MANIPAL INSTITUTE OF TECHNOLOGY

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VII SEMESTER B. Tech. (BME) DEGREE END SEM EXAMINATIONS NOV/DEC 2016 SUBJECT: EMBEDDED SYSTEMS (BME 429) (Program Elective –III)

(REVISED CREDIT SYSTEM)

Wednesday, 30th November, 2016, 2 PM to 5 PM

TIME: 3 HOURS

MAX. MARKS: 100

- 1. Answer all FIVE full questions.
- 2. Draw labeled diagram wherever necessary
- 1. (a) What are the characteristics and constraints of embedded systems? 3+3
 - (b) List the target hardware architectures, that are suitable for embedded systems, and 1+4 compare them in terms of
 - (i) Performance
 - (ii) NRE cost
 - (iii) Unit cost
 - (iv) Time-to-market
 - (c) Differentiate between the ARM and THUMB programmer's models of the ARM7-TDMI **4**+1 processor. How do you switch between these two models as and when required?
 - (d) What are the purposes served by embedded systems? Write an example pertaining to each. 4
- 2. (a) How do you implement ascending and descending stacks in an ARM-7 based embedded 10 system? Illustrate with appropriate examples.
 - (b) Which embedded 'C' programming element is suitable for implementing "bit-fields"? 5Illustrate with an example.
 - (c) Write an ARM-7 assembly language program to translate an array of signed half-words in 5 to an array of words. Assume 100 elements in the source array.
- **3.** (a) Compare the ZigBee and the Bluetooth communication protocols. **5**
 - (b) What is bit stuffing? How is it utilized in the USB protocol to detect data error?
 - (c) Draw and explain hardware architecture of the I2C communication protocol. How are the signals "START", "STOP", and "ACK" communicated in this protocol?
 - (d) How do you make use of the SPI in the bus topology? Illustrate.

4

3

- 4. (a) What are the significances of Semaphores, Mutexes, and Pipes in the ROTS?
 - (b) How do you test, whether a set of given tasks is schedulable or not? For the set of tasks 4+4 given below:
 - (i) What is the total CPU utilization?
 - (ii) Is the set of tasks is schedulable in a single-processor based embedded system?

<u>Task (ti)</u>	Execution Time (Ei)	Period (Ti)
1	20	100
2	40	150
3	20	350

- (c) What causes priority inversion in the RTOS? How is it tackled? Illustrate with an 6 example.
- 5. (a) How is an embedded system co-design approach different from that of traditional 6 approach?
 - (b) What are the advantages and disadvantages of DRAM? 4
 - (c) With reference to EDLC, explain
 - (i) Different phases involved in the process of embedded product design.
 - (ii) Most popular model used for an embedded product design.
 - (a) Draw the hardware and software architecture of a hand-held computer. 5
 - (b) Write an embedded 'C' program to send ASCII codes of characters 0-9 to an output port 5 of a microcontroller.
 - (c) Write the function of following AMBA-AHB signals: 4
 - (i) HADDR
 - (ii) HSIZE
 - (iii) HPROT
 - (iv) HRESP

(d) Write the scopes and life-time of the following embedded 'C' storage classes:

- (i) auto
- (ii) register
- (iii) static

6

5 + 5

6