EMBEDDED SYSTEM DESIGN

Subject Code: **(A70440)**
Regulations : R16 JNTUH
Class :IV Year B.Tech ECE I Semester

Department of Electronics and communication Engineering

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

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EMBEDDED SYSTEM DESIGN (A70440)
COURSE PLANNER

I. COURSE OVERVIEW:

Embedded systems course is continuous of the Microprocessor and Microcontrollers, is intended to Designing, Implementation and Test of embedded applications. The topics covered are definition of embedded systems, history, classification, characteristics and major applications, Quality attributes of embedded systems, types of processors, ASICs, PLDs, COTS, Memory Interface, communication interface, embedded firmware design and development, RTC, RTOS, Task, task scheduling ,threads, multitasking, Task communication, Task synchronization techniques , device drivers.

Understand need of microprocessors, microcontrollers in development of various projects and to know complete Operating Systems, RTOS.

II. PREREQUISITES:
1. Microprocessor & Microcontroller concepts and applications
2. Assembly language concepts
3. Operating system concepts
4. Computer organization and architecture concepts
5. Design analysis of different day to day equipments
6. Basics of all electronics components

III. COURSE OBJECTIVES:

1.	Students have knowledge about the basic functions, structure, concepts and applications of embedded systems.
2.	Develop familiarity with 8051 Microcontrollers and their applications in an embedded environment.
3.	To learn the method of designing and program an Embedded Systems for real time applications.
4.	To understand operating system concepts, types and choosing RTOS.
5.	Students have knowledge about the development of embedded software using RTOS and implement small programs to solve well-defined problems on an embedded platform.
6.	Develop familiarity with tools used to develop in an embedded environment.

IV. COURSE OUTCOMES:

S.No	Description	Bloom's Taxonomy Level
1.	Understand basic concept of embedded systems.	Knowledge, Understand(Level1, Level2)
2.	Apply and analyze the applications in various processors and domains of embedded system.	Apply, Create(Level 3, Level 6)
3.	Analyze and develop embedded hardware and software development cycles and tools.	Analyze (Level4)
4.	Analyze to understand what a microcomputer, core of the embedded system.	Analyze (Level4)
5.	Remember the definitions of ASICs, PLDs, memory, memory interface.	Knowledge, Understand(Level1, Level2)
6.	Analyze to understand different concepts of a RTOS, sensors, memory interface, communication interface.	Analyze (Level4), Apply (Level 3)

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems related to Electronics & Communication and Engineering.	3	Lectures and problem solving
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems related to Electronics & Communication Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	Design Exercises, Assignments
PO3	**Design/development of solutions**: Design solutions for complex engineering problems related to Electronics & Communication Engineering and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	Lectures, Assignments, Exams
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	Lectures, Assignments, Exams
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	Lectures and Design Exercises

Program Outcomes		Level	Proficiency assessed by
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Electronics & Communication Engineering professional engineering practice.	3	Lectures, Assignments, Exams
PO7	**Environment and sustainability**: Understand the impact of the Electronics & Communication Engineering professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	3	Lectures, Assignments, Exams
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	-	-
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	Group discussions
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Document Preparation and Presentation
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	3	Discussions Exams, Seminars
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	3	Development of Mini Projects

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO 1	**Professional Skills:** An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex	1	Lectures, Assignments

	systems.		
PSO 2	**Problem-Solving Skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.	2	Tutorials
PSO 3	**Successful Career and Entrepreneurship:** An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.	3	Seminars, Projects

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

VII. SYLLABUS:

UNIT -I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT -II:

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT -III:

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV:

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multi processing and Multi tasking, Task Scheduling.

UNIT -V:

TASK COMMUNICATION: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

TEXT BOOKS:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

REFERENCE BOOKS:

1. Embedded Systems - Raj Kamal, TMH.

2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013.
4. An Embedded Software Primer - David E. Simon, Pearson Education.

NPTEL Web Course:

1. http://nptel.ac.in/courses/108102045/

NPTEL Video Course: Embedded Systems

1. http://nptel.ac.in/courses/108102045/

GATE SYLLABUS: Not Applicable

IES SYLLABUS: Not Applicable

VIII. COURSE PLAN(WEEK-WISE):

Session	Week	Unit	Topics	Course Learning outcomes	Reference
1	1	I	Introduction to embedded systems	**Memorize** about Embedded systems	T1
2			Embedded systems vs general computing systems	**Describe** about embedded systems	T1
3			Embedded systems vs general computing systems	**Describe** about embedded systems	T1
4			Classification of embedded systems	**Classify** embedded systems	T1
5			Classification of embedded systems	**Classify** embedded systems	T1
6	2		Major applications area	**Describe** about major applications area	T1
7			Characteristics and quality attributes of embedded systems.	**Analysis** of Characteristics and quality attributes of embedded systems.	T1
8			Characteristics and quality attributes of embedded systems.	**Analysis** of Characteristics and quality attributes of embedded systems.	T1
9		II	Typical embedded systems	**Explain** the typical embedded systems	T1

10			Typical embedded systems	**Explain** the typical embedded systems	T1
11	3		Typical embedded systems	**Explain** the typical embedded systems	T1
12			General purpose and domain specific processors	**Explain** the general purpose and domain specific processors	T1
13			general purpose and domain specific processors	**Explain** the general purpose and domain specific processors	T1
14			ASICs, PLDs	**Describe** about ASICs,PLDs	T1
15			ASICs, PLDs	**Describe** about ASICs,PLDs	T1
16	4		Commercial off-the shelf components(COTS),	**Analysis** of commercial off-the shelf components(COTS),	T1
17			Commercial off-the shelf components(COTS),	**Analysis** of commercial off-the shelf components(COTS),	T1
18			Memory	**Classification** of Memories	T1
19			Memory according to the types of interface	**Explain** the Memory according to the types of interface	T1
20			Memory according to the types of interface	**Explain** the Memory according to the types of interface	T1
21	5		Sensors and actuators	**Explain** the sensors and actuators	T1
22			Sensors and actuators	**Explain** the sensors and actuators	T1
23			Communication interface	**Explain** the communication interface	T1
24		III	Embedded Firmware	**Describe** about Embedded Firmware	T1
25			Reset circuit	**Explain** about Reset circuit	T1
26	6		Brown-out Protection circuit	**Explain** about Brown-out Protection circuit	T1
27			Oscillator Unit	**Explain** the Oscillator Unit	T1
28			Real time clock	**Explain** the Real time clock	T1
29			Watchdog Timer	**Explain** the watchdog Timer	T1
30			Embedded Firmware Design Approaches	**Analysis** of Embedded Firmware Design Approaches	T1
31	7		Embedded Firmware Design Approaches	**Analysis** of Embedded Firmware Design Approaches	T1
32			Developments Languages	**Developments** Languages	T1

33			Developments Languages	**Developments** Languages	T1
34			RTOS BAESD EMBEDDED SYETMS DESIGN	**Applying** knowledge on RTOS baesd embedded syetms design	T1
35			Operating systems basics	**Explain** the Operating systems basics	T1
36			Types of operating systems	**Different** types of operating systems	T1
37			Types of operating systems	**Different** types of operating systems	T1
38	8	IV	Tasks, Process and Threads	**Explain** about Tasks, Process and Threads	T1
39			Tasks, Process and Threads	**Explain** about Tasks, Process and Threads	T1
40			Multiprocessing and multitasking	**Describe** the Multiprocessing and multitasking	T1
41			Multiprocessing and multitasking	**Describe** the Multiprocessing and multitasking	T1
42			Task scheduling	**Analysis** of Task scheduling	T1
43	9		Task Communication	**Discuss** Task Communication	T1
44			Task Communication	**Discuss** Task Communication	T1
45			Shared memory	**Discuss** shared memory	T1
46			Message passing	**Explain** the message passing.	T1
47			Remote procedure call	**Explain** the remote procedure call.	T1
48	10		Sockets	**Explain** about the sockets.	T1
49		V	Task synchronization issues	**Discuss** task synchronization issues	T1
50			Task synchronization Techniques	**Explain** the task synchronization techniques	T1
51			Task synchronization Techniques	**Explain** the task synchronization techniques	T1
52	11		Device drivers	**Explain** the device drivers	T1
53			Device drivers	**Explain** the device drivers	T1
54			How to choose an RTOS	**Analysis** concepts of how to choose an RTOS	T1

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO 2	PSO3
CO1	2	2	2	2	3	2	2	-	2	2	2	2	1	2	2
CO2	3	3	2	2	2	3	3	-	2	2	2	2	1	2	2
CO3	2	2	3	2	2	3	3	-	3	3	3	3	1	3	3
CO4	2	2	2	3	3	3	2	-	2	2	2	2	1	2	2
CO5	3	3	3	3	2	2	3	-	2	2	2	2	3	1	2
CO6	3	3	3	3	3	2	2	-	3	3	3	3	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

X. JUSTIFICATIONS FOR CO-PO MAPPING

Mapping	Low (1)/ Medium (2)/ High (3)	Justification
CO1-PO1	2	Memorize about Embedded systems
CO1-PO2	2	Describe about embedded systems
CO1-PO3	2	Describe about embedded systems
CO1-PO4	2	Classify embedded systems
CO1-PO5	3	Classify embedded systems
CO1-PO6	2	Describe about major applications area
CO1-PO7	2	Analysis of Characteristics and quality attributes of embedded systems.
CO1-PO9	2	Analysis of Characteristics and quality attributes of embedded systems.
CO1-PO10	2	Explain the typical embedded systems
CO1-PO11	2	Explain the typical embedded systems
CO1-PO12	2	Explain the typical embedded systems
CO1-PSO1	1	Explain the general purpose and domain specific processors
CO1-PSO2	2	Explain the general purpose and domain specific processors
CO1-PSO3	2	Describe about ASICs,PLDs
CO2-PO1	3	Describe about ASICs,PLDs
CO2-PO2	3	Analysis of commercial off-the shelf components(COTS)
CO2-PO3	2	Analysis of commercial off-the shelf components(COTS)
CO2-PO4	2	Classification of Memories
CO2-PO5	2	Explain the Memory according to the types of interface
CO2-PO6	3	Explain the Memory according to the types of interface

CO2-PO7	3	Explain the sensors and actuators
CO2-PO9	2	Explain the sensors and actuators
CO2-PO10	2	Explain the communication interface
CO2-PO11	2	Describe about Embedded Firmware
CO2-PO12	2	Explain about Reset circuit
CO2-PSO1	1	Explain about Brown-out Protection circuit
CO2-PSO2	2	Explain the Oscillator Unit
CO2-PSO3	2	Explain the Real time clock
CO3-PO1	2	Explain the watchdog Timer
CO3-PO2	2	Analysis of Embedded Firmware Design Approaches
CO3-PO3	3	Analysis of Embedded Firmware Design Approaches
CO3-PO4	2	Developments Languages
CO3-PO5	2	Developments Languages
CO3-PO6	3	Different types of operating systems
CO3-PO7	3	Explain about Tasks, Process and Threads
CO3-PO9	3	Explain about Tasks, Process and Threads
CO3-PO10	3	Describe the Multiprocessing and multitasking
CO3-PO11	3	Describe the Multiprocessing and multitasking
CO3-PO12	3	Analysis of Task scheduling
CO3-PSO1	1	Discuss Task Communication
CO3-PSO2	3	Discuss Task Communication
CO3-PSO3	3	Discuss shared memory
CO4-PO1	2	Explain the typical embedded systems
CO4-PO2	2	Explain the general purpose and domain specific processors
CO4-PO3	2	Explain the general purpose and domain specific processors
CO4-PO4	3	Describe about ASICs,PLDs
CO4-PO5	3	Describe about ASICs,PLDs
CO4-PO6	3	Analysis of commercial off-the shelf components(COTS)
CO4-PO7	2	Discuss task synchronization issues
CO4-PO9	2	Explain the task synchronization techniques
CO4-PO10	2	Explain the sensors and actuators
CO4-PO11	2	Explain the typical embedded system examples.
CO4-PO12	2	Explain the communication interface
CO4-PSO1	1	Describe about Embedded Firmware
CO4-PSO2	2	Explain about Reset circuit
CO4-PSO3	2	Explain about Brown-out Protection circuit
CO5-PO1	3	Explain the Oscillator Unit
CO5-PO2	3	Explain the Real time clock
CO5-PO3	3	Explain the watchdog Timer
CO5-PO4	3	Analysis of Embedded Firmware Design Approaches
CO5-PO5	2	Analysis of Embedded Firmware Design Approaches
CO5-PO6	2	Developments Languages
CO5-PO7	3	Developments Languages
CO5-PO9	2	Applying knowledge on RTOS baesd embedded syetms design
CO5-PO10	2	Explain the Operating systems basics

CO5-PO11	2	Different types of operating systems
CO5-PO12	2	Different types of operating systems
CO5-PSO1	3	Explain about Tasks, Process and Threads
CO5-PSO2	1	Explain about Tasks, Process and Threads
CO5-PSO3	2	Describe the Multiprocessing and multitasking
CO6-PO1	3	Describe the Multiprocessing and multitasking
CO6-PO2	3	Analysis of Task scheduling
CO6-PO3	3	Discuss Task Communication
CO6-PO4	3	Discuss Task Communication
CO6-PO5	3	Discuss shared memory
CO6-PO6	2	Explain the message passing.
CO6-PO7	2	Explain the remote procedure call.
CO6-PO9	3	Explain about the sockets.
CO6-PO10	3	Discuss task synchronization issues
CO6-PO11	3	Explain the task synchronization techniques
CO6-PO12	3	Explain the task synchronization techniques
CO6-PSO1	1	Explain the device drivers
CO6-PSO2	3	Explain the device drivers
CO6-PSO3	3	Analysis concepts of how to choose an RTOS

XI. QUESTION BANK: (JNTUH)

UNIT I
Long Answer Questions:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	What is an embedded system? Explain the different applications of embedded systems?	Remember	1
2	Explain the various purposes of embedded systems in detail with illustrative examples?	Understand	1
3	Explain the different classifications of embedded systems. Give an example for each?	Evaluate	1
4	Explain the different characteristics of embedded systems in detail?	Understand	1
5	Explain quality attribute in the embedded system development context	Remember	1
6	What are the different qualities attributes to be considered in an embedded system design?	Understand	1
7	What is the operational quality attribute? Explain the important operational quality attributes to be considered in any embedded system design?	Understand	1
8	What is the non-operational quality attribute? Explain the important operational quality attributes to be considered in any embedded system	Understand	1
9	Explain the quality attribute Response in the embedded system design Context?	Evaluate	1
10	Explain the quality attribute Throughput in the embedded system design Context?	Evaluate	1

11	Explain the quality attribute Reliability in the embedded system design context? Explain the quality attribute maintainability in the embedded system design context?	Evaluate	1
12	Explain the quality attribute information security in the embedded system design context? Explain the quality attribute safety in the embedded system design Context?	Evaluate	1
13	Explain the quality attribute portability in the embedded system design Context?	Evaluate	1

Short Answer Questions:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	Define a System. With examples	Understand	1
2	Discuss an embedded system	Understand	1
3	Write the advantages of embedded system	Apply	1
4	Write the disadvantages of embedded system	Understand	1
5	Give the applications of an embedded system	Understand	1
6	Describe various classifications of embedded systems?	Remember	1
7	Give two essential units of a processor on an embedded system	Apply	1
8	Analyze the execution unit of a processor in an embedded system do	Apply	1
9	Give the classification of embedded system	Apply	1
10	Discuss the various embedded system requirements	Understand	1
11	Give examples for small scale embedded systems	Apply	1
12	Give examples for medium scale embedded systems	Apply	1
13	Give examples for large scale embedded systems	Apply	1
14	Define is the operational quality attribute?	Understand	1
15	Define is the non-operational quality attribute?	Understand	1

UNIT II
Long Answer Questions:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain the components of typical embedded systems in detail?	Evaluate	2
2	Which are the components used as the core of an embedded systems? Explain the merits and drawbacks?	Understand	2
3	What is the difference between microprocessor and microcontroller? explain the role of micro processors and micro controller	Understand	2
4	What is digital signal processing (DSP)? Explain the role of DSP in embedded system design?	Evaluate	2

5	What is processor architecture? What is the different processor architectures available processor/controller design? Give an example	Evaluate	2
6	What is programmable logic device? What are different types of PLDs? Explain the role of PLDs in embedded system design?	Understand	2
7	What are the different types of memories used in embedded systems design? Explain the role of each?	Analyze	2
8	What are the different types of memories used for program storage in embedded systems design?	Analyze	2
9	What are the advantages of FLASH over other program storage memory in Embedded system design?	Understand	2
10	What is sensor? Explain its role in embedded system design? Illustrate	Evaluate	2
11	What is actuator? Explain its role in embedded system design? Illustrate with an example?	Evaluate	2
12	Explain the different factors that need to be consider in the selection of memory for embedded system?	Apply	2
13	What are differences between general purpose processor and application specific instruction set processors with an example?	Understand	2
14	a. Explain the on different onboard communication interface in brief? b. Explain the on different external communication interface in brief?	Apply	2
15	Explain the sequence of operation for communicating with an I2C slave device?	Apply	2

Short Answer Questions:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	Describe the components used as the core of an embedded system?	Understand	2
2	Give the difference between microprocessor and microcontroller?	Understand	2
3	Define is digital signal processing (DSP)?	Understand	2
4	Define is processor architecture?	Understand	2
5	Define programmable logic device?	Understand	2
6	Write the difference between RISC and CISC processors	Analyze	2
7	Write the difference between PLD and ASIC?	Analyze	2
8	Write the difference between masked ROM and OTP?	Analyze	2
9	Discuss the different types of RAM used for embedded system design?	Apply	2
10	Define SRAM cell?	Understand	2

UNIT III

Long Answer Questions:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	What is embedded firmware? What are the different approaches available for embedded firmware development?.	Understand	3
2	Explain the role of RESET circuit in embedded system	Analyze	3
3	Explain the role of Real Time Clock in embedded system	Analyze	3
4	Explain the role of Watch dog Timer in embedded system	Evaluate	3
5	Explain the role of Brown out protection circuit in embedded system	Evaluate	3
6	Explain the various steps involved in the assembling of an assembly language program?	Evaluate	3
7	Explain the advantages of Assembly level language based on embedded firmware development?	Evaluate	3
8	Explain the high level language based on embedded firmware development technique?	Apply	3
9	Explain about source file to object file translation in the assembly language based development	Apply	3
10	Explain about library file creation and usage in the assembly language based development?	Evaluate	3
11	Write the advantages and drawbacks of assembly language based development?	Understand	4
12	Write the advantages and limitations of high language based development?	Understand	4
13	Explain about mixing assembly with high level language (assembly language with C)?	Apply	4
14	Explain about mixing high level language with assembly (C with assembly language)?	Apply	4

Short Answer Questions:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	Define Assembly Level Language?	Remember	3
2	Discuss about format of the assembly level language?	Remember	3
3	What is absolute object file?	Understand	3

4	Write the difference between compiler and cross compiler?	Understand	3
5	Define inline assembly?	Analyze	4
6	Give the limitations of the high level language based development?	Analyze	4
7	Write short notes on Linker and Locater?	Understand	4
8	Discuss about the object to hex file converter?	Understand	4

UNIT IV
Long Answer Questions:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	What is kernel? What are the different functions handled by a general purpose kernel?	Understand	4
2	What is the difference between a general purpose kernel and real time kernel? Give an example for both?	Understand	4
3	Explain the difference between memory management of general purpose kernel and real time kernel?	Apply	4
4	Explain how accurate time management is achieved in real time kernel	Apply	4
5	Explain the TASK and Process in the operating system context?		4
6	Explain the memory architecture of a process?	Apply	4
7	Explain various activities involved in the creation of process and threads?	Apply	4
8	What is process control block (PCB)? Explain the structure of the PCB	Understand	5
9	What is task control block (TCB)? Explain the structure of the TCB	Understand	5
10	Explain how Threads and process are related? what are the common to process and threads?	Evaluate	5
11	Explain how multithreading can improve the performance of an application with an illustrative example?	Apply	5
12	Explain thread context switch and the various activities performed in thread context switching for user level and kernel level threads	Evaluate	5

Short Answer Questions:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	Define is an operating system?	Understand	4
2	Define kernel?	Understand	4

3	Discuss about kernel space and user space	Understand	4
4	Define monolithic and micro kernel?	Understand	4
5	Define task control block?	Understand	4
6	Define virtual memory?	Understand	4
7	Analyze how accurate time management is achieved in real time kernel?	Analyze	4
8	Define process life cycle?	Understand	4
9	Define process control block?	Understand	5
10	Analyze how threads and process are related?	Analyze	5
11	Give the difference between threads and process in detail?	Understand	5
12	Give the comparison between multitasking, multiprogramming, multi processing?	Understand	5
13	Discuss all activates are involved in the context switching?	Evaluate	5
14	Define task scheduling?	Understand	5
15	Explain the different queues are associated with process scheduling?		5

UNIT V

Long Answer Questions:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain the various process interaction models in detail	Understand	6
1	Explain the various process interaction models in detail	Understand	6
2	What is inter process communication (IPC)? give an overview of different IPC mechanisms adopted by various operating systems?	Understand	6
3	Explain The message passing technique for IPC. What are the merits and demerits of message based IPC?	Apply	6
4	Explain the synchronous and asynchronous messaging mechanisms for IPC under windows kernel?	Remember	6
5	What is priority inversion? What are the different techniques adopted for handling priority inversion?	Remember	6
6	What is mutual exclusion in the process synchronization context? Explain the different mechanisms for mutual exclusion?	Understand	6
7	What is priority inversion? What are the different techniques adopted for handling priority inversion?	Remember	6

8	Explain the interlocked functions for locked based mutual under windows OS	Understand	6
9	What is semaphore? Explain the different types of semaphores. Where it is used?	Understand	6
10	Explain the semaphore based process synchronization under windows OS	Understand	6
11	Explain the event and event object based synchronization mechanism for IPC Windows OS	Remember	6
12	What is critical section? What are the different techniques for controlling access to critical section?	Remember	6
13	Explain the architecture of Device drivers	Remember	6

Short Answer Questions:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	Define deadlock?	Understand	6
2	Discuss about Coffman conditions	Understand	6
3	Discuss about the different methods of handling deadlocks?	Apply	6
4	Give the difference between buffer over run and buffer under run?	Analyze	6
5	Define task synchronization?	Understand	6
6	Give the difference between mutex and semaphores?	Analyze	6
7	Analyze the critical section problem?	Understand	6
8	Define device driver?	Apply	6
9	Discuss about the sleep and wakeup mechanism for mutual exclusion	Understand	6

OBJECTIVE-TYPE QUESTIONS:

UNIT I

1. _____ causes the machine to leave a state after a certain amount of time
   a) Call event b) time out c) both d) none
2. In UML, _____ diagram shows the sequence of events
   a) Sequential diagram b) collaboration diagram c) class diagram d) state diagram
3. ._____ is a type of aggregation in which the owner does not allow access to the Components objects

4. _____ is a type of aggregation in which the owner does not allow access to
5. The component objects
   a) Composition b) aggregation c) association d) generalization
6. _____ allows us to define one class in terms of another
   a) Composition b) inheritance c) generalization d) none
7. In state machine, changes from one state to another are triggered by the occurrence of_____
8. Requirements of embedded systems can be divided into _____ categories
9. An object includes a set of _____ that define its internal states

UNIT II

1. Shift key is also called as _____..
2. In 8051, two 16 bit registers are _____, _____
3. The difference between port 0 and port 1 is _____
4. All counter action is controlled by _____-
5. What a TCON register consists?
6. The primary function of the SCON register is _____
7. Internal ROM size in the 8031 _____
8. Execution time of a single cycle instruction for a 6MHz crystal_____
9. The flags stored in PSW are_____
10. Address of the stack when the 8051 is reset_____
11. Number of register banks and their address_____
12. The baud rate for the serial port in mode 0 for a 6MHz crystal_____
13. Address of a subroutine that handles a timer 1 interrupt_____

UNIT III

1. Command always ends with _____ return.
2. A _____ opcode is encountered at the end of the subroutine.
3. 8051 mnemonic code for NOT Boolean operator is _____.
4. The 8-bit _____register is used to hold internal RAM address.
5. 8051 mnemonic code for AND Boolean operator is _____ is an input/output similar Port to Port1.
6. In 8051 architecture,_____ is a 16-bit register which holds the address of the external data memory address to be accessed.
7. The 8051 contains _____ general purpose registers.
8. Name three high level languages_____
9. The utility used to test a program _____
10. The following rotates the A register one bit position to he left
    a. a)RLA b) RLCA c) RRA d) RRCA
11. Rotation of nibbles in register A results in _____ operation
    a. a)Swap b) rotate right c) circular rotation d) non

UNIT IV

1. PSOC is based on _____ architecture.
2. PSOC stands for _____.
3. PSOC is inbuilt with _____ and _____- blocks.

4. PSOC has _____- number of analog blocks.
5. PSOC has _____ number of digital blocks.
6. PSOC has on chip memory flash of _____ size.
7. PSOC has onchip memory of _____ bytes of SRAM.
8. It has external programmable clocking of _____ KHZ.
9. It has _____ and _____ dedicated peripherals.
10. _____ is a key application point in PSOC
11. It has _____ number of addressing modes.
12. PSOC has _____ number of instruction formats.
13. In programming model we have _____ and _____ editors.

UNIT V

1. The purpose of application generating multiple PWM signals from single PWM generator is to demonstrate the _____ of digital system.
2. Application code is based on a _____ with four states.
3. The purpose of application which establishes a point to point remote control channel in the 2.4 GHz ISM band is _____.
4. The above application has two components as _____ and _____.
5. In the above application transmitter continuously samples the switch connected to _____.
6. When pressed the transmitter sends the packet containing _____ to the receiver on channel0.
7. The device editor in PSOC is first used to _____ the transmitter and receiver nodes.
8. The _____ is used next to write the application code for both.
9. _____ is the drawback in considering such architectures.
10. Can PSOC be used for serial communication (Y/N) _____.

XII. GATE QUESTIONS: Not Applicable

XIII. WEBSITES:

1. www.ARM.org
2. www.embeddedworld.com
3. www.iitd.ac.in
4. www.google.com

XIV. EXPERT DETAILS:

1. Sai Pavan Sudha Manager – Ami Tech India Pvt. Ltd.
2. P. Raghu Sr. Hardware Engineer – Ami Tech India Pvt. Ltd.
3. Pratap Reddy Prof. JNTUH
4. Dr. E. Venkat Reddy Prof. BIET

XV. JOURNALS:

INTERNATIONAL

1. International Journal of Embedded Systems
2. International Journal of Embedded Systems and Applications
3. American Journal of Embedded Systems and Applications

NATIONAL

1. Journal of Embedded Systems
2. I-Manager Journal On Embedded System
3. Advances In Computer Science & Engineering
4. Invent Impact : Robotics

XVI. LIST OF TOPICS FOR STUDENTS SEMINARS:

1. Embedded system design process
2. GPS system and toy train applications
3. Overview of 8051
4. Programming of 8051
5. Applications using 8051
6. Instruction set in 8051
7. Assembly language programming process
8. Interfacing of display units
9. Serial data communication
10. Interfacing of key board & stepper motor
11. Classification of operating systems
12. Overview of RTOS
13. Inter task communication tools
14. ARM overview
15. Advantages and applications of ARM

XVII. CASE STUDIES / SMALL PROJECTS:

1. Automization of house hold application
2. Industrial atomization system for temperature & pressure monitoring
3. Automization of railway signalling system
4. GPS monitoring system
5. Theft control on motor vehicles using GSM & GPRS
6. Digital notice board
7. Embedded applications in army application.