# SCHEME OF COURSE WORK

## Course Details:

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| **Course Title:** | **Embedded Systems-II** | | |
| **Course Code:** | **15CT1136** | **L T P C** | **: 3 0 0 3** |
| **Program:** | **B.Tech.** | | |
| **Specialization:** | **Information Technology** | | |
| **Semester:** | **VII** | | |
| **Prerequisites:** | **Electronics Devices and Circuits, Computer Organization** | | |
| **Courses to which it is a prerequisite:** | **N/A** | | |

**Course Outcomes (COs):**

| | At the end of the course the student will be able to |
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| 1 | Understand the ARM processor architecture |
| 2 | Understand ARM Instruction set |
| 3 | Develop optimized programs for ARM processor |
| 4 | Use interrupt handling techniques in ARM Applications |
| 5 | Describe ARM memory management |

**Program Outcomes (POs):**

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| 1 | Graduates will be able to apply the knowledge of mathematics, science, engineering fundamentals and principles of Computer Science & Engineering to solve complex problems in different domains. |
| 2 | Graduates can identify, formulate, study contemporary domain literature and analyze real life problems and make effective conclusions using the basic principles of science and engineering. |
| 3 | Graduates will be in a position to design solutions for Engineering problems requiring in depth knowledge of Computer Science and design system components and processes as per standards with emphasis on privacy, security, public health and safety. |
| 4 | Graduates will be able to conduct experiments, perform analysis and interpret data as per the prevailing research methods and to provide valid conclusions. |
| 5 | Graduates will be able to select and apply appropriate techniques and use modern software design and development tools. They will be able to predict and model complex engineering activities with the awareness of the practical limitations. |

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| 6 | Graduates will be able to carry out their professional practice in Computer Science & Engineering by appropriately considering and weighing the issues related to society and culture and the consequent responsibilities. |
| 7 | Graduates would understand the impact of the professional engineering solutions on environmental safety and legal issues. |
| 8 | Graduates will transform into responsible citizens by adhering to professional ethics. |
| 9 | Graduates will be able to function effectively in a large team of multidisciplinary streams consisting of persons of diverse cultures without forgetting the significance of each individual's contribution. |
| 10 | Graduates will be able to communicate effectively about complex engineering activities with the engineering community as well as the general society, and will be able to prepare reports. |
| 11 | Graduates will be able to demonstrate knowledge and understanding of the engineering and management principles and apply the same while managing projects in multidisciplinary environments. |
| 12 | Graduates will engage themselves in self and life-long learning in the context of rapid technological changes happening in Computer Science and other domains. |

**Course Outcome** versus **Program Outcomes:**

| PO / CO | PO1 | PO2 | PO3* | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| **CO-1** | 3 | | | | | | | | | | | |
| **CO-2** | 3 | | | | 2 | | | | | | | |
| **CO-3** | 3 | | | | 2 | | | | | | | |
| **CO-4** | 3 | | | | | | | | | | | 2 |
| **CO-5** | 3 | | | | | | | | | | | 2 |

S - **Strongly correlated**, M - **Moderately correlated**, Blank - **No correlation**

| **Assessment Methods:** | Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam |
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## Teaching-Learning and Evaluation

| **Week** | **TOPIC / CONTENTS** | **Course Outcomes** | **TEACHING-LEARNING STRATEGY** | **Assessment Method & Schedule** |
|---|---|---|---|---|
| 1 | **ARM EMBEDDED SYSTEMS:** The RISC Design Philosophy, The ARM Design Philosophy, | CO-1 | ▫ Lecture | Assignment-1, Quiz-1, Mid-1 |
| 2 | Embedded System Hardware, Embedded System Software. | CO-1 | ▫ Lecture | Assignment-1, Quiz-1, Mid-1 |
| 3 | ARM PROCESSOR FUNDAMENTALS Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table | CO-1 | ▫ Lecture | Assignment-1, Quiz-1, Mid-1 |
| 4 | THE ARM INSTRUCTION SET Introduction, Exceptions, Conditional execution, Branch and Branch with Link (B, BL), Branch, Branch with Link and eXchange (BX, BLX), Software Interrupt (SWI). | CO-2 | ▫ Lecture | Assignment-1, Quiz-1, Mid-1 |
| 5 | Data processing instructions, Multiply instructions, Count leading zeros (CLZ - architecture v5T only), Single word and unsigned byte data transfer instructions, Half-word and signed byte data transfer instructions, | CO-2 | ▫ Lecture | Assignment-1, Quiz-1, Mid-1 |
| 6 | Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to | CO-2 | ▫ Lecture | Assignment-1, Quiz-1, Mid-1 |

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| | status register transfer instructions | | | |
| 7 | WRITING AND OPTIMIZING ASSEMBLY CODE<br>Profiling and Cycle Counting: Instruction Scheduling, Scheduling of<br>Load Instructions. | CO-3 | ▫ Lecture | Assignment-1,<br>Quiz-1,<br>Mid-1 |
| 8 | Register Allocation: Allocating Variables to Register Numbers, Using More than 14 Local Variables: Making the Most of Available Registers, Conditional Execution | CO-3 | ▫ Lecture | Assignment-1,<br>Quiz-1,<br>Mid-1 |
| 9 | **Mid-Test 1** | | | |
| 10 | Looping Constructs:<br>Decremented Counted Loops, Unrolled Counted Loops, Multiple<br>Nested Loops, Other Counted Loops, Bit Manipulation: Fixed-Width<br>Bit-Field Packing and Unpacking, Variable-Width Bitstream Packing,<br>Variable-Width Bitstream Unpacking | CO-3 | ▫ Lecture | Assignment-2,<br>Quiz-2,<br>Mid-2 |
| 11 | EXCEPTION AND INTERRUPT HANDLING<br>Exception Handling, Interrupts, Interrupt Handling Schemes: nonnested interrupt handler | CO-4 | ▫ Lecture | Assignment-2,<br>Quiz-2,<br>Mid-2 |
| 12 | EMBEDDED OPERATING SYSTEMS:<br>Fundamental components, Simple little operating system | CO-4 | ▫ Lecture | Assignment-2,<br>Quiz-2,<br>Mid-2 |
| 13 | Firmware: Firmware and Bootloader | CO-4 | ▫ Lecture | Assignment-2,<br>Quiz-2,<br>Mid-2 |
| 14 | MEMORY MANAGEMENT UNITS<br>Moving from an MPU to an MMU, How Virtual Memory Works,<br>Details of the ARM MMU, | CO-5 | ▫ Lecture | Assignment-2,<br>Quiz-2,<br>Mid-2 |

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| 15 | Page Tables, The Translation Lookaside Buffer, Domains and Memory Access Permission, The Caches and Write Buffer. | CO-5 | ▫ Lecture | Assignment-2, Quiz-2, Mid-2 |
| 16 | **Mid-Test 2** | | | |