**20EC32E1-EMBEDDED SYSTEMS & IOT**

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| **Course category:** | Program Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3 - 0 – 0 |
| **Prerequisite:** | Microcontrollers and Microprocessors, C-Programming. | **Sessional Evaluation :****External Evaluation:****Total Marks:** | 4060100 |

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| **Course****Objectives** | Students undergoing this course are expected to understand: |
| 1. The basic idea regarding the nature of embedded systems.
2. The advantages of using Aurdino and MSP430 microcontrollers in Embedded and IoT applications.
3. The Basics of MSP430 controller.
4. The skill in simple program writing for MSP430 and applications.
5. The basics of IoT concepts.
6. The different Wireless services to access/control IoT devices.
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| **Course Outcomes** | Upon successful completion of the course , the students will be able to: |
| CO1 | Understand the selection procedure of Processors in the Embedded domain. |
| CO2 | Develop Embedded Systems on Arduino and MSP430. |
| CO3 | Know the internal architecture and organization of MSP430. |
| CO4 | Understand the interfacing techniques to MSP 430 and can design and implement programs on MSP430 controller. |
| CO5 | Know the application areas of IoT. |
| CO6 | Develop Wireless Technologies to access/control IoT devices. |
| **Course****Content****Course****Content** | **UNIT-I****INTRODUCTION TO EMBEDDED SYSTEMS**: Introduction, Hardware and Software requirements, Processor selection, categories of embedded system, applications of embedded systems. Development Process: Development process of embedded systems, linkers and locators**UNIT – II****INTRODUCTION TO AURDINO AND MSP430:** **ARDUINO**: AVR Family with Arduino ATMega 328- Interfaces - Arduino IDE – Programming – Interfacing LED- Interfacing LED and Switch with Arduino.**MSP430:** Introduction,Features of MSP430, Architecture of MSP430, Exceptions, Addressing Modes of MSP430, Instruction Set, Interrupts, Timers.**UNIT – III****MSP430 I/O REGISTERS AND MODES:** I/O ports pull up/down registers concepts, Interrupts and interrupt programming. Watchdog timer. System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power & reliability.**UNIT – IV****MSP430 INTERFACING:** Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA.**UNIT – V****INTRODUCTION TO IOT:** Definition & Characteristics of IoT, Physical design, Logical design, IoT Enabling Technologies, IoT Levels and Deployment Templates, IoT vs M2M.**UNIT-VI****WIRELESS TECHNOLOGIES FOR IOT (LAYER 1 & 2):**WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBeeSmart , UWB (IEEE 802.15.4). |
| **Text Books and Reference Books** | **TEXT BOOKS :**1. “Introduction to Embedded Systems”, by Shibu K.V, Mc Graw Hil, 2nd edition, 2017.
2. “Intel® Galileo and Intel® Galileo Gen 2:API Features and Arduino Projects for Linux Programmers”, by Manoel Carlos Ramon, Apress, 2014.
3. “MSP430 microcontroller basics”, by. John H. Davies, Newnes Publication, I st Edition, 2008.
4. ”Internet of Things A Hands-On- Approach”, byVijay Madisetti, Arshdeep Bahga,Orient Blackswan Private Limited, First edition ,2015, ISBN:978-1-118-43062-0

**REFERENCE BOOKS :**1. “Designing the Internet of Things”, by Adrian McEwen, Hakim Cassimally, Wiley Publishers, 2nd edition, 2015.
2. “Internet of Things with the Arduino Yun”, by Marco Schwartz, , Packt Publishing, 2014.
3. “The Silent Intelligence: The Internet of Things”. by Daniel Kellmereit, Lightning Source Inc; 1st edition, 2014.
4. 'Learning Internet of Things', by Peter Waher, Packt Publishing, 2015.
5. Internet of Things – From Research and Innovation to Market deployment”,

by OvidiuVermesan,Peter Friess,River Publishers; 1st edition,2014. |
| **E-Resources** | 1. http://processors.wiki.ti.com/index.php/MSP430\_LaunchPad\_Low\_Power\_Mode
2. http://processors.wiki.ti.com/index.php/MSP430\_16-Bit\_UltraLow\_Power\_MCU\_Training
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| **Contribution of Course Outcomes towards achievement of Program Outcomes** |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 2 | 1 | - | - | 2 | - | - | - | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 1 | - | - | 2 | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 1 |  - |  - | 2 |  - |  - |  - |  2 | 2 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 1 | - | - | 2 | - | 2 | - | 2 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 1 | - | - | 2 | - | - | - | 2 | 3 | 2 |
| CO6 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | - | 2 | 2 | 2 | 3 | 2 |