



SARVAJANIK UNIVERSITY
Sarvajani College of Engineering and Technology
Bachelor of Technology



B. Tech. Semester V

Subject Name: Advance Microcontroller

Subject Code: BTEC14501

Type of course: PEC

Prerequisite: Number systems, Digital Logic

Rationale: Students will learn ARM architecture, instruction set and programming in this course. ARM is very popular for portable applications because of its high performance with low power consumption. Students will learn detailed architecture, assembly language and C programming for ARM microcontroller

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

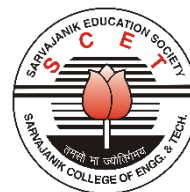
CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. no.	Topics	Teaching Hrs.	Module % Weightage
1.	ARM Introduction: Types of computer Architectures, ISA's and ARM, Difference between RISC and CISC, RISC Design philosophy, ARM Design Philosophy, History of ARM microprocessor, ARM processor family, Embedded System Software and Hardware.	6	15
2.	ARM Architecture and pipeline structure: The Acorn RISC Machine, ARM Core data flow model, Architectural inheritance, The ARM7TDMI programmer's model: General purpose registers, CPSR, SPSR, ARM memory map, data format, load and store architecture, ARM 3 stage Pipeline, ARM 5 stage Pipeline, Pipeline Hazards, Data forwarding - a hardware solution, Stack implementation in ARM, Endianness, condition codes. Processor core Vs CPU core, ARM7TDMI Interface signals, coprocessor for system control	12	25
3.	ARM7TDMI assembly language and Embedded C programming: Instructions and Programming Different Types of Instructions, ARM Instruction set, data processing instructions. Addressing modes with examples. Instruction Timing, Swap Instructions,	12	25



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	Swap Register related Instructions, Loading Constants. Program Control Flow, Control Flow Instructions. Thumb state, Thumb Programmers model, Thumb Implementation, Thumb Applications. Thumb Instructions, Interrupt processing. ramming for ARM: ARM Development Environment Embedded Software, Overview of C compiler and optimization, Basic C data types, C Looping structures, Register allocations, function calls, pointer aliasing, structure arrangement, bit-fields, unaligned data and Endianness.		
4.	Cache and Memory Management: Memory Technologies, memory Hierarchy, Hierarchical Memory Organization, Virtual Memory and classification, Cache Memory and types, Cache Design and organization, Unified or split cache, multiple level of caches, ARM cache features, Memory Map, Protected Systems, ARM systems with MPU, memory Protection Unit, Physical Vs Virtual Memory, Memory Management and Architecture, Paging, Segmentation. MMU Advantage, Translational lookaside buffer, Multitasking with MMU.	10	20
5.	AMBA bus architecture: Overview, Typical AMBA Based Microcontroller, AHB bus features, AHB Bus transfers, APB bus transfers, APB bridge. Overview of ARM Versions and comparison.	5	15

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	25	25	10	10	20

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels (**Revised Bloom’s Taxonomy**)

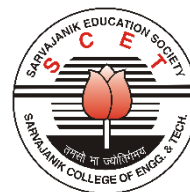
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Embedded System Architecture Programming and Design	Raj Kamal	TMH	2008	2 nd



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2.	ARM Assembly Language Programming & Architecture	Muhammad Ali Mazidi	MicroDigitalEd.com 9780997925906	2016	2 nd
3.	Arm System-on-chip Architecture	Steve Furber	Pearson	2000	2 nd

Course Outcome:

Sr. No.	CO Statement After learning this subject ,students will be able to	Marks % weightage
CO-1	Analyze and explain the RISC architecture of ARM7 processor and pipelining.	15
CO-2	Explain instructions of ARM7 processor	25
CO-3	Write assembly language and embedded C programs and execute on the LPC2148 training boards.	25
CO-4	Analyze and explain memory management units of ARM processor.	20
CO-5	Describe microprocessor bus architecture and peripherals	15

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	-	2	2	2	2	-	-	2	2	1	2	2	-	-
CO-2	3	2	2	2		2	-	-	2	2	-	2	3	3	-
CO-3	3	3	3	3	3	3	2	-	3	3	2	2	3	3	-
CO-4	3	2	2	3	2	2	-	-	2	2	1	2	2	-	-
CO-5	3	-	2	2	2	2	-	-	2	2	-	2	2	-	-

List of Experiment:

- Study features of ARM7 Development board LPC2148.
 - Do classification of various microcontrollers available in the market with example.
 - List any 5 companies which make ARM9/ARM11 based processors.
 - Identify any 4 processors used in smart phones and do comparative analysis of their features and applications in tabular form.
- Write and simulate a program in KEIL to perform the following task. Use Instruction of ARM7
 - Addition of data in a single array
 - Addition of 5 (32 bit) data stored in two array and store the result in third array
Compare the data from the given array and store the smallest number in the register.
- A 32 bit value is stored at a certain location in the ARM processor. Write a program to



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- store this 32 bit value in reverse manner using the ARM instruction set.
4. Two 32 bit values are stored in code memory in the ARM processor. Write a program to perform multiplication of two 32 bit values and store the result at data memory.
 5. Write a Program to blink 4 LED's connected on LPC2148 board on pin P1.16. to P1.19 and reset them in reverse manner. Test program in Keil and observe output on kit.
 6. Write a program to monitor status of switch connected on port 0 pin 0. If the switch reads a value 0 generate square wave of 50 % duty cycle else activate alarm. Test program in Keil and observe output on kit.
 7. Interface 8 LEDs and a switch with LPC2148 and write a program to demonstrate an up/down counter with mod control. Simulate program in Proteus. Simulate program in Proteus.
 8. Write an embedded C program to generate a triangular and square wave form using internal 10 bit DAC using LPC2148 ARM Micro controller
 9. Write a program to display "Advanced Microcontroller" on an LCD connected to an ARM processor.
 10. Study serial communication in an ARM processor and print "Hello World" on the serial port.
 11. Write the embedded C program to operate Relays via commands passed through serial ports to operate AC device on LPC2148 ARM Micro controller.
 12. Study and implementation of following modules on Proteus and real time interfacing with ARM Processor
 1. Zigbee
 2. GSM Modem
 13. Mini Project

Major Equipment:

- LPC 2148 development board, LEDs, Switches, DSO, LCD

List of Open Source/learning website:

- <https://nptel.ac.in/courses/117106111> - ARM Based Development