

GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme		Master of Technology				Branch/Spec.		Electronics and Communication Engineering – Embedded Systems	
Semester		I				Version		1.0.0.0	
Effective from Academic Year			2026-27			Effective for the Batch admitted in			July 2026
Course Code		3ES1103		Course Name		IoT System Design & Protocols			
Teaching Scheme						Examination Scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	1	-	4	Theory	50	50	100
Hours	3	0	2	-	5	Practical	25	25	50
Pre-requisites									
Basics of Embedded Systems, Computer Networks, Wireless Communication, and Programming Fundamentals.									
Course Outcomes									
On successful completion of the course, the students will be able to:									
CO1	Explain IoT architectures, system design methodologies, communication models, and enabling technologies used in modern IoT systems.								
CO2	Design embedded IoT systems using suitable networking technologies, communication protocols, edge computing, and cloud platforms.								
CO3	Evaluate and implement secure IoT communication using lightweight messaging protocols, interoperability standards, and cybersecurity mechanisms.								
CO4	Develop scalable IoT solutions by integrating edge devices, cloud services, real-time data analytics, and industrial IoT deployment practices.								
Theory Syllabus									
Unit	Content								Hrs.
1	IoT System Fundamentals and Architecture: Introduction to IoT, Evolution of IoT, Characteristics of IoT Systems, IoT Ecosystem, Design Principles of IoT Systems, Functional Blocks, Layered Architecture, IoT Reference Architectures, IoT Communication Models, IoT vs M2M, Cyber-Physical Systems (CPS), Digital Twins (Introduction), IoT Design Methodology, Embedded IoT Platforms Overview, Smart Devices, Industrial IoT (IIoT), Consumer IoT, Smart City Applications, Emerging IoT Trends.								8
2	IoT Networking and Connectivity: IoT Networking Requirements, IPv6 for IoT, 6LoWPAN, RPL Routing Protocol, TCP/IP Stack for IoT, Wireless Communication Technologies: Wi-Fi 6/6E, Bluetooth Low Energy (BLE), Zigbee, Thread, Matter, LoRaWAN, NB-IoT, LTE-M, 5G for IoT, Wireless Sensor Networks Overview, Time-Sensitive Networking (TSN) Concepts, IoT Gateways, Network Topologies, Energy-Efficient Networking, QoS Considerations.								8
3	IoT Communication Protocols and Middleware: Client–Server and Publish–Subscribe Models, MQTT 5.0, MQTT Broker Architecture, QoS, Retained Messages, CoAP Protocol, REST APIs, HTTP/HTTPS, WebSockets, AMQP, DDS (Introduction), OPC UA Basics for Industrial IoT, Data Representation: JSON, CBOR,								10

	Protocol Buffers, Message Serialization, IoT Middleware, Device Discovery, Service Discovery, Interoperability Frameworks.	
4	Edge Computing, Cloud Integration and IoT Security: Edge Computing Architecture, Fog Computing, Cloud Computing for IoT, Device-to-Edge and Edge-to-Cloud Communication, Containerized Edge Applications (Docker Basics), Edge AI Fundamentals, Cloud Platforms for IoT, Data Pipelines, Stream Processing, OTA Firmware Updates, Device Lifecycle Management, Identity Management, IoT Security Architecture, Authentication, Authorization, PKI, TLS/DTLS, Secure Boot, Trusted Platform Module (TPM) Concepts, Zero Trust Architecture, Privacy and Data Protection.	10
5	IoT System Design, Deployment and Case Studies: IoT System Design Workflow, Requirement Analysis, Device Provisioning, Scalability, Reliability, Fault Tolerance, Performance Evaluation, Power Optimization Strategies, Real-Time IoT Systems, Industrial IoT Deployment, Smart Manufacturing, Predictive Maintenance, Smart Healthcare, Smart Agriculture, Connected Vehicles, Digital Twin Applications, IoT Testing and Validation, Case Studies, Emerging Trends: TinyML, Edge Intelligence, Federated Learning (Introduction), Sustainable IoT. MINI PROJECT Smart IoT-Based Environmental Monitoring and Automation System	9
Practical Content		
Practical, assignments and tutorials are based on above syllabus.		
Text Books		
1	Switching and finite automata by Zvikhavi and Niraj Jha, 3rd Edition, Cambridge 2010.	
Reference Books		
1	Digital Design - Principles & Practices by J. F. Wakerly. 4 th Edition, Pearson, 2005.	
ICT/MOOCs Reference		
1	https://www.youtube.com/watch?v=fByKuk2VmJc&list=PLE7VH8RC_N3bpVn-e8QzOAHziEgmjQ2qE&index=5	
2	https://www.youtube.com/watch?v=GHUR_GfQQsQ&list=PLE7VH8RC_N3bpVn-e8QzOAHziEgmjQ2qE&index=9	

Mapping of CO with PO and PSO :															
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	3	2	3	2	2	2	3	1	1	1	2
CO2	2	2	2	2	2	3	2	3	3	3	2	2	2	2	1
CO3	3	3	3	3	3	2	2	3	3	2	2	1	1	1	2
CO4	3	1	3	3	2	2	3	1	3	2	2	3	3	3	2