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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: MEDICAL ELECTRONICS ENGINEERING **Duration: 3 hrs.**
Course Code: 19ML5PCESD **Max Marks: 100**
Course: Embedded System Design with ARM **Date: 27.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1	a)	Clarify the role of Brown-out Protection Circuit in an embedded system design.	**05**
	b)	Discuss the data transmission mechanism using serial half duplex mode with 2 wires, if EEPROM, ADC and RTC are required to be interfaced with a microcontroller. What are its advantages and disadvantages?	**07**
	c)	Discuss the different types of embedded systems classified on the basis of purpose of their usage. Briefly explain any four.	**08**

OR

2	a)	Discourse how power up reset is different from watchdog timer reset.	**06**
	b)	How will you connect multiple slaves with a master, for Full-duplex, fast and power efficient Synchronous communication? Discuss the corresponding protocol.	**07**
	c)	How is Bluetooth different from IrDA protocol?	**07**

UNIT - II

3	a)	Illustrate the architecture of Cortex M3 microcontroller and explain the purpose of various units in it.	**08**
	b)	What is an exception? In brief, discuss the exceptions ARM Cortex M3 supports.	**08**
	c)	Depict how the two stack pointers are differently used in ARM processor.	**04**

UNIT - III

4	a)	Exemplify operation of the following instructions i. UBFX ii. BFI	**06**

b) Analyze the code snippet and identify addressing modes used in each line. **08**
Assume R1=0x00000008 R5=0x00000001 R4=0x00000100

```
LDR R0, [R1, R5, LSL #2]
STRH R0, [R4], #4
LDRNE R2, [R4, #8]!
```

c) Develop an embedded C program for the following operations. **06**

i. Use Port 0 to perform GPIO operation. Make P0.3 as output and P0.31 as input.
ii. Give Logical1 input to port pins P1.4 and P1.5 and remaining port pins are at logic 0.
iii. Then invert this data.

OR

5 a) Exemplify operation of the following instructions **06**
i. REV16 ii. STMDB

b) Develop an Embedded C code for Cortex M3 to convert Hex number to its ASCII equivalent. Display the result on P3. **07**

c) Explain the bit banding in Cortex M3 and the specific advantage it brings in. **07**

UNIT - IV

6 a) If the source code is written in embedded C, how is ROM image obtained in an embedded system design? Discuss. **07**

b) Discuss operational quality attributes of an embedded system. **06**

c) Design a coin operated public telephone unit based on FSM model for the following requirements. **07**

1. The calling process is initiated by lifting the receiver (off-hook) of the telephone unit. After lifting the phone the user needs to insert a 1 rupee coin to make the call. If the line is busy, the coin is returned on placing the receiver back on the hook (on-hook)
2. If the line is through, the user is allowed to talk till 60 seconds and at the end of 45th second, prompt for inserting another 1 rupee coin for continuing the call is initiated
3. If the user doesn't insert another 1 rupee coin, the call is terminated on completing the 60 seconds time slot.
4. The system is ready to accept new call request when the receiver is placed back on the hook

The system goes to the 'Out of Order' state when there is a line fault.

UNIT - V

7 a) Differentiate between the properties of Process and Thread in the context of RTOS based embedded system. **07**

b) There are 7 processes in an embedded system. Execution of these processes is based on Preemptive Priority Scheduling. Their respective priorities, Arrival Times and Burst times are given in the table below. **06**

Process Id	Priority	Arrival Time	Burst Time
1	2(L)	0	1
2	6	1	7
3	3	2	3
4	5	3	6
5	4	4	5
6	10(H)	5	15
7	9	15	8

Represent Gantt chart and calculate waiting time, completion time and TAT for each process. Also calculate the average waiting time and average turnaround time.

c) What is semaphore primitive? Differentiate between counting and binary semaphore giving application of it in embedded system design. **07**

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