Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SIXTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION
APRIL/MAY 2019
SUBJECT: EMBEDDED SYSTEM DESIGN (ECE - 4003)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

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

1A. Explain the different characteristics of embedded systems in detail.

1B. What is a "market window" and why is it so important for products to reach the market early in this window?

1C. For a particular product, the NRE cost and unit cost to be the following for the three listed IC technologies: FPGA: ($10,000, $50); ASIC: ($50,000, $10); VLSI: ($200,000, $5). Determine precise volumes for which each technology yields the lowest total cost.

(4+3+3)

2A. Design a zener diode and transistor based brown-out protection circuit with active low reset pulse for the following design parameters.
(a). Use PNP transistor for the design. (b). The supply voltage to the system is 5V.
(c). The reset pulse is asserted when the supply voltage falls below 4.7V

2B. Explain the quality attribute "Maintainability" in the embedded system design context. Calculate Mean Time To Repair (MTTR) in hours for the product when the availability of the product is 90% and the Mean Time Between Failure (MTBF) is 30 days.

2C. What are the different types of memories used for Program storage in Embedded System Design? Explain them briefly.

(4+3+3)

3A. Three processes with process IDs P1, P2, P3 with estimated completion time 8, 4, 7 milliseconds respectively enters the ready queue together. P1 contains an I/O waiting time of 2 milliseconds when it completes 4 milliseconds of its execution. P2 and P3 do not contain any I/O waiting. Calculate the waiting time and Turn Around Time (TAT) for each process and the average waiting time and Turn Around Time in the SRT scheduling. All the estimated execution completion time is excluding I/O waiting time.

3B. Explain the sequence of operation for communicating with a I2C slave device.

3C. Draw the interfacing diagram for connecting an LED to the port pin of a microcontroller. The LED is turned ON when the microcontroller port pin is at Logic '0'. Calculate the resistance required to connect in series with the LED for the following design parameters.
(a). LED voltage drop on conducting = 1.7V (b). LED current rating = 20mA
(c). Power Supply Voltage = 5V

(4+3+3)

4A. Design a coin operated public telephone unit based on FSM model for the following requirements.

1. The calling process is initiated by lifting the receiver (off-hook) of the telephone unit.
2. After lifting the phone, the user needs to insert a 1-rupee coin to make the call.
3. If the line is busy, the coin is returned on placing the receiver back on the hook (on-hook).
4. If the line is through, the user is allowed to talk till 60 seconds and at the end of 45^{th} second, prompt for inserting another 1-rupee coin for continuing the call is initiated.
5. If the user doesn't insert another 1-rupee coin, the call is terminated on completing the 60 seconds time slot.
6. The system is ready to accept new call request when the receiver is placed back on the hook (on-hook).
7. The system goes to the "Out of Order" state when there is a line fault.

4B. Write an embedded C program to set bit 2, clear bit 7 and to test the status of bit 5 of the status register and reset it if it is 1, of a device, which is memory mapped to the CPU. The status register of the device is memory mapped at location 0x7000. The data bus of the controller and the status register of the device is 8-bit wide. The application should illustrate the usage of bit-manipulation operations.

4C. What is volatile pointer? Explain the usage of 'volatile pointer' in Embedded C application. Which all variables need to be declared as volatile variables in embedded C application.

(4+3+3)

5A. Explain the various factors to be considered for the selection of a scheduling criteria in an Operating System of embedded system.

5B. What is EDLC? What are the objectives of it?

5C. Explain the different techniques for embedding the firmware into the target board for a non-OS based embedded system.

(4+3+3)