Program	Bachelor of Technology (BTech)	**Semester - 6**
Type of Course	-	
Prerequisite	Electrical Measurements & Measuring Instruments, and Microcontroller and Interfacing.	
Course Objective	This subject focuses on the study of different components of different practical controllers and making circuits by using them in practical applications by using different communication tools such as internet, Ethernet port or others and connections of Sensors.	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Practical	Credit	SEE (T)	CIA (T)	SEE (P)	CIA (P)	Total Marks
3	0	2	4	70	30	25	25	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Internet of Things** Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels, Domain-Specific IoTs – Home, City, Environment, Energy, Agriculture, and Industry.	5	20
2	**IoT Physical Devices and Endpoints** IoT & M2M: Machine to Machine, Difference between IoT and M2M, Software define Network, IoT Data Acquisition & Platforms. Introduction to Arduino and Raspberry Pi- Installation, Programming – Arduino and Raspberry Pi with focus on interfacing external gadgets, controlling output and reading input from pins.	6	20
3	**Sensors, Microcontrollers and interfacing** IoT Data Communication and Interfaces – Serial communication, SPI, I2C, MQTT, Sensor : Light sensor, Temperature sensor, Voltage sensor, ADC and DAC, Temperature and Humidity Sensor-DHT11, Motion Detection Sensor, Level Sensor, Ultrasonic Transducer, Heartbeat Sensor, Colour Sensor.	6	20
4	**Controlling Hardware** Connecting LED, Buzzer, Controlling AC Power devices with Relay, Controlling - Servo Motor, DC Motor, Unipolar and Bipolar Stepper Motors, Bluetooth Module, Zigbee Module.	6	20
5	**Domain specific applications of IoT** Home automation; Industry applications; Surveillance applications; Other IoT applications. Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor-based application through processing tool.	7	20
	Total	**30**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	20	40	40	0	0	0

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	**understand** basic concepts and structure of IoT.
CO2	**apply** IoT for developing real life applications using Arduino and Raspberry Pi programming.
CO3	**analyze** sensors and its interfacing with development boards.
CO4	**illustrate** functioning of hardware devices used with IoT.
CO5	**discuss** specific industry based application used by IoT.

Reference Books

1.	**Internet of Things - A Hands-on Approach** By Arshdeep Bahga and Vijay Madisetti | Oxferd Universities Press
2.	**Internet of Things : Architecture and Design Principles** By Raj Kamal | McGraw Hill Publication
3.	**Raspberry Pi Cookbook, Software and Hardware Problems and solutions** By Simon Monk | O'Reilly Publications
4.	**Enabling things to talk Designing IoT solutions with the IoT Architecture Reference Model** By Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, | Springer Open
5.	**Getting Started with Raspberry Pi** By Matt Richardson & Shawn Wallace | O'Reilly Publications

List of Practical

1.	**To study the functionality of the Arduino Uno board and Arduino IDE** 1. Installlation of the Arduino IDE. 2. Power up Arduino Uno Board 3. Uploading a program to the Arduino UNO
2.	**To study the functionality of Node MCU with installation of Arduino packages** 1. To study the Pin-diagram of the NodeMCU 2. Arduino IDE package Installation for the ESP8266 support 3. Uploading a program to Node MCU
3.	**To demonstrate digital input of Arduino board with push button** 1. To read status of Push button using NodeMCU 2. Toggle the state of LED with Push Button 3. To read multiple digital input simultaneously
4.	**To demonstrate digital output of Arduino board with LED control** 1. To control built-in LED 2. To blink LED with 1 sec. delay 3. To perform Traffic Light signal with Red , Yellow and Green LEDs.
5.	**To demonstrate Analog Input of Arduino board with potentiometer** 1. To read the value of Potentiometer 2. To map the value of Analog input into required range 3. To perform interfacing of Moisure module with Arduino for Soil moisture measurement 4. To perform interfacing of MQ-XX module with Arduino for gas detection
6.	**To demonstrate Analog Output of Arduino board with LED fading**

	1. To study the Pulse Width Modulation and PWM pins. 2. To perform Analog Output with LED fading 3. To control the brightness of LED using potentiometer
7.	**To study and perform Serial communication with Arduino board** 1. To demonstrate serial communication methods for Arduino 2. To demonstrate sending and receiving of data via serial communicaton pins
8.	**To study and perform Serial Peripheral Interface with Arduino board** 1. To perform SPI communication between Two Arduino boards 2. To perform one Master and multiple Slave communication between Arduino boards
9.	**Hands on practice for the interfacing of sensor and actuators with Arduino board** 1. To perform interfacing of Ultrasonic sound sensor module with Arduino board for distance measurement 2. To perform interfacing of LDR module with Arduino board for light intensity measurement 3. To perform interfacinng of DC motor with Arduino board 4. To perform interfacing of Servo motor with Arduino board
10.	**To demonstrate Smart Home application with IoT Cloud** 1. To demonstrate the account creation on IoT cloud 2. To demonstrate the integration of various IoT node with IoT cloud 3. To design the IoT Dashboard for Smart Home application 4. To perform the data integration between IoT dashboard, Mobile application and IoT nodes
11.	**To demonstrate the functionality of General Purpose Input-Output pins of Raspberry Pi** 1. To demonstrate digital Input and Output with Raspberry pi 2. To demonstrate Analog Input and Outout with Raspberry pi
12.	**To perform smart farming application with MQTT** 1. To connect Node MCU with MQTT server. 2. To send and receive data with MQTT server. 3. To develop IoT Smart farming application
13.	**To demonstrate interfacing of Arduino board with wireless Radio Frequency module** 1. To demonstrate Arduino board interfacing with Bluetooth Module 2. To demonstrate Arduino board interfacing with Zigbee Module