

Course Code	Course Title	L	T	P	C
1152EC116	EMBEDDED PROCESSORS	3	0	0	3

a) Course Category

Program elective

b) Preamble

This course covers application and design of ARM (Advanced RISC Machine) systems. Topics include assembly and C language programming and an introduction to the control and interfacing of ARM based systems

c) Prerequisite

Microprocessor and Microcontroller

d) Related Courses

Embedded Control System, Embedded Processors, Embedded Networking

e) Course educational objectives

1. Understand the basics of ARM processor and the architecture
2. Study the instruction sets of ARM
3. Understand the Cache concepts of embedded processor
4. Understand the memory management concepts
5. Explain real time operating systems, inter-task communication and an exemplary case of RTOS.

f) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Use the fundamentals of ARM processor with various registers and RISC architecture	K2
CO2	Apply various instructions and interrupt concept with the priority system to write a C program on basic problems.	K2
CO3	Study the cache concept dedicated to ARM	K2
CO4	Use the memory management involved in ARM	K2
CO5	Compare the IPC, Kernel Synchronization and scheduling concepts with multitasking	K2

g) Correlation of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	-	-	-	-	-	-	-	-	-	-	L	-	-
CO2	L	-	-	-	M	-	-	-	-	-	-	-	L	M
CO3	L	M	-	-	-	-	-	-	-	-	-	M	-	M
CO4	-	-	-	-	L	-	-	-	-	-	-	M	-	M
CO5	-	M	L	-	-	-	-	M	-	-	-	-	-	-

h) Course Content

UNIT I ARM PROCESSOR FUNDAMENTALS 9

Data Flow model, Registers, modes of operation, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table ARM nomenclature and families. Big Endian and Little Endian

UNIT II ARM INSTRUCTIONS , INTERRUPTS, EXCEPTIONS 9

ARM and Thumb Instruction Sets, Data Processing Instructions, Branch Instructions, Load- Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Conditional Execution, Stack Instructions, Software Interrupt Instruction.vector table, priorities, link Register offsets, interrupts, and IRQ / FIQ exceptions interrupt stack design and implementation Assembly language programming

UNIT III ARM CACHE MECHANISM 9

Introduction to cache memory, memory hierarchy and cache memory, Cache architecture and cache policies flushing and Cleaning ARM cache core locking Code and Data in CacheCache and write buffer

UNIT IV ARM MEMORY MANAGEMENT UNIT 9

MEMORY PROTECTION AND MANAGEMENT UNIT: Introduction to protection unit, Protected Regions, and Demonstration of an MPU system. Virtual Memory working principle

UNIT V REAL TIME SCHEDULING 9

Fundamental Components to Embedded OS, Simple Little Operating System: Initialization, memory model, interrupts and exceptions handling, Scheduler, and context switch .Introduction to Semaphores and types. Inter process communication: pipes and message box.

CASE STUDY: Smart phone, Smart TV, Global positioning System.

Total 45 Hrs

I) Learning Resources

Text Books

1. ARM System Developer's Guide Designing and Optimizing" by Andrew N.Sloss Elsevier publication, 2004.
2. "MicroC/OS – II" second edition The Real Time Kernel Jean J. Labrosse Publisher: Viva Books Private Ltd (Feb 2002)

Reference Books

1. Embedded systems" B.Kanta Rao PHI publishers, Eastern Economy Edition, 2011
2. Embedded Systems Architecture" - Tammy Noergaard, Newness edition, 2005
3. ARM System-on-Chip Architecture" 2nd Edition, Steve Furbe, Pearson Education, 2000
4. Embedded/Real Time Systems" Dr. K.V.K.K PRASAD Dream tech press, 2009

Online Resource

1. www.mit.org
2. www.nptel.ac.in