'A' to 'F' as shown in the table, at Port '0' with delay of 5s between each display.

Range of marks	Grades
≥80	A
60-79	B
40-59	C
<40	F

(04)

2B. i. Calculate the time taken by 8051 for the executions of the following program, if f_{osc}=12MHz.

```
        MOV R4, #0FH
LOOP3:  MOV R5, #0F0H
        NOP
LOOP2:  MOV R6, #0E0H
        DEC R5
LOOP1:  DJNZ R6, LOOP1
        MOV 06H, R6
        DJNZ R5, LOOP2
        DJNZ R4, LOOP3
```

ii. If f_{osc} is changed to 16MHz, determine the initial count value to 'R6' register in the above program, to obtain the same time delay as in part i. ***(03)***

2C. Write an 8051 ALP to enable and configure external interrupt '0' as edge triggered interrupt and wait for the interrupt. When interrupted, write an ISR to generate a 50Hz, 30% duty cycle rectangular waveform at port pin P1.2 of 8051. Assume crystal frequency as 11.0592MHz. Use timer '1' in mode '2' to obtain the required delay. ***(03)***

3A. Show the interfacing circuit to interface DAC-0800 to 8051 and write 8051 ALP to obtain the waveform shown in Fig.3A. Use Port '1' of 8051 to provide digital input to DAC. Assume XTAL = 12MHz. Use timer '0' in mode '1' to obtain the required delay.

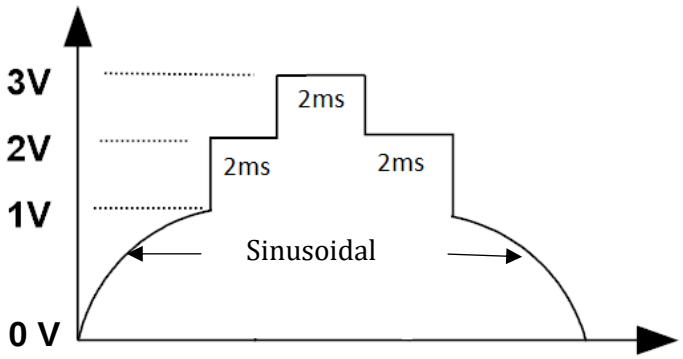

Fig.3A ***(04)***

3B. Answer the following with respect to 8051 interrupts.

i. Describe the (step by step) sequence of operation in 8051, when CPU of 8051 is interrupted.

ii. List the interrupts of 8051 according to changed priority sequence, when MOV IP, #9AH is executed. ***(03)***

3C. Show the interfacing circuit to interface ADC-0808 to 8051 and write 8051 ALP to obtain the digital output of analog input applied to channel 04(IN4) and store it at 50H. Use Port '0' to receive the digital output and Port '1' pins for the other interface to ADC. ***(03)***

4A. Show the interfacing circuit to interface a 14-pin, 16X2 LCD to 8051 and write an ALP to display 'MCBSD EXAM' on the center of first line, and display 'DATE: 27-11-2019' on the second line of LCD screen. Connect port '1' pins of 8051 to the data bus of LCD and port '2' pins for the other interface to LCD. ***(04)***

4B. Write an 8051 program to transmit the message "Welcome" using serial port in mode '1' at 2400 bits / sec. Given f_{osc} = 5.5296MHz. ***(03)***

4C. Describe the algorithm for detecting and identifying the key closed (pressed) in a 'n x n' matrix keyboard interfaced to 8051 (do not write the program). Explain the problems due to key bounce and the software technique used to avoid problems due to key bounce. ***(03)***

5A. Determine the values of registers 'R0', 'R1' and R2 and condition flags at the end of the execution of the following ARM7 program.

MOV R0, #0x00000050

MVN R1, #0xFFFF5324

ADDS R2, R1, R0, LSR #03

RSB R0, R0, R1 ***(02)***

5B. Determine the values of registers R2, R3 and R4 when ARM7 executes following instructions with a) Little endian mode b) Big endian mode.

Given, (0x00006000) = 96H
(0x00006001) = 5AH
(0x00006002) = FFH
(0x00006003) = EEH
(R3) = 0x00006000
(R4) = 0x00000008

i. LDRSH R2, [R3], -R4
ii. LDR R2, [R3], R4, LSL #02
iii. LDRB R2, [R3, #03]!
iv. LDRH R2, [R3, R4, LSR #02] ***(04)***

5C. Write ARM7 program for the following operations

i. a = 9* {[(a-b) *c] +d}; Use registers R0, R1, R2 and R3 for variables a, b, c and d respectively.
ii. e = 17 *{[7*(a*b) + 5*(c*d)]}; Use registers R0, R1, R2, R3 and R4 for variables a, b, c, d and e respectively. ***(04)***