U.S.N.										

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

Autonomous Institute Affiliated to VTU

July 2024 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Medical Electronics Engineering **Duration: 3 hrs.**
Course Code: 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)		Differentiate between Embedded and General-purpose computing system based on their hardware design, performance and applications.	*CO1*	*PO1*	**06**
	b)		Analyze I2C protocol used for on-board communication in embedded systems for a single master multiple slave mode using relevant timing diagrams.	*CO1*	*PO1*	**06**
	c)		Explain the Serial Peripheral Interface (SPI) protocol, highlighting its fundamental characteristics. Mention the hardware connections necessary for interfacing a microcontroller with an SPI device, specifying the functions of each SPI pin.	*CO1*	*PO1*	**08**
			OR			
2	a)		Examine the significance of a brownout circuit in embedded systems, detailing its purpose and functionality.	*CO1*	*PO1*	**06**
	b)		Discuss the key considerations in setting the timeout period for a Watchdog Timer and explain how it helps to prevent system malfunctions.	*CO1*	*PO1*	**06**
	c)		With a generic block diagram of embedded system hardware, briefly explain the functionality of each block.	*CO1*	*PO1*	**08**
			UNIT - II			
3	a)		Inspect the process of source file to object file translation with the help of a neat block diagram.	*CO2*	*PO2*	**06**
	b)		Analyze the FSM model for an automatic tea/coffee vending machine for the following requirement: 1. The tea/coffee vending is initiated by user inserting a 5rupee coin. 2. After inserting the coin, the user can either select 'Coffee' or 'Tea' or press 'Cancel' to cancel the order and take back the coin.	*CO2*	*PO2*	**06**

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<tr><td></td><td></td><td>c)</td><td>Explain the Operational and Non-operational quality attributes of embedded systems, specifying two attributes for each type.</td><td>CO2</td><td>PO2</td><td>08</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - III</td><td></td><td></td><td></td></tr>
<tr><td></td><td>4</td><td>a)</td><td>Mention the files generated during the cross-compilation of an Embedded C file? Explain them in detail.</td><td>CO2</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Explain the significance of In-Circuit Emulator (ICE) in firmware debugging with the help of a neat diagram.</td><td>CO2</td><td>PO2</td><td>06</td></tr>
<tr><td></td><td></td><td>c)</td><td>List the major details stored in an object file created during cross compiling.</td><td>CO2</td><td>PO2</td><td>04</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td></td><td>5</td><td>a)</td><td>Distinguish between the properties of Process and Thread in the context of RTOS based embedded system.</td><td>CO3</td><td>PO2</td><td>04</td></tr>
<tr><td></td><td></td><td>b)</td><td>For the given data, based on the average waiting time and average turnaround time, evaluate the performance of
a) Round Robin algorithm and b) Priority based algorithm in Pre-emptive Scheduling.
* (0 - highest priority, 3 - lowest priority) *Time slice = 4ms.
<table><tr><th>Process</th><th>Arrival Time</th><th>Execution Time</th><th>Priority</th></tr><tr><td>1</td><td>0</td><td>10</td><td>1</td></tr><tr><td>2</td><td>6</td><td>5</td><td>3</td></tr><tr><td>3</td><td>6</td><td>7</td><td>2</td></tr><tr><td>4</td><td>5</td><td>6</td><td>0</td></tr></table>* Assume all the processes contain only CPU operation and no I/O operations are involved.</td><td>CO3</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>c)</td><td>Examine a deadlock scenario involving two active tasks and propose a strategy to resolve such a situation.</td><td>CO3</td><td>PO2</td><td>06</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td>CO3</td><td>PO2</td><td></td></tr>
<tr><td></td><td>6</td><td>a)</td><td>Explain the criteria involved in choosing a Real-Time Operating System (RTOS), emphasizing both functional and non-functional requirements.</td><td>CO3</td><td>PO2</td><td>05</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. 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 operations are involved. Evaluate the performance of SJF algorithm in the case of Non-preemptive and Pre-emptive scheduling.</td><td>CO3</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>c)</td><td>Define the semaphore primitive. Distinguish between binary and counting semaphores</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>7</td><td>a)</td><td>Analyze the hardware and software architecture of an embedded system, taking the adaptive cruise control system in a car as a case</td><td>CO4</td><td>PO3</td><td>10</td></tr>
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			study. Discuss key considerations for achieving optimal performance and safety in adaptive cruise control.			
		b)	Explore the hardware and software architecture of an embedded system using a digital camera as a case study. Discuss the challenges faced in designing both the hardware and software components, and elaborate on the key considerations necessary for achieving efficiency and effectiveness in the overall system.	*CO4*	*PO3*	**10**

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