NIRMA UNIVERSITY
Institute of Technology
B. Tech. in Electrical Engineering
Semester – VI

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Course Code	**2EEDE58**
Course Title	**Advanced Microcontrollers**

Course Outcomes (COs):

At the end of the course, students will be able to-

1. apply the knowledge of architecture for selection of microcontroller for specific task
2. develop an embedded firmware for specific microcontroller
3. make use of communication protocols for information interchange
4. design an embedded controller-based system using internal and external peripherals

Syllabus: **Teaching Hours: 30**

Unit-1: Introduction to 16-bit microcontroller **07**

Device overview**,** Function block diagram, Pin diagram, CPU, System Resets, Interrupts, and Operating Modes, Digital I/O, Timers, Real time clock counter.

Unit-2: Introduction To 32-Bit Digital Signal Controller **06**

Hardware architecture, advance high performance bus, advance peripheral bus and concept of bus matrix, memory mapping and registers, interrupt controller, reset and clock circuit and power modes. embedded 'C' programming for 32-bit controllers, introduction to integrated development tool, registers and variables, declarations and mapping, software base code generation

Unit-3: General purpose Input Output and Timers programming **05**

Introduction to GPIO, GPIO programming in various modes, basic timers and advance, timer interrupt programming, input capture and PWM mode of controllers and quadrature encoder interfacing, software base code generation

Unit-4: ADC, DAC interfacing **07**

Concept of ADC and DAC, programming of Single continuous and scan mode operation of ADC, ADC start and end of conversion interrupts, Signal verification using DAC, Waveform generation using DAC. Direct Memory Access(DMA) based ADC data handling, software base code generation

Unit-5 : Communication Protocols **05**

Universal synchronous asynchronous receiver transmitter (USART), Serial Peripheral Interface (SPI), Inter IC Protocols (I2C), Controller area network (CAN).

Self-Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
This shall consist of at least 10 laboratory experiments / simulations based on the syllabus.

Suggested Readings:

1. MSP430FR4xx and MSP430FR2xx Family User's Guide and Datasheet, Texas instruments
2. J. H. Davies, MSP430 Microcontroller Basics, Elsevier
3. Cem Unsalan and H. Deniz Gurhan, Programmable Microcontrollers with Applications: MSP430 LaunchPad with CCS and Grace, McGraw Hill Education.
4. Mazidi, Muhammad Ali; Chen, Shujen; Ghaemi, Eshragh, STM32 Arm Programming for Embedded Systems, MicroDigital Ed.
5. Warren Gay, Beginning STM32: Developing with Free RTOS, libopencm3 and GCC, Apress
6. Alexander G. Dean, Embedded Systems Fundamentals with Arm Cortex M Based Microcontrollers: A Practical Approach, ARM Education Media
7. Cortex-M4 Technical Reference Manual, ARM.
8. STM32F407xx Datasheet, Reference manual and errata sheet, ST microelectronics
9. The Insider's Guide STM32, HITEX Inc.
10. STM32 Cortex®-M4 MCUs and MPUs Programming Manual, ST microelectronics
11. Recent literatures, articles, blogs, data sheets

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2020-21 and onwards