Birla Institute of Technology & Science, Pilani
Hyderabad Campus

ACADEMIC-GRADUATE STUDIES AND RESEARCH DIVISION

FIRST SEMESTER 2023-2024
COURSE HANDOUT (PART-II)

Date: 31/07/23

In addition to part I (General Handout for all courses appended to the Time table) this portion gives further specific details regarding the course.

Course Number : **EEE G512**
Course Title : **EMBEDDED SYSTEM DESIGN**
Instructor-in-Charge : **SYED ERSHAD AHMED**

Course Description: Introduction to embedded systems; embedded architectures: Architectures and programming of microcontrollers. Embedded applications and technologies; power issues in system design; introduction to software.

Scope and Objective of the course

The course intends to cover the design issues involved in embedded systems and system-on-chip technologies. The course also deals with programming techniques, processor architectures, on-chip & off-chip protocols, performance analysis, and optimization techniques used in embedded system development. This course introduces the students to standard Embedded System Development tools and gives 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:

R3.Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide, Designing and Optimizing System Software" Morgan Kaufmann Publishers, Elsevier, 2004.

R4. Vahid, F, and Givargis, T, Embedded System Design – A Unified Hardware/Software Introduction, John Wiley, 2002

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, R4 - Chapter 1 + Class Notes
3-5	Processors, Memory	Processors in Embedded Systems. RISC and CISC Architectures.	Class Notes

	and I/O Devices, Device Drivers	Memories, Exemplary Embedded Systems I/O Devices, Software in Embedded Systems, Device Driver Concepts	
6	Hardware Components of Embedded Systems	Memory Types Organization, Cache , Basic peripherals like Timers, ADC/DAC, Interrupts	R4-Chapter 5+ Class Notes
7-11	Embedded Architecture 1 – RISC ARM Architecture	1. Introduction to ARM CPU Architecture 2. Programmers Model of ARM CPU 2.1 Register Organization 2.2 Operating Modes 2.3 Pipelining 2.4 ARM Exception Handling 3. ARM Instruction Set	R3- Chapter 1 ,2+ Class Notes
12-14	ARM: Arithmetic and Logic Instructions and Programs	1. Arithmetic Instructions 2. Logic Instructions 3. Rotate and Barrel Shifter 4. Shift and Rotate Instructions 5. BCD conversion	R3- Chapter 5 + Class Notes
15-16	ARM: Branch, call and Looping	1.Looping and Branch instructions 2.Calling Subroutine with BL 3.ARM Time delay and Instruction Pipeline 4. Conditional Execution	R3- Chapter 3+ Class Notes
17	Signed Integer Arithmetic	1.Signed Number concept 2.Signed number instructions and operation	Class Notes
18-19	ARM Pipeline and CPU Evolution	1.ARM Pipeline Evolution 2. Other CPU Enhancements	R3- Chapter 4+ Class Notes
20-21	ARM and Thumb Instructions	1.Thumb Instructions 2.Thumb-2 Technology	R3- Chapter 7+ Class Notes
22-25	32-bit Processor Architecture	NXP's LPC23XX Microcontroller	Class Notes
26-27	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
36-39	Bus Architectures	LPC 2378's I^2C and CAN Bus Interface	Class Notes

	ARM Bus	AMBA Bus Architecture, GPIO, Timer, Watchdog, Interrupt Handling -VIC, ADC/DAC	R3- Chapter 11, R4-Chapter 4+ Class Notes
40	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	Weightage	*Date, Time*	Remark
1.	Midterm	90 mins	20 %	11/10 - 11.30 - 1.00PM	OB
2	Quizzes	30 mins	15 %	To be Announced	CB
2	Assignments		10 %	To be done throughout the course as and when given	OB
3.	Mini Project		10 %	To begin when announced	OB
4.	LAB		10 %	To be done throughout the course as and when given	OB
5.	Comprehensive Examination	3 hours	35%	12/12 AN	CB

I. **Chamber Consultation Hour:** To be announced in Class

II. **Notices:** All notices regarding the course will be put up on CMS

III. **Make-up Policy:** In general, Make-up will not be granted without prior permission. If the student is unable to appear for the Mid-Semester Test/ Comprehensive Examination due to genuine exigencies, the student must refer to the procedure for applying for Make-up.

IV. Note (if any): It shall be the responsibility of the individual student to be regular in attending lectures and the lab sessions as per the schedule announced in time table.

V. **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