



BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
Instruction Division

Birla Institute of Technology and Science, Pilani

Instruction Division

First Semester 2015-2016

EEE G512: Embedded System Design

Course Number: EEE G512

Credits: 4

Course Title: Embedded System Design

Evaluation marks: Out of 300

Instructor-in-charge: Dr. Anu Gupta/ Dr.Kota Solomon Raju

Scope and Objectives of the Course:

- General introduction of models and processor architecture models used for the embedded system design
- To teach the basic concepts of embedded system design using ARM (LPC 2148) and 8051 processors for various applications.
- Focuses on design issues involved in embedded system and system-on-chip technologies
- Use of standard embedded system development platform tools, analysis techniques, and methods for embedded system design.
- Programming concepts with hands-on experience using ARM LPC 2148 experimental board.
- Current trends in embedded system design.

Text Book (s) :

T1. Wolf, Wayne, **Computers as Components –Principles of Embedded Computing System Design**, Second Edition, Morgan-Kaufmann, 2005.

Reference Books/Journals/Magazines :

- R1. Muhammad Ali Mazidi, Janice Gillespie 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.
- R4. Qing Li and Caroline Yao, **"Real-Time Concepts for Embedded Systems"**, Elsevier publications, 2003.



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Course Plan :

| Lecture No. | Learning Objectives | Topics | Reference to Text books/References |
|-------------|--|--|--|
| 1 | Basics of Embedded Systems | Introduction to Embedded Systems, Design Methodology and Research Areas | T1-Chapter 1, +Clas Notes |
| 2-4 | 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 Drive Concepts | T1&R2-Chapter 2,3,4+Class Notes |
| 5 | Microcontrollers | Introduction to 8051 Family of Microcontrollers | R1-Chapter 1+ Class Notes |
| 6-9 | 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 |
| 10-11 | 32-bit Processor Architecture | Introduction to ARM Architecture & NXP's LPC2148 Microcontroller | R3-Chapter 1,2+Class Notes |
| 12-15 | 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 |
| 16 | Interfacing Techniques | Methodology , Synchronizing Software and Processor with I/O | Class Notes |
| 17-19 | 8051 On-chip Peripherals | 8051 Timers, Serial Ports, Programmable Counter Arrays(PCA),Keyboard Interface, Interrupt Vectors and Priority, Threads | R1-Chapter 9-11(relevant topics)+Class Notes |
| 20-23 | Interfacing External Peripherals | Interfacing of LCDs., Relays, DC motors, Stepper Motors, Sensors, External Memories, 8255 etc. | R1-Chapter 12-15 + Class Notes |
| 24-25 | LPC 2148 Peripherals | System and Power Control, clock module, GPIOs, Timers, Vector Interrupt Controller | Class Notes |
| 26-29 | LPC 2148 Peripherals | UARTs, ADC,DAC and PWM | Class Notes |
| 30-31 | Case Studies | General purpose Processor based design | Class Notes |





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|-------|--|---|------------------|
| 32-38 | Peripheral Interface Bus Architectures | LPC 2148's SPI, I2C and CAN Bus Interface | Class Notes |
| 39-40 | RTOS basics | Introduction to RTOS | R4 + Class Notes |
| 41 | RTOS basics on ARM | Introduction to VxWorks | R4 + Class Notes |
| 42 | Embedded System: HW SW Design Issues | CPU power Consumption and Optimization , ICE , Hardware – Software co-simulation and debugging, real time, Design Cycle | Class Notes |

Evaluation scheme:

| Component | Duration | Marks | Date |
|-----------------------------------|-----------------|--------------|---------------------------------|
| Mid-exam test (Closed book) | 90 Min | 35 | 8/10 10:00 - 11:30 AM |
| HW * (Open Book) | Continuous | 30 | Shall be announced in the class |
| Seminar and Project ** | Continuous | 80 | Report & Presentation |
| Lab*** | Continuous | 75 | By 30/10/2015; Report |
| Comprehensive Exam (Open Book) | 120 Min | 80 | 8/12 AN |
| Total | | 300 | |

* This component also includes regularity of the student and any HW given in the class should be submitted within a week.

** The seminar and project topic in a prescribed format should be intimated on or before **first week of sept.** and mid semester presentation in 2nd week of sept 2015, end sem presentation in 3rd week of nov 2015

** Final submission of project & seminar includes:

- Report (Hard Copy and Soft Copy)



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- Presentation using power-point (Soft Copy)
- Demonstration of project and presentation will be done on next day of final report submission date along with project directory softcopy.

*** Please refer **Lab handout** for more details (will be distributed in the first class)

Evaluation scheme for Seminar and Project

| Novelty | Feasibility | Practical implementation of concepts | Impact of the project for the product /society | Presentation (7), report (10) and demonstration (8) |
|----------------|--------------------|---|---|--|
| 15 marks | 10 marks | 20 marks | 10 marks | 25 marks |

Students may miss the deadline on their own risk. No compromise on quality.

Consultation Hours: Wednesday, 4.00 pm to 5.30 pm at E-107, DSG, CSIR-CEERI, Pilani (for Dr. K S Raju)

Notices: Course notices, if any, will be displayed on EEE notice board

August 3, 2015

Instructor-in-charge



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