



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)  
Dundigal, Hyderabad - 500 043

## ELECTRICAL AND ELECTRONICS ENGINEERING

### TUTORIAL QUESTION BANK

|                           |  |                  |                |                   |                |
|---------------------------|--|------------------|----------------|-------------------|----------------|
| <b>Course Title</b>       | <b>EMBEDDED SYSTEMS DESIGN AND PROGRAMMING</b> |                  |                |                   |                |
| <b>Course Code</b>        | AEC024   |                  |                |                   |                |
| <b>Programme</b>          | B.Tech   |                  |                |                   |                |
| <b>Semester</b>           | VIII   | EEE              |                |                   |                |
| <b>Course Type</b>        | Core   |                  |                |                   |                |
| <b>Regulation</b>         | IARE - R16                                     |                  |                |                   |                |
| <b>Course Structure</b>   | <b>Theory</b>                                  |                  |                | <b>Practical</b>  |                |
|                           | <b>Lectures</b>                                | <b>Tutorials</b> | <b>Credits</b> | <b>Laboratory</b> | <b>Credits</b> |
|                           | 3  | -                | 3              | -                 | -              |
| <b>Course Coordinator</b> | Ms. M. Suguna Sri, Assistant Professor         |                  |                |                   |                |
| <b>Course Faculty</b>     | Ms. M. Suguna Sri, Assistant Professor         |                  |                |                   |                |

### COURSE OBJECTIVES

|  |   |
|--|---|
| <b>The course should enable the students to:</b> |   |
| I  | Imbibe knowledge about the basic functions, structure, concepts and applications of Embedded Systems. |
| II   | Understand Real time operating system concepts.   |
| III  | Design interfacing of switches, displays and stepper motor.   |
| IV   | Analyze different tools for development of embedded software.   |
| V  | Be acquainted the architecture of advanced processors.  |

### COURSE OUTCOMES (COs):

|      |  |
|------|--|
| CO 1 | Understand the basic concepts of embedded system and various applications and characteristics, formalisms for system design of embedded system design  |
| CO 2 | Discuss the concepts of C and develop the C programming examples with Keil IDE, and understand the concepts of interfacing modules using embedded C.   |
| CO 3 | Understand the basic embedded programming concepts in C and assembly language.   |
| CO 4 | Understand the fundamentals of RTOS and its programming and Task communication, Task synchronization with its issues and techniques. Develop examples using embedded software and understand the debugging techniques. |
| CO 5 | Discuss the concepts of advanced processors like ARM and SHARC and protocols of I2C and CAN bus.   |

## **COURSE LEARNING OUTCOMES (CLOs):**

**Students, who complete the course, will have demonstrated the ability to do the following:**

|           |   |
|-----------|---|
| AEC024.1  | Understand basic concept of embedded systems.   |
| AEC024.2  | Analyze the applications in various domains of embedded system.   |
| AEC024.3  | Develop the embedded system and Design process and tools with examples.   |
| AEC024.4  | Understand characteristics and quality attributes of embedded systems, formalisms for system design.              |
| AEC024.5  | Understand the basic programming of c and its looping structure.  |
| AEC024.6  | Analyze the embedded C programming in Keil IDE, and compiling and building the hardware.                          |
| AEC024.7  | Understand different concepts of display and keyboard interfacing using embedded C.                               |
| AEC024.8  | Understand different concepts of serial communication using embedded C and user interfacing                       |
| AEC024.9  | Analyse the programming on switches   |
| AEC024.10 | Understanding the programming language tools.   |
| AEC024.11 | Understand different concepts of display and keyboard interfacing using embedded C.                               |
| AEC024.12 | Understand different concepts of stepper motor interfacing.   |
| AEC024.13 | Understand and analyze the RTOS concepts for firmware development.  |
| AEC024.14 | Remember how to choose an RTOS, task scheduling, semaphores and queues, hard real-time scheduling considerations. |
| AEC024.15 | Understand the task communication, its programming and Task synchronization with its issues and techniques.       |
| AEC024.16 | Develop host and target machines for linking to embedded software.  |
| AEC024.17 | Develop debugging techniques for testing on host machine with examples.   |
| AEC024.18 | Remember the advanced processors such as ARM and SHARC.   |
| AEC024.19 | Understand the bus protocols such as I2C and CAN bus.   |
| AEC024.20 | Design an application based on advanced technological changes.  |

## TUTORIAL QUESTION BANK

| S.No                                    | QUESTION  | Blooms Taxonomy Level | Course Outcomes | Course Learning Outcomes |
|---|---|-----------------------|-----------------|--------------------------|
| <b>UNIT-I</b>                           |   |                       |                 |                          |
| <b>EMBEDDED COMPUTING</b>               |   |                       |                 |                          |
| <b>Part - A(Short Answer Questions)</b> |   |                       |                 |                          |
| 1                                       | Define an embedded system.  | Understand            | CO 1            | AEC024.01                |
| 2                                       | Distinguish between embedded system vs general purpose system.  | Understand            | CO 1            | AEC024.01                |
| 3                                       | Demonstrate any four application areas of embedded systems.   | Understand            | CO 1            | AEC024.01                |
| 4                                       | List out classification embedded systems based on generation.   | Remember              | CO 1            | AEC024.01                |
| 5                                       | Discuss in briefly the history of embedded systems.   | Understand            | CO 1            | AEC024.01                |
| 6                                       | Outline the classification of embedded systems based on Triggering  | Remember              | CO 1            | AEC024.01                |
| 7                                       | Demonstrate the brake and stability control system of automobile example.                                       | Understand            | CO 1            | AEC024.02                |
| 8                                       | List out classification embedded systems based on and performance requirements                                  | Remember              | CO 1            | AEC024.02                |
| 9                                       | List the steps in embedded system design process.   | Remember              | CO 1            | AEC024.02                |
| 10                                      | Explain classification of embedded systems based on deterministic behavior.                                     | Understand            | CO 1            | AEC024.03                |
| 11                                      | Describe the typical characteristics of an embedded system?   | Remember              | CO 1            | AEC024.03                |
| 12                                      | Explain the main components of an embedded system?  | Understand            | CO 1            | AEC024.04                |
| 13                                      | Give examples for small, medium and sophisticated embedded systems.   | Understand            | CO 1            | AEC024.04                |
| 14                                      | Write short notes on formalism for the system design.   | Understand            | CO 1            | AEC024.04                |
| 15                                      | Draw the neat diagram of digital camera application.  | Understand            | CO 1            | AEC024.02                |
| 16                                      | Give the examples of formalism for the system design.   | Understand            | CO 1            | AEC024.04                |
| 17                                      | Define Operational Quality attributes of embedded computing.  | Understand            | CO 1            | AEC024.04                |
| 18                                      | Define Non-Operational Quality attributes of embedded computing.  | Understand            | CO 1            | AEC024.04                |
| 19                                      | List out classification embedded systems based on complexity requirements.                                      | Remember              | CO 1            | AEC024.02                |
| 20                                      | Define contrast topódown and bottomóup design in embedded systems.  | Understand            | CO 1            | AEC024.03                |
| <b>Part - B (Long Answer Questions)</b> |   |                       |                 |                          |
| 1                                       | Interpret the requirements for an embedded system design process.   | Understand            | CO 1            | AEC024.01                |
| 2                                       | Explain automatic chocolate vending machine with neat diagram.  | Remember              | CO 1            | AEC024.01                |
| 3                                       | Explicit about formalism for the system design with an example.   | Understand            | CO 1            | AEC024.04                |
| 4                                       | Discuss the specifications for an embedded system design process.   | Remember              | CO 1            | AEC024.02                |
| 5                                       | Examine the classification of embedded systems based on generation with examples.                               | Understand            | CO 1            | AEC024.01                |
| 6                                       | Demonstrate the digital camera application with neat diagram and explain how it works based on embedded design. | Understand            | CO 1            | AEC024.02                |
| 7                                       | Examine the architecture for an embedded system design process.   | Understand            | CO 1            | AEC024.02                |
| 8                                       | Explain classification embedded systems based on complexity and performance requirements.                       | Understand            | CO 1            | AEC024.01                |
| 9                                       | Analyze the components for an embedded system design process.   | Understand            | CO 1            | AEC024.02                |
| 10                                      | Describe major application areas of an embedded system with examples.   | Remember              | CO 1            | AEC024.02                |

| S.No                                   | QUESTION   | Blooms Taxonomy Level | Course Outcomes | Course Learning Outcomes |
|--|--|-----------------------|-----------------|--------------------------|
| 11                                     | Explain the characteristics of embedded computing applications   | Understand            | CO 1            | AEC024.03                |
| 12                                     | Discuss the Operational Quality attributes of embedded computing applications  | Understand            | CO 1            | AEC024.04                |
| 13                                     | Discuss the Non- Operational Quality attributes of embedded computing applications.  | Understand            | CO 1            | AEC024.04                |
| 14                                     | Which are the components used as the core of an embedded system? Explain the merits, drawbacks, if any, and the applications/domains where they are commonly used  | Remember              | CO 1            | AEC024.04                |
| 15                                     | Give domain specific examples of embedded system design and explain in detail about one example with a neat diagram  | Understand            | CO 1            | AEC024.02                |
| 16                                     | Explain the classification of Embedded system based on:<br>i) Generation<br>ii) Complexity and Performance   | Understand            | CO 1            | AEC024.01                |
| 17                                     | Explain some system components for the proper functioning of the processor of the embedded system.   | Understand            | CO 1            | AEC024.01                |
| 18                                     | Discuss the steps involved in designing a model train controller and explain its working functionality based on embedded system.   | Understand            | CO 1            | AEC024.02                |
| 19                                     | Define embedded system and compare embedded system and general computing system.   | Understand            | CO 1            | AEC024.01                |
| 20                                     | Explain the digital signal processing in embedded system design continued digitization of signals increasing the role of DSP in ES.  | Understand            | CO 1            | AEC024.02                |
| <b>Part - C (Analytical Questions)</b> |  |                       |                 |                          |
| 1                                      | Briefly describe the distinction between requirements and specification.   | Understand            | CO 1            | AEC024.02                |
| 2                                      | Briefly describe the distinction between specification and architecture.   | Understand            | CO 1            | AEC024.02                |
| 3                                      | At what stage of the design methodology would we determine what type of CPU to use (8-bit vs. 16-bit vs. 32-bit, which model of a particular type of CPU, etc.)?   | Remember              | CO 1            | AEC024.03                |
| 4                                      | At what stage of the design methodology would we choose a programming language?  | Understand            | CO 1            | AEC024.04                |
| 5                                      | At what stage of the design methodology would we test our design for functional correctness?   | Understand            | CO 1            | AEC024.04                |
| 6                                      | Compare and contrast top-down and bottom-up design in embedded systems design process.   | Understand            | CO 1            | AEC024.03                |
| 7                                      | Provide a concrete example of how bottom-up information from the software programming phase of design may be useful in refining the architectural design.  | Understand            | CO 1            | AEC024.04                |
| 8                                      | Create a UML state diagram for the issue-command ( ) behavior of the Controller class.   | Remember              | CO 1            | AEC024.04                |
| 9                                      | Draw a class diagram for the classes required in a basic microwave oven. The system should be able to set the microwave power level between 1 and 9 and time a cooking run up to 59 min and 59 s in 1-s increments. Include * classes for the physical interfaces to the telephone line, microphone, speaker, and buttons. | Understand            | CO 1            | AEC024.03                |
| 10                                     | Show how a Set-speed command flows through the refined class structure described in Figure   | Understand            | CO 1            | AEC024.03                |

| S.No | QUESTION   | Blooms Taxonomy Level | Course Outcomes | Course Learning Outcomes |
|------|--|-----------------------|-----------------|--------------------------|
|      | <p>moving from a change on the front panel to the required changes on the train:</p> <p>a. Show it in the form of a collaboration diagram.<br/>b. Show it in the form of a sequence diagram.</p> |                       |                 |                          |

**UNIT – II**  
**INTRODUCTION TO EMBEDDED C AND APPLICATIONS**

**Part – A (Short Answer Questions)**

|    |   |            |      |           |
|----|---|------------|------|-----------|
| 1  | Define Embedded Systems & List the applications.                                | Remember   | CO 2 | AEC024.05 |
| 2  | Write an embedded c program for simple super loop?                              | Understand | CO 2 | AEC024.05 |
| 3  | List out the features of 8051 microcontroller.                                  | Understand | CO 2 | AEC024.05 |
| 4  | List out the application areas of Embedded Systems.                             | Understand | CO 2 | AEC024.05 |
| 5  | Explain the memory Organization of 8051 microcontroller.                        | Understand | CO 2 | AEC024.05 |
| 6  | Explain the data types available in 8051 microcontroller.                       | Understand | CO 2 | AEC024.05 |
| 7  | Explain the use of Header files in Embedded Programming?                        | Remember   | CO 2 | AEC024.06 |
| 8  | Explain how to build the embedded c in keil IDE.                                | Understand | CO 2 | AEC024.06 |
| 9  | Write the Embedded-C code for toggling P0.5 bit                                 | Understand | CO 2 | AEC024.06 |
| 10 | List out the P0 bit registers addresses.  | Remember   | CO 2 | AEC024.06 |
| 11 | Explain how do you develop embedded software?                                   | Understand | CO 2 | AEC024.06 |
| 12 | Describe the External interface of the standard 8051?                           | Understand | CO 2 | AEC024.06 |
| 13 | Define switch bounce?   | Understand | CO 2 | AEC024.08 |
| 14 | Write an embedded C program for the project header (main.h)?                    | Understand | CO 2 | AEC024.07 |
| 15 | Define Interrupt?   | Understand | CO 2 | AEC024.07 |
| 16 | Explain port header (port.h) with a schematic representation?                   | Understand | CO 2 | AEC024.05 |
| 17 | Write an embedded C program for the port header (port.h)?                       | Understand | CO 2 | AEC024.05 |
| 18 | Describe about the power consumption of 8051?                                   | Understand | CO 2 | AEC024.06 |
| 19 | Explain the technical issues concerned to embedded c?                           | Understand | CO 2 | AEC024.06 |
| 20 | Write an embedded C program for restructuring the Hello embedded world example? | Understand | CO 2 | AEC024.07 |

**Part - B (Long Answer Questions)**

|   |   |            |      |           |
|---|---|------------|------|-----------|
| 1 | Define Embedded system, how do you develop embedded software, Explain in detail.  | Understand | CO 2 | AEC024.05 |
| 2 | Explain how to identify a suitable programming language for embedded system.  | Understand | CO 2 | AEC024.05 |
| 3 | Explain how do we select processor & which operating system we need to use for our design   | Understand | CO 2 | AEC024.05 |
| 4 | Explain the memory issues & I/O pins in 8051  | Remember   | CO 2 | AEC024.07 |
| 5 | Give the type of the processors used in embedded systems, Explain in detail   | Remember   | CO 2 | AEC024.07 |
| 6 | Explain about 8051 micro controller<br>(i) I/O pins, (ii) interrupts,<br>(iii) power consumptions (iv) memory issues of 8051 micro controller | Understand | CO 2 | AEC024.07 |

| S.No                                   | QUESTION  | Blooms Taxonomy Level | Course Outcomes | Course Learning Outcomes |
|--|---|-----------------------|-----------------|--------------------------|
| 7                                      | Explain in detail about The Project Header with example   | Remember              | CO 2            | AEC024.07                |
| 8                                      | Describe about the schematic representation of the port header file with the explanation of reliability and safety?   | Understand            | CO 2            | AEC024.08                |
| 9                                      | What is an interrupt? Explain the interrupt concept in 8051 microcontroller.  | Understand            | CO 2            | AEC024.08                |
| 10                                     | Explain the concept of switch bounce with example and develop an embedded C program for reading switch inputs?  | Remember              | CO 2            | AEC024.07                |
| 11                                     | Design and Develop an embedded C program for restructuring the Hello embedded world ?   | Understand            | CO 2            | AEC024.07                |
| 12                                     | Write an embedded code for the following<br>i. Simple super loop demonstration.<br>ii. Simple central heating system.   | Understand            | CO 2            | AEC024.05                |
| 13                                     | Explain the process of developing embedded software with example? Develop an embedded C program for simple super loop?  | Understand            | CO 2            | AEC024.05                |
| 14                                     | Explain the concept of switch bounce with example and develop an embedded C program for reading switch inputs?  | Understand            | CO 2            | AEC024.07                |
| 15                                     | Develop an Embedded-C code for Hello Embedded World Example   | Understand            | CO 2            | AEC024.07                |
| 16                                     | Describe some of the important issues linked to oscillator frequency and performance  | Understand            | CO 2            | AEC024.07                |
| 17                                     | Design and Develop an embedded C program for LED interfacing.   | Understand            | CO 2            | AEC024.07                |
| 18                                     | Explain in detail about serial data communication using embedded C.   | Understand            | CO 2            | AEC024.08                |
| 19                                     | i. Develop a Program to toggle all the bits of port P1 continuously with 250 ms delay<br>ii. Develop a Program to toggle only the bit P1.5 continuously with some delay | Understand            | CO 2            | AEC024.07                |
| 20                                     | Write a Program for serial communication between Microcontroller to PC communication the data should be transfer from microcontroller to PC terminal                    | Understand            | CO 2            | AEC024.08                |
| <b>Part - C (Analytical Questions)</b> |   |                       |                 |                          |
| 1                                      | Discuss in detail about the initial steps of embedded program development.  | Understand            | CO 2            | AEC024.05                |
| 2                                      | Explain in detail about the embedded C program in Keil IDE with example.  | Remember              | CO 2            | AEC024.06                |
| 3                                      | Analyze the basic flow of control construct in,<br>i) Constant time statements<br>ii) Sequence of statements<br>iii) For loops<br>iv) While loops                       | Understand            | CO 2            | AEC024.05                |
| 4                                      | Interpret the inline functions and inline assembly in C structures with an example.   | Remember              | CO 2            | AEC024.05                |
| 5                                      | Develop an embedded C program in order to perform bitwise operations on specified data.   | Understand            | CO 2            | AEC024.06                |
| 6                                      | Discuss in detail about the hardware simulator.   | Understand            | CO 2            | AEC024.07                |
| 7                                      | Write a program toggles P0 continuously between values of 0 and 0xFF.   | Understand            | CO 2            | AEC024.07                |
| 8                                      | Write a program in which P2 is given two different values. The values should be passed to P2 with a delay.  | Understand            | CO 2            | AEC024.07                |
| 9                                      | Develop an embedded C program for the following using 8051 microcontroller.   | Understand            | CO 2            | AEC024.07                |

| S.No | QUESTION   | Blooms Taxonomy Level | Course Outcomes | Course Learning Outcomes |
|------|--|-----------------------|-----------------|--------------------------|
|      | i. Project header (main.h)<br>ii. Port header (port.h)                   |                       |                 |                          |
| 10   | Write a Program to toggle LEADS using simple interrupt using embedded C. | Understand            | CO 2            | AEC024.07                |

**UNIT-III  
EMBEDDED C APPLICATIONS**

**Part - A (Short Answer Questions)**

| S.No | QUESTION   | Blooms Taxonomy Level | Course Outcomes | Course Learning Outcomes |
|------|--|-----------------------|-----------------|--------------------------|
| 1    | Explain the basic techniques for reading and writing from I/O port pins? | Understand            | CO 3            | AEC024.09                |
| 2    | Give the examples for reading and writing bytes (simple version).        | Remember              | CO 3            | AEC024.09                |
| 3    | Give the examples for reading and writing bytes (generic version).       | Understand            | CO 3            | AEC024.09                |
| 4    | Explain the need for pullup resistor.                                    | Remember              | CO 3            | AEC024.09                |
| 5    | Explain the method dealing with switch bounce.                           | Understand            | CO 3            | AEC024.10                |
| 6    | Write a basic code for reading switch input.                             | Understand            | CO 3            | AEC024.10                |
| 7    | Define an example for counting goats.                                    | Understand            | CO 3            | AEC024.10                |
| 8    | Draw the diagram of keyboard interfacing.                                | Understand            | CO 3            | AEC024.11                |
| 9    | Draw the diagram of display interfacing.                                 | Understand            | CO 3            | AEC024.11                |
| 10   | Draw the diagram of stepper motor interfacing.                           | Understand            | CO 3            | AEC024.10                |

**Part - B (Long Answer Questions)**

| S.No | QUESTION   | Blooms Taxonomy Level | Course Outcomes | Course Learning Outcomes |
|------|--|-----------------------|-----------------|--------------------------|
| 1    | Explain about<br>(a) Reading and Writing bytes<br>(b) Reading and writing bits in simple version           | Understand            | CO 3            | AEC024.09                |
| 2    | Illustrate the need for pull-up resistors in 8051 microcontroller with a schematic representation.         | Remember              | CO 3            | AEC024.09                |
| 3    | Develop an assembly level program for reading and writing bits   | Understand            | CO 3            | AEC024.09                |
| 4    | Develop an embedded C program based on 8051 microcontroller for reading and writing bits (generic version) | Remember              | CO 3            | AEC024.09                |
| 5    | Explain the basic techniques for reading from I/O port pins for building the Embedded hardware.            | Understand            | CO 3            | AEC024.10                |
| 6    | Write a C-code for Reading switch inputs and explain its operation.  | Understand            | CO 3            | AEC024.10                |
| 7    | Explain the Switch bounce behaviour with the help of waveforms.  | Understand            | CO 3            | AEC024.10                |
| 8    | Explain<br>a) Reading and writing bits(simple version)<br>b) Reading and writing bits(generic version)     | Understand            | CO 3            | AEC024.11                |

|    |  |            |      |           |
|----|--|------------|------|-----------|
| 9  | Outline the basic techniques for reading from port pins.   | Understand | CO 3 | AEC024.11 |
| 10 | Discuss in detail about pin TxD and RxD functionality in keyboard interfacing?                                 | Understand | CO 3 | AEC024.10 |
| 11 | Design and develop an embedded C program for LED interfacing.  | Understand | CO 3 | AEC024.10 |
| 12 | Draw the diagram of keyboard interfacing and explain each pin specifications?                                  | Understand | CO 3 | AEC024.12 |
| 13 | Draw the diagram of display interfacing and explain in detail about the circuit diagram.                       | Understand | CO 3 | AEC024.12 |
| 14 | Discuss about the process of port access from the embedded system using port file?                             | Understand | CO 3 | AEC024.12 |
| 15 | Develop an embedded code for Reading and writing bits from port 1 to port 2 along with flowchart and algorithm | Understand | CO 3 | AEC024.12 |

**UNIT-IV  
INTRODUCTION TO REAL – TIME OPERATING  
SYSTEMS**

**Part - A (Short Answer Questions)**

|    |   |            |      |           |
|----|---|------------|------|-----------|
| 1  | Define host in embedded systems.  | Understand | CO 4 | AEC024.13 |
| 2  | Define target machines in embedded systems.                                 | Understand | CO 4 | AEC024.13 |
| 3  | Write short notes on logic analyzer.  | Understand | CO 4 | AEC024.13 |
| 4  | Define debugging.   | Understand | CO 4 | AEC024.13 |
| 5  | What are the main goals of software development for embedded systems?       | Remember   | CO 4 | AEC024.13 |
| 6  | Write various software development tools provided by a Host System          | Understand | CO 4 | AEC024.13 |
| 7  | Explain linkers of embedded systems.  | Understand | CO 4 | AEC024.13 |
| 8  | Why software testing is critical in Embedded Systems?                       | Understand | CO 4 | AEC024.13 |
| 9  | Define locators of embedded systems.  | Understand | CO 4 | AEC024.13 |
| 10 | Describe how a host system meets the goals of a specific system.            | Remember   | CO 4 | AEC024.14 |
| 11 | Write Lab debugging tools for embedded systems software.                    | Understand | CO 4 | AEC024.14 |
| 12 | Define compilers in embedded software developing process.                   | Understand | CO 4 | AEC024.13 |
| 13 | Define linkers in embedded software developing process                      | Understand | CO 4 | AEC024.13 |
| 14 | Write short notes on debugging tools.                                       | Understand | CO 4 | AEC024.14 |
| 15 | List out the techniques for the debugging process.                          | Understand | CO 4 | AEC024.14 |
| 16 | What is mean by testing on host machine.                                    | Understand | CO 4 | AEC024.14 |
| 17 | List out the laboratory instruments for testing the embedded system.        | Understand | CO 4 | AEC024.14 |
| 18 | What are the hardware debugging tools used in embedded product development. | Understand | CO 4 | AEC024.14 |
| 19 | Describe the translation tools used in an Embedded system.                  | Understand | CO 4 | AEC024.14 |
| 20 | Write brief notes on the Emulators and Debugging.                           | Understand | CO 4 | AEC024.14 |

**Part - B (Long Answer Questions)**

|   |  |            |      |           |
|---|--|------------|------|-----------|
| 1 | Explain in detail about the real time operating systems with an example. | Understand | CO 4 | AEC024.09 |
| 2 | Discuss in detail how thread and process are used in embedded system.    | Remember   | CO 4 | AEC024.09 |



| S.No | QUESTION   | Blooms Taxonomy Level | Course Outcomes | Course Learning Outcomes |
|------|--|-----------------------|-----------------|--------------------------|
| 3    | Define Semaphores? Explain in detail about types of Semaphores.  | Understand            | CO 4            | AEC024.10                |
| 4    | Discuss in detail about how to choose an RTOS with an example.   | Understand            | CO 4            | AEC024.09                |
| 5    | Define task scheduling? Discuss in detail about the task states and scheduling?  | Understand            | CO 4            | AEC024.10                |
| 6    | Explain in detail about the semaphores with examples and write its specifications.   | Understand            | CO 4            | AEC024.10                |
| 7    | Write the examples of RTOS employed in embedded product development?   | Remember              | CO 4            | AEC024.09                |
| 8    | Explain in detail about the various states a task can be in during its execution life cycle under an RTOS Task State Transitions.  | Understand            | CO 4            | AEC024.09                |
| 9    | What are the situations under which a running task can go to the ready state and steady state?                                     | Understand            | CO 4            | AEC024.10                |
| 10   | What are the factors on which the execution time of a task depends on? While a task is executing, is the CPU continuously busy?    | Understand            | CO 4            | AEC024.09                |
| 11   | What is the need of an operating system? Explain the basics of an operating system.  | Understand            | CO 4            | AEC024.10                |
| 12   | Define and explain in detail about the synchronization and task operation with examples?   | Understand            | CO 4            | AEC024.11                |
| 13   | Explain in detail about the about shared memory of task communication.   | Understand            | CO 4            | AEC024.11                |
| 14   | What are the techniques are present in task synchronization? Discuss in detail about each of the technique.                        | Understand            | CO 4            | AEC024.12                |
| 15   | What is a device driver? Explain the role of device driver in an embedded OS.  | Remember              | CO 4            | AEC024.12                |
| 16   | Describe the terms message passing, remote procedure call and explain the functionality of message passing, remote procedure call. | Understand            | CO 4            | AEC024.11                |
| 17   | Explain the different task communication synchronization issues encountered in inter process communication?                        | Understand            | CO 4            | AEC024.11                |
| 18   | Explain in detail about the following terms with an example,<br>i. Preemptive scheduling<br>ii. Non-Preemptive scheduling          | Understand            | CO 4            | AEC024.12                |
| 19   | Explain in detail about the about device drivers of the task synchronization.  | Understand            | CO 4            | AEC024.12                |
| 20   | Write a short notes on the following terms,<br>i. Message queues<br>ii. Pipes<br>iii. Shared memory                                | Understand            | CO 4            | AEC024.12                |
| 21   | Explain about task communication and task scheduling of real time operating system.  | Understand            | CO 4            | AEC024.12                |
| 22   | Explain the differences between Host Computer System and Target System in terms of their hardware and software.                    | Understand            | CO 4            | AEC024.13                |
| 23   | What are the main goals of software development for embedded systems? Explain how a host system meets these goals?                 | Understand            | CO 4            | AEC024.13                |
| 24   | Discuss the goals of the typical testing process in embedded systems.  | Understand            | CO 4            | AEC024.13                |
| 25   | Write short notes on,<br>i. Logic Analyzer<br>ii. Lab debugging tools for embedded systems software.                               | Understand            | CO 4            | AEC024.13                |
| 26   | Demonstrate the role of linkers / locators for embedded systems.   | Remember              | CO 4            | AEC024.13                |
| 27   | Compare the characteristics of various software architectures for embedded applications.   | Understand            | CO 4            | AEC024.13                |
| 28   | What are the main issues of Embedded Software design and explain.  | Understand            | CO 4            | AEC024.14                |
| 29   | Define and Explain in detail about the debugging and target hardware debugging.  | Remember              | CO 4            | AEC024.14                |

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|--|---|-----------------------|-----------------|--------------------------|
| 30                                     | Discuss in detail about the testing on host machine related to embedded systems design technology.  | Understand            | CO 4            | AEC024.14                |
| 31                                     | Explain in detail about Integrated development environment based on embedded systems.   | Understand            | CO 4            | AEC024.14                |
| 32                                     | What is compilation? Explain the types of files generated on cross compilation.   | Understand            | CO 4            | AEC024.13                |
| 33                                     | Discuss in detail about embedded software development process and tools.  | Understand            | CO 4            | AEC024.13                |
| 34                                     | Express the comparison and differentiate between the host and target machines.  | Understand            | CO 4            | AEC024.13                |
| 35                                     | Describe the role of in-circuit emulator in the design of embedded system.  | Understand            | CO 4            | AEC024.13                |
| 36                                     | What are simulators? What are the advantages and disadvantages of simulators?   | Understand            | CO 4            | AEC024.13                |
| 37                                     | Describe the debugging strategies used in embedded systems in detail.   | Understand            | CO 4            | AEC024.14                |
| 38                                     | Distinguish between the linker and loader for embedded software.  | Understand            | CO 4            | AEC024.14                |
| 39                                     | Explain in detail about the getting embedded software into the target system.   | Understand            | CO 4            | AEC024.14                |
| 40                                     | Discuss the Quality assurance and testing of the embedded system design.  | Understand            | CO 4            | AEC024.14                |
| 41                                     | Explain how testing is possible on Host machine including steps during testing.   | Understand            | CO 4            | AEC024.14                |
| 42                                     | Describe the problems faced in designing an RTOS. What techniques are used to overcome it   | Understand            | CO 4            | AEC024.13                |
| <b>Part - C (Analytical Questions)</b> |   |                       |                 |                          |
| 1                                      | What is a process? With a neat representation explain the process states and state transition   | Understand            | CO 4            | AEC024.09                |
| 2                                      | Explain the different thread binding models for user and kernel level threads.  | Remember              | CO 4            | AEC024.09                |
| 3                                      | Write the basic design principles when using an RTOS to design of sample RTOS.  | Understand            | CO 4            | AEC024.09                |
| 4                                      | What is the difference between Hard and Soft real time systems? Give an example for Hard and Soft real time kernels?  | Understand            | CO 4            | AEC024.10                |
| 5                                      | Explain how Threads and process are related? What is common to process and threads?   | Understand            | CO 4            | AEC024.10                |
| 1                                      | Demonstrate the tools used to download the embedded software into the target system.  | Understand            | CO 4            | AEC024.13                |
| 2                                      | Explain in detail about the uses of compilers and Linkers in embedded software.   | Understand            | CO 4            | AEC024.13                |
| 3                                      | Why in general Host machine is used for the developments of embedded system software. Explain various software development tools provided by a Host system? | Understand            | CO 4            | AEC024.13                |
| 4                                      | Explain the function and use of the following test equipment for embedded system development,<br>i. Oscilloscope<br>ii. Ohm-meters                          | Understand            | CO 4            | AEC024.14                |
| 5                                      | Embedded System software design is an art as much as it is science. Discuss.  | Remember              | CO 4            | AEC024.14                |
| 6                                      | Explain the features of assemblers, compilers and cross-compilers used in Embedded systems.   | Understand            | CO 4            | AEC024.13                |
| 7                                      | Explain the boundary Scanning technique for Testing the interconnections.   | Understand            | CO 4            | AEC024.14                |
| 8                                      | Explain the differences between an öHost Computer Systemö and a öTarget Systemö in terms of their hardware and software.                                    | Understand            | CO 4            | AEC024.14                |
| 9                                      | What is the role of linkers / locators for embedded systems? Explain by taking address relocation into account?   | Understand            | CO 4            | AEC024.14                |
| 10                                     | What are the main goals of software development for embedded systems? Explain how a host system meets these goals?  | Understand            | CO 4            | AEC024.13                |

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|--|---|-----------------------|-----------------|--------------------------|
| <b>UNIT-V</b>                              |   |                       |                 |                          |
| <b>INTRODUCTION TO ADVANCED PROCESSORS</b> |   |                       |                 |                          |
| <b>Part - A (Short Answer Questions)</b>   |   |                       |                 |                          |
| 1  | Discuss about I2C?  | Understand            | CO 5            | AEC024.17                |
| 2  | What are the bits in I2C corresponding to?  | Remember              | CO 5            | AEC024.17                |
| 3  | Explain about CAN bus? Where is it used?  | Understand            | CO 5            | AEC024.17                |
| 4  | Describe about the instruction length of ARM processor  | Understand            | CO 5            | AEC024.15                |
| 5  | Draw the data frame format of CAN?  | Remember              | CO 5            | AEC024.17                |
| 6  | Define the address space in ARM processor?  | Remember              | CO 5            | AEC024.15                |
| 7  | What are disadvantages of I2C?  | Understand            | CO 5            | AEC024.17                |
| 8  | Demonstrate the important embedded processor chips?   | Understand            | CO 5            | AEC024.15                |
| 9  | What are the two essential units of a processor on an embedded system?  | Remember              | CO 5            | AEC024.15                |
| 10   | State the special features on SHARC?  | Remember              | CO 5            | AEC024.16                |
| 11   | Write the features of I2C   | Understand            | CO 5            | AEC024.17                |
| 12   | Write about SHARC   | Understand            | CO 5            | AEC024.16                |
| 13   | Give the size of ARM flash memory   | Remember              | CO 5            | AEC024.15                |
| 14   | Describe networking for embedded system   | Remember              | CO 5            | AEC024.15                |
| 15   | Explain briefly Memory organization of ARM processor  | Understand            | CO 5            | AEC024.15                |
| 16   | How many General purpose registers are there in the SHARC processor? Mention them.  | Understand            | CO 5            | AEC024.16                |
| 17   | Write about ARM two stages Address translation.   | Understand            | CO 5            | AEC024.15                |
| 18   | Write short notes on Fixed point ALU in SHARC   | Understand            | CO 5            | AEC024.16                |
| 19   | Write the Architectural features of ARM.  | Understand            | CO 5            | AEC024.15                |
| 20   | Why we build network embedded systems.  | Understand            | CO 5            | AEC024.17                |
| <b>Part - B (Long Answer Questions)</b>    |   |                       |                 |                          |
| 1  | Write short notes on SHARC processor and Internet enabled system.   | Understand            | CO 5            | AEC024.16                |
| 2  | Explain memory organization of ARM processor is different from conventional general purpose processors memory organization. | Understand            | CO 5            | AEC024.15                |
| 3  | How the embedded systems are enabled with internet? Give some examples.   | Understand            | CO 5            | AEC024.15                |
| 4  | Compare and contrast ARM Bus and SHARC Bus and give its applications.   | Understand            | CO 5            | AEC024.16                |
| 5  | What is ARM? Explain the features of Advanced RISC machine Processor.   | Remember              | CO 5            | AEC024.15                |
| 6  | Explain in detail about the CAN Bus architecture and give its features and applications.                                    | Understand            | CO 5            | AEC024.17                |
| 7  | Describe networked embedded systems and explain about the Inter integrated circuit bus.                                     | Understand            | CO 5            | AEC024.17                |
| 8  | Explain in detail instruction level parallelism in networked embedded systems.  | Remember              | CO 5            | AEC024.16                |

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| 9                                      | Discuss in detail about the serial communication programming with an example.   | Understand            | CO 5            | AEC024.17                |
| 10                                     | Describe networked embedded systems and explain about the controlled area network Bus.  | Understand            | CO 5            | AEC024.17                |
| 11                                     | Write a brief note on,<br>i. Memory organization of ARM processor<br>ii. Fixed point ALU in SHARC                                     | Understand            | CO 5            | AEC024.16                |
| 12                                     | Why we build network embedded systems? Explain in detail about networks for embedded systems.   | Understand            | CO 5            | AEC024.17                |
| 13                                     | Explain memory organization of ARM processor is different from conventional general purpose processors memory organization.           | Understand            | CO 5            | AEC024.15                |
| 14                                     | List out Fixed point ALU operations in SHARC processor and explain in detail.   | Understand            | CO 5            | AEC024.16                |
| 15                                     | Write two applications of ARM processor-based systems with functional block diagram for each application and explain its working.     | Understand            | CO 5            | AEC024.15                |
| 16                                     | Describe the various architectural features of one of the SHARC processors of your choice with its functional block diagram.          | Understand            | CO 5            | AEC024.16                |
| 17                                     | Write a brief notes on<br>i. CAN Bus architecture<br>ii. Programming model of ARM   | Understand            | CO 5            | AEC024.17                |
| 18                                     | Discuss in detail about the following terms,<br>i. Internet-enabled systems.<br>ii. CAN Bus architecture                              | Understand            | CO 5            | AEC024.17                |
| 19                                     | Explain in detail about the instruction level parallelism.  | Understand            | CO 5            | AEC024.17                |
| 20                                     | Compare and contrast between the ARM Bus and SHARC Bus.   | Understand            | CO 5            | AEC024.16                |
| <b>Part - C (Analytical Questions)</b> |   |                       |                 |                          |
| 1                                      | List out Fixed point ALU operations in SHARC processor and explain.   | Understand            | CO 5            | AEC024.16                |
| 2                                      | Write a program for the assignments in ARM instructions<br>i. $x=(a+b)-c$<br>ii. $y=a*(b+c)$  | Understand            | CO 5            | AEC024.15                |
| 3                                      | Explain distributed embedded architectures and state why they are needed.   | Remember              | CO 5            | AEC024.15                |
| 4                                      | Describe an I2C bus at the following OSI-compliant levels of detail:<br>i. Physical link ii. Data link iii. Network link              | Understand            | CO 5            | AEC024.17                |
| 5                                      | Give hardware and software at functional level for designing elevator controller using basic design principles using a RTOS.          | Understand            | CO 5            | AEC024.16                |
| 6                                      | Write two applications of ARM processor-based systems with functional block diagram for each application and explain its working.     | Understand            | CO 5            | AEC024.15                |
| 7                                      | Demonstrate the various architectural features of one of the SHARC processors of your choice with its functional block diagram.       | Understand            | CO 5            | AEC024.16                |
| 8                                      | Design Elevator controller system and explain in detail about the working model.  | Understand            | CO 5            | AEC024.17                |
| 9                                      | Explain in detail about the following terms along with its features,<br>i. I <sup>2</sup> C bus<br>ii. CAN bus                        | Understand            | CO 5            | AEC024.17                |
| 10                                     | Mention the similarities and differences between the ARM processor and SHARC processor based on architecture and memory organization. | Understand            | CO 5            | AEC024.16                |