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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

II SEMESTER M.TECH. (INDUSTRIAL AUTOMATION AND ROBOTICS)

END SEMESTER EXAMINATIONS, APR/MAY 2017

SUBJECT: EMBEDDED SYSTEMS [MTE 5202]

REVISED CREDIT SYSTEM
(22/04/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **Any Five Full** questions.
- Missing data may be suitable assumed.

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

1B. Discuss the relevance of bits present in Interrupt Priority register of 8051. What happens if 8051 is executing an ISR and another interrupt is activated at the same time? In 8051 microcontroller how are interrupts better than Polling? **(4)**

1C. Define EMI and explain two categories of EMI. **(2)**

2A. Three processes with process IDs P1, P2, and P3 with estimated time 9,10,4 milliseconds respectively enter the ready queue together. Process P4 with estimated execution completion time 1ms enters the ready queue after 2ms of start of first process 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 pre-emptive and non-pre-emptive Shortest Job First (SJF) scheduling. **(5)**

2B. Compare the results of pre-emptive and non-pre-emptive scheduling for Q.2A and write the inference. Discuss the drawbacks of SJF. **(2)**

2C. A manufacturer intends to have a machine which has to display messages based on its load condition. This machine is connected to a microcontroller. This microcontroller is connected to the hyper terminal of a PC through the serial port. As a developer engineer you get a requirement to develop an embedded C program to perform the following operation. **(3)**

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 "ok". The message to be displayed is sent serially to the hyper terminal of PC. The

measurement of load is connected to pin P2.5 of a microcontroller which triggers in case of excessive load. Assume XTAL=11.0592MHz, Baud rate of 9600, 8 bit data, 1 stop bit.

3A. In an ARM processor instructions are executed in a pipeline. An instruction causes the Processor to jump to another location and continue the execution of instruction. Demonstrate the datapath activity of pipeline with neat sketch when branch occurs also describe the binary encoding of branch instruction. **(5)**

3B. 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. Design a finite state model for 'automatic door lock' in an automotive (Car). **(3)**

3C. In a theatre a door is attached with a sensor to count the number of persons entering the theater. The sensor is connected to pin P3.4 of a microcontroller. Develop an embedded C program to count the people entering the theater and display the upper and lower bytes of count in registers on P1 and P2 respectively. (Use counter 0 in mode 1) **(2)**

4A. An 8051 microcontroller is used to monitor a temperature sensor unit continuously. Due to lack of I/O ports availability, the sensor unit is connected to 8051 via lower 4 pins of Port C of 8255 as shown in Fig.Q4 (A). A storage device is connected to upper 4 pins of Port C of 8255. Data must be continuously received from temperature sensor and must be sent to this storage device for further processing. Compute the I/O port addresses assigned to ports A, B, C and control register and also write an embedded c program to perform this action. **(4)**

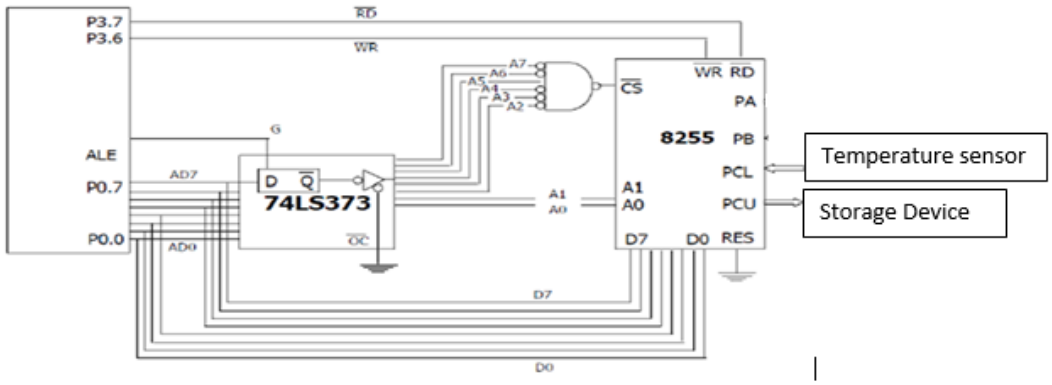

Fig.Q4(A)

4B. Elucidate AMBA bus protocol and differentiate types of buses present in ARM. **(3)**

4C. Describe the Program Status word of 8051 microcontroller format with the suitable sketch. **(3)**

5A. Describe the variations of ARM RISC instruction set that makes the ARM instruction set suitable for embedded applications. **(4)**

5B. Define baud rate and describe the different ways of doubling the baud rate of 8051. **(3)**

5C. In an ARM processor, identify the factors affecting the total time of execution of a program and relate them. Suggest different ways to improve the performance. **(3)**

6A. Illustrate time to market design metric and simplified revenue model for computing revenue loss from delayed entry. **(5)**

Determine suitable component for embedded system design to perform the following action and describe its working:

Circuit that prevents the processor/controller from unexpected program execution behavior when the supply voltage falls below a specified voltage.

6B. Discuss the privileged processor modes of ARM processor. **(3)**

6C. Illustrate data dependency in pipelining? How it can be resolved? **(2)**