R V R & J C COLLEGE OF ENGINEERING (Autonomous), CHOWDAVARAM, GUNTUR-19

B.Tech., Computer Science & Engineering (IoT)

Courses offered for Minor in Computer Science & Engineering (IoT)
(Offered for ChE / CE / ECE / EEE / ME branch students)

(w.e.f. the academic year 2021-2022)

CO MR1	Introduction to Internet of Things	L	P	C
		3	0	4

Course Objectives:

1. LO-1: To understand the basics of Internet of Things
2. LO-2: To impart knowledge of components of Internet of Things
3. LO-3: To understand the concepts of Embedded Systems
4. LO-4: To develop skills required to build real-life IoT based projects

Course Outcomes:

1. CO-1: Establish knowledge in a concise manner how the Internet of things work
2. CO-2: Illustrate various sensors and actuators for IoT system
3. CO-3: Identify and interpret design methodology of IoT platform
4. CO-4: Exhibit the knowledge of interfacing I/O devices with embedded board-RaspberryPi

COURSE CONTENT:

UNIT I [CO1, CO2, CO3] [12 Periods]

Introduction to IoT: IoT definition, Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Logical Design of IoT: IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, Enabling Technologies for IoT, IoT Levels & Deployment Templates

IoT Design Methodology: Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device & Component Integration, Application Development, Challenges in IoT Design, IoT System Management, IoT Servers.

UNIT II [CO1, CO2] [12 Periods]

Sensors and Actuators: Sensing devices, A/D-D/A Converters, Actuators, Sensors Classification, Working Principles of Sensors, Criteria to Choose a Sensor.
Smart IoT Endpoints: Vision system, Sensor fusion, I/O devices, Energy Sources and power management: Energy Harvesting, Energy Storage.

UNIT III [CO3, CO4] [12 Periods]

Embedded System Concepts: Embedded System, Applications and characteristics of Embedded Systems, Overview of Processors and Hardware units in an Embedded System, Embedded Software into -a system, Embedded System Design, Embedded System Architecture

Arduino : Introduction to Arduino, Arduino IDE, Basic Commands for Arduino, LCD Commands, Serial Communication Commands.

UNIT IV [CO3, CO4] [12 Periods]

Raspberry Pi: Introduction to Raspberry Pi, Getting Started with Raspberry pi, working with - Hardware, Software, Operating System, Programming and Interfacing, Comparison of single board mini-computers.

Domain Specific IoT Applications: Introduction, home automation, cities, environment, energy, retail, logistics, agriculture, industry, Health and Life style. Design Methodology for Home Automation and Weather Monitoring.

TEXT BOOKS:

1. Internet of Things, “A Hands on Approach”, by Vijay Madisetti, Arshdeep Bahga, University Press
2. “Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security”, by Perry Lea, Packt Publishing Ltd., 2018
3. Internet of Things with Raspberry Pi and Arduino. Boca Raton, by Singh, R., Gehlot, A., Gupta, L., Singh, B., Swain, M, CRC Press, 2020
4. Embedded Systems - SoC, IoT, AI and Real-Time Systems, 4th Edition Kindle Edition by Raj Kamal

REFERENCES:

1. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, by Pethuru Raj and Anupama C. Raman (CRC Press)
2. Getting Started with Arduino, by Massimo Banzi, 1st Edition, February 2009, O'Reilly Media, Inc
3. Arduino Cookbook, by Michael Margolis, 1st Edition, O'Reilly Media, Inc, Mar, 2011
4. Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, by Derek Molloy, Wiley

CO MR2	IOT Architecture and Protocols	L	P	C
		3	0	4

Course Objectives:

1. LO-1: IoT network architecture, design, connectivity technologies
2. LO-2: interoperability between systems, IoT connectivity technologies
3. LO-3: communication technologies, infrastructure protocols, discovery protocols in IoT
4. LO-4: data protocols, identification protocols, device management, semantic protocols in IoT

Course Outcomes:

1. CO-1: examine various IoT network architectures and connectivity technologies
2. CO-2: inspect various interoperable IoT protocols for wireless devices
3. CO-3: analyze infrastructure and discovery protocols for IoT
4. CO-4: interpret protocols to track, monitor and manage IoT devices

COURSE CONTENT:

UNIT I [CO1, CO2, CO3] [12 Periods]

IoT Network Architecture and Design: Drivers behind New Network Architectures, The OneM2M IoT Standardized Architecture, The IoT World Forum (IoTWF) Standardized Architecture, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack

IoT Connectivity Technologies: Introduction, IEEE 802.15.4- 802.15 standards, Architecture, Topology, Addressing Modes and Packet Structure, Security, Zigbee-Overview, PHY and MAC Layer, Protocol Stack, Addressing Modes and Packet Structure, Topology, Security; Z-Wave-Overview, Protocol Stack, Addressing, Topology and Routing.

UNIT II [CO2, CO3] [12 Periods]

IoT Connectivity Technologies: LoRa-Introduction, Physical Layer, MAC Layer and Topology, Physical Layer, MAC Layer, Protocol Stack and Topology, Thread, ISA100.11A, Wireless HART, RFID, NFC, DASH7, Weightless, NB-IoT, Wi-Fi, Bluetooth

UNIT III [CO1, CO2, CO3] [12 Periods]

IoT Communication Technologies: Introduction Constrained Nodes, Constrained Networks, Types of Constrained Devices, Low Power and Lossy Networks
Infrastructure Protocols: Internet Protocol Version 6 (IPv6), LOADIng, RPL, 6LoWPAN, QUIC, Micro Internet Protocol (uIP), Nano Internet Protocol (nanoIP), Content-centric networking (CCN)
Discovery Protocols:Physical Web, Multicast DNS (mDNS), Universal Plug and Play (UPnP)

UNIT IV [CO1, CO4] [12 Periods]

Data Protocols: MQTT-Publish-Subscribe, Architecture, Packet Structure and Communication Format MQTT-SN-Architecture, Topology, Transparent and Aggregating Gateways, Gateway advertisement and Discovery, COAP-Architecture, Message Formats, Usage Example; AMQP, XMPP, SOAT, REST, Websocket

Identification Protocols: EPC, uCode, URIs

Device Management: TR-069, OMA-DM

Semantic Protocols: JSON-LD, Web Thing Model

Learning Resources:
Text Book:

1. M.MorrisMano, Digital Design, 3rdEdition, PearsonEducation, 2009

ReferenceBooks:

1. Z.Kohavi-SwitchingandFiniteAutomataTheory,2nd Edition TataMcGrawHill.
2. R.P.Jain-Modern digitalelectronics,4thEdition, McGrawHill.

CO MR3	IoT Cloud and Data Analytics	L	P	C
		3	0	4

Course Objectives:

1. LO-1: To understand the basics of Internet of Things
2. LO-2: To impart knowledge of components of Internet of Things
3. LO-3: To understand the concepts of Embedded Systems
4. LO-4: To develop skills required to build real-life IoT based projects

Course Outcomes:

1. CO-1: Identify the need of cloud computing for IoT
2. CO-2: Apply Machine Learning Algorithms for IoT data
3. CO-3: Predict and visualize output using Data Analytics
4. CO-4: Identify the Vulnerability in connected networks

COURSE CONTENT:

UNIT I [CO1] [12 Periods]

Introduction to Internet of Things(IoT): Concepts and definitions of IoT, History of IoT, IoT data vs big data, IoT Analytics life cycle and Techniques, IoT Complete Technology Chain, Applications of IoT, Opportunities and challenges in IoT.
Colud computing: cloud services models, cloud Deployment models, Need of cloud computing for IoT, Fog computing Vs cloud computing for IoT.

UNIT II [CO2, CO3] [12 Periods]

IoT Cloud Platforms: Microsoft Azure IoT, Amazon Webs Services IoT, IBM WATSON IoT, Google's cloud IoT, 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.

UNIT III [CO2, CO3, CO4] [12 Periods]

Defining IoT Analytics: IoT Analytics challenges, IoT analytics for the cloud, Microsoft Azure overview, Designing data processing for analytics, Designing visual analytics for IoT data, Data Science for IoT, Feature engineering with IoT data.

UNIT IV [CO4] [12 Periods]

Overview of IoT security: Threats in IoT, API's in IoT, Authentication in IoT, Strategies for securing IoT, Public key Cryptography.

TEXT BOOKS:

1. Internet of Things, "A Hands on Approach", by Vijay Madisetti, Arshdeep Bahga, University Press
2. "Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security", by Perry Lea, Packt Publishing Ltd., 2018
3. Internet of Things with Raspberry Pi and Arduino. Boca Raton, by Singh, R., Gehlot, A., Gupta, L., Singh, B., Swain, M, CRC Press, 2020
4. Embedded Systems - SoC, IoT, AI and Real-Time Systems, 4th Edition Kindle Edition by Raj Kamal

REFERENCES:

1. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, by Pethuru Raj and Anupama C. Raman (CRC Press)
2. Getting Started with Arduino, by Massimo Banzi, 1st Edition, February 2009, O'Reilly Media, Inc
3. Arduino Cookbook, by Michael Margolis, 1st Edition, O'Reilly Media, Inc, Mar, 2011
4. Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, by Derek Molloy, Wiley

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R. V. R. & J. C. COLLGE OF ENGINERING (**AUTONOMOUS**)

COMR4 SMART SENSOR TECHNOLOGIES

B.Tech. IV Year I Sem. L T P C

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Course Objectives: Obtain knowledge on sensors, sensors with microcontrollers and their applications.

Course Outcomes:

1. Analyze the sensors available in IoT based on application requirements and the Sensing methods.
2. Create a Real-time application by choosing appropriate sensors for temperature monitoring.
3. Interfacing different types of Sensors with MCU.
4. Infer Wireless Sensing, RF Sensing and RF MEMS.
5. Design a real-time application for landslide monitoring and hazard mitigation.

UNIT - I: CO1

Basics of Sensors: Introduction- Sensor Vs Transducer, Nature of Sensors, Sensor Output Characteristics, Sensing Technologies, Digital Output Sensors. **(10H)**

UNIT - II: CO2

Application Specific Sensors: Occupancy and motion detectors: ultrasonic – microwave – capacitive detectors- optical presence sensor, Light Detectors: Photo diodes – phototransistor – photo resistor CCD and CMOS image sensors, Temperature Sensors: thermos-resistive sensors – thermoelectric contact sensor**.** **(15H)**

UNIT - III: CO3

Sensor with Microcontroller: Introduction, Amplification and Signal Conditioning, Integrated Signal Conditioning, Digital Conversion, MCU Control, MCUs for Sensor Interface, Techniques and Systems Considerations, Sensor Integration. **(12H)**

UNIT - IV: CO4, CO5

Wireless Sensing: Wireless Data and Communications, Wireless Sensing Networks, Industrial Wireless Sensing Networks, RF Sensing, Telemetry, RF MEMS, Complete System Consideration. Smart Applications and System Requirements: Automotive Applications, Industrial (Robotic) Applications, Consumer Applications, Future Sensor Plus Semiconductor Capabilities, Future System Requirements. **(15H)**

TEXT BOOKS:

1. Frank, Randy, “Understanding smart sensors”, Artech House integrated microsystems series, 3rd Edition, 2013.

2. Jacob Fraden, “Handbook of Modern Sensors: Physics, Designs, and Applications”, 5th Edition, Springer, 2016.

REFERENCE BOOKS:

1. Vlasios Tsiatsis, Stamatis Karnouskos, Jan Holler, David Boyle, Catherine Mulligan, "Internet of Things: Technologies and Applications for a New Age of Intelligence", Academic Press, 16- Nov- 2018.

2. Henry Leung, Subhas Chandra Mukhopadhyay, "Intelligent Environmental Sensing", Springer, 22-Jan-2015.

E-BOOKS

1. https://www.sciencedirect.com/topics/engineering/smart-sensors

2. https://www.azosensors.com/article.aspx?ArticleID=1289