Reg. No.										

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

VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, JAN 2018

SUBJECT: MECHATRONICS SYSTEM DESIGN [MTE 4101]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer ALL the questions.
- Data not provided may be suitably assumed with justification.

1A. Describe Inter Integrated Circuit **(**I2C) interface along with the sequence of operation involved in I2C communication. **4**

1B. Define multiprocessing. Differentiate the terms SIMD & MIMD with respect to a multiprocessor. List the advantages of multiprocessing. **4**

1C. In a manufacture unit, LPC1768 is used to monitor the overload condition of a unit and has to send a signal serially to the hyper terminal of PC to display the overload condition. The excessive load condition triggers a switch connected to p10 of LPC1768. Whenever the load in the machine exceeds the limit, a message "overload" must be displayed on the PC screen and in the normal load condition it must display the message "Normal". As a developer engineer you are given a requirement of developing a mbed program to perform this operation. **2**

2A. Describe the following with reference to ARM Cortex M3: **4**
i) The Nested Vectored Interrupt Controller (NVIC)
ii) Embedded Trace Macrocell (ETM)

2B. Explain all the bits and modes of Current Program Status Register of ARM with the help of a bit diagram. **3**

2C. A Processor with ARM core is executing an operation in Thumb mode to monitor the signal coming from device1 attached to it. In between this execution the processor switched to ARM mode. Identify the possible reasons for this switching from Thumb mode to ARM mode. With the help of appropriate instructions, describe the various methods of switching to ARM mode from Thumb mode.
Similarly describe the different ways in which a processor working in ARM mode switch to Thumb mode. **3**

3A. In an ARM processor the data has to be copied from register to memory. Identify the instruction to perform this operation. With a neat diagram explain the data path activity for the same. **4**

3B. Describe briefly the following structural units present in a processor. **4**

(i) Instruction Register:
(ii) Data Cache
(iii) Atomic Operation Unit
(iv) Memory management Unit

3C. Discuss the use of sign extend hardware and coprocessors in ARM processor. **2**

4A. Differentiate between RISC instruction set and ARM RISC instruction set suitable for embedded applications. **4**

4B. A CCTV camera's movement (0 to 180^0) is to be controlled by LPC1768 via serial communication using USB protocol. The position control of the servo motor (connected at pin P21) is done by taking inputs serially from a keyboard. Pressing a specific character rotates the camera in a specific direction as follows: 'M' – Middle, 'L' – Full Left, 'R' – Full Right. Develop an mbed program to perform this task. **3**

4C. With suitable examples, describe following ARM instructions. **3**

(i) STMIA R1, {R0, R2, R4}
(ii) SWP R0, R1, [R2]
(iii) MOVEQ R1, #10

5A. As an embedded system designer, you are given with the task of developing a Handheld GPS device. Prepare a detailed proposal for the steps involved in designing this device. **5**

5B. Develop an ARM assembly level program to perform addition of two 64 bit numbers. The numbers are to be defined in the memory map. Store the result in the memory. **3**

5C. Compare Super scalar and Multi core processor. **2**