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**15EC62**

## Sixth Semester B.E. Degree Examination, July/August 2021 ARM Microcontroller and Embedded Systems

Time: 3 hrs.

Max. Marks: 80

**Note: Answer any FIVE full questions.**

- 1
  - a. With a neat block diagram, explain the architecture of ARM Cortex-M3 processor. (07 Marks)
  - b. Explain the applications of Cortex-M3 processor. (05 Marks)
  - c. Explain the debugging features of Cortex-M3. (04 Marks)
  
- 2
  - a. Explain the functions of general purpose registers and special registers of Cortex-M3. (08 Marks)
  - b. Explain Cortex-M3 stack implementation and two-stack model with neat diagrams. (08 Marks)
  
- 3
  - a. Explain the following instructions of Cortex-M3 with examples:  
i) BL ii) LDR iii) SVC. (06 Marks)
  - b. Briefly explain bit-band operations in Cortex-M3. (05 Marks)
  - c. With a neat diagram, explain the organization of CMSIS. (05 Marks)
  
- 4
  - a. Explain any four data processing instructions of Cortex-M3 with examples. (06 Marks)
  - b. With a neat diagram, explain the memory map of ARM Cortex-M3. (06 Marks)
  - c. Write a C program to toggle an LED using Cortex-M3. (04 Marks)
  
- 5
  - a. What is an embedded system? Differentiate between embedded system and general purpose computing system. (05 Marks)
  - b. Differentiate between RISC and CISC processors. (04 Marks)
  - c. Explain the following: i) Optocoupler ii) I2C Bus. (07 Marks)
  
- 6
  - a. What is Programmable Logic Device (PLD)? Explain the different types of PLD. (05 Marks)
  - b. With neat diagrams, explain the implementation of SRAM and DRAM cells and compare both of them. (06 Marks)
  - c. Explain the role of reset circuit and watchdog timer in embedded systems. (05 Marks)
  
- 7
  - a. Explain the characteristics of an embedded system. (06 Marks)
  - b. Explain data flow graph and control data flow graph models used in embedded system design. (04 Marks)
  - c. Describe super loop based and embedded OS based approaches for embedded firmware design. (06 Marks)
  
- 8
  - a. Explain the non-operational quality attributes of an embedded system. (05 Marks)
  - b. Explain the role of embedded systems in automotive domain. (05 Marks)
  - c. Design an automatic tea/coffee vending machine based on FSM model for the following requirement:  
The tea/coffee vending is initiated by user inserting a 5 rupee coin. After inserting the coin, the user can either select 'Coffee' or 'Tea' or press 'Cancel' to cancel the order and take back the coin. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.



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- 9 a. With a neat diagram, explain the operating system architecture. **(06 Marks)**  
b. Differentiate between processes and threads. **(04 Marks)**  
c. Briefly describe Out-of-Circuit programming and In system programming techniques for embedding firm ware for a non-os based embedded system. **(06 Marks)**
- 10 a. What is a real-time kernel? Describe the basic functions of a real-time kernel. **(06 Marks)**  
b. Three processes with process IDs P1, P2 and P3 with estimated completion time 10, 5 and 7 ms respectively enter the ready queue together. A new process P4 with estimated completion time 2ms enters the ready queue after 2ms. Assume all the processes contain only CPU operation and no I/O operation are involved. Using Shortest Job First (SJF) based preemptive scheduling, calculate the waiting time and turn around time for all the processes. Also calculate the average waiting time and average turn around time. **(06 Marks)**  
c. Briefly explain simulator and emulator. **(04 Marks)**

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