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MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

II SEMESTER M.Tech (BME) DEGREE END SEM EXAMINATIONS, APR/MAY 2019

SUBJECT: EMBEDED SYSTEMS (BME 5235)

Elective III (REVISED CREDIT SYSTEM) Saturday, 4th May, 2019, 9 am to 12 noon

TIME: 3 HOURS

MAX. MARKS: 50

Answer ALL questions.
 Draw labeled diagram wherever necessary
 Assume suitable data, if missing

- 1. (A) Why do you think embedded systems are different from that of general computing 3 systems? Justify.
 - (B) It is desired to transfer a character "A" to an output device from a microcontroller, 4 in the form of ASCII code on an I2C bus. Sketch the I2C signals showing the necessary transitions required to carry out the data transfer.
 - (C) Can you think of any advantages and disadvantages of Harvard memory structure 3 over the conventional Von Neumann structure? Also draw the structure of the two processor architectures.
- 2. (A) An embedded system requires a total of 32 Kbytes of read-only memory using 4 8KB memory chips. How do you map these memory chips using bank-switching technique? Explain with the help of relevant diagrams.
 - (B) What causes priority inversion in a Real-Time operating system? Explain with an 3 illustration. And how do you solve the priority inversion problem?
 - (C) State and explain the RMA theorem. Determine the order of priority of the tasks 3 run by a CPU as shown in the figure 1, and test whether the tasks are schedulable?
- 3. (A) How do you schedule n-tasks in a single CPU based system, to make the kernel 3 deterministic? Illustrate with an example.
 - (B) What are the possible ways of implementing a stack in an ARM processor? 5 Illustrate with examples.
 - (C) It is required to interface in cascade, five on-board serial devices to a 2 microcontroller to have synchronized data transfer. Selecting an appropriate protocol, interface the devices.

- 4. (A) For a microcontroller architecture, it is required to implement the flags "CY, P, 4 Z, F0, RS1, RS0, M2, M1, M0, AC, IF1, IF0", in the order, starting from most significant bit. How do you implement the flags using embedded C? Explain.
 - (B) Write the control word format of the 8255 PPI, and frame the control word to set
 3 the Port A as input port, Port B as input port and Port C as output port in Simple I/O mode, and the control word to set the 5th bit of Port C.
 - (C) What are the fundamental issues encountered by the designer in embedded 3 hardware and software designs? Explain.
- 5. (A) It is required to take up an embedded product development project, whose 4 requirements are not fully available and are subject to change. What is your approach to such a situation? Illustrate and justify your approach.
 - (B) How do you implement an infinite loop to send BCD numbers 00 to 99 to Port1 3 of the microcontroller, say Intel 8051, with a delay of approximately 1sec between each data output?
 - (C) An automobile requires a digital thermometer to monitor and the engine 3 temperature every second. Study the problem and suggest an embedded solution for the same.



Fig. 1