



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: PG

Branch: Artificial Intelligence and Data Science

Subject Code: ME02095101

Course/Subject Name: IoT and Embedded System Architecture

WEF Academic Year	2024-25
Semester	2
Category of the Course	Professional Elective Course

Prerequisite	Basic knowledge of analog and digital electronics, wireless networking, microprocessor, assembly language, C programming.
Rationale:	<ul style="list-style-type: none">• The Internet of Things (IoT) has emerging requirements with different ways of working.• Various kinds of things, architecture, protocols and networks are required to design and develop for new solutions based on IoT.• It is required to impart basic understanding and implementation of various requirements of the IoT based systems to the students.• Wireless sensor network communication required for connecting smart embedded devices.

Course Outcome:

After completion of the Course, Students will be able to:

No	Course Outcomes	RBT Level*
01	Understand the basics of IoT, smart connecting devices and IoT network design	UN
02	Apply communication protocols for IoT and Embedded Networks	AP
03	Implement protocols on real time IoT applications	AP
04	Analyse various IoT systems and embedded technologies	AN
05	Evaluate performance of various IoT and Embedded networks	EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create



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Teaching and Examination Scheme:

Teaching Scheme (in hours)			Total Credits (L+T+PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				ESE (E)	PA/CA (M)	PA/CA (I)	ESE (V)	
03	00	02	04	70	30	20	30	150

Course Content:

Unit	Course Content	No of Hours	% of Weightage
1.	Introduction The genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and OT, IoT Challenges, Embedded System Overview.	4	10
2.	IoT Network Architecture and Design: Drivers behind new network architectures, Comparing IoT architectures, A simplified IoT Architecture, The core IoT functional stack, IoT Data management and compute stack	6	15
3.	Smart Objects and its connectivity: Sensors, Actuators, Micro-electro-mechanical systems (MEMS), smart objects, trends in smart objects, sensor networks, Communication criteria, IoT Access Technologies – IEEE 802.15.4, IEEE 802.15.4g & 802.15.4e, IEEE 802.11ah, LoRaWAN, NB-IoT and other LTE variations	7	20
4.	IP as the IoT Network Layer The business case for IP, The need for optimization, optimizing IP for IoT, Profiles and Compliance, Generic web-based protocols, IoT application layer protocols: CoAP, MQTT	7	15



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5.	Embedded System Architecture ARM processor family, application of ARM processor, the architectural inheritance, the ARM programmer's model, ARM development tools	7	15
6.	Embedded Communication Protocols Embedded Networking: Introduction–Serial / Parallel Communication–Serial communication protocols ,RS232 standard ,RS485,Synchronous Serial Protocols , Serial Peripheral Interface (SPI) ,Inter-Integrated Circuits (I2C) , PCI Bus protocols, CAN protocol	8	15
7.	Recent Trends in IoT Embedded Systems	6	10
TOTAL		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	20	20	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Reference/Suggested Learning Resources:

(a) Books:

1. David Hanes, Gonzelo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Hentry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press, 2017.
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
3. Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands-on- Approach)", 1st Edition, VPT, 2014.
4. Frank Vahid, Givargis 'Embedded Systems Design: A Unified Hardware/Software Introduction', Wiley Publications, 2012.
5. Embedded Systems -Raj Kamal, TMH Gurusamy, PHI, EEE, Latest Edition.



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(b) Open source software and website

- Course-related online MOOCs on NPTEL/SWAYAM platform.
- Recently Published papers/articles in reputed journals.

Suggested Course Practical List:

- The practical work will be carried out based on the content covered during the academic sessions.

List of Laboratory/Learning Resources Required: Programming development environment (open source is encouraged) related to the course content.

Suggested Project List: The subject teacher has to assign the relevant project work to the students in individual/team.

Suggested Activities for Students: The subject teacher has to assign the outcome based activities to the students in individual/team.
