2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech.		
Code: B6901	Internet of Things Fundamentals (Open Elective)	L	T	P
Credits: 3		3	-	-

Pre-requisite of course: Nil

Objective: In this course, student will explore various components of Internet of things such as Sensors, internetworking and cyber space. In the end they will also be able to design and implement IoT circuits and solutions.

Course Outcomes: After successful completion of this course, student will be able to
- Understand general concepts of Internet of Things (IoT) (Understand)
- Recognize various devices, sensors and applications (Knowledge)
- Apply design concept to IoT solutions (Apply)
- Analyze various M2M and IoT architectures (Analyze)
- Evaluate design issues in IoT applications (Evaluate)
- Create IoT solutions using sensors, actuators and Devices (Create)

Module I: Introduction to IoT   **[9 Periods]**
Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

Module II: M2M to IoT   **[10 Periods]**
The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT.

Module III: M2M vs IoT An Architectural Overview   **[10 Periods]**
A: Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.
B: Reference Architecture and Reference Model of IoT

Module IV: IoT Reference Architecture   **[10 Periods]**
Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world- Introduction, Technical design Constraints.
Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT application.

Module V: Developing IoT solutions: **[9 Periods]**
Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.

Text Books:
1. Jan Holler, Vlasios Tsiatsis, 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.
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", 1st Edition, VPT, 2014
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
4. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1

Reference Books:
1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2			3				2		3	3	3	
CO2	3	3	3			3				3		3	3	3	
CO3	3	3	3			2				3		2	3	3	
CO4	3	2	1			1				1		1			
CO5	3	1	1			1						1			

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech		
Code:B6904	**APPLICATIONS OF IoT** (Open Elective)	L	T	P
Credits: 3		3	-	-

Course Objectives:
- Explain the definition and usage of the term "The Internet of Things" in different contexts.
- Understand where the IoT concept fits within the broader ICT industry and possible future trends
- Appreciate the role of big data, cloud computing and data analytics in a typical IoT system.
- Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack.
- Design a simple IoT system comprising sensors, edge devices, wireless network connections and data analytics capabilities.
- Use the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis.

MODULE 1: INTRODUCTION TO INTERNET OF THINGS

The technology of the internet of things, making the internet of things, Elements of an IoT ecosystem, design principles for connected devices, Web thinking for connected devices.

MODULE 2: IoT Deviccs

IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Connecting Raspberry Pi via SSH. Linux on Raspberry Pi, Raspberry Pi Interfaces, Other IoT devices.

MODULE 3: Python with Raspberry pi

Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operate the Raspberry Pi in "headless mode", Bash Command line, operating Raspberry Pi without needing a GUI interface, Basics of the Python programming language, programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow, Programming RaspberryPi with Python,

MODULE 4: M2M and IoT Technology Fundamentals

Devices and gateways , Local and wide area networking , Data management , Business processes in IoT security, Steps towards a Secure Platform, Privacy-Preserving sharing of IOT Data, Secure Authentication and Access Control in Constrained Devices, Smarties Approach.

MODULE 5: IoT Applications

IoT Applications — IoT applications in home, infrastructures, buildings, Industries, Home appliances, other IoT electronic equipments, Industry 4.0 concepts. Value Creation for Industry, Value Creation and Challenges, The Smart Factory Initiative, Cost-effective Process Integration of IoT Devices, IoT for Retailing Industry.

TEXT BOOKS

1. Ovidiu Vermesan, Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems" River Publishers, 2013.
2. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", January 2012, McGraw Hill Professional.
3. Adrian McEwen,Hakim Cassimally "Designing the Internet of Things", John Wiley & Sons, 2014.
4. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014.

REFERENCE BOOKS

1. Qusay F. Hassan, "Internet of Things A to Z: Technologies and Applications", John Wiley & Sons,2018.
2. Alessandro Bassi, Martin Bauer, "Enabling Things to Talk: Designing IoT solutions with the IoT Architectural Reference Model", Springer, 2013.
3. Eben Upton and Gareth Halfacree, "Raspberry Pi User Guide", August 2016, 4th edition, John Wiley & Sons.
4. Joe Biron and Jonathan Follett "Foundational Elements of an IoT Solution: The Edge, The Cloud,and Application Development", First Edition. Cisco Press, 2017.
5.

E BOOKS

1. https://www.worldcat.org/title/internet-of-things/oclc/896359016&referer=brief_results

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COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3										2	2		
CO2	2	2										2	2		
CO3	2	2										2		2	
CO4	3	2						2				2		2	
CO5	3	2										2	2		

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech.		
Code: B6908	**IOT CLOUD AND DATA NALYTICS** (Open Elective)	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Nil
Course Objectives:
> The objective the course is to get familiar with knowledge of IoT, Cloud computing for IoT, application of various data visualizing, processing methodologies and machine learning algorithms for IoT data. To get hands on various data visualization tools to visualize IoT cloud data.

MODULE 1: INTRODUCTION TO IoT
Introduction to Internet of Things (IoT)- Concepts and definitions of IoT-History of IoT –IoT data vs big data- IoT Analytics lifecycle and Techniques-IoT complete Technology chain- Applications of IoT-Opportunities and challenges in IoT.

MODULE 2: IoT and CLOUD
Cloud computing – Cloud service models – Cloud Deployment models – Need of cloud computing for IoT-Fog computing Vs Cloud Computing for IoT-IoT Cloud Platforms –Microsoft Azure IoT-Amazon Web Services IoT-IBM WATSON IoT-Google's cloud IoT.

MODULE 3: IOT AND MACHINE LEARNING
Principles and foundation of Artificial intelligence and IoT – Machine Learning Paradigms for IoT – Supervised learning for IoT-Linear regression-Logistic regression-SVM – Decision Tree -Naïve's bayes- Deep Learning for IoT-Neural Network.

MODULE 4: DATA ANALYTICS FOR IoT
Defining IoT Analytics - IoT Analytics challenges – IoT analytics for the cloud-Microsoft Azure overview– Designing data processing for analytics – Designing visual analysis for IoT data-Data science for IoT-Feature engineering with IoT data.

MODULE 5:IoT SECURITY
Overview of IoT Security- security Threats in IoT- APIs in IoT-Authentication in IoT-Strategies for securing IoT-Public Key Cryptography.

TEXT BOOKS
1. Rajkumar Buyya, Amir Vahid Dastjerdi," Internet of Things: Principles and Paradigms",Elsevier,2016.
2. R. Chandrasekaran," Essentials of Cloud computing", 2nd Edition, Chapman and Hall/CRC, 2015.
3. Amita Kapoor, "Hands on Artificial intelligence for IoT", 1st Edition, Packt Publishing, 2019.
4. David Etter," IoT Security: Practical Guide Book", CreateSpace Independent Publishing Platform, 2016.

REFERENCE BOOKS
1. John Soldatos, "Building Blocks for IoT Analytics", River Publishers,2016.
2. John E. Rossman, "The Amazon way on IoT", Volume 2, John E. Rossman publication, 2016.

E-BOOKS
1. http://index-of.co.uk/Cloud-Computing-books/Essentials%20of%20cloud%20computing%20(2015).pdf

2. https://www.iottechexpo.com/2018/11/iot/the-iot-analytics-lifecycle-from-generating-data-to-predicting-the-future-losant/

Online Resources
1. **https://www.coursera.org/learn/cloud-iot-platform**

2. **https://www.udemy.com/course/iothacking1/**

COURSE OUTCOMES

1. Demonstrate the working of IoT
2. Identify the need of cloud computing for IoT
3. Apply Machine Learning Algorithms for IoT data
4. Predict and visualize output using Data Analytic tools
5. Identify the Vulnerability in connected networks

COs	CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														

COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO1	PSO2	PSO3
CO1	2		1									2	1		2
CO2	3	2										2	2		
CO3	2														
CO4	3	1	1										1		
CO5	2	2	1										1		

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech.		
Code: B6915	EDGE ANALYTICS (Open Elective)	L	T	P
Credits: 3		3	-	-

Prerequisites
- Nil

Course Objectives
1. The aim of the course is to introduce the fundamentals of Edge Analytics.
2. The course gives an overview of – Architectures, Components, Communication Protocols andtools used for Edge Analytics.

Course Outcomes
1. Understand the concepts of Edge Analytics, both in theory and in practical application.
2. Demonstrate a comprehensive understanding of different tools used at edge analytics.
3. Formulate, Design and Implement the solutions for real world edge analytics .

UNIT - I
Introduction to Edge Analytics
What is edge analytics, Applying and comparing architectures, Key benefits of edge analytics, Edge analytics architectures, Using edge analytics in the real world.

UNIT - II
Basic edge analytics components, Connecting a sensor to the ESP-12F microcontroller, KOM-MICS smart factory platform, Communications protocols used in edge analytics, Wi-Fi communication for edge analytics, Bluetooth for edge analytics communication, Cellular technologies for edge analytics communication, Long-distance communication using LoRa and Signfox for edge analytics.

UNIT - III
Working with Microsoft Azure IoT Hub, Cloud Service providers, Microsoft Azure, Exploring the Azure portal, Azure ioT Hub, Using the Raspberry Pi with Azure IoT edge, Connecting our Raspberry Pi edgedevice, adding a simulated temperature sensor to our edge device.

UNIT - IV
Using Micropython for Edge Analytics, Understanding Micropython, Exploring the hardware that runs MicroPython, Using MicroPython for an edge analytics application, Using edge intelligence with microcontrollers, Azure Machine Learning designer, Azure IoT edge custom vision.

UNIT - V
Designing a Smart Doorbell with Visual Recognition setting up the environment, Writing the edge code, creating the Node-RED dashboard, Types of attacks against our edge analytics applications, Protectingour edge analytics applications

TEXT BOOK:

1. Hands-On Edge Analytics with Azure IoT: Design and develop IoT applications with edge analytical solutions including Azure IoT Edge by Colin Dow

REFERENCES:

1. Learn Edge Analytics - Fundamentals of Edge Analytics: Automated analytics at source usingMicrosoft Azure by Ashish Mahajan

<table>
<tr><td colspan="16">CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
<tr><td rowspan="2">COs</td><td colspan="12">Programme Outcomes(POs)</td><td colspan="3">PSOs</td></tr>
<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>PO9</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td><td>PSO3</td></tr>
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