

Govt. Polytechnic Bhubaneswar
ACADEMIC LESSON PLAN OF WINTER 2025

Discipline: CE & IoT

Semester: 4th

Name of the Teaching Faculty: Dr. SANJAY KUMAR JENA

Subject: **IoT OPERATING SYSTEM AND SECURITY**(Course Code: CEIPE 204A)

No. of Days/Week Class Allotted: 03

Semester Duration: From 22/12/2025 to 18/04/2026

No. of Weeks: 15

Week	Class Day	Unit	Sub-topics / Activities
1	1st, 2nd & 3rd	I	Introduction to IoT and its Operating System; IoT challenges; role of OS in IoT devices; Components of IoT; Differences between traditional OS and IoT OS
2	1st, 2nd & 3rd	I	Examples of popular IoT OS (Ubuntu Core, RIOT, Tizen, TinyOS, Android Things, LibreELEC, eLinux, and Contiki) and usage scenarios; Challenges in IoT
3	1st, 2nd & 3rd	I	Features of IoT OS: Low-power operation, real-time processing needs, scalability, interoperability; need for secure communication; Unit I Quiz.
4	1st, 2nd & 3rd	II	Generic architecture of an IoT OS; kernel and basic services; introduction to microkernel and monolithic kernel styles in IoT.
5	1st, 2nd & 3rd	II	Features, pros and cons of microkernel vs monolithic for constrained devices; example scenarios for each style.
6	1st, 2nd & 3rd	II	Memory and process management approaches in IoT devices; task scheduling under energy constraints; power-management features; Unit II Quiz.
7	1st, 2nd & 3rd	III	MQTT model (publish/subscribe, broker); use of TLS/SSL with MQTT; benefits and overheads in IoT environments.
8	1st, 2nd & 3rd	III	CoAP basics and DTLS protection; HTTPS for RESTful IoT APIs; WebSockets for real-time communication; security considerations and trade-offs.
9	1st, 2nd & 3rd	III	Idea of secure middleware; examples: Node-RED (Node-RE in syllabus) security features at high level; OpenHAB and secure IoT gateways; Unit III Quiz
10	1st, 2nd & 3rd	IV	Overview of IoT-specific security challenges; attack surface of IoT OS, devices, and networks; Discuss about some common IoT Security Threats
11	1st, 2nd & 3rd	IV	Working of DDoS Attacks in IoT(Mirai botnet story as case study); lessons learned and mitigation strategies for IoT deployments; Man-in-the-middle (MITM) in IoT
12	1st, 2nd & 3rd	IV	Ransomware/malware on embedded devices; Other Security risks in IoT OS and insecure firmware; Unit IV Quiz.
13	1st, 2nd & 3rd	V	Cryptography Techniques for IoT Security; Lightweight Cryptography for IoT: overview of DES; constraints on key size and computation.
14	1st, 2nd & 3rd	V	Principles of secure boot; verifying firmware integrity; secure firmware-update mechanisms and rollback protection in IoT devices.
15	1st, 2nd & 3rd	V	End-to-end encryption concepts in IoT systems; tying together OS features, protocols, and security; Unit V Quiz.

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Discipline: CE & IoT

Semester: 4th

Name of the Teaching Faculty: Dr. SANJAY KUMAR JENA

Subject: **IoT ARCHITECTURE AND PROTOCOLS** (Course Code: CEIPE 202B)

No. of Days/Week Class Allotted: 03

Semester Duration: From 22/12/2025 to 18/04/2026

No. of Weeks: 15

Week	Class Day	Unit	Sub-topics / Activities
1	1st, 2nd & 3rd	I	Basic IoT concept; characteristics of IoT systems; elements of an IoT solution; motivation and evolution of IoT.
2	1st, 2nd & 3rd	I & II	IoT applications in logistics, healthcare, smart homes, smart cities, industry; simple case illustrations; Unit I Quiz. Unit II- IoT Architectural Reference Model (ARM); IoT ARM as an enabler;
3	1st, 2nd & 3rd	II	Overview of domain, information, functional, communication views; IoT in Practice with examples of IoT in logistics (tracking, fleet) and health (remote monitoring);
4	1st, 2nd & 3rd	II	mapping ARM concepts to these examples; Domain model (entities, resources, services); information model (data, metadata, relationships);
5	1st, 2nd & 3rd	II	functional and communication models: Functional groups, interfaces; communication models and interactions; Unit II Quiz.
6	1st, 2nd & 3rd	III	Layered view of IoT reference architecture; requirements (scalability, interoperability, security); deployment and operation views.
7	1st, 2nd & 3rd	III	Service-oriented concepts; services, service registry, service composition in IoT; benefits and limitations of SOA for IoT.
8	1st, 2nd & 3rd	III	RESTful APIs, resource addressing, typical API gateway; examples of API-based IoT platforms; mapping to ARM components.
9	1st, 2nd & 3rd	III & IV	OPENIoT architecture blocks; data acquisition, cloud services, applications; IoT-cloud integration patterns; Unit III Quiz. Unit IV-Need for application protocols; Application Protocols of IoT: UPnP, CoAP, MQTT, XMPP. SCADA; basics of HTTP/REST,
10	1st, 2nd & 3rd	IV	WebSocket communication; UPnP idea for device discovery/control; MQTT publish/subscribe model; CoAP over UDP and REST mapping;
11	1st, 2nd & 3rd	IV	XMPP idea; SCADA overview for IIoT; 6LoWPAN header compression & adaptation; RPL routing basics; IEEE 802.15.4 features for low-power WPANs;
12	1st, 2nd & 3rd	IV & V	Authentication needs in IoT protocols; simple mechanisms (keys, certificates at high level); aligning protocol choice with security. Unit IV Quiz. Unit V- Selecting various case studies
13	1st, 2nd & 3rd	V	Case study with mapping each to ARM and protocols: cloud-based smart-facilities management,
14	1st, 2nd & 3rd	V	Case study with mapping each to ARM and protocols: healthcare,
15	1st, 2nd & 3rd	V	Case study with mapping each to ARM and protocols: Environment Monitoring System

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Discipline: CE & IoT

Semester: 4th

Name of the Teaching Faculty: Dr. SANJAY KUMAR JENA

Subject: **Operating System** (Course Code: CEIPC 202/TH1)

No. of Days/Week Class Allotted: 03

Semester Duration: From 22/12/2025 to 18/04/2026

No. of Weeks: 15

Week	Class Day	Unit	Topics to be Covered
1st	1st, 2nd & 3rd	I	Unit I- Overview of Operating System: Basic concepts of OS, goals, functions, types of OS; OS as resource manager and VM
2nd	1st, 2nd & 3rd	I	UNIX/LINUX architecture; kernel, shell; services and system calls; system programs with examples
3rd	1st, 2nd & 3rd	II	Unit II- Process Management: Process concept and PCB; process states and transitions; operations on processes (create, terminate).
4th	1st, 2nd & 3rd	II	Inter-process communication (overview: message passing, shared memory); scheduling criteria; basic CPU scheduling algorithms
5th	1st, 2nd & 3rd	II & III	Multithreaded programming concept; threads vs processes; simple examples. Unit III- Memory management: Memory allocation basics; contiguous allocation; swapping; Virtual memory, demand paging;
6th	1st, 2nd & 3rd	III	page faults and other memory faults (high-level view); internal and external fragmentation; segmentation concepts; address translation idea; Virtual Memory,
7th	1st, 2nd & 3rd	III & IV	Advantages and limitations of Memory Management. Unit IV-File management: Concept of a file; file attributes and operations; access methods (sequential, direct, indexed).
8th	1st, 2nd & 3rd	IV	Directory structure and hierarchy; file system mounting; file sharing and basic protection ideas; File-system structure and implementation;
9th	1st, 2nd & 3rd	IV	Directory implementation; free-space management; Efficiency and performance
10th	1st, 2nd & 3rd	IV & V	Different types of file systems (FAT, ext) Unit V-I/O System: Mass storage structure; disk structure and attachment;
11th	1st, 2nd & 3rd	V	Disk scheduling algorithms (FCFS, SSTF, SCAN family – concepts); swap-space management;
12th	1st, 2nd & 3rd	V & VI	RAID types- RAID0, RAID1, RAID5 Unit VI-Dead Locks: Deadlock concept; resources and necessary conditions;
13th	1st, 2nd & 3rd	VI	Deadlock prevention, avoidance; Banker Algorithm, Safety Algorithm, Ostrich algorithm
14th	1st, 2nd & 3rd	VI & VII	Deadlock Detection and Recovery Unit VII- OS Security: authentication, access control,
15th	1st, 2nd & 3rd	VII	access rights, system logs;

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