Emerging Minor Courses in Internet of Things

Sr. No.	Semester	Course Code	Title	L	T	P	Hrs. / Week	Credits
1	III	**UELMN0361**	Introduction to Internet of Things	3	0	0	3	3
2	IV	**UELMN0461**	Introduction to Security of Cyber- Physical Systems	3	0	0	3	3
3	V	**UELMN0561**	Sensing, Computing and Communication	3	0	0	3	3
4	VI	**UELMN0661**	Embedded Systems for IoT	3	0	0	3	3
5	VII	**UELMN0761**	IoT with Arduino, ESP	3	0	0	3	3
			Total	**15**	**0**	**0**	**15**	**15**

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DEPARTMENT OF ELECTRICAL ENGINEERING

Title of the Course: Sensing, Computing and Communication **Course Code: UELMN0561**	**L**	**T**	**P**	**Credit**
	03	**-**	**-**	**03**

Course Prerequisite: Students should have a foundational understanding of basic electronics and computer science concepts. Prior knowledge of digital logic design, signals and systems, and programming fundamentals (preferably in languages like C or Python) is essential. Familiarity with basic networking principles and embedded systems will be beneficial for comprehending communication protocols and distributed computing. A background in mathematics, including calculus and linear algebra, will help in understanding sensor data processing and signal analysis.

Course Description: This course explores the fundamentals and advanced topics of sensing, computing, and communication within the Internet of Things (IoT) and ubiquitous computing environments. It covers key concepts such as location and context-aware computing, privacy and energy challenges, wearable and mobile technologies, as well as data analytics and real-time processing for smart applications.

Course Objectives:

1. Basic introduction of all the elements of IoT-Mechanical, Electronics/sensor platform, Wireless and wireline protocols, Mobile to Electronics integration, Mobile to enterprise integration.
2. To have an understanding of basics of open source/commercial electronics platform for IoT.
3. To have an understanding of basics of open source /commercial enterprise cloud platform for IoT.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom s level**	**Descriptor**
CO1	Explain the fundamental concepts of IoT, ubiquitous computing, and wireless communication technologies, including location and context-aware systems.	II	Understanding
CO2	**Analyze** the challenges related to privacy, security, energy constraints, and emerging innovations in wearable and mobile computing technologies.	IV	Analyzing
CO3	**Apply** data management and analytics techniques to process and interpret heterogeneous IoT data for real-time decision-making and smart environment applications.	III	Apply

PO MAPPING

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	1	2			1				2	1	1	1
CO2	1	2	1	2		2	1				1	1	1
CO3	1	1	1	2		1		1		1	1	1	1

Assessments:

Teachers' assessment-

It consists of one End Semester Examination (ESE) having 100% weight.

Assessment	Marks
ESE	100

ESE: Assessment is based on 100% course content with 100% weightage for course content

Course Contents:	
Unit 1: Introduction : Overview, Challenges in IoT, Networking Basics of IoT, NFC, Bluetooth, Zigbee, Wireless LAN.	**7Hrs.**
Unit 2: Location in ubiquitous computing: Personal assistants, Location aware computing, Location tracking, Architecture, Location based service and applications, Location based social networks (LBSN), LBSN Recommendation. **Context-aware computing**: Context and Context-aware Computing, Issues and Challenges, Developing Context-aware Applications, System Architecture.	**8Hrs.**
Unit 3: Challenges and Innovations in Computing: Privacy and security in ubiquitous computing, Energy constraints in ubiquitous computing, Wearable computing, Glass and Augmented Reality, Eye-Tracking, Digital Pen and Paper, Mobile social networking & crowd sensing, Event based social network.	**8Hrs.**
Unit 4: Mobile affective computing: Human Activity and Emotion Sensing, Health Apps, Mobile p2p computing, Smart Homes and Intelligent Buildings, Mobile HCI, Cloud centric IoT, Open challenges, Architecture, Energy Efficiency, Participatory sensing, Protocols, QoS, QoE.	**8Hrs.**
Unit 5: IoT and data analytics IoT and Data Management: Data cleaning and processing, Data storage models. Search techniques, Deep Web, Semantic sensor web, Semantic Web Data Management, Searching in IoT. Real-time and Big Data Analytics for The Internet of Things, Heterogeneous Data Processing, High-dimensional Data Processing, Parallel and Distributed Data Processing.	**8Hrs.**

Texts books:

1. N. Jeyanthi, Ajith Abraham, Hamid Mcheick, "Ubiquitous Computing and Computing Security of IoT", Springer.
2. John Krumm, Ubiquitous Computing Fundamentals, CRC Press, Taylor & Francis.
3. Dirk Slama, "Enterprise IoT", Shroff Publisher/O'Reilly Publisher.

References:

1) RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, Internet of Things, John Wiley and Sons

Unit wise Measurable students Learning Outcomes:

1. The students will be able to learn the various networking basics of Internet of Things.
2. The students will be able to understand the location- aware and context- aware computing.
3. The students will be able to analyze challenges and innovations in computing.
4. The students will be able to acquire skills mobile affective computing.
5. The students will be able to analyze the data and perform data processing.

Kolhapur Institute of Technology's
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DEPARTMENT OF ELECTRICAL ENGINEERING

Title of the Course: Embedded Systems for IoT **Course Code: UELMN0661**	**L**	**T**	**P**	**Credit**
	03	**-**	**-**	**03**

Course Prerequisite: Students should have a basic understanding of computer networks, embedded systems, and programming fundamentals. Familiarity with sensors, communication protocols, and cloud computing concepts will help in grasping the advanced IoT topics covered in this course.

Course Description: This course explores the design, development, and integration of embedded IoT systems, covering sensors, actuators, communication technologies, and cloud platforms. Students will learn to build scalable and secure IoT solutions by understanding device architectures, enabling technologies, and the Web of Things.

Course Objectives:

1. To make students know the basic concept and architecture of embedded systems.
2. Different design platforms used for an embedded system for IoT applications.
3. To have knowledge about the IoT enabled technology.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Blooms level**	**Descriptor**
CO1	**Understand** the purpose, specifications, and key components of embedded IoT systems, including device integration and IoT physical devices.	II	Understanding
CO2	**Relate** design and implementation of embedded system architectures using sensors, actuators, processors, and communication protocols tailored for IoT applications.	III	Apply
CO3	**Evaluate** IoT enabling technologies, cloud platforms, and Web of Things architectures to develop scalable, connected IoT solutions.	V	Evaluate

PO MAPPING

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	1	2			1				2	1	1	1
CO2	1	2	1	2		1	1				1	1	1
CO3	1	1	1	2		1		1		1	1	1	1

Assessments:
Teachers' assessment-
It consists of one End Semester Examination (ESE) having 100% weight.

Assessment	Marks
ESE	100

ESE: Assessment is based on 100% course content with 100% weightage for course content

Course Contents: **Unit 1: Purpose and requirement specification**: IoT level specification, Functional view specification, Operational view specification, Device and component integration, Pillars of Embedded IoT and Physical Devices: The internet of devices. .	**4Hrs.**
Unit 2: Design of Embedded Systems: Common Sensors, Actuators, Embedded Processors, Memory Architectures, Software architecture.	**7Hrs.**
Unit 3: Inputs and Outputs: Digital Inputs and Outputs, Digital Inputs, Digital Outputs, BusIn, BusOut, and BusInOut, Analog Inputs and Outputs, Analog Inputs, Analog Outputs, Pulse Width Modulation (PWM), Accelerometer and Magnetometer, SD Card, Local File System (LPC1768).	**7Hrs.**
Unit 4: IoT Enabling Technologies: Communications, RFID and NFC (Near-Field Communication), Bluetooth Low Energy (BLE), LiFi, 6LowPAN, ZigBee, Z-Wave, LoRa, Protocols, HTTP, WebSocket, MQTT, CoAP, XMPP, Node-RED, Platforms, IBM Watson IoT—Bluemix, Eclipse IoT, AWS IoT, Microsoft Azure IoT Suite, Google Cloud IoT, ThingWorx, GE Predix, Xively, macchina.io, Carriots.	**6Hrs.**
Unit 5: Web of Things and Cloud of Things: Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Cloud of Things. IoT Physical Servers, Cloud Offerings and IoT Case Studies: Introduction to Cloud Storage Models, Communication API.	**6Hrs.**

Texts books:

1. RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, Internet of Things, John Wiley and Sons.
2. Klaus Elk, "Embedded Software for the IoT".
3. Perry Xiao, "Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed".

References:

1. Elizabeth Gootman et. al, "Designing Connected Products", Shroff Publisher/O'Reilly Publisher.

Unit wise Measurable students Learning Outcomes:

1. The students will be able to explain the purpose and requirement specifications of embedded IoT systems and their device integration
2. The students will be able to use embedded system architectures using sensors, actuators, processors, and memory components.
3. The students will be able to demonstrate the operation and interfacing of digital and analog inputs/outputs and peripheral devices in embedded IoT.
4. The students will be able to analyze and compare IoT enabling communication technologies, protocols, and cloud platforms.
5. The students will be able to evaluate Web of Things and Cloud of Things architectures and their applications in scalable IoT solutions.