Course code	Course Title	L	T	P	C
BITE403L	Embedded Systems and IoT	3	0	0	3
Pre-requisite	BITE301L	Syllabus version			
		1.0			

Course Objectives:

1. Understand the design level of modern embedded systems with a hardware platform.
2. Explore the IoT devices for physical world and cyber space integration.
3. Comprehend the programming skills and IT tools necessary for embedded product development

Course Outcomes:

1. Interpret embedded systems components for a real time product applying all the relevant Standards with realistic constraints across all domains.
2. Build a hardware platform encompassing microcontrollers, sensors and peripherals.
3. Make use of modern real-time operating systems in embedded systems for engineering practices.
4. Analyze complex real-world problems through challenges posed by IoT leading to new low-cost architectural models.

Module:1	Processor Trends in Embedded Systems	6 hours

Embedded Systems Vs. General Computing Systems – Architecture of Embedded Systems- Classification of Embedded Systems - Characteristics and Quality attributes of Embedded Systems. Embedded Firmware - System on Chip (SoC) -CISC and RISC Architectures- FPGA Architecture.

Module:2	RTOS Based Embedded System Design and Development	6 hours

Types of Real-time Operating Systems - Context switching mechanisms - CPU Scheduling policies; Rate-monotonic and Earliest Deadline First scheduling - Priority inversion - Embedded Firmware Development Languages – Assemblers - Compilers – Simulators – Emulators.

Module:3	Embedded Design Programming	8 hours

8051 Microcontroller and Assembly language programming - Embedded C Programming - Arithmetic, Logic Instructions and Programs - I/O port programming – Timers - Interrupts and Serial Port Programming.

Module:4	Introduction to Internet of Things	5 hours

Basic Building blocks of an IoT Device - Physical and Logical Design of IoT – Communication Protocols - IoT Deployment Levels - IoT Physical Servers and Cloud offerings - IoT and M2M.

Module:5	IoT Hardware Platforms	5 hours

Overview of PIC - AVR and ARM family of processors - Raspberry pi – Arduino – NodeMCU - Intel Galileo boards – Beagle Bone Black.

Module:6	Python in IoT Development	7 hours

Python Packages for IoT - Programming Raspberry Pi with Python - Python Web application Framework - Rapid Prototyping IoT Applications.

Module:7	Sensors and Actuators	6 hours

Data Acquisition Sensors: Temperature, Pressure, Humidity, Water Quality, Soil Moisture, Gas and Smoke, Proximity - Infrared Sensors (IR), Ultrasonic, GPS, Accelerometers – Actuators-Servo motors – Relay switches.

Module:8	**Contemporary Issues**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Books	
1.	Shibu K V, "Introduction to Embedded Systems", 2017, 2nd Edition, Mc Graw Hill, New Delhi, India.
2.	Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", 2016, 1st Edition-Reprint, Universities Press, Hyderabad, India.

Reference Books	
1.	Rajkumar Buyya and Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", 2016, 1st Edition, Morgan Kaufmann, Elsevier, USA.
2.	Gary Smart, "Practical Python Programming for IoT: Build Advanced IoT Projects using a Raspberry Pi 4, MQTT, RESTful APIs", 2020, 1st Edition, Packt Publishing Ltd., UK.

Mode of Evaluation: Continuous Assessment Tests, Assignment, Quiz, Final Assessment Test			
Recommended by Board of Studies	20-05-2022		
Approved by Academic Council	No. 66	Date	16-06-2022