Course No.   : **15-EM5205**
Course Title   : **RISC Processor Architecture and Programming**
Course Structure   : **3-0-2**
SYLLABUS:
UNIT – I

MSP430 – 16-bit Microcontroller family: CPU architecture, Instruction set, Interrupt mechanism, Clock system, Memory subsystem, bus –architecture, the assembly language and 'C' programming for MSP-430 microcontrollers.

Low Power embedded systems: On-chip peripherals, Examples of applications.

UNIT – II

On-chip peripherals: digital input, output, Liquid crystal display, Watchdog timer, Op-Amp, Timer, Basic Timer, Real Time Clock (RTC),

Mixed signal systems: Comparator, Analog-to-digital conversion- general issues, Successive approximation, Sigma delta, signal conditioning using operational amplifiers and Digital-to-analog conversion.

UNIT - III

Low power features of MSP430: Clock system, low-power modes, Clock request feature, Low-power programming and interrupts.

Communication peripherals: Serial peripheral interface, Inter-integrated circuit bus, Asynchronous serial communication

Applications of MSP430: Thermometer using I2C–Low Power RF circuits; Pulse Width Modulation (PWM) in Power Supplies.

UNIT – IV

32 bit microcontroller: ARM Cortex M0 technical overview, Architecture, ARM Cortex M0 operation modes, Registers & Special Registers, Stack Pointer, Link Register, Program Counter, combined Program Status Register

Instruction set: moving data, memory access, arithmetic & logic operations, shift & rotate, Instruction usage examples.

Memory System: memory map, program memory, boot loading, data memory, Little endian and Big endian support, memory attributes

UNIT – V

Exceptions and interrupts: Exception types, exception priority definition, vector table, Interrupt control & system control, overview of NVIC and Control block features, Interrupt Enable and Clear Enable, Interrupt pending status. 11

Introduction to ARM Cortex M3 & M4: Technical overview, Comparison of features of Cortex M0, M3 & M4.

Text Books:

1. John H. Davies, "MSP430 Microcontroller Basics", Newnes (Elsevier Science), 2nd Edition, 2008.
2. Joseph Yiu "The Definitive Guide to the ARM Cortex-M0", Newnes, (Elsevier), 2011.
3. MSP430 Teaching CD-ROM, Texas Instruments, 2008.
4. Sample Programs for MSP430 downloadable from msp430.com
5. David Patterson and John L. Hennessey, "Computer Organization and Design", (ARM Edition), 3rd Revised Edition, Morgan Kauffman Publishers, 2007.

Project Based Lab: The students will do five basic experiments to gain the knowledge and hands on experience with IDE's and Simulators of 32 bit RISC processor (ARM) and then Develop an application using this knowledge.