MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SIXTH SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION
MAY 2023
SUBJECT: EMBEDDED SYSTEM DESIGN (ECE - 4053)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer all questions.
- Missing data may be suitably assumed.

		M	CO	AHEP	BLT
1a.	Explain the concept of dangling pointers with a code snippet and relevant diagrams. What is the effect of dangling pointer on program run time behavior?	3	3	5,6, 16	Understand
1b.	int add (int a, int b) { return a+b; } int mul (int a, int b) { return a*b; } int sub (int a, int b) { return a-b; } int div (int a, int b) { return a/b; } Write a program to do the following. Declare a function pointer which can be used to point to above functions. Assign all these functions in all possible ways to a function pointer. Call all these functions in all possible ways using function pointers.	3	3	5, 6. 16	Apply
1c.	Define a task in embedded system. Draw the state-transition diagram of a task and explain.	4	2	1, 3, 4, 5	Understand
2a.	Explain SPI with diagram showing pin connections between master and slave device. With relevant diagram, explain how bidirectional data transfer takes place through SPI interface.	3	2	1, 3, 4, 5	Understand
2b.	Define the three main IC technologies. What are the benefits of using each of the three different IC technologies?	3	1	1, 3	Understand

2c.	What is a watchdog timer? Explain the working of a multi-stage WDT with relevant diagram. List the corrective actions that can be taken in a 2-stage WDT.	4	2	1, 3, 4, 5	Understand
3a.	Explain function que scheduling. Write the code framework for the same. Explain its advantages and disadvantages.	5	2	1, 3, 4, 5	Understand
3b.	Discuss the categories of program memory with a neat diagram showing memory structure while a program is running.	3	3	5, 6, 16	Understand

3c.	Suppose that two tasks have several critical sections, protected by different mutexes. The following are two of those critical sections, with their protection code.
	
	code segment 1
	lock(m1);
	… /* code protected by m1 */
	lock(m2);
	… /* code protected by m2 */
	unlock(m2);
	unlock(m1)
	
	code segment 2
	lock(m2);
	… /* code protected by m2 */
	lock(m1);
	… /* code protected by m1 */
	unlock(m1);
	unlock(m2)
	Is this a sensible way to protect this critical code in a multi-tasking environment? Say yes or no, and comment on your opinion.
		2	2	1, 3, 4, 5	Analyze

4a.	With a neat diagram, explain FSMD model. Write general C code template for implementing FSM model and explain it.	4	4	13, 16	Apply
4b	Explain the factors on which interrupt latency depends.	3	2	1, 3, 4, 5	Understand
4c	Explain the use of extern keyword in C programming with simple program illustration.	3	3	5,6, 16	Understand
5a.	List and explain the three objectives which ensure	4	5	15	Understand

	profitable ROI by developing an embedded product.				
5b.	Explain the following operational quality attributes of an embedded system. a) Response b) Maintainability and availability c) Reliability	3	1	1, 3	Understand
5c.	Write C functions to implement the following definitions related to Queue data structure. Use dynamic memory allocation wherever applicable. Use the following definition for structure. struct node { int data; struct node *next; }; struct node* create_Q(); EnQ (int x); int DeQ (); void printQ (struct node*);	3	3	5, 6, 16	Create