Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. (INFORMATION TECHNOLOGY)

END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: EMBEDDED SYSTEMS [ICT 3102]

REVISED CREDIT SYSTEM

21/11/2018

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Explain the following ARM instructions with an example for each:
i) TEQ ii) SMLAL iii) BMI iv) LDRSH v) RSB **5**

1B. Write an embedded C program using interrupts to generate a square waveform of frequency 100 kHz on P0.3 using TIMER-0 while simultaneously displaying the number of pulses received at EINT2 (P2.12, function-2) on the LEDs connected to P0.11-P0.4. (PCLK = 3 MHz) **3**

1C. Bring out the salient features of RISC family of microcontrollers. **2**

2A. Explain the operation of PWM module with a necessary diagram. List and explain the role of various registers associated with PWM. **5**

2B. Write an assembly language program to find the factorial of an unsigned byte available in the code memory using recursion and store the result in the data memory. **3**

2C. It is required to find the difference in analog voltages applied at ADC channel-4 and channel-5. Explain how this task can be accomplished using BURST mode of an ADC. **2**

3A. What is the role of MAX232 in serial communication? Write an embedded C program using serial interrupt to transfer the message "Failures are stepping stones to success" serially on TxD0 (P0.2, function 2), at 9600 baud. Assume 1-start bit, 1- stop bit and 8-bit data. (PCLK=3 MHz) **5**

3B. With a neat diagram, explain how a 16x2 LCD can be interfaced in 4-bit mode to the ARM microcontroller. **3**

3C. Differentiate between
i) Memory mapped IO and IO mapped IO.
ii) Interrupt and Polling **2**

4A. Assume that columns of a 3x3 matrix keyboard are connected to P0.0-P0.2 and rows are connected to P1.0-P1.2, write an embedded C program using GPIO interrupt to display the key code of the key pressed on a seven segment display. **5**

4B. Assume that a switch is connected to P2.12. Write an embedded C program to generate a sinusoidal waveform at A_{OUT} (P0.26, function-3) with peak to peak amplitude of 2 volts and DC value of 1.2 volts. The frequency of the waveform is controlled by the switch as mentioned in the Table Q.4B. **3**

Table Q.4B

Frequency	Switch status
2 kHz	ON
4 kHz	OFF

4C. Explain the mechanism for peripheral clock generation in ARM microcontroller. **2**

5A. Explain with a neat diagram, how the 4-digit multiplexed seven segment display is interfaced with ARM microcontroller. Write an embedded C program to display a 4-digit BCD number on this display. **5**

5B. With a neat diagram, explain the stepper motor interfacing to ARM microcontroller. Write an embedded C program to rotate the motor 200 steps in the clockwise direction at 60 rpm. Assume step angle of the motor as 6 degrees. **3**

5C. Explain various SFRs available in ARM microcontroller to configure and handle external hardware interrupts. **2**