INTRODUCTION TO EMBEDDED SYSTEMS (IT601PC)
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.	Course Outcomes	Bloom's Taxonomy Levels
CO 1	Understand basic concept of embedded systems.	Understand
CO2	Apply and analyze the applications in various processors and domains of embedded system.	Apply
CO3	Analyze and develop embedded hardware and software development cycles and tools.	Create
CO4	Analyze to understand what a microcomputer, core of the embedded system.	Understand
CO5	Remember the definitions of ASICs, PLDs, memory, memory interface.	Remember

CO6	Analyze to understand different concepts of a RTOS, sensors, memory interface, communication interface.	Understand

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
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.	-	-

Program Outcomes		Level	Proficiency assessed by
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 systems.	1	Lectures, Assignments
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 of Embedded Systems, Major application areas, Purpose of E bedded Systems, Characteristics and Quality attributes of Embedded Systems.

UNIT - II

The Typical Embedded System:

Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System components.

UNIT - III

Embedded Firmware Design and Development:

Embedded Firmware Design, Embedded Firmware Development Languages, Programming in Embedded C.

UNIT - IV

RTOS Based Embedded System Design:

Operating System basics, Types of Operating Systems, Tasks, Process, Threads, Multiprocessing and Multi-tasking, Task Scheduling, Threads-Processes-Scheduling putting them together, Task Communication, Task Synchronization, Device Drivers, How to choose an RTOS

UNIT - V

Integration and Testing of Embedded Hardware and Firmware:

Integration of Hardware and Firmware, Boards Bring up

The Embedded System Development Environment:

The Integrated Development Environment (IDE), Types of files generated on Cross-Compilation, Disassembler/Decompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

TEXT BOOKS:

1. Shibu K V, "Introduction to Embedded Systems", Second Edition, Mc Graw Hill

REFERENCES:

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill
2. Frank Vahid and Tony Givargis, "Embedded Systems Design" - A Unified Hardware/Software Introduction, John Wiley
3. Lyla, "Embedded Systems" –Pearson
4. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.

GATE SYLLABUS: Not Applicable

IES SYLLABUS: Not Applicable

VIII. COURSE PLAN:

Lecture No.	Topics to be covered	Link for PPT	Link for PDF	Link for Small Projects/ Numericals(if any)	Course learning outcomes	Teaching Methodology	Reference
1	Course Objectives and Prerequisites	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Memorize** about Embedded systems	PPT and BB	**Shibu K V, " Introduction to Embedded Systems" , Second Edition, Mc Graw Hill**
2	Introduction and defination of Embedded System	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Memorize** about Embedded systems	PPT and BB	
3	History of Embedded Systems, Major Application Areas and Purpose of Embedded Systems	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Memorize** about Embedded systems	PPT and BB	
4	Classification of embedded systems	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Describe** about embedded Systems	PPT and BB	

5	Embedded System Versus General Computing Systems	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Describe** about embedded Systems	PPT and BB	
6	Unit 1 Student Presentation	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Describe** about embedded	PPT and BB	
7	Purpose of Embedded System	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Describe** about embedded systems	PPT and BB	
8	Purpose of Embedded System	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Classify** embedded systems	PPT and BB	
9	ES Design Process	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Describe** about major applications area and purpose	PPT and BB	
10	Unit 1 Student Presentation	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Describe** about major applications area and purpose	PPT and BB	

11	Characteristics of embedded systems	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Analysis** of Characteristics and quality attributes of embedded systems.	PPT and BB	
12	Quality Attributes of Embedded Systems	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Analysis** of Characteristics and quality attributes of embedded systems.	PPT and BB	
13	Typical embedded systems: General purpose and domain specific processors	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the general purpose and domain specific processors	PPT and BB	**Shibu K V, "Introduction to Embedded Systems", Second Edition, Mc Graw Hill**
14	Unit 2 Student Presentation	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the general purpose and domain specific processors	PPT and BB	
15	microprocessors and Microcontrollers, ASICs, PLDs	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Describe** about ASICs,PLDs	PPT and BB	

16	Commercial off-the shelf components(COTS),	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Analysis** of commercial off-the shelf components(COTS),	PPT and BB	
17	Memory according to the types of interface	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the Memory according to the types of interface	PPT and BB	
18	Unit 2 Student Presentation	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the Memory according to the types of interface	PPT and BB	
19	Sensors and actuators	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the sensors and actuators	PPT and BB	
20	Communication interface	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the communication interface	PPT and BB	
21	Embedded Firmware Reset circuit	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=shari	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Describe** about Embedded	PPT and BB	

		ng			Firmware and Reset Circuit		
22	Unit 2 Student Presentation	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Describe** about Embedded Firmware and Reset Circuit	PPT and BB	
23	Brown-out Protection circuit	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the brown out circuit, Protection Circuit and Oscillator circuit	PPT and BB	
24	Oscillator Unit Real time Clock	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the Real Time clock and Watchdog Timer	PPT and BB	
25	Watchdog Timer	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Analysis** of Embedded Firmware Design Approaches	PPT and BB	
26	Unit 3 Student Presentation	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Analysis** of Embedded Firmware Design Approaches	PPT and BB	

27	Embedded Firmware Design Approaches	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Analysis** of Embedded Firmware Design Approaches	PPT and BB	**Shibu K V, "Introduction to Embedded Systems", Second Edition, Mc Graw Hill**
28	Developments Languages	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Development** Languages	PPT and BB	
29	RTOS BAESD EMBEDDED SYETMS DESIGN	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Applying** knowledge on RTOS baesd embedded syetms design	PPT and BB	
30	Unit 3 Student Presentation	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Applying** knowledge on RTOS baesd embedded syetms design	PPT and BB	
31	Operating systems basics Types of operating systems	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the Operating systems basics. **Different** types of operating systems,	PPT and BB	

32	Tasks, Process and Threads	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** about Tasks, Process and Threads. **Describe** Multiprocessing and Multithreading	PPT and BB	
33	Multi Processing and Multi Threading	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** about Tasks, Process and Threads. **Describe** Multiprocessing and Multithreading	PPT and BB	
34	Unit 4 Student Presentation	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** about Tasks, Process and Threads. **Describe** Multiprocessing and Multithreading	PPT and BB	
35	Task Scheduling,	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Analysis** of Task scheduling	PPT and BB	

36	Threads-Processes-Scheduling putting them together	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Analysis** of Task scheduling	PPT and BB	
37	Task Communication	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Discuss** Task Communication	PPT and BB	
38	Unit 4 Student Presentation	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Discuss** Task Communication	PPT and BB	
39	Task Synchronization, Device Drivers	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Discuss** Task Synchronization and Device Drivers	PPT and BB	
40	How to choose an RTOS	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Analysis** concepts of how to choose an RTOS	PPT and BB	

41	Integration of Hardware and Firmware, Boards Bring up	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the integration of hardware and firmware	PPT and BB	**Shibu K V, "Introduction to Embedded Systems", Second Edition, Mc Graw Hill**
42	Unit 5 student Presentaion	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the integration of hardware and firmware	PPT and BB	
43	The Integrated Development Environment (IDE),	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the integrated development environment	PPT and BB	
44	Types of files generated on Cross-Compilation,	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the files generated in cross compilation	PPT and BB	
45	Disassembler/ Decompiler	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Discuss** the concept of Disassembler and Decompiler	PPT and BB	

46	Unit 5 student Presentaion	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Discuss** the concept of Disassembler and Decompiler	PPT and BB	
47	Simulators	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Discuss** the simulator	PPT and BB	
48	Emulators and Debugging	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the emulators and debugging	PPT and BB	
49	Target Hardware Debugging and Boundary Scan	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Explain** the concept of Target Hardware Debugging and Boundary Scan	PPT and BB	
50	Revision Unit I, II	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Revision** of concepts	PPT and BB	

51	Revision Unit III, IV, V	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	https://drive.google.com/drive/folders/13yxQTO1AQfAl8nR_Cw7fGrVoHngj-wrs?usp=sharing	**Small Projects/ Numericals (if any) Link**	**Revision** of concepts	PPT and BB	

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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO	PO12	PSO1	PSO2	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. QUESTION BANK: (JNTUH)

DESCRIPTIVE QUESTIONS

UNIT I

SHORT ANSWER QUESTIONS:

S.No	Questions	Bloom's Taxonomy Levels
1	Explain in detail about embedded system, design process with examples.	Understand
2	What is an embedded system and write about the design process.	Understand
3	Write about formalisms for embedded system design in detail.	Remember
4	Explain about Embedded Computing in detail.	Understand
5	What are the reasons for using microprocessor in embedded systems?	Remember

LONG ANSWER QUESTIONS:

S.No	Questions	Bloom's Taxonomy Levels
1	Discuss why micro controllers are preferred for embedded systems.	Understand
2	Briefly explain the challenges involved in the embedded system development?	Understand
3	Explain the hardware and software features of the	Understand

	microcontroller i.e. 8051 that are useful for embedded systems.	
4	What are the various hardware functional blocks required to build a typical embedded system? Briefly explain their features and use	Understand
5	Explain the general features of microprocessors and microcontrollers by giving one example for each. Discuss why microcontrollers are preferred for embedded systems	Understand
6	What are the levels of abstraction in a embedded system design process?	Understand
7	What are the major components of embedded system hardware?	Understand
8	Define an embedded system? List out the software tools needed on designing on embedded system. Discuss about any one of them.	Remember
9	What are the basic functional circuit chips in an embedded system? Explain.	Remember
10	What are the techniques of energy and power management in an embedded system?	Remember
11	compare and contrast top-down and bottom up design	Understand
12	Design 'model train controller' using UML.	Apply

UNIT II

SHORT ANSWER QUESTIONS

S.No	Questions	Bloom's Taxonomy Levels
1	Explain the electrical specifications of RS232.	Understand
2	List the two major states in the operation of Bluetooth.	Understand
3	What is a CAN bus? Where is it used?	Understand
4	Define the term carrier sense in CSMA/CD?	Understand
5	What is I2C?	Apply

LONG ANSWER QUESTIONS

S.No	Questions	Bloom's Taxonomy Levels
1	Explain the various features in USB communication protocol.	Understand
2	With neat sketches explain about Bluetooth technology.	Understand
3	Describe the frame format and working of I2C Protocol with features.	Understand
4	Describe the CAN protocol bringing out the architecture, message formats and error detection on detail.	Understand
5	Explain the encoding method, frame format, network access protocol used by Ethernet standard Explain the role of interrupts in embedded applications. Describe how they are handled by the CPU.	Understand
6	What is Computational model. List out the different	Remember

	Real time models or Computational Model.	
7	Which are the different Parallel I/O ports? Explain in brief.	Remember
8	Short note on: Timers/Counters.	Remember
9	Explain serial communication with an example.	Remember
10	Short note on : Analog interfaces	Remember
11	Differentiate between hardware and software co-design.	Understand
12	Explain Process Control in terms of operating system.	Understand
13	Write a short note on: Functional units of Digital Camera.	Understand
14	What do you mean by Network Router? Explain in brief.	Understand
15	Write a short note on : RTLinux	Understand
16	Differentiate between IC and Design technology.	Understand
17	Compare RISC vs CISC processor.	Understand
18	Draw and explain CISC processor architecture	Understand

UNIT III

SHORT ANSWER QUESTIONS

S.No	Questions	Bloom's Taxonomy Levels
1	What is firmware	Remember
2	What is a linker.	Remember
3	What is kernel	Remember
4	What is the difference between RISC and CISC	Remember
5	What is a digital signal processor	Remember
6	What are the features of SPI?	Remember
7	What is the difference between C and Embedded C	Remember
8	What is process life cycle?	Remember
9	What are the advantages of simulator base debugging?	Remember

LONG ANSWER QUESTIONS

S.No	Questions	Bloom's Taxonomy Levels
1	Discuss about Multiprocessing and Multitasking techniques used in RTOS?	Understand
2	Briefly explain (i) Task scheduling (ii) Hardware software trade-offs	Understand
3	Explain about Assembly Language Programming tools and techniques. Explain about data transfer and logical instructions with examples.	Understand
4	Write about the assembly language programming process, programming tools and techniques.	Understand
5	Draw and explain the integrated embedded system development environment.	Understand
6	Write notes on Embedded software development-process?	Remember
7	Explain about ASICs, PLDs and COTs.	Understand

8	Explain the significance of reset circuit and brownout protection circuit.	Understand
9	Explain about firmware design approaches	Understand
10	Explain the shared memory concept in inter process communication	Understand

UNIT IV

SHORT ANSWER QUESTIONS

S.No	Questions	Bloom's Taxonomy Levels
1	Define process.	Remember
2	Define task and Task state.	Remember
3	Name any two important RTOS.	Remember
4	Summarize sophisticated multitasking embedded system?	Remember
5	Explain multi task and their functions in embedded system.	Understand
6	How watchdog timer helps the circuit in protection?	Understand
7	Explain the difference between software and firmware.	Understand
8	Give examples of different firmware's	Understand

LONG ANSWER QUESTIONS

S.No	Questions	Bloom's Taxonomy Levels
1	What is Digital Signal Processor? Explain the role of DSP in embedded system design.	Understand
2	Explain the different characteristics of embedded systems in detail?	Understand
3	Explain the role of Watchdog timer in embedded system	Understand
4	Compare the operation of ZigBee and Wi-Fi networks	Understand
5	Explain the advantages and disadvantages of high level language based embedded firmware development.	Understand
6	What is Device driver? explain about device driver programming	Understand
7	What is task scheduling? Explain Round Rabin scheduling algorithm	Remember
8	Explain about how to choose an RTOS	Remember

UNIT V

SHORT ANSWER QUESTIONS

S.No	Questions	Bloom's Taxonomy Levels
1	Explain different application areas of embedded systems.	Understand
2	Write an application program for blinking of an LED.	Understand
3	Write an application program for cap sense.	Understand
4	Explain the application with digital logic.	Understand

LONG ANSWER QUESTIONS

S.No	Questions	Bloom's Taxonomy Levels
1	Explain an application with precision analog communication.	Understand
2	Explain an application program for serial transmission.	Understand
3	Explain an application program for serial reception.	Understand
4	Write an application program for LED glowing.	Understand
5	Write an application program for dancing LED.	Understand
6	Write an application program for blinking of an LED with given delay.	Understand
7	Explain how serial communication from one I/O to other I/O device is carried out using PSOC.	Understand

XI. 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. Which of the following is (are) an intended purpose(s) of embedded systems? [d]

[a] Data Collection [b] Data Processing [c] Data Communication [d] all of these [e] none of these

2. Which of the following is an (are) example(s) of embedded system for data communication? [b]

[a] USB Mass storage device [b]Network router [c] Digital camera [d]Music player [e]all the above [f] none of these

3. A digital multi meter is an example of an embedded system for [b]

[a] data communication [b] Monitoring [c] Control [d] All of these [e] none of these

4. Which of the following is an (are) example(s) of an embedded system for signal processing? [a]

[a] Apple iPOD (media player device) [b] SanDisk USB mass storage device [c] Both a and b [d] none of these.

5. Embedded hardware/software systems are basically designed to [d]

[a] Regulate a physical variable [b] Change the state of some device [c] Measure/Read the state of a variable/device [d] Any/all of these

6. Little Endian Processor means [a]

[a] Store the lower order byte of the data at the lowest address and the higher order byte of the data at the highest address memory

[b] Store the higher-order byte of the data at the lowest address and the lower order-byte of the data at the highest address of memory

[c] Store both higher order and lower order byte of the data at the same address of memory

[d] Store both higher order and lower byte of the data at the higher address of memory

[e] Store both higher order and lower byte of the data at the lower address of memory

7. An integer variable with value 255 is stored in memory location at 0x8000. The processor word length is 8 bits and the processor is big endian processor. The size of integer is considered as 4 bytes in the system. What is the value held by the memory location 0x8000? [b]

[a] 0xFF [b]0x00 [c]0x01 [d]255 [e]256 [f]none

8. The instruction set of RISC processor is [a]

[a]Simple and lesser in number [b] complex and lesser in number [c] Simple and larger in number [d] Complex and larger in number

9. Which of the following is true about CISC processor? [c]

[a] The instruction set is non-orthogonal[b]The number of general purpose registers is limited. [c] Instructions are like macros in C language [d] Variable length instructions [e] all the above [f]None of the above

10. Which of the following processor architecture supports easier instruction pipelining?

[a]Harvard [b] Von Neumann [c]Both of them [d] None of these [b]

11. Microprocessors/controllers based on the Harvard architecture will have separate data bus and instruction bus. This allows the data transfer and program fetching to occur simultaneously on both buses. State true or false [a]

[a] true [b] false

12. Embedded systems are application and domain specific. State true or false [a]

[a] True [b] False

UNIT III

1. Command always ends with _____ return.
2. A _____ opcode is encountered at the end of the subroutine.
3. 25. Which of the following are header files? [a]

a) #include b) file c) struct() d) proc()

4. Which is the standard C compiler used for the UNIX systems? [c]

a) simulator b) compiler c) cc d) sc

5. Which compiling option is used to compile programs to form part of a library?[a]

a) –c b) –p c) –f d) -g

6. Which compiling option can be used for finding which part of the program are consuming most of the processing time? [c]

a) –f b) –g c) –p d) -c

7. Which compiling option can generate symbolic debug information for debuggers?[d]

a) –c b) –p c) –f d) -g

8. Which of the following is also known as loader? [b]

a) locater b) linker c) assembler d) compiler

9. Which of the following gives the final control to the Courser? [a]

a) linker b) compiler c) locater d) simulator

10. Which command takes the object file and searches library files to find the routine calls? [d]

a) simulator b) emulator c) debugger d) linker

UNIT IV

1. What is the output of the specific code?

Char str1[]="Hello"
Char str2*+="World";
Str1=str2;
Printf("%s\n", str1);

A: Illegal, str1=str2 is not valid for string copy. correct operation is strcpy(str1,str2);

2. What is the output of the specific code?

Char str1*+="Hello"
Char str2*+="World";
Str1+=str2;
Printf("%s\n", str1);

A: Illegal, str1+=str2 leads to str1=str1+str2, addition of strings is not valid. Or addition of string with a constant "Hello" string is not valid. Correct operation is strcat(str1, str2).

3. Translation of assembly code to machine code is performed by---------

A. Assembler

4. What is ORG in the following piece of code

Org 4000h
SJMP 6000h

A: pseudo code

5. Give the name of file inclusion preprocessor directive?

A: #include

6. The user application and kernel interface is provided through--------

A: System call

7. The memory area which holds the program code corresponding to the core OS applications/services is known as -------

A: (a) user space

8. Which is an example of RTOS

A: (e) both a and d -> Windows CE, & QNX

9. Missing any deadline leads to catastrophic error is true for -------systems

A: hard real time systems

10. Say true or false: A Process is sequential in execution.

A: True

11. A Process has

(a) stack memory (b) program memory (c) working registers (d)data memory (e) all of these

A: all of these (e)

12. Say True or False :The stack memory of a process holds all temporary data such as variables local to the process.

A: True

13. The data memory of process holds

A: global variables

14. A Process when loaded to the memory is allocated a virtual memory space in the range 0x08000 to 0x08FF8. What is the content of the stack pointer of the process when it is created?

A: 0x7FFF

15. The state at which a process is being created is referred as ----------

A: Created state

16. The state, where a process is incepted into the memory and awaiting the processor time for execution, is known as -------

A: Ready state

17. Say True or False : Thread is also known as light weight process.

A: True

18. Different threads, which are part of a process, share the same address space. State True or False.

A: False

19. The CPU allocation for a process may change when it changes its state from

(a) 'running' to 'ready' (b) 'ready' to 'running' (c) 'running' to 'blocked'

(d) 'running' to 'completed' (e) b and c (f)a and d

A: (e) b and c

20. Multi-Processor System contain

A: (b) Multiple CPUs

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. Atomization of house hold application
2. Industrial atomization system for temperature & pressure monitoring
3. Atomization 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.