U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: Medical Electronics Engineering **Duration: 3 hrs.**

Course Code: 23MD5PCESD / 22MD5PCESD **Max Marks: 100**

Course: Embedded System Design

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

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Consider, a space probe software hangs and needs to be rebooted. Which hardware should be part of such an embedded system? Describe its operation.	*CO1*	*PO1*	**06**
	b)		Assume that there are multiple devices in a plant at 1m distance to be connected in multi-master, multi-slave, half duplex mode to transmit data in packets at 100K baud. In the design of such a system which protocol would have you used? Discourse its operation. What are its disadvantages?	*CO1*	*PO1*	**09**
	c)		How embedded system is different from general purpose computing system?	*CO1*	*PO1*	**05**
			OR			
2	a)		Design and explain the working of a hardware circuit for an embedded system to prevent the microntroller from unexpected program execution behavior when the supply voltage falls below a specified voltage.	*CO1*	*PO1*	**06**
	b)		Discuss the serial data transmission mechanism using full duplex mode to interface LCD with a microcontroller. What are its advantages?	*CO1*	*PO1*	**09**
	c)		Discuss the role of Cache memory in embedded systems.	*CO1*	*PO1*	**05**
			UNIT - II			
3	a)		Discuss operational quality attributes of an embedded system and exemplify their significance for medical embedded systems.	*CO1*	*PO1*	**10**
	b)		Develop and explain the concurrent processing model for a Seat Belt Warning System for the following criteria i. When the ignition is turned on and the seat belt is not fastened within 10 seconds of ignition ON, the system	*CO2*	*PO2*	**10**

			generates an alarm signal for 5 seconds ii. The Alarm is turned off when the alarm time expires after 5 seconds or if the driver fastens the belt or if the ignition switch is turned off, whichever happens first.			
			OR			
	4	a)	Discuss nonoperational quality attributes of an embedded system and exemplify their significance for medical embedded systems.	*CO1*	*PO1*	**10**
		b)	Develop and explain the finite state machine model for an automatic chocolate vending machine for the following requirements 1. Insert a coin of Rs 5 into the vending machine to get a coffee chocolate or milk chocolate. 2. press 'Cancel' to cancel the order	*CO2*	*PO2*	**10**
			UNIT - III			
	5	a)	Differentiate between Emulator and simulator.	*CO1*	*PO1*	**07**
		b)	What do you mean by board bring up an embedded system environment?	*CO1*	*PO1*	**06**
		c)	How In System programming is different from out of circuit programming?	*CO1*	*PO1*	**07**
			OR			
	6	a)	Discuss the significance of various files generated during cross compilation	*CO3*	*PO1*	**07**
		b)	Elaborate on debugging process in embedded system development	*CO3*	*PO1*	**06**
		c)	Discuss the binary executable file generation and its format in embedded system environment	*CO3*	*PO1*	**07**
			UNIT - IV			
	7	a)	What is critical section? Discuss the different techniques for controlling access to critical section?	*CO3*	*PO2*	**07**
		b)	Discuss how Microkernel is different from Monolithic Kernel. Which one is widely used in real-time operating systems, and reason why?	*CO3*	*PO2*	**05**

<table>
<tr><td></td><td></td><td>c)</td><td>Assume you have the following jobs to execute with one processor, with the jobs arriving in the order listed here. Suppose a system uses RR scheduling with a quantum of 5. Create a Gantt chart illustrating the execution of these processes. What is the turnaround time for each process? What is the wait time for each process? Also calculate the average waiting time and average turnaround time.
<table>
<tr><th>process ID</th><th>Burst Time</th><th>Arrival Time</th></tr>
<tr><td>1</td><td>7</td><td>0</td></tr>
<tr><td>2</td><td>4</td><td>1</td></tr>
<tr><td>3</td><td>15</td><td>2</td></tr>
<tr><td>4</td><td>11</td><td>3</td></tr>
<tr><td>5</td><td>20</td><td>4</td></tr>
<tr><td>6</td><td>9</td><td>4</td></tr>
</table></td><td>CO3</td><td>PO2</td><td>08</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>8</td><td>a)</td><td>Discourse the functions of a Real time kernel.</td><td>CO3</td><td>PO2</td><td>07</td></tr>
<tr><td></td><td></td><td>b)</td><td>Three processes with process IDs P1, P2, P3 with estimated completion time 10, 5, 7 milliseconds respectively enter the ready queue together in the order P2, P3, P1. Process P4 with estimated execution time 4 milliseconds enters the Ready queue after 6 milliseconds. Calculate the waiting time and Turn Around Time (TAT) for each process and the Average waiting time and Turn Around Time (Assuming there is no I/O waiting for the processes) in the LIFO scheduling.</td><td>CO3</td><td>PO2</td><td>08</td></tr>
<tr><td></td><td></td><td>c)</td><td>Describe the various states of a task in RTOS.</td><td>CO3</td><td>PO2</td><td>05</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - V</td><td></td><td></td><td></td></tr>
<tr><td></td><td>9</td><td>a)</td><td>With necessary sketches, describe hardware and software requirements for an Automated chocolate vending machine</td><td>CO4</td><td>PO3</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Develop multiple tasks and their synchronization model for ACVM using semaphores and mailbox messages. Deliberate the flow of operations</td><td>CO4</td><td>PO3</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>10</td><td>a)</td><td>Discuss the hardware architecture of a digital camera giving function of each block.</td><td>CO4</td><td>PO3</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Identify the necessary software components to design a digital camera</td><td>CO4</td><td>PO3</td><td>10</td></tr>
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