Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: EMBEDDED SYSTEM DESIGN [ECE 356]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL q**uestions.
- Missing data may be suitably assumed.

1A. What are the quality attributes of Embedded system? Explain operational quality attributes of Embedded system in detail. **(5)**

1B. Describe the sequence of operations for embedding firmware with a programmer using Out of circuit programming. **(5)**

2A. What is Inter process communication? Give an overview of different mechanisms used by various operating systems to share memory. **(4)**

2B. Explain Inter Integrated Circuit **(**I2C) interface along with the sequence of operation involved in I2C communication. **(4)**

2C. What is data dependency in pipelining? How it can be resolved? **(2)**

3A. Define the following terms: i) Process ii) Task iii) Thread iv) Socket v) Remote procedure call vi)Task Scheduling **(6)**

3B. Illustrate the datapath activity for 'Data transfer' instruction in ARM with the help of a neat diagram. **(4)**

4A. Discuss the following phases of EDLC- Need, Conceptualization, Analysis, and Deployment. **(4)**

4B. Write a short note on cache and Tightly coupled memory with respect to ARM. **(3)**

4C. Design an embedded system for 'automatic door lock' in an automotive (Car) using the FSM model. A person inside the car, opens door and goes out of the car and closes the car door. After door closure, the door gets locked if the key is not in ignition (Key hole). If the key is in the ignition, timer waits for 5 seconds for the person to open the door and remove the key. If the key is still in the ignition after 5 seconds of door closure, alarm rings for 10 seconds. Alarm turns off automatically when alarm time (10seconds) expires or if the door is opened and key is removed from ignition, whichever happens first. **(3)**

5A. Explain the common design metrics used in the embedded system design. **(5)**

5B. Explain Bit Banding and Nested Vector Interrupt in ARM Cortex M3. **(3)**

5C. A door sensor is connected to P1.1 pin, and a buzzer is connected to P1.7. Write an embedded C program to monitor door sensor continuously, and when it opens, sound the buzzer. Buzzer sound can be generated by sending a square wave of 10kHz (use XTAL =22MHz, timer 1 mode 2). **(2)**

6A. Define preemptive scheduling? Three processes with process ID's P1, P2, and P3 with estimated time 9,10,4 milliseconds respectively enters the ready queue together. Process P4 with estimated execution completion time 1ms enters the ready queue after 2ms and a process P5 with estimated execution time 7ms enters ready queue after 1ms of start of process P1. Calculate the waiting time and Turn Around Time (TAT) for each processes. Also calculate average waiting time and average TAT (Assuming there is no I/O waiting for the process) in the pre-emptive SJF scheduling. **(4)**

6B. Write an embedded C program that continuously gets a single bit of data from P1.7 and sends it to P1.0 in the main, while simultaneously (a) creating a square wave of 200μs period on pin P2.5, and (b) sending letter 'A' to the serial port. Use Timer 0 to create the square wave. Assume that XTAL=11.0592MHz. Use 9600 baud rate. **(3)**

6C. Describe AMBA bus protocol. **(3)**