



SRI KRISHNA INSTITUTE OF TECHNOLOGY

(Accredited by NAAC Approved by A.I.C.T.E. New Delhi, Recognized by Govt. of Karnataka & Affiliated to V.T U., Belagavi)

#57, Chimney Hills, Hesaraghatta Main Road, Chikkabanavara Post, Bengaluru- 560090

Department of Computer Science & Engineering

Academic Year	:	2025-2026	Course Name	:	Microcontrollers
Semester	:	4 A	Course Code	:	BCS402
Scheme	:	2022	L: T: P: S	:	3:0:2: 0 Credit-4
Total Contact hours	:	40T + 20P	CIE Marks	:	50
Course Plan Author	:	Mrs. Manjushree G	SEE Marks	:	50
Date	:	23-02-2026	Total Marks	:	100

Course Prerequisites:

- Operating systems, DDCO

Learning Objectives:

- Understand the fundamentals of ARM-based systems, including programming modules with registers and the CPSR
- Familiarize with the ARM Programming modules along with registers, CPSR and flags
- Develop ALP using various instructions to program the ARM controller.
- Understand the Exceptions and Interrupt handling mechanism in Microcontrollers.
- Discuss the ARM firmware packages and Cache memory policy

Course Outcomes:

CO	At the end of the course, student should be able to . . .	Blooms' Level
C01	: Explain the ARM architectural features and instructions.	L2
C02	: Demonstrate programs using ARM instruction set for ARM microcontroller	L3
C03	: Discuss C-compiler optimizations and portability issues in ARM microcontroller.	L2
C04	: Apply the concepts of Exceptions and Interrupt handling mechanisms in developing applications.	L3
C05	: Demonstrate the role of Cache management and firmware in microcontrollers	L3

Blooms' Taxonomy:

L1	L2	L3	L4	L5	L6
Remembering	Understanding	Applying	Analyzing	Evaluating	Creating



SRI KRISHNA INSTITUTE OF TECHNOLOGY

(Accredited by NAAC Approved by A.I.C.T.E. New Delhi, Recognized by Govt. of Karnataka & Affiliated to V.T U., Belagavi)

#57, Chimney Hills, Hesaraghatta Main Road, Chikkabanavara Post, Bengaluru- 560090

Program Outcomes:

P01	:	Engineering knowledge	P07	:	Environment and sustainability
P02	:	Problem analysis	P08	:	Ethics
P03	:	Design/development of solutions	P09	:	Individual and team work
P04	:	Conduct investigations of complex problems	P010	:	Communication
P05	:	Modern tool usage	P011	:	Project management and finance
P06	:	The engineer and society	P012	:	Life-long learning

Program Specific Outcomes:

PSO1:	Accomplish the Skills to Design and Develop Computer Applications in Areas Related to Computer and Networking Systems, Artificial Intelligence, Data Processing and Photoshop.
PSO2:	Dexterity to Apply Modern Computing Languages and Platforms in Creating Career Paths to Be an Entrepreneur and Relish for Higher Studies.
PSO3:	Ability to Use and Enhance Open Ended Programming Environment To Deliver A Quality Product.

CO-PO-PSO Mapping:

CO	Program Outcomes														
	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
CO1	3	2	1	–	1	–	–	–	–	1	–	2	2	-	1
CO2	3	3	2	1	2	–	–	–	1	1	–	2	1	1	2
CO3	3	3	3	2	3	–	–	–	1	1	1	2	2	1	2
CO4	3	2	2	2	2	–	–	–	1	1	–	2	2	-	1
CO5	3	3	2	2	2	–	–	–	–	1	–	2	3	-	2
Target	3	2.6	2	1.4	2	0	0	0	0.6	1	0.2	2	2	0.4	1.6

Course Content (Syllabus)

Module 1	CH
ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions Textbook 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5	08
Module 2	
Introduction to the ARM Instruction Set: Data Processing Instructions, Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants. Textbook 1: Textbook 1: Chapter 3 - 3.1 to 3.6	08



SRI KRISHNA INSTITUTE OF TECHNOLOGY

(Accredited by NAAC Approved by A.I.C.T.E. New Delhi, Recognized by Govt. of Karnataka & Affiliated to V.T U., Belagavi)

#57, Chimney Hills, Hesaraghatta Main Road, Chikkabanavara Post, Bengaluru- 560090

Module 3	
C Compilers and Optimization: Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing, Portability Issues. Textbook 1: Chapter 5.1 to 5.7 and 5.13	08 RBT: L1, L2,L3
Module 4	
Exception and Interrupt Handling: Exception handling, ARM processor exceptions and modes, vector table, exception priorities, link register offsets, interrupts, assigning interrupts, interrupt latency, IRQ and FIQ exceptions, basic interrupt stack design and implementation. Firmware: Firmware and bootloader, ARM firmware suite, Red Hat redboot, Example: sandstone, sandstone directory layout, sandstone code structure. Textbook 1: : Chapter 9.1 and 9.2, Chapter 10	08 RBT: L1, L2,L3
Module 5	
CACHES: The Memory Hierarchy and Cache Memory, Caches and Memory Management Units: CACHE Architecture: Basic Architecture of a Cache Memory, Basic Operation of a Cache Controller, The Relationship between Cache and Main Memory, Set Associativity, Write Buffers, Measuring Cache Efficiency, CACHE POLICY: Write Policy—Writeback or Writethrough, Cache Line Replacement Policies, Allocation Policy on a Cache Miss. Coprocessor 15 and caches. Textbook 1: Chapter 12.1 to 12.4	08 RBT: L1, L2,L3

Schedule of Instruction:

Class no	Topic	Date	RBT	CO	Mode
Module-1	Chapter Name: Microprocessors versus Microcontrollers, ARM Embedded Systems				
1	Introduction to subject, course handout discussion	23/2/20 26	L1	CO1	Interactive Lecture
2	Microprocessors verses Microcontroller, ARM Embedded systems: The RISC design philosophy,	24/2/20 26	L2	CO1	Presentation-Based Learning
3	The ARM Design Philosophy,	26/2/20 26	L2	CO1	Presentation-Based Learning
4	Embedded System Hardware,	27/2/20 26	L2	CO1	Presentation-Based Learning
5	Embedded System Software.	2/3/20 26	L2	CO1	Presentation-Based Learning



SRI KRISHNA INSTITUTE OF TECHNOLOGY

(Accredited by NAAC Approved by A.I.C.T.E. New Delhi, Recognized by Govt. of Karnataka & Affiliated to V.T U., Belagavi)

#57, Chimney Hills, Hesaraghatta Main Road, Chikkabanavara Post, Bengaluru- 560090

6	ARM Processor Fundamentals: Registers	3/3/20 26	L2	CO1	Presentation-Ba sed Learning
7	Pipeline	5/3/20 26	L2	CO1	Presentation-Ba sed Learning
8	Exceptions, Interrupts, and the Vector Table	6/3/20 26	L2	CO1	Presentation-Ba sed Learning
9	Core Extensions	9/3/20 26	L2	CO1	Presentation-Ba sed Learning
10	REVISION – FORMAL ASSESSMENT	10/3/2 026	Class test		
Module- 2	Chapter Name: Introduction to the ARM Instruction Set				
11	Data Processing Instructions	12/3/2 026	L2	CO2	Presentation-Ba sed Learning
12	Branch Instructions	13/3/2 026	L2	CO2	Presentation-Ba sed Learning
13	Branch Instructions	16/3/2 026	L2	CO2	Presentation-Ba sed Learning
14	Software Interrupt Instructions	17/3/2 026	L2	CO2	Presentation-Ba sed Learning
15	Software Interrupt Instructions	23/3/2 026	L2	CO2	Presentation-Ba sed Learning
16	Program Status Register Instructions	24/3/2 026	L2	CO2	Presentation-Ba sed Learning
17	Coprocessor Instructions	26/3/2 026	L2	CO2	Presentation-Ba sed Learning
18	Loading Constants.	27/3/2 026	L2	CO2	Presentation-Ba sed Learning
19	REVISION – FORMAL ASSESSMENT	30/3/2 026	Class test		



SRI KRISHNA INSTITUTE OF TECHNOLOGY

(Accredited by NAAC Approved by A.I.C.T.E. New Delhi, Recognized by Govt. of Karnataka & Affiliated to V.T U., Belagavi)

#57, Chimney Hills, Hesaraghatta Main Road, Chikkabanavara Post, Bengaluru- 560090

Module-3	Chapter Name: C Compilers and Optimization				
20	Basic C datatypes Structure Arrangement,	31/3/2026	L2	CO3	Presentation-Based Learning
21	Basic C datatypes Structure Arrangement,	2/4/2026	L2	CO3	Presentation-Based Learning
22	Looping Structures	6/4/2026	L3	CO3	Presentation-Based Learning
23	Looping Structures	7/4/2026	L3	CO3	Presentation-Based Learning
24	Register Allocation	9/4/2026	L3	CO3	Presentation-Based Learning
25	Pointer Aliasing	13/4/2026	L3	CO3	Presentation-Based Learning
26	Function calls	16/4/2026	L3	CO3	Presentation-Based Learning
27	Portability Issues.	17/4/2026	L3	CO3	Presentation-Based Learning
28	Recap- formal assessment	24/4/2026	Class test		
Module-4	Chapter Name: Exception and Interrupt Handling & Firmware				
30	Exception handling	27/4/2026	L2	CO4	Presentation-Based Learning
31	ARM processor exceptions and modes	28/4/2026	L2	CO4	Presentation-Based Learning
32	vector table	30/4/2026	L2	CO4	Presentation-Based Learning
33	exception priorities	4/5/2026	L2	CO4	Presentation-Based Learning



SRI KRISHNA INSTITUTE OF TECHNOLOGY

(Accredited by NAAC Approved by A.I.C.T.E. New Delhi, Recognized by Govt. of Karnataka & Affiliated to V.T U., Belagavi)

#57, Chimney Hills, Hesaraghatta Main Road, Chikkabanavara Post, Bengaluru- 560090

34	link register offsets, interrupts	5/5/20 26	L2	CO4	Presentation-Ba sed Learning
35	assigning interrupts, interrupt latency	7/5/20 26	L2	CO4	Presentation-Ba sed Learning
36	IRQ and FIQ exceptions	8/5/20 26	L2	CO4	Presentation-Ba sed Learning
37	basic interrupt stack design and implementation	11/5/2 026	L2	CO4	Presentation-Ba sed Learning
38	Recap- Formal Assessment	12/5/2 026	Class test		
Module- 5	Chapter Name: CACHES				
39	The Memory Hierarchy and Cache Memory	14/5/2 026	L2	CO5	Presentation-Ba sed Learning
40	Caches and Memory Management Units:	15/5/2 026	L2	CO5	Presentation-Ba sed Learning
41	CACHE Architecture: Basic Architecture of a Cache Memory	18/5/2 026	L2	CO5	Presentation-Ba sed Learning
42	Basic Operation of a Cache Controller, The Relationship between Cache and Main Memory	19/5/2 026	L2	CO5	Presentation-Ba sed Learning
43	Set Associativity, Write Buffer, Measuring Cache Efficiency	21/5/2 026	L2	CO5	Presentation-Ba sed Learning
44	CACHE POLICY: Write Policy—Writeback or Writethrough,	22/5/2 026	L2	CO5	Presentation-Ba sed Learning
45	Cache Line Replacement Policies	25/5/2 026	L2	CO5	Presentation-Ba sed Learning
46	Allocation Policy on a Cache Miss. Coprocessor 15 and caches.	26/5/2 026	L2	CO5	Presentation-Ba sed Learning
47	Recap- Formal Assessment	29/5/2 026	Class test		



SRI KRISHNA INSTITUTE OF TECHNOLOGY

(Accredited by NAAC Approved by A.I.C.T.E. New Delhi, Recognized by Govt. of Karnataka & Affiliated to V.T U., Belagavi)

#57, Chimney Hills, Hesaraghatta Main Road, Chikkabanavara Post, Bengaluru- 560090

Practical Component of IPCC

Lab	Topic	Date	RBT	CO	Mode
1.	Using Keil software, observe the various Registers, Dump, CPSR, with a simple Assembly Language Programs (ALP).	25/2/2026 &27/2/2026	L2	CO1	Simulation
2.	Develop and simulate ARM ALP for Data Transfer, Arithmetic and Logical operations (Demonstrate with the help of a suitable program).	4/3/2026 &6/3/2026	L3	CO2	Simulation
3.	Develop an ALP to multiply two 16-bit binary numbers.	11/3/2026 &13/3/2026	L3	CO2	Simulation
4.	Develop an ALP to find the sum of first 10 integer numbers.	18/3/2026 &27/3/2026	L3	CO2	Simulation
5.	Develop an ALP to find the largest/smallest number in an array of 32 numbers.	25/3/2026 &10/4/2026	L3	CO2	Simulation
6.	Develop an ALP to count the number of ones and zeros in two consecutive memory locations.	8/4/2026 &17/4/2026	L3	CO2	Simulation
7.	Simulate a program in C for ARM microcontroller using KEIL to sort the numbers in ascending/descending order using bubble sort.	15/4/2026 &24/4/2026	L3	CO3	Simulation
8.	Simulate a program in C for ARM microcontroller to find factorial of a number.	22/4/2026 &8/5/2026	L3	CO3	Simulation
9.	Simulate a program in C for ARM microcontroller to demonstrate case conversion of characters from upper to lowercase and lower to uppercase.	29/4/2026 &15/5/2026	L3	CO3	Simulation
10.	Demonstrate enabling and disabling of Interrupts in ARM.	6/5/2026 &22/5/2026	L3	CO4	Demonstration
11.	Demonstrate the handling of divide by zero, Invalid Operation and Overflow exceptions in ARM.	13/5/2026 &29/5/2026	L3	CO5	Demonstration

Textbooks:

T1	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008.
----	---

Reference books:



SRI KRISHNA INSTITUTE OF TECHNOLOGY

(Accredited by NAAC Approved by A.I.C.T.E. New Delhi, Recognized by Govt. of Karnataka & Affiliated to V.T U., Belagavi)

#57, Chimney Hills, Hesaraghatta Main Road, Chikkabanavara Post, Bengaluru- 560090

R1	Raghunandan.G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication, 2019.
R2	Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd., 1st edition, 2005

Web links and Video Lectures (e-Resources):

1.	https://sites.google.com/view/manjujshree-coursewebsite/course-material/microcontroller
----	---

Assessment Schedule:

S.N.	Assessment Type	Content	CO	Duration	Marks	Date
1.	CIE 1 (Theory)	Module 1,2,3,5	1,2,3		15	21/4/2026
2.	CIE 2 (Theory)	Module 3,5,4,5	3,4,5			4/5/2026
3.	CIE (Lab) - Record	Module 1,2,3,4,5	1,2,3,4,5		15	
4.	CIE (Lab) - Test	Module 1,2,3,4,5	1,2,3,4,5		10	May 2026
5.	Class test	Mini Project	1,2,3,4,5		10	
6.	Semester End Examination	Module 1,2,3,4,5	1,2,3,4,5	3Hrs	50	June 2026

RB – Text Book/Reference Book, ***L** – Lecture, **V**- Videos or any other mode, ***RBT** – Revised Blooms' Taxonomy, **L: T: P: C** – Theory/Lecture: Tutorial: Practical/Drawing: Credits, **SEE**: Semester End Examination, **CIE**: Continuous Internal Evaluation, **Seminar**: Group of 6-8 students, **Module** 1,2,3,4 & 5,

The weightage of Continuous Internal Evaluation (**CIE**) is 50% and for Semester End Exam (**SEE**) is 50%. The **minimum passing mark for the CIE is 40%** of the maximum marks (20 marks out of 50) and for the **SEE minimum passing mark is 35%** of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a **minimum of 40% (40 marks out of 100)** in the **sum total** of the **CIE** (Continuous Internal Evaluation) and **SEE** (Semester End Examination) taken together.

Faculty In charge

Course Coordinator

HoD



SRI KRISHNA INSTITUTE OF TECHNOLOGY

(Accredited by NAAC Approved by A.I.C.T.E. New Delhi, Recognized by Govt. of Karnataka & Affiliated to V.T U., Belagavi)

#57, Chimney Hills, Hesaraghatta Main Road, Chikkabanavara Post, Bengaluru- 560090

MINI PROJECT TITLES FOR MICROCONTROLLERS

✓ Course Outcomes (COs)

CO1: Apply microcontroller concepts to design and implement an embedded system solution for a real-world problem.

CO2: Analyze system requirements and integrate hardware and software components to achieve desired functionality.

CO3: Test, evaluate, and document the developed system using appropriate tools and engineering practices.

Sl. No	Evaluation Criteria	Marks
1	Problem Identification & Objectives	2
2	Design & Methodology (Block diagram, flowchart, approach)	2
3	Implementation & Working Model / Code	3
4	Results, Testing & Demonstration	2
5	Report Quality, Presentation & Viva	1
Total		10 Marks

CO	Course Outcome	Evaluation Criteria	Marks
CO1	Apply microcontroller concepts to design a solution	Problem definition, objectives, system design	4
CO2	Analyze requirements and integrate hardware & software	Implementation, coding, hardware interfacing	4
CO3	Test, evaluate and document the system	Results, report, presentation & viva	2
Total			10 Marks

SAMPLE LIST OF MINI PROJECT TITLES FOR REFERENCE

1. Smart Street Light System using Arduino
2. Digital Temperature & Humidity Monitoring System
3. Automatic Water Level Controller using Microcontroller
4. RFID-Based Attendance System



5. Home Automation using Bluetooth and Arduino
6. Obstacle Detection Robot using Ultrasonic Sensor
7. Smart Dustbin using IR Sensors
8. Smart Fan Speed Controller based on Temperature
9. Gas Leakage Detection and Alert System
10. Automatic Plant Watering System
11. IoT-Based Smart Energy Meter using ESP32
12. Smart Parking System using Microcontroller and IR Sensors
13. Fingerprint-Based Door Lock System
14. Vehicle Accident Detection and SMS Alert System
15. Smart Irrigation System using Soil Moisture Sensor
16. Industrial Temperature Monitoring and Control System
17. Smart Traffic Light System with Density Control
18. Voice-Controlled Home Automation using Microcontroller
19. Smart Blind Stick for Visually Impaired
20. Smart Classroom Automation System
21. IoT-Based Health Monitoring System using Microcontroller
22. Smart Waste Management System using Sensors and IoT
23. Smart Security System with Face Recognition & Microcontroller
24. Automatic Toll Collection System using RFID
25. Smart Power Grid Monitoring System
26. IoT-Based Air Quality Monitoring System
27. Smart Agriculture Monitoring using Wireless Sensor Networks
28. Smart Vehicle Tracking System using GPS-GSM
29. Industrial Fault Detection using Embedded Systems
30. Smart Fire Detection and Suppression System