GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3172424

Semester – VII

Subject Name: Internet of Things in Power Electronics Applications

Type of course: Professional Elective Course- IV

Prerequisite:
1. Industrial Automation (3162421)
2. Embedded Systems for Power Electronics (3162417)
3. Microcontrollers Architecture Interfacing and Applications (3152409)

Rationale: Smart devices fueled by the hyperconnected Internet of Things (IoT) are becoming ever more prevalent and pervasive in our personal lives. Sensors are everywhere, and the trend will only continue. Today, sensor-equipped industrial equipment is powered by artificial intelligence (AI). Medical devices can self-diagnose and send alerts to patients and doctors to remotely manage healthcare. Automobiles with in-car connectivity can download new features on the fly. Very soon, refrigerators will plan your dinner and ovens will know how to cook it. In continuation with this, IoT will bring about a major change in power electronics and create a new generation of the power electronics. To enable the IoT assisted Power Electronics, the integration of the sensors, the programmable hardware, and VLSIs for the controller into the power devices/modules is very important. So, for Power Electronics Engineers, concepts of IoT and its use in Power Electronics Applications is necessary.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	8
2	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards	8

	considerations.	
3	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.	8
4	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.	8
5	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	8
6	Implementation of IoT in Power Electronics Applications used for home, industrial and building automation.	5

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	15	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
3. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-44939357-1

Course Outcomes:

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Sr. No.	CO statement **After studying this subject, student will be able to**	Marks % weightage
CO-1	understand the vision of IoT from a global context.	20
CO-2	determine the Market perspective of IoT	20
CO-3	use of Devices, Gateways and Data Management in IoT.	20
CO-4	understand governance, privacy and security issues related to IoT based systems.	20
CO-5	apply knowledge gained for IoT architecture of various automation applications.	20

List of Experiments:

Directions for Laboratory work:

- ✓ The list of experiments is given as a sample.
- ✓ Similar laboratory work fulfilling the objectives can also be considered.
- ✓ As far as possible, **printed manual should be preferred** so that students can concentrate in laboratory experiments and related study. The sample list of experiments is given below.

Suggested List of Experiments and Design Based (DP)/Open Ended Problems:

1. Define and Explain Eclipse IoT Project.
2. List and summarize few Eclipse IoT Projects.
3. Sketch the architecture of IoT Toolkit and explain each entity in brief.
4. Demonstrate a smart object API gateway service reference implementation in IoT toolkit.
5. Write and explain working of an HTTP- to-CoAP semantic mapping proxy in IoT toolkit.
6. Describe gateway-as-a-service deployment in IoT toolkit.
7. Explain application framework and embedded software agents for IoT toolkit.
8. Explain working of Raspberry Pi.
9. Connect Raspberry Pi with your existing system components.
10. Give overview of Zetta.

Major Equipment:

Raspbari Pi kit, Microcontroller kit, Logic analyser, DSO etc.

List of Open-Source Software/learning website:

Learning website:

1. https://github.com/connectIOT/iottoolkit
2. https://www.arduino.cc/
3. http://www.zettajs.org/
4. Contiki (Open source IoT operating system)
5. Arduino (open source IoT project)
6. IoT Toolkit (smart object API gateway service reference implementation)

7. Zetta (Based on Node.js, Zetta can create IoT servers that link to various devices and sensors)
8. https://nptel.ac.in/courses/106/105/106105166/
9. https://nptel.ac.in/courses/108/108/108108098/
10. https://nptel.ac.in/courses/106/105/106105195/
11. https://www.edx.org/learn/iot-internet-of-things
12. https://www.coursera.org/learn/introduction-iot-boards