# SRM VALLIAMMAI ENGINEERING COLLEGE
## (An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

**DEPARTMENT OF**

**ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**QUESTION BANK**

**I - SEMESTER**

**M.E. CONTROL AND INSTRUMENTATION**

**1913104 – DESIGN OF EMBEDDED SYSTEMS**

**REGULATION – 2019**

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*Prepared by*

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| UNIT I - INTRODUCTION TO EMBEDDED SYSTEMS | | | |
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| **Introduction to Embedded Systems –Structural units in Embedded processor, selection of processor& memory devices- DMA, Memory management methods- memory mapping, cache replacement concept, Timer and Counting devices, Watchdog Timer, Real Time Clock** | | | |
| **PART-A** | | | |
| **Q.No** | **Questions** | **BT Level** | **Competence** |
| **1.** | How embedded systems are different from conventional PC? | **BTL 2** | **Understand** |
| **2.** | What are the different types of memory used in embedded system design? | **BTL 1** | **Remember** |
| **3.** | Examine the function of pre-processor macros. | **BTL 3** | **Apply** |
| **4.** | What are the steps involved in the build process? | **BTL 1** | **Remember** |
| **5.** | Differentiate between editor and compiler. | **BTL 2** | **Understand** |
| **6.** | How watchdog timers are different from conventional timers? | **BTL 6** | **Create** |
| **7.** | Assess the role of additional structural units in advanced embedded processor. | **BTL 6** | **Create** |
| **8.** | What are the different modes of DMA transfer? Which one is suitable for embedded system? | **BTL 1** | **Remember** |
| **9.** | Analyze the need for memory management in Embedded Systems. | **BTL 4** | **Analyze** |
| **10.** | List out the states of timer. | **BTL 1** | **Remember** |
| **11.** | How does a program reside in ROM in embedded systems? | **BTL 5** | **Evaluate** |
| **12.** | Classify the various models used in embedded system Design. | **BTL 3** | **Apply** |
| **13.** | Define Real Time Clock (RTC). | **BTL 1** | **Remember** |
| **14.** | Why do we need at least one timer in an ES? | **BTL 1** | **Remember** |
| **15.** | Point out some control bits of a timer. | **BTL 4** | **Analyze** |
| **16.** | Classify embedded Real time systems. Give an example for each. | **BTL 3** | **Apply** |
| **17.** | List out the importance of In-circuit emulator (ICE). | **BTL 2** | **Understand** |
| **18.** | Prioritize the various development processes used in ICE. | **BTL 5** | **Evaluate** |
| **19.** | Differentiate between host machine and target machine. | **BTL 2** | **Understand** |
| **20.** | Point out the issues that impact the selection of processor for an application. | **BTL 4** | **Analyze** |
| **PART-B** | | | |
| **1.** | **(i)**Describe the memory management concepts in embedded system design. **(6)**<br>**(ii)**Examine how real time systems differ from conventional system. What is the necessity of real time system in embedded applications? **(7)** | **BTL 1** | **Remember** |
| **2.** | With neat diagram, explain the working of Direct Memory Access (DMA) and mention the memory | **BTL 6** | **Create** |

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| | management methods (13) | | |
| **3.** | **(i)** Summarize the various form of memories present in an embedded system. **(7)**<br>**(ii)** Discuss the software tools in designing of an embedded system**. (6)** | **BTL 2** | **Understand** |
| **4.** | **(i)**Quote in brief about the various steps involved in the Embedded System build process. **(7)**<br>**(ii)** Describe the basic block diagram of embedded real time system. **(6)** | **BTL 1** | **Remember** |
| **5.** | **(i)** Explain the need for memory management.(7)<br>**(ii)**Discuss in detail about embedded computory applications. **(6)** | **BTL 2** | **Understand** |
| **6.** | Demonstrate in detail about the different 'Embedded Processors' in a system**. (13)** | **BTL 3** | **Apply** |
| **7.** | Explain the different types of single purpose processors. (13) | **BTL 4** | **Analyze** |
| **8.** | Explain the differences between timer and counting devices used in embedded system with necessary diagrams. **(13)** | **BTL 4** | **Analyze** |
| **9.** | **(i)** Summarize in detail about memory organisation and memory enhancement. **(6)**<br>**(ii)** How co-verification is done? Explain. **(7)** | **BTL 5** | **Evaluate** |
| **10.** | **(i)** Explain how suitable processor are selected for an embedded system design. **(7)**<br>**(ii)** Explain how suitable memory devices are selected for an embedded system design. **(6)** | **BTL 6** | **Create** |
| **11.** | **(i)**Discuss about the structural units in embedded processor. **(7)**<br>**(ii)** Discuss the function of In-Circuit emulator **(6)** | **BTL 2** | **Understand** |
| **12.** | Analyze the role and importance of following in an embedded system<br>**(i)**Watchdog Timer, **(ii)** Real Time Clock **(6+7)** | **BTL 4** | **Analyze** |
| **13.** | **(i)** Discuss in detail about how the timers and counters are useful in system design in embedded systems **(7)**<br>**(ii)**Discuss about the applications of hardware units and devices in an embedded system. **(6)** | **BTL 3** | **Apply** |
| **14.** | **(i)** What does u mean by cache replacement technique? why it is needed for embedded system .**(7)**<br>**(ii)Tabulate** the necessity of flash memory and RAM used in embedded system.**(6)** | **BTL 3**<br><br>**BTL 5** | **Applying**<br><br>**Evaluate** |
| **PART-C** | | | |
| **1.** | Discuss briefly on memory management of overlap memory on cache replacement techniques. **(15)** | **BTL2** | **Understand** |
| **2.** | List the need for watchdog timer in an embedded application. Explain how it protects the system with an example.**(15)** | **BTL 6** | **create** |
| **3.** | Elucidate the selection of processor and memory | **BTL 6** | **create** |

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| | for any one embedded applications with suitable diagram in detail. **(15)** | | |
| **4.** | **(i)** Develop a chart for brief about the importance of following :**(1)** Multitasking OS (**2)** IP core **(3)** System on Chip **(4)** ASSP in modern trends. **(8)** **(ii)** List out the tests of five industry-specific tests suite of EEMBC benchmark tests list.**(7)** | **BTL 6** | **create** |

| **UNIT II - EMBEDDED NETWORKING AND INTERRUPTS SERVICE MECHANISM** | | | |
|---|---|---|---|
| **Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols -RS232 standard – RS485 –USB – Inter Integrated Circuits (I2C) – interrupt sources , Programmed-I/Obusy-wait approach without interrupt service mechanism- ISR concept-– multiple interrupts – context and periods for context switching, interrupt latency and deadline -Introduction to Basic Concept Device Drivers**. | | | |
| **PART-A** | | | |
| **Q.No** | **Questions** | **BT Level** | **Competence** |
| **1.** | List out the types of I/O ports. | **BTL 1** | **Remember** |
| **2.** | Differentiate between serial port and parallel port. | **BTL 2** | **Understand** |
| **3.** | What is meant by embedded networking? | **BTL 1** | **Remember** |
| **4.** | What is full duplex communication? | **BTL 1** | **Remember** |
| **5.** | Compare parallel port interfaces for keypad, printer, LCD-controller and touch screen. | **BTL 4** | **Analyze** |
| **6.** | Identify the major features of USB bus. | **BTL 2** | **Understand** |
| **7.** | What is USB? Where is it used? | **BTL 1** | **Remember** |
| **8.** | | **BTL 2** | **Understand** |
| **9.** | State any four standard band rates supported by RS 232 | **BTL 4** | **Analyze** |
| **10.** | Mention the main features of CAN bus. | **BTL 3** | **Apply** |
| **11.** | What is CAN Bus? | **BTL 1** | **Remember** |
| **12.** | Evaluate the merits of advanced serial high speed buses. | **BTL 5** | **Evaluate** |
| **13.** | Mention the concept of plug and play. | **BTL 3** | **Apply** |
| **14.** | Justify that why device drivers are necessary for interfacing a device with a processor. | **BTL 6** | **Create** |
| **15.** | What is meant by I2C? | **BTL 1** | **Remember** |
| **16.** | | **BTL 2** | **Understand** |
| **17.** | Classify between device register and device address? | **BTL 3** | **Apply** |
| **18.** | Justify the advantages of SPI protocol. | **BTL 5** | **Evaluate** |
| **19.** | Analyze MISO and MOSI in SPI protocol. | **BTL 4** | **Analyze** |
| **20.** | Assess the transmission rates of I2C. | **BTL 6** | **Create** |
| **PART-B** | | | |
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| **1.** | Mention the features of buses and common | **BTL 3** | **Apply** |

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| | modes used in serial communication and explain them. **(13)** | | |
| **2.** | Analyze the importance of interrupts in embedded system and explain how context switching is executed in it.(13) | **BTL 4** | **Analyze** |
| **3.** | **(i)**What are interrupts?(3)<br>**(ii)** How they are generated? (5)<br>**(iii)**What are types of interrupts and brief them in detail?(5) | **BTL 1** | **Remember** |
| **4.** | What do you mean by context switching? how it is handled by scheduler.(13) | **BTL 1** | **Remember** |
| **5.** | Examine the functions of device drivers and interrupt service mechanisms employed in it. **(13)** | **BTL 6** | **Create** |
| **6.** | Write short notes on the applications of :<br>**(i)** RS 232 standard **(4)**<br>**(ii)** USB **(5)**<br>**(iii)** Inter Integrated Circuits Bus **(4)** | **BTL 3** | **Apply** |
| **7.** | **(i)**Explain the functions of device drivers. **(5)**<br>**(ii)** List out the steps involved in writing a device driver.**(8)** | **BTL 2** | **Understand** |
| **8.** | Discuss about the differences in execution between programmed I/O and busy wait approach in embedded system. **(13)** | **BTL 2** | **Understand** |
| **9.** | Explain how serial data transfer is performed in I2C bus. Also brief the steps involved in transfer of a byte using I2C? **(13)** | **BTL 4** | **Analyze** |
| **10.** | Write a detailed technical short note on the characteristics of the I2C and explain the process of arbitration. **(13)** | **BTL 1** | **Remember** |
| **11.** | **(i)** Briefly explain about input/output device ports and buses. **(9)**<br>**(ii)** Compare RS 232,RS 422,and RS 485.**(4)** | **BTL 2** | **Understand** |
| **12.** | Explain the need and working of the following :<br>**(i)**MAX 232 **(7)**<br>**(ii)**Device Drivers **(6)** | **BTL 4** | **Analyze** |
| **13.** | Describe Daisy chain arrangement in programmed I/O and comment on it. **(13)** | **BTL 1** | **Remember** |
| **14.** | Design and explain a parallel priority interrupt hardware for a system with eight sources**(13)** | **BTL 5** | **Evaluate** |
| **PART-C** | | | |
| **1.** | Analyse that how serial communication protocols are used for embedded networking?**(15)** | **BTL 4** | **Analyze** |
| **2.** | Create a List about the importance of latency, deadline and context switching in embedded networking.**(15)** | **BTL 6** | **Create** |

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| **3.** | Where multiple interrupts are needed? how they are executed in embedded system based applications.**(15)** | **BTL 6** | **Create** |
| **4.** | What do you mean by context period and interrupt service routine? how do they executed by embedded system based applications**.(15)** | **BTL 6** | **Create** |

| **UNIT - III RTOS BASED EMBEDDED SYSTEM DESIGN** | | | |
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| **Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multi processing and Multitasking, Pre emptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication –synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance-comparison of commercial RTOS features - RTOS Lite, Full RTOS, VxWorks, µC/OS-II, RT Linux** | | | |
| **PART-A** | | | |
| **Q.No** | **Questions** | **BT Level** | **Competence** |
| **1.** | Compare the difference between RTOS and Operating System. | **BTL 6** | **Create** |
| **2.** | List any four commercial RTOS. | **BTL 1** | **Remember** |
| **3.** | Assess when an RTOS is necessary and not necessary in an embedded system. | **BTL 6** | **Create** |
| **4.** | How does a data output generated by one process transfer to another process using an IPC? | **BTL 1** | **Remember** |
| **5.** | Differentiate process, threads and tasks. | **BTL 2** | **Understand** |
| **6.** | What are the different states of a task? | **BTL 1** | **Remember** |
| **7.** | Mention the consequences of context switching. | **BTL 3** | **Apply** |
| **8.** | Mention the characteristics of functions, Interrupt Service Routines and Tasks. | **BTL 3** | **Apply** |
| **9.** | Distinguish between multiprocessing and multitasking. | **BTL 2** | **Understand** |
| **10.** | List out the importance of preemptive scheduling. | **BTL 1** | **Remember** |
| **11.** | Distinguish non preemptive and preemptive scheduling in RTOS. | **BTL 2** | **Understand** |
| **12.** | What is shared data problem? How will you eliminate it? | **BTL 1** | **Remember** |
| **13.** | What is the use of semaphore? | **BTL 1** | **Remember** |
| **14.** | Examine the importance of disability of interrupts in Embedded System. | **BTL 3** | **Apply** |
| **15.** | Analyze the situations which lead to priority inversion? | **BTL 4** | **Analyze** |
| **16.** | How will you define active task in the context of Vx works? What are the features of Vx works? | **BTL 5** | **Evaluate** |

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| **17.** | Point out the functions performed by Real time OS in an embedded system? | **BTL 4** | **Analyze** |
| **18.** | Outline the features of RT Linux. | **BTL 4** | **Analyze** |
| **19.** | Summarize the goals of operating system? | **BTL 2** | **Understand** |
| **20.** | Justify the advantages of mail boxes in RTOS. | **BTL 5** | **Evaluate** |
| | **PART-B** | | |
| **1.** | Explain the principle of preemptive and non preemptive multitasking. Discuss about the scheduling algorithms suitable to these two types of multitasking. **(13)** | **BTL 2** | **Understand** |
| **2.** | **(i)**Explain the goals of operating system services. **(7)**<br>**(ii)**Explain the three alternative systems in RTOS for responding a hardware source call with a neat sketch. **(6)** | **BTL 4** | **Analyze** |
| **3.** | **(i)**Describe the features of Vx works RTOS. **(7)**<br>**(ii)** Enumerate the merits and demerits of various Real time operating systems. **(6)** | **BTL 1** | **Remember** |
| **4.** | Write the fifteen point strategy for synchronization between the processes, ISRs, OS functions and tasks for resource management. **(13)** | **BTL 1** | **Remember** |
| **5.** | Describe the features of various Contemporary Real Time Operating Systems. **(13)** | **BTL 1** | **Remember** |
| **6.** | **(i)** Explain the basic concepts of RTOS. **(4)**<br>**(ii)** What are the different types of RTOS? **(4)**<br>**(iii)** Explain the features of Micro OS-II. **(5)** | **BTL 4** | **Analyze** |
| **7.** | Write about the use of semaphores for the critical sections of a task with necessary diagram. **(13)** | **BTL 5** | **Evaluate** |
| **8.** | Summarize the system level and task service functions of µc/OS. **(13)** | **BTL 6** | **Create** |
| **9.** | What is shared data problem? Demonstrate how shared data problem will be handled in real time system. **(13)** | **BTL 3** | **Apply** |
| **10.** | Illustrate with suitable example about the use of semaphore in multitasking? What are the various semaphore operations? **(13)** | **BTL 3** | **Apply** |
| **11.** | Explain how the interrupt routines are handled by RTOS and illustrate the features of Vx Works. **(13)** | **BTL 2** | **Understand** |
| **12.** | Explain the terminologies Semaphores, Mail box, pipes and shared memory in RTOS. **(13)** | **BTL 4** | **Analyze** |
| **13.** | **(i)**Discuss about inter-process communication. **(3)**<br>**(ii)**Explain about the real time operating system of RTOS lite. **(10)** | **BTL 2** | **Understand** |
| **14.** | **(i)**Describe in detail about RT Linux RTOS. **(6)**<br>**(ii)**Describe about task creation, management and scheduling in µC/OS-II. **(7)** | **BTL 1** | **Remember** |
| | **PART-C** | | |
| **1.** | Prepare about the list of usage issues encountered | **BTL 6** | **Create** |

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| | in In-circuit emulators **(15)** | | |
| **2.** | Analyze about the performance of an embedded system, based on the special software techniques that are considered by embedded system programmers, when developing software for the application.**(15)** | **BTL 4** | **Analyze** |
| **3.** | Develop the list of points to be considered for the selection of RTOS for various embedded applications. Give some known design examples.(**15)** | **BTL 6** | **Create** |
| **4.** | How to select debugging tools to develop an embedded system.(**15)** | **BTL 6** | **Create** |

| **UNIT IV SOFTWARE DEVELOPMENT TOOLS** | | | |
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| **Software Development environment-IDE, assembler, compiler, linker, simulator, debugger, Incircuit emulator, Target Hardware Debugging, need for Hardware-Software Partitioning and Co-Design.Overview of UML, Scope of UML modeling, Conceptual model of UML, Architectural, UML basic elements-Diagram- Modeling techniques - structural, Behavioral, Activity Diagrams** | | | |
| **PART-A** | | | |
| **Q.No** | **Questions** | **BT Level** | **Competence** |
| **1.** | Define UML. | **BTL 1** | **Remember** |
| **2.** | What are the three ways and perspectives to apply UML? | **BTL 3** | **Apply** |
| **3.** | Describe the Primary goals in the Design of UML. | **BTL 2** | **Understand** |
| **4.** | What is UML Activity Diagrams? | **BTL 3** | **Apply** |
| **5.** | Point out the issues involved in the Hardware – Software integration of embedded system design | **BTL 4** | **Analyze** |
| **6.** | Quote any four features for the selection of compilers. | **BTL 1** | **Remember** |
| **7.** | Compare the source code with object code | **BTL 5** | **Evaluate** |
| **8.** | Explain the need for co-verification in embedded product development. | **BTL 4** | **Analyze** |
| **9.** | Tabulate the advantages and disadvantages of debug kernel | **BTL 1** | **Remember** |
| **10.** | List the elements of ROM emulator. Also give limitations of it | **BTL 2** | **Understand** |
| **11.** | Name the two resources needed for the debug kernel from the target device? | **BTL 1** | **Remember** |
| **12.** | Write the minimum requirements of special debug tools, used in system integration | **BTL 6** | **Create** |
| **13.** | How does the Host-based debugging perform? Examine the problems associated with this debugging | **BTL 3** | **Apply** |
| **14.** | Give the advantages of emulator. | **BTL 2** | **Understand** |
| **15.** | Name the methods for finding the bug in the single line and block of the given code. | **BTL 1** | **Remember** |
| **16.** | Discuss, where do we use triggers in emulation? Why? | **BTL 2** | **Understand** |

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| **17.** | Define In-circuit emulator | **BTL 1** | **Remember** |
| **18.** | What is the need for break point in debugging? How it is integrated with the program? | **BTL 6** | **Creating** |
| **19.** | Summarize the role of memory steering logic in ICE | **BTL5** | **Evaluate** |
| **20.** | Explain how emulators steering circuitry interposed between processor and the target system | **BTL4** | **Analyze** |
| | **PART-B** | | |
| **1.** | List the various UML diagram and examine the purpose of each diagram.**(13)** | **BTL 1** | **Remember** |
| **2.** | Generalize your views and write notes on Structural and Behavioral Pattern.(**13)** | **BTL 6** | **Create** |
| **3.** | **(i).**Compare sequence diagram and communication diagram with suitable example.<br>**(ii).**Explain the Concepts of frames in UML.(**13)** | **BTL 5** | **Evaluate** |
| **4.** | **(i)**Explain hardware and software design of embedded system in detail. **(10)**<br>**(ii)**List the product specification details needed for an embedded system design.**(3)** | **BTL 4**<br>**BTL 1** | **Analyze**<br>**Remember** |
| **5.** | **(i)**With suitable example, illustrate the concept of Hardware/software partitioning**.(9)**<br>**(ii)**Discuss about the tasks are carried out in iteration and implementation phase in embedded design**.(4)** | **BTL 3**<br>**BTL 2** | **Apply**<br>**Understand** |
| **6.** | Write short notes on the following:<br>**(i)**Compilers. **(6)**<br>**(ii)**Hardware and software debugging tools**.(7)** | **BTL 1** | **Remember** |
| **7.** | **(i)**With suitable example, describe the concept of Partitioning decision. (**8)**<br>**(ii)**Illustrate how to code the hardware in the View of HW/SW duality. (**5)** | **BTL 2**<br>**BTL 3** | **Understand**<br>**Apply** |
| **8.** | Explain with an application how to do host based debugging. Also discuss about the problems associated with it. **(8+5)** | **BTL 4** | **Analyze** |
| **9.** | **(i)** With a neat block diagram, explain the operation of ROM emulator. Differentiate its functionality from ICE. **(8)**<br>**(ii)** Write the advantages and disadvantages of debug kernel.**(5)** | **BTL 4**<br>**BTL 1** | **Analyze**<br>**Remember** |
| **10.** | With neat schematic explain briefly about remote debuggers and debug kernels. **(13)** | **BTL 1** | **Remember** |
| **11.** | Explain in detail on the JTAG emulator.**(13)** | **BTL 1** | **Remember** |
| **12.** | Mention the merits and demerits of Structural and behavioural UML Model. **(13)** | **BTL 3** | **Apply** |
| **13.** | Analyse the importance of each basic elements in UML.(**13)** | **BTL 4** | **Analyze** |
| **14.** | Discuss the scope of UML modelling in embedded system design**.(13)** | **BTL2** | **Understand** |

| PART-C | | | |
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| **1.** | Explain product integration and the challenges to be addressed upon product integration with example.**(15)** | **BTL 5** | **Evaluate** |
| **2.** | Develop an UML model for a simple home automation application**.(15)** | **BTL 6** | **Create** |
| **3.** | Create a computational model any one embedded system application with the role of hardware software co-design **(15)** | **BTL 6** | **Create** |
| **4.** | Develop the list for various issues related with design of embedded system for automotive applications. **(15)** | **BTL 6** | **Create** |

| **UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT** | | | |
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| **Objectives, different Phases & Modeling of the Embedded product Development Life Cycle (EDLC),Case studies on Smart card- Adaptive Cruise control in a Car -Mobile Phone software for key inputs.** | | | |
| **PART-A** | | | |
| **Q. No** | **Questions** | **BT Level** | **Competence** |
| **1.** | Mention the importance of sensors and actuators in embedded applications | **BTL 3** | **Apply** |
| **2.** | Identify the importance of temperature and level sensor in washing machine. | **BTL 2** | **Understand** |
| **3.** | Compare High Speed Electronic Control Unit and Low Speed Electronic Control Unit. | **BTL 6** | **Create** |
| **4.** | State the role of interfacing I/O circuit in smart card. | **BTL 1** | **Remember** |
| **5.** | List the embedded devices present in a high end car. | **BTL 1** | **Remember** |
| **6.** | What is adaptive control? How does adaptive control algorithm differ from feedback proportional control? | **BTL 1** | **Remember** |
| **7.** | Examine the features of OS in automobile applications? | **BTL 4** | **Analyze** |
| **8.** | How do you identify an application that would benefit from using a smart card? | **BTL 5** | **Evaluate** |
| **9.** | Point out the advantage of encryption when using a fabrication key, personalization key, utilization lock and PIN? | **BTL 4** | **Analyze** |
| **10.** | List the objectives of Embedded product Development Life Cycle. | **BTL 1** | **Remember** |
| **11.** | Point out the basic concept of EDLC | **BTL 2** | **Understand** |
| **12.** | Why EDLC is essential in embedded systems? | **BTL 5** | **Evaluate** |
| **13.** | Predict the aim of product development in embedded systems. | **BTL 2** | **Understand** |
| **14.** | List the role of quality in embedded product | **BTL 1** | **Remember** |

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| | development. | | |
| **15.** | Discuss the importance of budget allocation in EDLC. | **BTL 2** | **Understand** |
| **16.** | Examine the necessity of Product re-engineering. | **BTL 3** | **Apply** |
| **17.** | Define conceptualization. | **BTL 1** | **Remember** |
| **18.** | Compare iterative /incremental/foundation EDLC model. | **BTL 4** | **Analyze** |
| **19.** | Mention the computational models in EDLC. | **BTL 3** | **Apply** |
| **20.** | Propose the best suited circumstances of object oriented model for embedded design. | **BTL 6** | **Create** |
| | **PART-B** | | |
| **1.** | Discuss the role of an embedded application which provides extensive support in home automation. **(13)** | **BTL 2** | **Understand** |
| **2.** | Mention the different communication buses used in automotive applications and explain.**(13)**. | **BTL 3** | **Apply** |
| **3.** | Describe the architecture of a contactless smart card. **(13)** | **BTL 1** | **Remember** |
| **4.** | Tabulate the requirements and functionalities of smart card communication system. **(13)** | **BTL 1** | **Remember** |
| **5.** | Analyze various steps of embedded system design with respect to design of automatic washing machine. **(13)** | **BTL 4** | **Analyze** |
| **6.** | **(i)**Justify the merits of hardware software co-design. **(4)**<br>**(ii)** Explain the fundamental issues in hardware software co-design. **(9)** | **BTL 6** | **Create** |
| **7.** | Analyze the different computational models in embedded system design. **(13)** | **BTL 4** | **Analyze** |
| **8.** | **(i)** List the different phases of EDLC and mention the significance of each phase.(7)<br>**(ii)**With examples ,tabulate the difference between control dominated systems with data dominated systems.(8) | **BTL 1** | **Remember** |
| **9.** | **(i)**What is the difference between Data Flow Graph and Control data flow graph? **(6)**<br>**(ii)** Explain their significance in embedded system design. **(7)** | **BTL 2** | **Understand** |
| **10.** | Examine the classic embedded product development life cycle model and discuss about conceptualization. **(13)** | **BTL 5** | **Evaluate** |
| **11.** | Illustrate with an example the phenomenon of Linear/waterfall model in embedded system design. **(13)** | **BTL 3** | **Apply** |
| **12.** | With suitable example, explain about the state machine model of mobile phone with key inputs.**(13)** | **BTL 1** | **Remember** |
| **13.** | Illustrate with functional description about the | **BTL 4** | **Analyze** |

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| | different phases of Embedded system life cycle model. **(13)** | | |
| **14.** | Describe the various types of electronic control units employed in automotive applications. **(13)** | **BTL 2** | **Understand** |
| **PART-C** | | | |
| **1.** | **(i)** What are the major phases, an embedded product undergo? Consider a sample product for design and development and analyze the challenges faced at each phase.**(10)**<br>**(ii)** Why should the embedded system RTOS be scalable.**(5)** | **BTL 6**<br>**BTL 4** | **Create**<br>**Analyze** |
| **2.** | Analyze the factors that an embedded system designer should consider to help him to decide which RTOS is appropriate for his application. **(15)** | **BTL 6** | **Create** |
| **3.** | Develop the hardware/ software design flow in detail highlighting the similarity between the activities followed in each design. **(15)** | **BTL 6** | **Create** |
| **4.** | Narrate the objective, need, different phases and modelling of EDLC**(15)** | **BTL 5** | **Evaluate** |