**3EE06: MICROPROCESSORS AND MICROCONTROLLERS**  
CREDITS - 3 (LTP: 3,0,0)

**Course Objective:**  
To provide solid foundation on the fundamentals of microprocessors and applications, interfacing the external devices to the processor according to the user requirements thus, enabling to create novel products and solutions for real time problems.

**Teaching and Assessment Scheme:**

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<tr>
<th>Teaching Scheme (Hours per Week)</th>
<th>Credits</th>
<th>Assessment Scheme</th>
<th>Total Marks</th>
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**Course Contents:**

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<th>Unit No.</th>
<th>Topics</th>
<th>Teaching Hours</th>
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<tr>
<td>1</td>
<td><strong>Fundamentals of Microprocessors:</strong> Fundamentals of Microprocessor Architecture. 8-bit Microprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.</td>
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<td>2</td>
<td><strong>Microcontroller Basics:</strong> Difference between microprocessor and microcontroller, CISC vs RISC design philosophy, Von Neumann vs Harvard architecture, Introduction to MCS -51 Family microcontrollers, address bus, data bus, control signals, clock and reset circuits, working registers, special function registers, stack and use of stack pointer, program counter, I/O Ports, power saving modes and its operation, timing diagram for execution cycle.</td>
<td>04</td>
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<td>3</td>
<td><strong>8051 Microcontroller Architecture:</strong> 80C51 Central Processing Unit Diagram, Architectural block diagram, Pin diagram and Pin Functions, memory organization, Internal program and data memory.</td>
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<td>4</td>
<td><strong>On Chip Peripherals:</strong> Timer/Counters and associated registers, Various modes of timer/counter operations, Concept of Interrupt, Interrupt versus polling, Types of Interrupts in 8051, Interrupt control and associated registers, Interrupt vectors, Interrupt execution, Basics of serial communication, Serial data input/output and associated registers, Various modes of serial data communication.</td>
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<td>5</td>
<td><strong>Integrated Development Environment (IDE) for Microcontrollers:</strong> Editor, linker, loader, debugger, simulator, emulator. Instruction set, instruction formats, concept of assembler directives and various addressing modes. Basic programming using assembly instructions. Introduction to embedded-C, Integrated Development Environment (IDE), cross compiler, ISP (In-System Programming) and IAP (In-Application Programming)</td>
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<td>6</td>
<td><strong>External Peripheral Interfaces:</strong> ADC, DAC, LCD, LED &amp; keyboard interfacing, External Memory Interfacing, Stepper motor interfacing, DC Motor interfacing, sensor interfacing. Introduction to CAN Protocol and its</td>
<td>05</td>
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interfacing, USB protocol and its interfacing, Blue-tooth, Zig-bee protocol and its interfacing.

### 7 Introduction to Advanced Microcontrollers
Advanced concepts of 8-bit controllers, study of watchdog timer, study of PCA timer in different modes like capture mode, PWM generation mode, High speed output, toggle mode, migrating from 8-bit to 16-bit and 32-bit ARM Processors.  

### 8 Application of Microcontrollers
Application of Microcontroller in day to day life devices, Industrial control devices, Metering & Measurement devices, Energy management and automobiles.  

### Total 42

**List of References:**


**Web Resources:**

1. Nptel Web course on Microprocessor by Dr. Pramod Agarwal, IITRoorkee.  
   [https://nptel.ac.in/courses/108/107/108107029/](https://nptel.ac.in/courses/108/107/108107029/)
2. Nptel Web course on Microcontrollers and Applications by Dr. S. P. Das, IITKanpur.  
   [https://nptel.ac.in/courses/117/104/117104072/](https://nptel.ac.in/courses/117/104/117104072/)

**Course Outcomes (COs):**

At the end of this course students will be able to:

1. Understand the fundamentals of Microprocessors.
2. Understand the internal design of 8051 microcontroller along with the features and their programming.
3. Competent with the on chip peripherals of microcontrollers.
4. Design different interfacing applications using microcontrollers and peripherals.
5. Demonstrate the limitations and strengths of different types of microcontrollers and their comparison.
6. Build systems using microcontrollers for real-time applications.