

BCSE312L	Programming for IoT Boards	L	T	P	C
		2	0	0	2
Pre-requisite	NIL	Syllabus version			
		1.0			
Course Objectives					
1. To introduce Internet of Things (IoT) environment and its technologies for designing smart systems 2. To explore open-source computer hardware/software platform, development and debugging environment, programming constructs and necessary libraries 3. To learn embedded programming constructs and real time systems					
Course Outcome					
At the end of this course, student will be able to: 1. Investigate various challenges and explore open source hardware prototyping platforms for designing IoT devices 2. Understand basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world 3. Program SBC by exploring protocols, data conversion process, API and expansion boards for practical IoT devices using Python 4. Learn embedded programming constructs and constraints in real time systems for real world socio-economic problems					
Module:1	IoT Ecosystem	3 hours			
Challenges and Levels of implementation - Enabling Technologies - Overview of Processing Elements and Peripherals					
Module:2	Programming for Prototyping Boards	4 hours			
Environment: Board, IDE, shields – Programming: syntax, variables, types, operators, constructs and functions – Sketch: skeleton, compile and upload, accessing pins – debugging: UART communication protocol and serial library					
Module:3	Interfacing for Prototyping Boards	5 hours			
Circuits: design, wiring, passive components - sensors and actuators: interfacing, read and write - software libraries – shields - interfacing and libraries					
Module:4	Programming for Single Board Computers	4 hours			
Board schematic – setup - configure and use - OS implications: linux - basics, file system and processes - shell CLI – GUI - Programming API's - RPi.GPIO - PWM library to access pins -Tkinter.					
Module:5	Interfacing with Single Board Computers	5 hours			
Networking - Internet Connectivity - Standard Internet Protocols – MQTT – CoAP - Networking Socket Interface - Cloud - Public APIs and SDK's for accessing cloud services - Social Network APIs - Interfacing - sensors and actuators - Pi Camera - Servo - APIs for data conversion.					
Module:6	Embedded Programming and RTOS	4 hours			
MCU – GPIO – WDT - timers/counters - I/O - A/D - D/A – PWM – Interrupts – Memory - serial communication UART - I2C – SPI - Peripheral Interfacing OS – basics – types – tasks – process - threads (POSIX Threads) - thread preemption - Preemptive Task Scheduling Policies - Priority Inversion - Task communication - Task Synchronization issues - racing and deadlock - binary and counting semaphores (Mutex example) - choosing RTOS					
Module:7	Real World Projects	3 hours			
IoT Integrated Primary Health Care - Face Detection by AI - Cloud IoT Systems for Smart Agriculture - Smart Home Gadgets - Autonomous Car Features – speed and horn intensity control					
Module:8	Contemporary Issues	2 hours			
Total Lecture hours:					30 hours

Text Book(s)			
1.	Yamanoor, Sai, and Srihari Yamanoor. Python Programming with Raspberry Pi, 2017, 1st edition, Packt Publishing Ltd., UK		
Reference Books			
1.	Donald Norris, The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi, and BeagleBone Black, 2015, 1st edition, McGraw Hill Education, India		
2.	Marco Schwartz, Home Automation with Arduino, 3rd edition, Open Home Automation 2014. Schwartz, Marco. Internet of things with arduino cookbook, 2016, 1st edition, Packt Publishing Ltd., UK		
3.	Kooijman, Matthijs. Building Wireless Sensor Networks Using Arduino, 2015, 1st edition, Packt Publishing Ltd., UK		
Mode of Evaluation: CAT / Written Assignment / Quiz / FAT			
Recommended by Board of Studies		04-03-2022	
Approved by Academic Council		No. 65	Date 17-03-2022