Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2021-22, COURSE HANDOUT
(PART-II)

Course Number	:	**EEE G512**	**Date: 10-08-2021**
Course Title	:	**EMBEDDED SYSTEM DESIGN**	
Instructor-in-Charge	:	**M B Srinivas**	

Course Description :

Introduction to embedded systems; embedded architectures: Architectures and programming of microcontrollers and DSPs. Embedded applications and technologies; power issues in system design; introduction to software and hardware co-design

This course provides a practical introduction to embedded systems with a detailed exposure to embedded architectures and programming of microcontrollers and DSPs. Several issues and constraints related to embedded system development will be discussed. Programming for 8051 and ARM controllers using assembly and embedded C is a part of the laboratory.

Scope and Objective of the course:

Introduction to embedded systems; embedded architectures: Architectures and programming of microcontrollers and DSPs. Embedded applications and technologies power issues in system design, introduction to software and hardware co-design.

The course intends to cover the design issues involved in embedded systems and system-on-chip technologies. The course also deals with the applications and programming languages used for embedded systems. This course introduces the students to standard Embedded System Development tools and gives a hands-on experience in developing various embedded applications.

Text Book:
T1. Wolf, Wayne, Computers as Components – Principles of Embedded Computing
System Design, Second Edition, Elsevier, 2008.

Reference Books:
R1. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Second Edition, Pearson Education,2008.
R2.Raj Kamal, Embedded Systems, Tata McGraw Hill, New Delhi, 2003.
R3.Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide, Designing and Optimizing System Software" Morgan Kaufmann Publishers, Elsevier, 2004.

Course Plan:

Lecture No.	Learning Objectives	Topics	Reference to Text books/ References

1-2	Basics of Embedded System	Introduction to Embedded Systems, Design Methodology and Research Areas	T1-Chapter 1, R2 - Chapter 1 + Class Notes
3-5	Processors, Memory and I/O Devices, Device Drivers	Processors in Embedded Systems. RISC and CISC Architectures. Memories, Exemplary Embedded Systems I/O Devices, Software in Embedded Systems, Device Driver Concepts	T1 & R2 - Chapter 2, 3, 4 + Class Notes
6	Microcontrollers	Introduction to 8051 Family of Microcontroller	R1- Chapter 1 + Class Notes
7-10	Design of Software Systems	8051 Programming Model, Addressing Modes, Instruction Set, Special Function Registers(SFRs), Memory Maps, C versus Assembly, Embedded Programming in C	R1- Chapter 2-7, + Class Notes
11	Interfacing Techniques	Methodology, Synchronizing Software and Processor with I/O.	Class Notes
12-14	8051 On-chip Peripherals	8051 Timers, Serial Ports, Programmable Counter Arrays (PCA), Keyboard Interface, Interrupt, Interrupt Vectors and Priority, Threads	R1- Chapter 9-11 (relevant topics) + Class Notes
15-17	Interfacing External Peripheral	Interfacing of LCDs, Relays, DC Motors, Stepper Motors, Sensors, External Memories, 8255 etc	R1- Chapter 12-15 + Class Notes
18	Real Time Operating System Basics	Introduction to RTOS on 8051 (RTX51 Full and RTX51 Tiny)	Class Notes
19	Case Study	General Purpose Processor based Design	Class Note
20-21	32-bit Processor Architecture	Introduction to ARM Architecture & NXP's LPC2378 Microcontroller/AVR	R3 – Chapter 1, 2 + Class Notes
22-26	ARM Instruction Set and Programming	Addressing Modes and Instruction Set Overview, Overview of Thumb Mode Instruction Set, ARM Assembly Programming and C Programming Concepts	R3 – Chapter 3, 4, 5 + Class Notes

27-28	LPC 2378 Peripherals	System and Power Control, Clock Module, GPIOs, Timers, Vectored Interrupt Controller.	Class Notes
28-32	LPC 2378 Peripherals	UARTs, ADC, DAC and PWM	Class Notes
33	Real Time Operating System on ARM	Introduction to RTOS on ARM (RTX Kernel)	Class Notes
34-35	Case Studies	General Purpose Processor based Design	Class Notes
35-41	Bus Architectures	LPC 2378's I^{2}C and CAN Bus Interface	Class Notes
42	Embedded System Hardware and Software Design Issues	CPU Power Consumption and Optimization, ICE, hardware –Software co-simulation and debugging, Real-time, Design Cycle	Class Notes

Evaluation Scheme:

EC No.	Evaluation Component	Type	Duration	Weight	Date
1	Mid-Semester Test	Closed Book	90 minutes	**30% (70M)**	To be Announced
2	Assignments+Presentations +Project	Open Book	All Semester	**40% (70M)**	To be Announced
3	Comprehensive Exam	**Open Book**	2 hours	**30% (60M)**	To be Announced

Chamber Consultation Hour: To be announced in Class

Notices: All notices regarding the course will be put up in EEE notice board/CMS.

Make-up Policy: No make-up without prior permission. Make-up for the tests will be granted only on genuine grounds of sickness. In all cases prior intimation must be given to IC. There will be no make-up for the project /term paper presentations.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable

Instructor-in-charge
EEE G512