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

V SEMESTER B. TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, NOVEMBER 2018
SUBJECT: MICROCONTROLLER BASED SYSTEM DESIGN [ELE 3106]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 30, November 2018** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- 8051 and ARM instruction set will be provided.

1A. With the help of neat block diagram explain the architecture of 8051-microcontroller. Also explain the bit-wise details of Program Status Word Register. ***(05)***

1B. Write an 8051 ALP to find the address of given byte '64H' in an array of numbers stored in external RAM locations starting at address 2018H. Size of the Array is store in memory location 2017H. If the number 64H is found in the array, then display the address of first occurrence in P0 and P1 respectively and store the count of such occurrences in memory location 2000H. If the number 64H is not found in the array, then display AAH in both P0 and P1 as an error code. ***(05)***

2A. Describe the following and compare their merits and de-merits.

I. Princeton (Von Neumann) and Harvard Architectures
II. RISC and CISC Processors ***(04)***

2B. A simple burglar alarm system has 4 zone inputs connected to pins P3.0 to P3.3 of 8051. If any one of these inputs is activated (low) a bell will sound for 5 minutes and the corresponding zone LED (P1.0 to P1.3 respectively), will be activated. Design an 8051-assembly language program to implement the required functionality for this system shown in **Figure 2B**. ***(04)***

2C. Calculate the exact time delay offered by the following program. Assume XTAL=20MHz.

```
ORG 0000H
        MOV R6, #0FH
        MOV A, #09H
LOOP2: MOV R7, #0FFH
LOOP1: NOP
        DJNZ R7, LOOP1
        NOP
        DJNZ R6, LOOP2
        NOP
        MOV B, #03H
        DIV AB
        MOV R3, A
LOOP3: DJNZ R3, LOOP3
END
```

(02)

3A. Describe and differentiate between the operation of 8051 timers in timer mode and counter mode. Determine the value to be loaded to TMOD register to configure timer '0' in mode '0', with internal clock, external start/stop control and timer '1' in counter mode in mode '2' with internal start/stop control. List the various uses (applications) of timer mode of operation and counter mode of operation. ***(03)***

3B. As part of an industrial automation system two wheels are driven by two separate motors, motor A and motor B. The rotation sensors give a logic low level as the wheel magnet passes the sensor. Each motor can be turned on or off by providing a logic signal as indicated in **Figure 3B**. An 8051 is to be used to control these motors, where a motor can be turned ON and allowed to run for N rotations and then turned OFF. The sensor signals will cause timer/counter interrupts. Write an 8051-assembly language program which will turn on the two motors at the same time. Motor A will do 20 rotations and will then be stopped. Motor B will do 200 rotations and will then be stopped. ***(05)***

3C. Show the interfacing circuit to interface 16X2 LCD to 8051. Explain the steps to check the status of busy flag in LCD operation. ***(02)***

4A. Show the interfacing circuit to interface 4X3 matrix keyboard containing 12-keys (1 to 9, *, 0, #) to 8051. Write an 8051 ALP to identify the key pressed and display the code of the key pressed in port 0. Use P1(rows) and P2(columns) pins for interfacing. Use software de-bouncing technique. ***(05)***

4B. The **Figure 4B** shows a D/A (digital to analog) converter which drives a dc motor. Assume the power stage is included in the D/A converter so that the motor can be driven directly by Vout. An 8051 microcontroller has this D/A converter connected to an I/O port P1. The 8051 is connected to a Computer via the serial port. When 8-bit data character is received from the Computer, it interrupts the 8051 through the 8051's serial port interrupt and the received 8-bit data value is passed to the D/A converter so that the Computer is effectively controlling the motor speed. Write an 8051-assembly language program to implement this system. Assume a serial data baud rate of 9,600 baud. ***(05)***

5A. Explain the Register Organization of ARM7-TDMI processor. ***(04)***

5B. Explain the following Instruction of ARM7-TDMI processor.

I. RSB R9, R5, R5, LSL#3
II. LDRH R2, [R1, R3, LSL#08]!
III. BIC R5, R5, #08 ***(03)***

5C. Write an ARM-ALP to multiply a 32-bit number stored in 2020H with another 32-bit number stored in the next aligned memory location. Store the 64-bit result in next successive aligned memory locations. ***(03)***

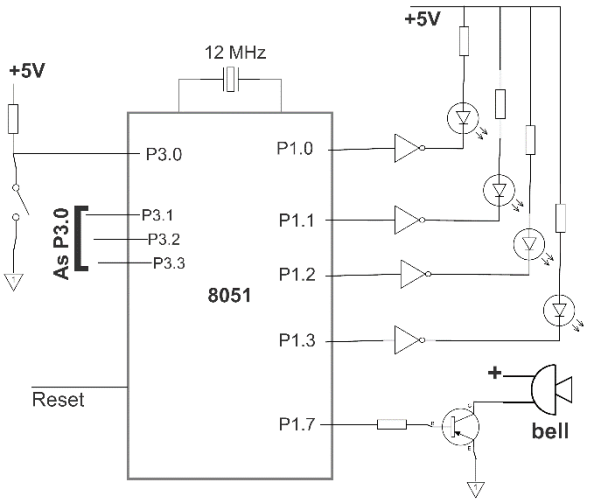

Figure 2B

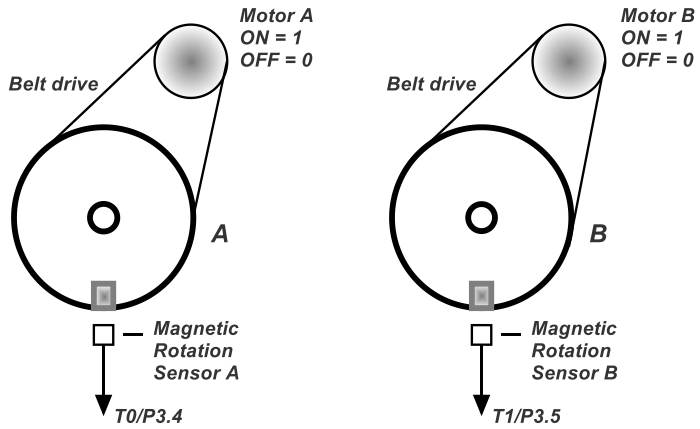

Figure 3B

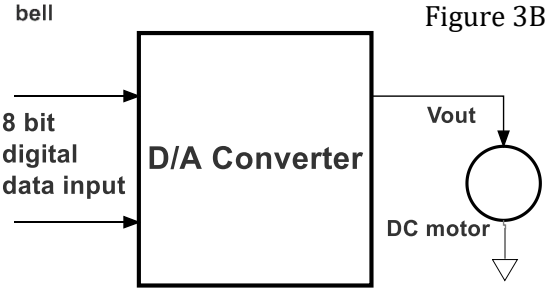

Figure 4B