Course Code: CSE3722 Program Specific: VI Semester, CSE	**Course Name:** IoT Networks, Architectures and Applications	
Credits: 3 (L-D-P: 3-0-0)	**Contact Hours:** 3 hours per week.	
Course Faculties: 1. Dr. Sandeep Kumar: sandeep.kumar@bmu.edu.in **(Coordinator)** *[CSE-1, CSE-2 and CSE-3 (Hand-on sessions)]* 2. Dr. Abhishek Jain: abhishek.jain@bmu.edu.in *[CSE-3 (Theory), CSE-4, CSE-5]*		

Aim of the course: This course is designed to provide students with solid technical knowledge and skills to understand the Internet of Things (IoT) systems. The beginning portion focuses on the basic concepts, architectures, applications and design challenges of the internet of things. The various topics on the IoT protocols, gateway, computing layers, security and wireless sensing have been covered in the middle portion of this course. The remaining part takes up the IoT circuits, embedded systems, case studies and a number of online IoT platforms.

Topics of the Course:

- Basics of networking, OSI and TCP/IP models, Addressing, TCP connections.
- What is IoT and why is IoT. Applications of IoT, potential and challenges. IoT network architectures. Type of communication: M2M, machine to cloud, etc.
- Network protocols and standards for internet of things: IEEE-802.15.4, ZigBee, RFID, NFC, Z-Wave, SigFox, LoRa, NB-IoT, Wi-Fi, Bluetooth, IPv6, RPL, 6LoWPAN, MQTT, MQTT-SN, CoAP, AMQP, XMPP, WebSocket, EPC and uCode.
- IoT Gateway: Overview of hardware and software. Computing Technologies: Cloud and fog computing. Basics of Security: Network, transport and application layer Security. Wireless Sensor Networks: Nodes, features, architecture and deployment.
- Circuits: overview of circuits used in IoT, battery current, and wireless links, digital computing and analog to digital interfaces.
- Embedded systems: internet connectivity and MGC architecture, Cortex M and BLE
- IoT case studies: Industrial IoT, home automation, internet of vehicles, e-Health, smart cities, etc.
- Open source IoT platforms: CupCarbon, Tinkercad, Wokwi, Proteus, Blynk, ThingSpeak etc.

Course Outcomes:

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

CO1: Understand the basic concepts, network architectures, applications and design challenges in the internet of things.

CO2: Analyze the functionality of various IoT protocols, computing paradigms, sensor networks and security layers.

CO3: Apply the acquired knowledge to design IoT circuits, systems and prototypes.

Lecture Plan:

Topics	CO#	No. of Sessions (48)	Reference
Basics of networking, OSI and TCP/IP models, Addressing, TCP connections.	CO1	3	T1: Chapter-1
What is IoT and why is IoT.	CO1	4	T1: Chapter-4
Applications of IoT, potential and challenges.	CO1	3	T1: Chapter-15
IoT network architectures.	CO1	5	R1: Chapter-2
Type of communication: M2M, machine to cloud, etc.	CO2	3	T2: Chapter-1 and 3.
Network protocols and standards for internet of things: IEEE-802.15.4, ZigBee, RFID, NFC, Z-Wave, SigFox, LoRa, NB-IoT, Wi-Fi, Bluetooth, IPv6, RPL, 6LoWPAN, MQTT, MQTT-SN, CoAP, AMQP, XMPP, WebSocket, EPC and uCode.	CO2	8	T1: Chapter-7 and 8.
IoT Gateway: Overview of hardware and software. Computing Technologies: Cloud and fog computing.	CO2	4	T1: Chapter-10, 11 and Class Notes.
Basics of Security: Network, transport and application layer Security. Wireless Sensor Networks: Nodes, features, architecture and deployment.	CO2	3	T1: Chapter-2 and 3.
Circuits: overview of circuits used in IoT, battery current, and wireless links, digital computing and analog to digital interfaces.	CO3	4	Class Notes
Embedded systems: internet connectivity and MGC architecture, Cortex M and BLE.	CO3	3	Class Notes
IoT case studies: Industrial IoT, home automation, internet of vehicles, e-Health, smart cities, etc.	CO3	4	R2: Chapter-3, and Class Notes.
Open source IoT platforms: CupCarbon, Tinkercad, Wokwi, Proteus, Blynk, ThingSpeak etc.	CO3	4	Class Notes

CO/PO Mapping:

CO/PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1			2		2							1	2		2	
CO2		3									1				2	
CO3	3		3	2				1		2	2			1		3

Text Books:

(T1): "Introduction to IoT" by Sudip Misra, Anandarup Mukherjee and Arijit Roy. Cambridge University Press, 2021 edition.

(T2): "Internet of Things: A Hands-on Approach" by Arshdeep Bahga and Vijay Madisetti. Universities Press India Pvt. Ltd., 1st edition (2016).

Reference Books:

(R1): "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton and Jerome Henry. Cisco Press, 2017 Cisco Systems, Inc.

(R2): "Building The Internet of Things With IPv6 and MIPv6: The Evolving World of M2M Communications" by Daniel Minoli. Wiley, 2013 by John Wiley & Sons, Inc.

Assessment Pattern:

The final grade will be based on the marks/ grades obtained in the mid-term and end-term evaluations along with other components as defined in the evaluation plan/table. The relative grading method defined in the academic regulations of the university will be followed to grade the students. The student has to secure a minimum of 40% of marks after completing all the assessments in the following table to become eligible for grading.

Assessment Components:

S. No	Evaluation Component	Weightage	Marks (out of 100)	Timeline	Evaluation Type/Remarks
1	Hands-on Assignments	15%	15	Continuous	Assignments
2	Mid-Term Exam	30%	30	As per academic calendar	Closed book
3	Quiz (Including Coursera)	20%	20	3rd week of April.	One Quiz, Closed book
4	End-Term Project	35%	35	During 1st to 10th of May.	**[To be managed and conducted by course faculties]** Demonstration, viva and report.

Experiential Learning: The hands-on assignments and end-term project will facilitate 50% experiential learning.

Student's Responsibilities:

- To attend all lectures and labs and to obtain all the course material.
- Check announcements on Maitri/Google-classroom and emails regularly.
- Regularly, check your marks on the Maitri and make sure they are up to date.

Attendance Policy: Students are expected to attend the classes regularly. Failure to attend the classes regularly and adhere to the expected attendance percentage will result in a reduction of the grade as per the University's grading policy.

Late assignment submission policy: Late submission of any assignment is not allowed, and any late submission will be awarded "0" marks in that assignment.

Recourse examination policy: As per the academic regulations of the University.

Make-up policy: No make-up work will be provided for unexcused absences. The faculty needs to be informed in advance in case the student is not going to be able to submit an assignment or take any evaluation component, and it is at the discretion of the faculty to sanction make up for an evaluation component.

Behavioral Expectations: No mobile phones and other gadgets causing distraction are permitted in the class.

Academic dishonesty/cheating/plagiarism: Plagiarism and dishonesty in any form in any evaluation component will lead to appropriate disciplinary action.