Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune

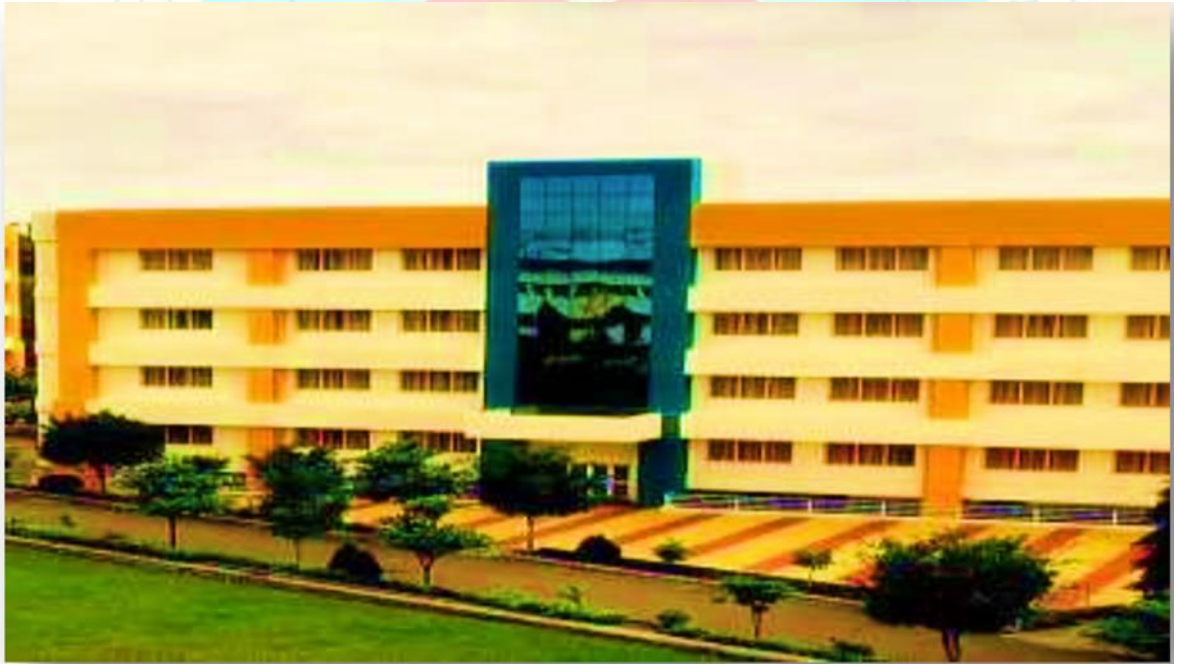
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Curriculum Structure and Syllabus

Minors in

Internet of Things (IoT)

(Regulations 2023)



Effective from Academic Year 2026-27

(Updated with Minor Changes)

Institute Vision

To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education.
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with an ability to think and act independently in demanding situations.

EOMS Policy

“We at PCCOE are committed to offer exemplarily Ethical, Sustainable and Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders.

We shall strive for technical development of students by creating globally competent and sensible engineers, researchers and entrepreneurs through Quality Education.

We are committed for Institute’s social responsibilities and managing Intellectual property.

We shall achieve this by establishing and strengthening state-of-the-art Engineering Institute through continual improvement in effective implementation of Educational Organizations Management Systems (EOMS).”

Course Approval Summary

Board of Studies - Department of E&TC Engineering

Sr. No.	Name of the Course	Course Code Scheme A/B	Page number	Signature and stamp of BoS chairman
1	Fundamental of Internet of Things	BET25MN11	9	
2	Fundamentals of Internet of Things Lab	BET25MN12	11	
3	IoT systems design	BET26MN11	12	
4	IoT systems design Lab	BET26MN12	14	
5	Technologies Enabling IoT	BET27MN11/ BET28MN12	15	
6	Project	BET28MN11/ BET27MN13	17	

Approved by Academic Council:

Chairman, Academic Council
Pimpri Chinchwad College of Engineering, Pune

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Preface

Looking at Global Scenario to enhance the employability skills and impart deep knowledge in emerging/ multidisciplinary areas, an additional avenue is provided to passionate learners through the Minors and Honors Degree Scheme in academic structure.
For **Minors degree** program, student has to earn additional 20 credits in multidisciplinary areas of other domains.

Objectives of Minors Degree

- To impart knowledge in multidisciplinary areas.
- To provide effective yet flexible options for students to achieve basic to intermediate level competence in the multidisciplinary area.
- To enhance the employability skills through different combinations in the diverse fields of engineering.
- To provide an academic mechanism for fulfilling multidisciplinary demands of industries.
- To provide a strong foundation to students aiming to pursue research/ higher studies in an interdisciplinary field of study.

Internet of Things

The Internet of Things in Engineering is embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet together. IoT has a huge impact on the field of civil and mechanical engineering such as Preventive Maintenance Programs, Real-Time Construction Management Solution, Workers' safety, Ease of governing the machines, increased communication, Field testing etc.

Objectives of Minor program:

1. To familiarize the students with the fundamentals of hardware and software required for designing an IoT system.
2. To familiarize the students with the technologies those, contribute in building an IoT application.
3. The promise of the Industrial Internet of Things (IIoT) brings many new business prospects.

Outcomes of Minor program:

On the completion of the course, students will be able to

1. Develop embedded applications using microcontrollers, sensors and actuators.
2. Choose the appropriate protocol, cloud service and data handling methods for an IoT application.
3. Develop skills in identifying areas in mechanical and civil where IoT can be deployed for making the application smart and in turn contributing to the overall development of the particular sector.
4. Examine technological developments that will likely shape the industrial Automation in the future.

Curriculum Structure

Curriculum Structure
Scheme-A

Sem-ester	Course Code	Course Name	Teaching Scheme					Evaluation Scheme						
			L	P	T	Hrs.	CR	FA1	FA2	SA	TW	PR	OR	Total
V	BET25MN11	Fundamental of Internet of Things	4	-	-	4	4	20	20	60	-	-	-	100
	BET25MN12	Fundamentals of Internet of Things Lab	-	2	-	2	1	-	-	-	25	-	25	50
VI	BET26MN11	IoT systems design	4	-	-	4	4	20	20	60	-	-	-	100
	BET26MN12	IoT systems design Lab	-	2	-	2	1	-	-	-	25	-	25	50
VII	BET27MN11	Technologies Enabling IoT	4	-	-	4	4	20	20	60	-	-	-	100
VIII	BET28MN11	Project	-	8		8	4	-	-	-	100		50	150
Total			**12**	**12**		**24**	**18**	**60**	**60**	**180**	**150**	**-**	**100**	**550**

Curriculum Structure
Scheme-B

Sem-ester	Course Code	Course Name	Teaching Scheme					Evaluation Scheme						
			L	P	T	Hrs.	CR	FA1	FA2	SA	TW	PR	OR	Total
V	BET25MN11	Fundamental of Internet of Things	4	-	-	4	4	20	20	60	-	-	-	100
	BET25MN12	Fundamentals of Internet of Things Lab	-	2	-	2	1	-	-	-	25	-	25	50
VI	BET26MN11	IoT systems design	4	-	-	4	4	20	20	60	-	-	-	100
	BET26MN12	IoT systems design Lab	-	2	-	2	1	-	-	-	25	-	25	50
VII	BET27MN13	Project	-	8		8	4	-	-	-	100		50	150
VIII	BET28MN12	Technologies Enabling IoT	4	-	-	4	4	20	20	60	-	-	-	100
Total			**12**	**12**		**24**	**18**	**60**	**60**	**180**	**150**	**-**	**100**	**550**

Abbreviations:
L-Lecture, P- Practical, T-Tutorial, H- Hours, FA-Formative Assessment, SA- Summative Assessment, TW–Term work OR – Oral, CR- Credits

Course Syllabus

Program:	B. Tech. (E&TC)-Minors in Internet of Things	Semester: V
Course Name:	Fundamentals of Internet of Things	Course Code: BET25MN11

Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks				
Credit	Lecture	Practical	Tutorial	FA		SA		Total
				FA1	FA2			
4	4	-	-	20	20	60		100

Prior Knowledge of

- Basic Electronics **Engineering Is essential**

Course Objectives:

1. To study the fundamentals about IoT
2. To study various protocols used in the Internet of Things environment
3. To study the design methodology and different IoT hardware platforms.
4. To study about various IoT case studies and industrial applications

Course Outcomes:

On the completion of the course, students will be able to,

1. Understand the basic architecture of Internet of Things based Devices
2. Illustrate wireless communication systems.
3. Identify actuators and sensor technologies for s for sensing real world entities.
4. Apply design methodology and cloud platforms involved in IoT
5. Deploy an IoT application and connect to the cloud.
6. Compare IoT Applications in Industrial &real world.

Detailed Syllabus:

Unit	Description	Duration (Hrs.)
1.	**Introduction to IoT: -** Introduction to Internet of Things (IoT), Functional Characteristics, Recent Trends in the Adoption of IoT, Role of cloud in IoT, Societal Benefits of IoT: - Health Care, Machine to Machine (M2M), Smart Transportation, Smart Living, Smart Cities, Smart Grid	11
2.	**Communication Principles**: - RFID, ZigBee, Bluetooth, Internet Communication- IP Addresses - MAC Addresses, IEEE 802 Family of Protocols, I/O interfaces Software Components	9
3.	**Sensing and Actuation: -** Definition of Sensor, Sensor features, Resolution, Classes, Different types of sensors, Actuator, Different types of Actuators, purpose of Sensors and Actuators in IoT	11
4.	**IoT Application Development: -** Frame work for IoT Applications-Implementation of Device integration, Data acquisition and Integration, Device data storage on cloud/local server, Authentication, authorization of Devices	9
5.	**Cloud computation: -** Evolution of Cloud Computation, Commercial clouds and their features, open source IoT platforms, cloud dashboards, Interfacing and data logging with cloud: Blync, Thing speak, platforms.	11
6.	**IoT Case Studies: -**IoT Case studies based on industrial Automation, Transportation, Smart cities, smart supply chain, Remote site monitoring.	9
	Total Hrs.	60

Textbooks:

1. Adrian Mcewen, Hakin Cassimally, "Designing The Internet of Things", First Edition, Wiley, 2014.
2. Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.
3. Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach",2014, ISBN:978 0996025515

Reference Books:

1. Raj Kamal , “Internet of Things: Architecture and Design”, McGraw Hill.2nd edition June 2022
2. Pethuru Raj, Anupama C. Raman ,” The Internet of Things Enabling Technologies, Platforms, and Use Cases”, Taylor and Francis group. February 2017
3. Peter Waher, “Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3”, First Edition, Packt Publishing, 2018.

Program: B. Tech. (E&TC)-Minors in Internet of Things				Semester: V			
Course: Fundamentals of Internet of Things Lab				Code: BET25MN12			
Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
Credit	**Theory**	**Practical**	**Tutorial**	**TW**	**OR**	**PR**	**Total**
1	-	2	-	25	25	-	50

Prior knowledge of: Basic electronics and basic of programming is essential.

Objectives:

The main objective of this course is to

1. To study fundamental concepts of IoT
2. To study roles of sensors in IoT
3. To correlate the connection of smart objects and IoT access technologies.

Outcomes:

At the end of Laboratory work, the students will be able to:

1. To understand the various concepts, terminologies and architecture of IoT
2. To understand use of sensors and actuators for design of IoT
3. To understand design methodology and hardware platforms.

General Guidelines: Any Six Experiments is to be performed.

Detailed Syllabus:

Expt. No.	List of Experiments
1	Basics of Internet of Things: Sensors, Actuators, IoT architecture and Gateway
2	IoT Networking: Connectivity technologies, Protocols and Interoperability in IoT.
3	LED blinking with Arduino Uno.
4	IoT sensors interface with Arduino (Temperature/Light sensors)
5	Integration of Actuators with nodeMCU (Servo motor/Relay).
6	Capture Image with node MCU.
7	To interface LCD and real time clock with Arduino.
8	Upload/download sensor data on cloud and server.

Virtual Lab Links: -

1. https://docs.simuli.co/getting-started/arduino/arduino-ide-and-vlab
2. https://docs.simuli.co/getting-started/raspberry-pi/setting-up-iotify-virtual-lab

Program: B. Tech. (E&TC)-Minors in IoT				Semester: VI			
Course Name: IoT systems design				Course code: BET26MN11			
Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
Credit	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
4	4	-	-	20	20	60	100

Pre-requisites: Fundamental knowledge of Sensors, Actuators & networking.

Course Objectives:

1. Describe the basic concepts of IoT.
2. Explain various IoT protocols required for implementing IoT applications.
3. Explain the key requirements for implementing IoT with Arduino Uno and Raspberry Pi development boards.
4. Describe the Node-RED tool for designing the IoT applications in Raspberry PI.

Course Outcomes:

On the completion of the course, students will be able to,

1. Understand the fundamentals IoT.
2. Gain the knowledge of various IoT protocols.
3. Deploy Arduino uno for designing the IoT applications.
4. Deploy Raspberry Pi for designing the IoT applications.
5. Develop an IoT system with Node-RED tool using Raspberry Pi
6. Develop the logic for Python Programming.

Detailed Syllabus:

Unit	Description	Duration (Hrs.)
1	**IoT-An Architectural Overview**– Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology.	11
2	**IoT Protocols:** Internet and Web layering, Introduction to wired and wireless communication technologies for IoT, Edge connectivity, IoT protocols - MQTT, MQTT-SN, Constrained Application Protocol (CoAP), STOMP, AMQP, Comparison of protocols, IPv4 and IPv6	9
3	**Implementing IoT with Arduino:** Introduction to Arduino Platforms, Arduino Uno architecture, IDE setup, importing Arduino boards in Arduino IDE tool, Installation of Arduino libraries, Basics of Embedded C Programming, Interfacing of Sensors and Actuators with Arduino Uno.	11
4	**Implementing IoT with Raspberry Pi (RPi):** Basic functionality of RPi board, setting up the board by installing OS, first boot and basic configuration of Rpi, Basic Linux Commands, Accessing RPi remotely using networking tools, RPi GPIO pins	9
5	**Getting started with Node-RED tool on Rpi:** Prerequisite for Node-RED, Installing and upgrading Node-RED, Running Node-RED app locally and as a service on network, auto-start on boot, opening the editor, installation of various libraries for Node-RED, adding node, add debug node, wire the nodes, deploy the flow.	11
6	**Python Programming: -** Installation of python, Numbers and Math in python, Variables and Inputs, built –in modules, functions, strings, python lists, python slicing, Save and run python files	9
	Total Hrs.-60	

Textbooks:

1. Programming the Raspberry Pi: Getting Started with Python, Simon Monk, 2nd Edition, ISBN: 978-1259587405, Tata McGraw Hill Publication. 2012
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press,2017
3. Arduino for Dummies, John Nussey, 2nd Edition, ISBN: 978-1119489542, For Dummies Publishing,2018

Reference Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications,2013
2. Programming Arduino: Getting started with sketches, 2ndEdition,Simon Monk, ISBN: 978-1259641633, Tata McGraw Hill Publication.
3. Exploring Raspberry Pi: Interfacing to the real world with Embedded Linux, Derex Molly, 1st Edition, ISBN: 978-1119188681, Wiley Publication,2016
4. Arduino Programming in 24 hours, Richard Blum, 1st Edition, ISBN: 978-0672337123, Sams Tech Yourself Publishing.2014

Program: B. Tech. (E&TC)-Minors in IoT				Semester: VI			
Course Name: IoT systems design Lab				Course code: BET26MN12			
Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
Credit	**Theory**	**Practical**	**Tutorial**	**TW**	**OR**	**PR**	**Total**
1	-	2	-	25	25	-	50

Pre-requisites:

1. Programming languages 'C'& Python.
2. Interfacing with microcontroller.

Course Objectives:

1. To deliver practical knowledge of interfacing of sensors and actuators with Raspberry Pi.
2. To deliver practical hands-on using cloud-based interfacing with Arduino uno and Rpi.
3. To design IoT applications using Node-RED tool with RPi
4. To deliver the knowledge of NodeMCU to design various IoT applications

Course Outcomes:

On the completion of the course, students will be able to,

1. Select appropriate sensors, actuators, cloud platform for designing IoT applications.
2. To Design IoT based real-time monitoring system using an appropriate cloud platform.
3. Automate the systems using various sensors, actuators and cloud platforms

Detailed Syllabus:

List of Experiments (Any 6)

Expt. No.	List of Experiments
1	To detect occupancy of an area using PIR sensors
2	Web-based home automation using Arduino Uno and Bluetooth
3	Installation of Noobs/Raspbian OS in Raspberry Pi
4	Home Automation using Node-RED and Raspberry Pi
5	Introduction to the MQTT Protocol on NodeMCU
6	Interfacing and programming of actuators.
7	Temperature and Humidity monitoring using Node-Red and Raspberry Pi
8	Web based device control.

Textbooks:

1. Programming the Raspberry Pi: Getting Started with Python, Simon Monk, 2nd Edition, ISBN: 978-1259587405, Tata McGraw Hill Publication. 2012
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press,2017
3. Arduino for Dummies, John Nussey, 2nd Edition, ISBN: 978-1119489542, For Dummies Publishing,2018

Reference Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications,2013
2. Programming Arduino: Getting started with sketches, 2ndEdition,Simon Monk, ISBN: 978-1259641633, Tata McGraw Hill Publication.
3. Exploring Raspberry Pi: Interfacing to the real world with Embedded Linux, Derex Molly, 1st Edition, ISBN: 978-1119188681, Wiley Publication,2016
4. Arduino Programming in 24 hours, Richard Blum, 1st Edition, ISBN: 978-0672337123, Sams Tech Yourself Publishing.2014

Program: B. Tech. (E&TC)-Minors in IoT						Semester: VII/VIII	
Course: Technologies Enabling IoT						Code: BET27MN11/ BET28MN12	
Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
Credit	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
04	4	-	--	20	20	60	100

Prior knowledge of

1. Fundamental knowledge of communication
2. Fundamental knowledge of microcontrollers is essential

Course Objectives:

1. Students will get an exposure to the different IoT enabling technologies.
2. Students will understand the handling huge amount of data for its analysis.
3. Students will learn the contemporary aspects like cloud computing.
4. Students will learn the different applications of IoT aligned withIndustrial Automation and Smart cities .

Course Outcomes:

After learning the course, the students should be able to:

1. Understand the hardware required for building an IoT system
2. Comprehend the concepts of WSN and choose the required communication protocol
3. Identify the required cloud service based on the requirement
4. Handle and analyze the big data.
5. Analyze Industrial IoT business Model
6. Apply the IoT enabling technologies for the development of an IoT system

Detailed Syllabus:

Unit		Duration
1	**Embedded Systems** • Introduction to IoT Boards, • IoT deployment for Raspberry Pi /Arduino/Equivalent platform – Interfacing of Sensors and actuators, • Communication: Connecting microcontroller with mobile devices – communication through Bluetooth and Wi-Fi	10
2	**Wireless Sensor Network** • What is WSN? WSN node, Anatomy of the network node, Architecture of WSN, Types of WSN • WSN standards: IEEE 802.15.4, Low rate WPAN, Zigbee, Wireless HART, 6LOWPAN, Zwave, BLE, LoRA. • Protocol stack of WSNs	10
3	**Cloud Computing** Introduction to Cloud Computing (concept, architecture, working) Introduction to Cloud service models- SaaS, PaaS, IaaS, NaaS, IdaaS, DbaaS Cloud Platforms: Google App Engine, Amazon Web Services, Microsoft Azure Cloud services, Windows Azure Platform Appliance. Distributed Computing: Need, Distributed computing vs. Cloud computing	10
4	**Big Data** • Introduction to Big data, Types of data, Characteristics of Big data, • Data handling technologies, Flow of data, Data acquisition, Data storage, • Introduction to Hadoop, Introduction to Data Analytics, Types of data analytics-Local Analytics, Cloud analytics and applications	10
5	**Introduction to Industrial IoT: -** Business Model and Reference Architecture: IIoT-Business Models, IIoTSensing,IIoT Communication ,IIoT Security and Fog Computing.	10
6	**Industrial IoT Applications** • Home Automation, Industrial IoT, Logistics, Driver assistance, collision impact, Inventory Management & Quality Control	10

	• Smart Cities, Environmental Protection, Lavatory maintenance, Water quality, Power Plants • Food, Warehouse, Retail, Energy management, Agriculture, Health and Lifestyle**,** Facility Management	
	Total Hrs.	**60**

Text Books:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press,2017
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, —The Internet of Things: Key Applications and Protocols‖, WileyPublications, 2012
3. Giacomo Veneri Antonio Capasso, "Hands-On Industrial Internet of Things", Packtr Publications, January 2018

Reference Books:

1. HakimaChaouchi, — The Internet of Things Connecting Objects to the Web‖ ISBN : 978-1- 84821- 140-7, Wiley Publications, 2013
2. Kazem Sohraby, Daniel Minoli and TaiebZnati, — Wireless Sensor Networks Technology, Protocols, and Applications—, John Wiley & Sons, 2010.
3. Holger Karl and Andreas Willig, —Protocols and Architectures for Wireless Sensor Networks‖, John Wiley & Sons, Ltd, 2007.
4. Daniel Minoli, —Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications‖, ISBN: 978-1-118-47347-4, Wiley Publications, 2013

MOOC courses:

1. NPTEL course on "Components and Applications of IoT" by Dr. Sanjoy Parida, https://onlinecourses.swayam2.ac.in/arp19_ap52/preview
2. Coursera Course "Introduction to IoT and Embedded systems" by Ian Harris, https://www.coursera.org/learn/iot
3. NPTEL Course "Sensors and Actuators" by Prof. Hardik Pandya https://nptel.ac.in/courses/108108147

Program:	B. Tech. (E&TC)-Minors in IoT			Semester:		VII /VIII
Course:	Project			Code:		BET28MN11/ BET27MN13
Teaching Scheme (Hrs./Week)			**Evaluation Scheme and Marks**			
Credit	**Theory**	**Practical**	**TW**	**OR**	**PR**	**Total**
4	-	**8**	100	50	-	150

Prior Knowledge of: basics of hardware, software and services required for an IoT application

Course Objectives:

1. To test students' knowledge of course implementation.
2. To make students ready for development of an IoT system

Course Outcomes: After learning the course, the students should be able to:

1. Apply Knowledge of IoT for solving real time issues.
2. Design a IoT system to solve Societal Issue.
3. Able to manage the project and communicate it to outside world.

Detailed Guidelines:

1. The students are encouraged to take projects for developing software solutions and hardware platforms using the concept of course taken under the certification.
2. The project guidelines mentioned in B.Tech (E&TC) structure will be followed for evaluation of performance and certification compliance.

Vision and Mission of E&TC Department

VISION : To be recognized as a distinguished department in the field of electronics and telecommunication transforming students into competent technocrats by providing an Ethical, Sustainable and Value-Added Quality Education.

MISSION :

1. To create competent Electronics and Tele-communication engineers with Knowledge, Skill and Attitude by establishing a conducive learning environment.
2. To nurture technical competency, entrepreneurship skills and promote higher studies through the state-of-art facilities for building successful careers.
3. To facilitate research by engaging in projects of industrial requirement and national importance.
4. To impart Life skills, Ethical and Social values for self-sustainability.

Programme Educational Objectives (PEO's)

1. Establish a strong base in mathematics, basic sciences, and the fundamental principles of Electronics and Telecommunication Engineering for the students.
2. Equip students with a comprehensive understanding of Electronics and Telecommunication Engineering, enabling them to effectively comprehend, analyse, design, and to innovate practical solutions for real-world challenges.
3. Foster the development of effective communication skills, teamwork, and professional ethics among students, in order to meet the demands of employers and prepare them for higher studies and successful careers.
4. Promote social consciousness and a sense of responsibility among students, creating awareness about their commitment and obligations to society.

Program Outcomes (PO's)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

1. **PSO1:** Ability to exhibit the competency to solve the problems related to Electronics & Telecommunications Engineering by applying advanced knowledge in the fields of VLSI, Embedded Systems, Signal Processing, Communication, Computing and Automation.
2. **PSO2:** Ability to design and analyse Electronics & Telecommunications systems using state of the art hardware and software tools to address the needs of the industry and society.
3. **PSO3:** Ability to build research and problem-solving attitude through Project based learning to address the societal, environmental, health and safety issues.