

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH



Minor Degree in Electronics Engineering (Internet of Things (IoT))

SCHOOL OF ELECTRONIC SCIENCES

Curriculum and Syllabus
(2023-24 admitted students)



ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Admission Batch: 2023-24)

Name of the school: School of Electronic Sciences

Minor Degree in Electronics Engineering (Internet of Things (IoT))

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PE	EI3261	Introduction to Internet of Things	3	0	0	3	40	60	-	100
2		EI3262	Introduction to Security of Cyber Physical Systems	3	0	0	3	40	60	-	100
3		ET3562	IOT Lab- 1	0	0	3	1.5			100	100
4		EI4261	Ubiquitous Sensing, Computing and Communication	3	0	0	3	40	60	-	100
5		EI4263	Embedded Systems for IoT	3	0	0	3	40	60	-	100
6		ET4561	IOT Lab- 2	0	0	3	1.5			100	100
7		EI4262	IoT with Arduino, ESP, and Raspberry Pi	3	0	0	3	40	60	-	100
Total				15	0	6	18	200	300	100	600



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SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
INTRODUCTION TO INTERNET OF THINGS	EI3261	3-0-0	3

Prerequisite: Basic knowledge of computer networks, embedded systems, and programming in Python or C.

Course Outcomes:

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

- CO1:** Describe the technology and standards relating to IoT.
- CO2:** Analyze the ecosystem and enabling components for mainstream IoT adoption.
- CO3:** Develop IoT applications and system-level solutions.
- CO4:** Evaluate real-world use cases of IoT in industrial and societal contexts.

Module I: 08 Hours

IoT and Web Technology, IoT vision, applications, infrastructure, data management, security, energy issues, and standardization

Module II: 08 Hours

M2M to IoT transition, value chains, IoT architecture design principles, standards, and architectural overview.

Module III: 08 Hours

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Module IV: 8 Hours

IoT architecture reference models, functional and operational views, deployment considerations, and architectural case studies.

Total lecture hours: 32 Hours

Text Book:

1. Nitesh Dhanjani, *Abusing the Internet of Things*, Shroff/O'Reilly Publisher.
2. Shriram K. Vasudevan, Abhishek S. Nagarajan, R.M.D. Sundaram, *Internet of Things*, Wiley India.
3. Vijay Madisetti and Arshdeep Bahga, *Internet of Things: A Hands-On Approach*, Universities Press.
4. William Stallings, *Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud*, Pearson.

Reference Book:

1. Cuno Pfister, *Getting Started with the Internet of Things*, O'Reilly Media.
2. Francis daCosta, *Rethinking the Internet of Things: A Scalable Approach to Connecting Everything*, Apress.
3. Massimo Banzi, Michael Shiloh, *Make: Getting Started with Arduino*, Maker Media.
4. Samuel Greengard, *The Internet of Things*, MIT Press.

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SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
INTRODUCTION TO SECURITY OF CYBER PHYSICAL SYSTEMS	EI3262	3-0-0	3

Prerequisite: Basic knowledge of Computer Networks, Operating Systems, and Information Security.

Course Outcomes:

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

- CO1:** Apply basics of security and understand issues related to information systems security.
- CO2:** Analyze biometric techniques and their applications in modern security systems.
- CO3:** Investigate security threats in web systems and evaluate defense mechanisms.
- CO4:** Evaluate and design secure transport and network protocols for cyber-physical systems.

Module I:

04 Hours

Overview of Security and Privacy in Information System. Applied Cryptography & Intrusion Detection, Architecture of Applied Cryptography, One Way Hash Function and Integrity, Encryption Algorithms and Confidentiality, Digital Signature and Authentication (DH, RSA, 2 class), Intrusion Detection and Information Theory.

Module II:

08 Hours

Internet of Things Security, Security and Privacy for IoT Case Study: Smart Home, Smart Grid Network, Modern Vehicle, Wearable Computing & BYOD, Mobile HealthCare.

Module III:

08 Hours

Software-Defined Networks, Introduction of Software-Defined Networks, Security for Software-Defined Networks, Privacy Leakages for Software-Defined Networks, Case Studies: How to Attack Software-Defined Networks.

Module IV:

10 Hours

Cyber-Physical Systems (CPS), CPS - Platform components, CPS implementation issues, Intelligent CPS, Secure Deployment of CPS.

Total lecture hours:

30 Hours

Text Book:

1. Nina Godbole, *Cyber Security*, John Wiley & Sons.
2. Li Da Xu, Shancang Li, *Securing the Internet of Things*, Syngress.
3. Alasdair Gilchrist, *IoT Security Issues*, De Gruyter.
4. Sean Smith, *The Internet of Risky Things*, O'Reilly Publisher.

Reference Book:

1. William Stallings, *Cryptography and Network Security*, Pearson.
2. Jonathan Katz, Yehuda Lindell, *Introduction to Modern Cryptography*, CRC Press.
3. Raj Rajkumar, *Cyber-Physical Systems*, Addison-Wesley.
4. S. Rajasekaran, G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms*, PHI.

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Syllabus (Admission Batch: 2023-24)

SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
IOT LABORATORY-1	EI3261	0-0-3	1.5

LIST OF EXPERIMENTS

One Mini Project (1) to be implemented based on the knowledge of theory paper.



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SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
UBIQUITOUS SENSING, COMPUTING AND COMMUNICATION	EI4261	3-0-0	3

Prerequisite: Nil

Course Outcomes:

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

- CO1:** Understand the components and challenges of ubiquitous computing systems.
- CO2:** Analyze the role of location-aware and context-aware computing in IoT.
- CO3:** Examine privacy, energy constraints, and emerging wearable and mobile technologies.
- CO4:** Apply cloud and data analytics concepts in building scalable ubiquitous IoT applications.

Module I: **04 Hours**

Introduction, Overview, Challenges in IoT, Networking Basics of IoT, NFC, Wireless LAN.

Module II: **08 Hours**

Location-based and context-aware computing, architecture and applications, LBSN recommendations.

Module III: **08 Hours**

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.

Module IV: **10 Hours**

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.

Total lecture hours: **30 Hours**

Text Book:

1. N. Jeyanthi, Ajith Abraham, Hamid Mcheick, *Ubiquitous Computing and Computing Security of IoT*.
2. John Krumm, *Ubiquitous Computing Fundamentals*, CRC Press.
3. Dirk Slama, *Enterprise IoT*, O'Reilly Media.
4. Ferscha A., *Context-Aware Computing: A Primer*, Springer.

Reference Book:

1. Jason H. Moore, *Smart Environments: Technologies, Protocols and Applications*, Wiley.
2. Marc Langheinrich, *Privacy by Design in Ambient Intelligence*, Springer.
3. Ovidiu Vermesan, Peter Friess, *Internet of Things: Converging Technologies for Smart Environments*, River Publishers.
4. Joseph L. Hellerstein, *The Datacenter as a Computer*, Morgan & Claypool.

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SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
EMBEDDED SYSTEMS FOR IOT	EI4263	3-0-0	3

Prerequisite: Fundamentals of microcontrollers, digital electronics, and basic programming knowledge.

Course Outcomes:

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

- CO1:** Understand the architecture and components of embedded systems for IoT.
- CO2:** Analyze the role of sensors, actuators, and embedded processors in IoT design.
- CO3:** Apply embedded system concepts for interfacing I/O devices and data communication.
- CO4:** Evaluate IoT enabling technologies and cloud platforms for real-world applications.

Module I: 04 Hours

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.

Module II: 08 Hours

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).

Module III: 08 Hours

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

Module IV: 10 Hours

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.

Total lecture hours: 30 Hours

Text Book:

1. R.M.D. Sundaram, Shriram K. Vasudevan, Abhishek S. Nagarajan, *Internet of Things*, Wiley.
2. Klaus Elk, *Embedded Software for the IoT*.
3. Perry Xiao, *Designing Embedded Systems and the IoT with ARM Mbed*, Wiley.
4. Elizabeth Gootman et al., *Designing Connected Products*, O'Reilly Media.

Reference Book:

1. Jonathan W. Valvano, *Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers*.
2. Marilyn Wolf, *Computers as Components: Principles of Embedded Computing System Design*.
3. Peter Marwedel, *Embedded System Design*.
4. Raj Kamal, *Embedded Systems: Architecture, Programming and Design*.

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SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
IOT LABORATORY-2	ET4561	0-0-3	1.5
LIST OF EXPERIMENTS			

One Mini Project (2) to be implemented based on the knowledge of theory paper.



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SUBJECT NAME	SUBJECT CODE	L-T-P	CREDIT
IOT WITH ARDUINO, ESP, AND RASPBERRY PI	EI4262	3-0-0	3

Prerequisite: Basic knowledge of programming (C/Python), microcontroller fundamentals, and computer networks.

Course Outcomes:

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

- CO1:** Understand the architecture and programming environment of Arduino, ESP, and Raspberry Pi.
- CO2:** Interface sensors and actuators with IoT boards and apply communication protocols.
- CO3:** Develop IoT applications using cloud integration and real-time data logging.
- CO4:** Evaluate performance, scalability, and integration challenges of IoT hardware platforms.

Module I: **04 Hours**

IoT introduction, components, sensors, actuators, and overview of Arduino, ESP, Raspberry Pi boards.

Module II: **08 Hours**

Arduino Uno: programming, sensor interfacing, interrupts, case studies on GSM-based data transmission.

Module III: **08 Hours**

ESP8266: Micropython, WiFi connectivity, REST API, MQTT, smart home automation case studies.

Module IV: **10 Hours**

Raspberry Pi 3: setup, GPIO scripting, remote access via SSH, interfacing sensors and cloud integration.

Total lecture hours: **30 Hours**

Text Book:

1. M. Rao, *Internet of Things with Raspberry Pi 3*, Packt Publishing.
2. J. Baichtal, *Arduino for Beginners*, Pearson Education.
3. M. Schwartz, *Internet of Things with ESP8266*, Packt Publishing.
4. M. Richardson & S. Wallace, *Getting Started with Raspberry Pi*, O'Reilly Media.

Reference Book:

1. Peter Waher, *Learning Internet of Things*, Packt.
2. Y. Zhang, *Designing Connected Products*, O'Reilly Media.
3. D. Norris, *Raspberry Pi Projects for the Evil Genius*, McGraw Hill.
4. D. G. Smith, *Practical Internet of Things with JavaScript*, Apress.

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