Internet of Things		Semester	VII
Course Code	**BCS701**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/practical		

Course objectives:

- Understand about the fundamentals of Internet of Things and its building blocks along with their characteristics.
- Understand the recent application domains of IoT in everyday life.
- Understand the protocols and standards designed for IoT and the current research on it.
- Understand the other associated technologies like cloud and fog computing in the domain of IoT.
- Improve their knowledge about the various cutting-edge technologies in the field IoT and machine learning applications.
- Gain insights about the current trends of machine learning and AI techniques used in IoT to orient towards the present industrial scenario.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Use of PowerPoint presentation
2. Think -pair and share techniques
3. Workshop on Arduino and Raspberry Pi
4. Usage of Tinker Cad tool
5. Overview of the real-world applications of IoT from the published papers

MODULE-1

Introduction to Internet of Things: Introduction, Physical design of IOT, Logical Design of IOT, IOT enabling technologies, IOT Levels & Deployment Templates.

Textbook : Ch.1

MODULE-2

IOT and M2M: Introduction: M2M, Difference between IoT and M2M, SDN and NFV for IOT, IOT System Management with NETCONF-YANG, Need for IOT Systems Management, Simple Network Management Protocol (SNMP), Network operator requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG.

Textbook: Ch. 3.1-3.4,4.1-4.6

MODULE-3

IoT Platforms Design Methodology: Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring, loT Systems - Logical Design using Python: Introduction, Installing Python, Python Data Types and Data structures, Control flow, Functions, Modules, Packages, File Handling, Operations, Classes, Python Packages of Interest for IoT.

Textbook 1: Ch.5.1-5.3,6.2-6.11

MODULE-4

IoT Physical Devices & End points: What is a loT Device, Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Case Studies illustrating IoT design – Home Automation, Cities, Agriculture.

Textbook : Ch. 7.1-7.6,9.2,9.3,9.5

MODULE-5

Data Analytics for IoT: Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analytics, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis. Textbook: Ch.10

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Develop a program to blink 5 LEDs back and forth.
2	Develop a program to interface a relay with Arduino board.
3	Develop a program to deploy an intrusion detection system using Ultrasonic and sound sensors.
4	Develop a program to control a DC motor with Arduino board.
5	Develop a program to deploy smart street light system using LDR sensor.
6	Develop a program to classify dry and wet waste with the Moisture sensor (DHT22).
7	Develop a program to read the pH value of a various substances like milk, lime and water.
8	Develop a program to detect the gas leakage in the surrounding environment.
9	Develop a program to demonstrate weather station readings using Arduino.
10	Develop a program to setup a UART protocol and pass a string through the protocol.
11	Develop a water level depth detection system using Ultrasonic sensor.
12	Develop a program to simulate interfacing with the keypad module to record the keystrokes.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

. At the end of the course, the student will be able to :

- Explain the evolution of IoT, IoT networking components, and addressing strategies in IoT. C
- Analyze various sensing devices and actuator types.
- Demonstrate the processing in IoT.
- Apply different connectivity technologies.
- Elaborate the need for Data Analytics and Security in IoT.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.

- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scoredby the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

textbook

Arshdeep Bahga, Vijay Madisetti, " Internet of Things- A Hands On Approach", Universities press, 2014.

Reference Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
- https://docs.arduino.cc/
- https://www.arduino.cc/education/certification
- https://www.udemy.com/topic/arduino/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Mini projects by the students (2 to 4) using Arduino board and Raspberry Pi boards – 10 Marks
- Demonstration of projects using Tinker Cad tool.