

IAGE – 319
Advanced Microcontrollers

(02 credits – 50 marks)

Course Outcomes:

On completion of the Course, students should be able to

1	State configuration of ARM Microcontroller, Registers, addressing modes, interfacing methods, ISR, Timing generations and measurements
2	Classify Data types , Thumb instructions used in programming,
3	Illustrate ARM architecture and architectural support for system development & operating system
4	Explain implementation of ARM
5	Summarize instructions used for high level language
6	design an embedded hardware using ARM series of Microcontroller

Course Contents:

Module – I: The ARM architecture

(05 Hrs)

Introduction to ARM microcontrollers. The Acorn RISC Machine, The architectural inheritance, The ARM programmer's model, ARM development tools, Basics of Assembly Language Programming.

Module – II: ARM organization and Implementation

(08 Hrs)

3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, The ARM coprocessor interface. ARM instruction set-Branch, branch with link(B,BL),branch, branch with link and exchange(BX,BLX),software interrupt(SWI),data processing instructions, multiply instructions, multiple register transfer instructions, Co-processor instructions. Memory Hierarchy- Memory size and speed, On-chip memory, Caches, Cache design, Memory management.

Module – III: Architectural Support for High level Language

(08 Hrs)

Data types, floating point data types, ARM Floating point Architecture, Expressions, Conditional statements, Loops, Functions and Procedure, Use of memory, run time environment, Thumb Instruction set - The Thumb bit in the CPSR, The Thumb programmer's model, Thumb branch instructions ,Thumb software interrupt instruction, Thumb data processing instructions, Thumb

single register data transfer instructions ,Thumb multiple register data transfer instructions, Thumb breakpoint instruction, Thumb implementation, Thumb application.

Module – IV: Architectural Support for System Development & Operating System
(07 Hrs)

The ARM memory interface, The Advanced Microcontroller Bus Architecture (AMBA), The ARM reference peripheral specification Hardware system prototyping tools, The ARMulator, The JTAG boundary scan test architecture, The ARM debug architecture, ARM processor Cores-ARM7TDMI, ARM8, An introduction to operating systems, The ARM system control coprocessor, CP15 protection Modularegisters, ARM protection Module, CP15 MMU registers, ARM-MMU architecture, Synchronization, Context switching, Input/output.

Module-V: Tutorials, assignments and presentation based on Module I to IV

References:

1. ARM System on chip Architecture- Prof. Steve Furber, 2nd Edition, Addison Wesley, 2000, ISBN-0-201-67519-6.
2. RM Microcontrollers, Part 1: 35 Projects For Beginners, Bert Van Dam, Elektor International Media, ISBN-10: 0905705947, ISBN-13: 9780905705941.
3. Embedded Systems: Introduction to Arm(r) Cortex(tm)-M Microcontrollers: 1; Jonathan Valvano
4. Steve Furber, "ARM system – on – chip architecture", Addison Wesley, 2000
5. Daniel Tabak, "Advanced Microprocessors", McGraw Hill. Inc., 1995