SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203.

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

VI SEMESTER

1905608 EMBEDDED SYSTEMS

(Common to EEE)

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Prepared by

Mr.K.R.Ganesh, AP- (Sr.G)/ EIE

Mrs. S.Vanila, AP-Sel.G/EEE

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SUBJECT : 1905608 EMBEDDED SYSTEMS

SEM / YEAR: VI / III

UNIT I - INTRODUCTION TO EMBEDDED SYSTEMS				
Introduction to Embedded Systems - Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.				
PART-A				
Q.No	Questions	COs	BT Level	Competence
1.	List the characteristics of an embedded system.	CO1	1	Remember
2.	Name some of the hardware components of Embedded system.	CO1	1	Remember
3.	Write the purpose of timing and counting devices	CO1	2	Understand
4.	Identify the use of DMAC.	CO1	2	Understand
5.	Brief the important considerations when selecting a processor.	CO1	2	Understand
6.	What is Real Time Clock?	CO1	1	Remember
7.	Classify the methods of memory management system.	CO1	2	Understand
8.	What is a Compiler?	CO1	1	Remember
9.	Give the purpose of Watch dog timer.	CO1	2	Understand
10.	Define In circuit emulator.	CO1	2	Understand
11.	Justify the Need of Target Hardware debugging.	CO1	2	Understand
12.	State the abbreviation term MAR and MDR	CO1	2	Understand
13.	Compare embedded system and non-embedded system with examples.	CO1	2	Understand
14.	Define Simulator.	CO1	2	Understand
15.	Define DMA.	CO1	1	Remember
16.	Distinguish between CISC and RISC.	CO1	2	Understand
17.	Classify the types of processors in Embedded System.	CO1	2	Understand
18.	Define Embedded system.	CO1	1	Remember
19.	How can an embedded system be illustrated?	CO1	2	Understand
20.	Write about memory management system used in Embedded system.	CO1	2	Understand
21.	List out some classifications of embedded systems	CO1	1	Remember
22.	List the list of steps involved in the design of an embedded systems.	CO1	1	Remember
23.	List the factors to be considered while selecting a processor for an embedded system.	CO1	1	Remember
24.	Classify various forms of memory used in embedded systems	CO1	1	Remember
PATR-B				
1.	How do you select processor for different application of Embedded system?(13)	CO1	3	Apply
2.	Explain the classification of embedded systems with examples.(13)	CO1	3	Apply

3.	Outline the process of memory allocation for different application of Embedded systems.(13)		CO1	3	Apply
4.	Write a short note on		CO1	3	Apply
	(i)	Timing unit. (7)			
	(ii)	Counting devices. (6)			
5.	Describe the advanced architectures of embedded processor with neat diagram.(13)		CO1	4	Analyze
6.	(i) How much amount of memory required for Embedded systems for different applications.(7) (ii) Compare memory allocation for different application of Embedded system.(6)		CO1	4	Analyze
7.	With a neat diagram explain the working of Direct Memory Access (DMA) with architecture. (13)		CO1	4	Analyze
8.	Discuss the following terms		CO1	3	Apply
	(i)	In Circuit Emulator (6)			
	(ii)	Target Hardware Debugging (7)			
9.	Demonstrate about the different data transfer techniques involved in DMA method. (13)		CO1	3	Apply
10.	Explain the main components of Embedded hardware units with neat diagram. (13)		CO1	4	Analyze
11.	Describe about the structural units of processor architecture and advanced processor architecture with neat diagram. (6+7)		CO1	4	Analyze
12.	Explain the various forms of memories present in an embedded systems. (13)		CO1	4	Analyze
13.	Discuss an embedded processor for any application of your own.(13)		CO1	3	Apply
14.	Describe the design process for embedded system (13)		CO1	4	Analyze
15.	Analyze the design metrics used in embedded systems (13)		CO1	4	Analyze
16.	Briefly explain some examples for each classifications of an embedded systems. (13)		CO1	4	Understand
17.	With a neat diagram discuss the following terms in Embedded Processor		CO1	4	Analyze
	(i) Watch dog Timer. (6)				
	(ii) Real Time Clock. (7)				
	PART – C				
1.	Mention the necessary hardware units that must be present in the embedded systems.(15)		CO1	3	Apply
2.	Elaborate about Structural unit of Embedded Processor including processor architecture and advanced processor architecture.(15)		CO1	4	Analyze
3.	Analyze in detail with suitable diagram for		CO1	3	Apply
	(i)	In Circuit Emulator. (7)			
	(ii)	Target Hardware Debugging (8)			
4.	Discuss in detail about Timer and counting devices for Embedded systems with neat diagram. (15)		CO1	4	Analyze
5	Analyze the challenges present in embedded system design. (15)		CO1	4	Analyze

UNIT II - EMBEDDED NETWORKING					
Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers. USB, Bluetooth, Zigbee.					
PART – A					
Q.No	Questions		COs	BT Level	Competence
1.	What is half duplex communication?		CO2	1	Remember
2.	Expand : SPI , SCI		CO2	2	Understand
3.	What is a CAN bus? Where is it used?		CO2	1	Remember
4.	Show which is better Zigbee or Bluetooth?		CO2	1	Remember
5.	State the special features of I^2C.		CO2	1	Remember
6.	Define body electronics.		CO2	1	Remember
7.	Mention few serial bus communication protocols.		CO2	1	Remember
8.	Distinguish between Synchronous and Asynchronous communication.		CO2	2	Understand
9.	Draw the write byte format and read byte format of I^2C.		CO2	2	Understand
10.	Classify I/O devices in embedded system.		CO2	1	Remember
11.	What are the two characteristics of synchronous communication?		CO2	1	Remember
12.	State the difference between RS422 and RS485.		CO2	2	Understand
13.	Differentiate between RS232 and RS485.		CO2	2	Understand
14.	Brief about the limitations of I^2C.		CO2	2	Understand
15.	Justify the need for RS-485.		CO2	1	Remember
16.	List the features of RS232 standard.		CO2	1	Remember
17.	What is USB? Where is it used?		CO2	1	Remember
18.	Compare the buses used in serial communication.		CO2	1	Remember
19.	Draw the data frame format of CAN.		CO2	2	Understand
20.	What is the need for device driver? Justify it.		CO2	2	Understand
21.	Does Zigbee use Bluetooth?		CO2	1	Remember
22.	List out the classifications of device drivers.		CO2	1	Remember
23.	State the limitations of Bluetooth.		CO2	1	Remember
24.	Mention the structural units of and application areas ZigBee		CO2	2	Understand
PART-B					
1.	(i)	Describe the functions of a I/O interface with a neat diagram. (8)	CO2	3	Apply
	(ii)	Explain the classification of IO devices. (5)			
2.	Elaborate the architecture of CAN with necessary sketches (13)		CO2	4	Analyze
3.	Write a short note on		CO2	3	Apply
	(i)	Data frame format in CAN bus (7)			
	(ii)	Error frame format in CAN bus (6)			
4.	Explain in detail about serial bus communication protocols. (13)		CO2	4	Understand
5.	With neat diagram, explain about EIA 485 standard Configuration. (13)		CO2	4	Analyze
6.	Demonstrate with all necessary sketches to enable intra communications among peripherals using I^2C bus.(13)		CO2	3	Apply
7.	Tabulate the difference between the EIA 232, EIA 485 and EIA 422 standard.(13)		CO2	4	Analyze
8.	Illustrate about the following multiple slave configuration in SPI bus		CO2	3	Apply
	(i)	Independent slave configuration. (7)	CO2		
	(ii)	Daisy chain configuration. (6)	CO2		

9.	Explain in detail about SPI communication protocol and its interfacing techniques. (13)	CO2	3	Apply
10.	Explain with all necessary sketches to enable intra communications among peripherals using I^2C bus. (13)	CO2	4	Apply
11.	Explain in detail about	CO2	4	Analyze
	(i) Zigbee. (7)			
	(ii) Bluetooth. (6)			
12.	Explain the various features in USB communication protocol. (13)	CO2	3	Apply
13.	Describe about the EIA 422 standard Configuration with neat diagram and summarize the limitations of EIA 422 standard configuration. (13)	CO2	4	Analyze
14.	Illustrate the EIA -232 interface standard and major elements of EIA -232 with the help of neat diagram. (13)	CO2	3	Apply
15.	Justify the need of device drivers with suitable examples.(13)	CO2	4	Analyze
16.	Explain the functions of master and slave devices during I2C communication (13)	CO2	4	Analyze
17.	Draw and explain the structure of network during transfer of data using CAN also draw the format of the bits at CAN bus. (13)	CO2	3	Apply
	PART-C			
1.	Describe one type of serial communication bus with its communication protocol.(15)	CO2	3	Apply
2.	Present a case study on comparison of features of RS-232,RS485 and CAN bus standards. (15)	CO2	4	Analyze
3.	Describe the Half-duplex operational sequence of EIA -232 with neat flow sketch between DTE and DCE over public switched telephone network. (15)	CO2	3	Apply
4.	Demonstrate the signal using a transfer of byte when using the I^2C bus and also the format of bits at the I^2C bus with diagram.(15)	CO2	3	Apply
5.	Why we need wireless transmission? Choose and explain any one protocol which supports for longer this wireless communication. (15)	CO2	4	Analyze

UNIT III - EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT				
Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.				
PART-A				
Q.No	Questions	COs	BT Level	Competence
1.	List the different phases in EDLC.	CO3	1	Remember
2.	Mention different models used for the development of an embedded system.	CO3	2	Understand
3.	Summarize the objective of EDLC.	CO3	2	Understand
4.	Point out the features of Linear or Water fall Model.	CO3	1	Evaluate
5.	Classify the 3 categories of product development.	CO3	2	Apply
6.	Define Conceptualization phase.	CO3	1	Remember

7.	Define Product design phase and development phase.	CO3	1	Remember
8.	Elucidate on data flow graph.	CO3	2	Evaluate
9.	What is meant by need?	CO3	1	Remember
10.	What are the activities performed in deployment phase?	CO3	1	Remember
11.	Why is state model essential?	CO3	2	Analyze
12.	Define Evolutionary Model.	CO3	2	Apply
13.	What is state machine model?	CO3	1	Analyze
14.	What are the differences between data flow model and finite state model?	CO3	2	Understand
15.	State Object Oriented Model.	CO3	1	Remember
16.	Summarize the advantages and disadvantages of Linear or Water fall model.	CO3	2	Understand
17.	Analyze the issues of hardware-software co-design.	CO3	2	Analyze
18.	Mention the different types of product development. What are the processes involved in Co-Design?	CO3	1	Create
19.	Justify the quality of products.	CO3	1	Create
20.	Define Concurrent Model.	CO3	1	Apply
21.	List out the various types of models in program model	CO3	2	Analyze
22.	What is meant by SDFG?	CO3	1	Remember
23.	Define state machine and state transition	CO3	1	Remember
24.	Give some examples for non-acyclic data input.	CO3	2	Apply
	PART – B			
1.	Explain in detail about Embedded Product Development Cycle(EDLC). (13)	CO3	3	Apply
2.	Mention the essential and objectives of following phases of Embedded Product Development Life Cycle (i) Need phase (6) (ii) Conceptualization phase (7)	CO3	3	Apply
3.	Demonstrate about the State Machine Model of an Automatic Tea Vending Machine with suitable example.(13)	CO3	4	Analyze
4.	Describe Data Flow Graph model, Control Data Flow Graph model and State Machine model with a suitable example. (13)	CO3	3	Apply
5.	Name the different phases of ELDC and explain EDLC model with neat diagram. (13)	CO3	4	Analyze
6.	Discuss in detail about the computational models of Concurrent Process Model and Sequential Program Model computational models in embedded system. (13)		4	Analyze
7.	(i) Describe in detail explain the Waterfall model and Incremental or Fountain Model with suitable flowchart.(7) (ii) Describe in detail explain the Evolutionary model and spiral Model with suitable flow chart. (6)	CO3	3	Apply
8.	Discuss in detail about Hardware Software co-Design and program modelling.(13)	CO3	3	Apply
9.	Discuss about the fundamental issues in Hardware and Software Co- Design.(13)	CO3	4	Analyze
10.	(i) Explain about sequential program model for the development of embedded platform.(6) (ii) With a suitable example, explain about the State Machine model of embedded platform. (7)	CO3	3	Apply
11.	(i) Write detailed notes on Linear and iterative model in EDLC. (7)			

	(ii)	Explain about prototyping model and spiral model in EDLC. (6)	CO3	3	Apply
12.	(i)	Explain about Concurrent Process Model with suitable diagram.(6)	CO3	4	Analyze
	(ii)	Explain the Object Oriented Model with suitable example.			
13.	Illustrate the following type of computational state model		CO3	4	Analyze
	(i)	Data Flow Graph Type Model. (7)			
	(ii)	State Diagram Type Model. (6)			
14.	Explain the Sequential Model Program for seat belt warning system with suitable flow chart. (13)		CO3	3	Apply
15.	What are the various types of program models and explain briefly. (13)		CO3	3	Apply
16.	Explain briefly about State machine programming models for event controlled program flow.(13)		CO3	4	Analyze
17.	Explain in detail about Concurrent process and its implementation.(13)		CO3	4	Analyze
PART – C					
1.	Evaluate functional description about the different phases of Embedded Design Life Cycle Method. (15)		CO3	3	Apply
2.	Analyze the various modeling of EDLC With neat flow chart. (15)		CO3	4	Analyze
3.	Analyze the various computational models in embedded design with suitable example. (15)		CO3	3	Apply
4.	With a neat diagram, explain about State Machine Model for seat belt alarm system. (15)		CO3	4	Analyze
5.	Explain the design concept of an Elevator control mechanism using a sequential model. (15)		CO3	3	Apply

UNIT IV - RTOS BASED EMBEDDED SYSTEM DESIGN				
Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Pre-emptive and non-pre-emptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance				
PART-A				
Q.No	Questions	COs	BT Level	Competence
1.	Define task and task state.	CO4	1	Remember
2.	Define the Process Control Block (PCB).	CO4	2	Understand
3.	What is multithreading?	CO4	1	Remember
4.	Differentiate pre-emptive and non pre-emptive multitasking.	CO4	2	Understand
5.	Define real time operating system.	CO4	1	Remember
6.	Point out the consequences of context switching.	CO4	2	Understand
7.	List the functions of kernel.	CO4	1	Remember
8.	Define multi-rate embedded system.	CO4	2	Understand
9.	Compare the release time and deadline.	CO4	2	Understand
10.	How deadlock condition is raised in embedded system?	CO4	2	Understand
11.	Compare pre-emptive and non pre-emptive scheduling.	CO4	2	Understand
12.	Classify the three basic scheduling states in OS.	CO4	1	Remember

13.	Define scheduling policy.	CO4	1	Remember
14.	What do you mean by priority inversion?	CO4	2	Understand
15.	Compare user threads and kernel threads.	CO4	1	Remember
16.	Justify the use of a thread in a process.	CO4	1	Remember
17.	Discuss the concept of message passing.	CO4	2	Understand
18.	Define shared data problem.	CO4	1	Remember
19.	How can a scheduling process be explained in real time?	CO4	1	Remember
20.	Compare counting semaphore and binary semaphore.	CO4	2	Understand
21.	List out the various types of task states.	CO4	2	Understand
22.	What is meant by context and context switching?	CO4	1	Remember
23.	Differentiate counting semaphore and binary semaphore.	CO4	2	Understand
24.	What is Deadlock situation?	CO4	1	Remember
	PART-B			
1.	Describe the real time operating systems. Compare its features with window based real time operating systems.(13)	CO4	3	Apply
2.	Discuss in detail about semaphores and its applications. (13)	CO4	3	Apply
3.	Show the appropriate diagrams explain multiple tasks and multiple processes.(13)	CO4	4	Analyze
4.	Write brief notes on (i) Pre-emptive multitasking. (ii) Non-pre-emptive multitasking.	CO4	3	Apply
5.	With an example describe the different methods of Task scheduling algorithm. (13)	CO4	3	Apply
6.	(i) Discuss critical section service by a pre-emptive scheduler.(7) (ii) Brief about priority inheritance (6)	CO4	4	Analyze
7.	(i) List out the goals of operating system services. (5) (ii) Describe about round robin scheduling with a suitable diagram. (8)	CO4	4	Analyze
8.	Show the appropriate diagrams explain Task Communication and Synchronization.(13)	CO4	3	Apply
9.	How do you resolve shared data problem in Embedded system? Explain the methods involved in it. (13)	CO4	4	Analyze
10.	What is IPC? Mention the two methods available for it. Explain in detail about message queues.(13)	CO4	3	Apply
11.	Discuss about the basic concepts for Inter Process Communication. (13)	CO4	4	Analyze
12.	Summarize the system level and task service functions of (i) Priority inversion. (ii) Priority inheritance.	CO4	4	Analyze
13.	Explain how the interrupt routines are handled by RTOS. (13)	CO4	3	Apply
14.	Explain the following (i) Mailbox and message for inter process communication. (7) (ii) Pipe and queue for multitasking. (6)	CO4	3	Apply
15.	What is meant by shared data? Explain the various problems present in shared data. How it can overcome? (13)	CO4	4	Analyze

16.	Explain in detail about memory management and its managing strategy.(13)	CO4	4	Analyze
17.	Discuss in detail about inter process communication. (13)	CO4	4	Analyze
	PART-C			
1.	Explain task, process and thread with their types and examples which aids the real time system. (15)	CO4	3	Apply
2.	Analyze interrupt handling mechanism for (i) Polling (ii) Wait States (iii) Interrupt. (15)	CO4	4	Analyze
3.	Analyze the various terminologies given below (i) Semaphores (ii) Mail box (iii) Pipes (iv) Shared memory RTOS. (15)	CO4	3	Apply
4.	Define the term Multitasking. How the multitasking is distinguished with multiprocessing. (15)	CO4	4	Analyze
5.	Elaborate the Interrupt routines in RTOS environment and handling of interrupt source calls. (15)	CO4	3	Apply

UNIT V - EMBEDDED SYSTEM APPLICATION DEVELOPMENT				
Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM Machines-Digital Camera.				
PART-A				
Q.No	Questions	COs	BT Level	Competence
1.	What is meant by smart card? What are the events involved in smart card application?	CO5	1	Remember
2.	State the basic requirements while designing an embedded system.	CO5	1	Remember
3.	Show the architectural hardware units needed in automotive applications.	CO5	2	Understand
4.	List some evident examples of Real time embedded application.	CO5	1	Remember
5.	What is the hardware units needed to design smartcard?	CO5	2	Understand
6.	State the tasks for smartcard.	CO5	1	Remember
7.	Integrate the various types of memory units that must be present in smartcard, adaptive cruise control and washing Machine.	CO5	2	Understand
8.	Show the architectural hardware units needed in washing machine.	CO5	2	Understand
9.	Name the software units needed to design Digital Camera.	CO5	1	Remember
10.	Draw the system components in the smart card.	CO5	1	Remember
11.	Summarize the applications of embedded system.	CO5	2	Understand
12.	Points out the various inter process communication methods required in implementing the washing machine.	CO5	1	Remember
13.	What is the hardware units needed to design adaptive cruise control?	CO5	2	Understand
14.	List the design specification for automatic washing machine.	CO5	1	Remember
15.	What is the software units needed to design Automotive application?	CO5	2	Understand
16.	Justify the need for watchdog timer.	CO5	2	Understand
17.	Analyze the major function of timer device in an Automotive application.	CO5	1	Remember
18.	Define the tasks for an ATM.	CO5	1	Remember
19.	Recommend the different task for washing machine.	CO5	2	Understand

20.	List the various inter process communication methods required in implementing the smartcard.	CO5	2	Understand
21.	List out the various basic functions of RTOS.	CO5	2	Understand
22.	List out the various features or functions present in MUCOS-II.	CO5	2	Understand
23.	What are the various features of Vx Works?	CO5	1	Remember
24.	What are the major role of Adaptive Cruise Control (ACC)?	CO5	1	Remember
	PART – B			
1.	Elucidate the selection of processor and memory for any one embedded applications with suitable diagram in detail. (13)	CO5	3	Apply
2.	With suitable diagram explain in detail about the concept of washing machine application for Embedded system. (13)	CO5	3	Apply
3.	Tabulate hardware units needed in each of the systems: Smart card, Automotive applications, Washing machine. (13)	CO5	4	Analyze
4.	Discuss the case study an adaptive cruise control system with neat diagram. (13)	CO5	3	Apply
5.	List various types of memories and the application of each in the following systems: Automotive applications, Smart card, and Washing machine. (13)	CO5	4	Analyze
6.	Show and explain basic system of Automotive applications. (13)	CO5	3	Apply
7.	Apply suitable hardware and software to develop the embedded system for a smart card. (13)	CO5	4	Analyze
8.	(i) With suitable diagram explain in detail about the concept of Smart Card System Application. (7) (ii) Design architectural hardware and software units needed in smart card. (6)	CO5	4	Analyze
9.	(i) With suitable Hardware and Software explain the case study for a High end CAR using Embedded System. (6) (ii) Identify the tasks for a High end CAR. Explain the various inter process communication methods required in implementing the application. (7)	CO5	4	Analyze
10.	With suitable diagram explain in detail about the concept of Automated Teller Machine. (13)	CO5	3	Apply
11.	Identify and explain hardware units needed in digital camera.(13)	CO5	4	Analyze
12.	Discuss case study an ambulance vehicle with class diagram.(13)	CO5	3	Apply
13.	With suitable hardware and software explain the Digital Camera of the automotive embedded application domain. (13)	CO5	3	Apply
14.	With a suitable example, explain about an Automatic Chocolate Vending Machine. (13)	CO5	4	Analyze
15.	Explain briefly about various design process in Adaptive cruise control in a car system. (13)	CO5	3	Apply
16.	Explain briefly about various design process in Automatic Chocolate Vending Machine. (13)	CO5	4	Analyze
17.	Write the case study on IoT based Smart Irrigation with examples. (13)	CO5	4	Analyze
	PART – C			
1.	Create the block diagram for the case study of Embedded System for an Adaptive Cruise Control Systems in a car. (15)	CO5	4	Analyze
2.	With suitable Hardware and Software explain the case study for an ATM Machine using Embedded System. (15)	CO5	3	Apply
3.	With suitable Hardware and Software explain the case study for a Washing Machine using Embedded System. (15)	CO5	3	Apply

4.	Design and discuss an embedded system solution for a typical automotive system. Your answer must include design and development of necessary hard wares and software for an automotive system to incorporate efficient fuel management systems, vehicle performance monitoring systems, and vehicle tracking and navigation systems. (15)	CO5	4	Analyze
5.	Write the case study on IoT based Weather monitoring with examples. (15)	CO5	4	Analyze