R19

Department of Electronics and Communications Engineering

Offers

B. Tech.
(Minor Program - IoT)

VIGNANA BHARATHI INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)
Aushapur (V), Ghatkesar (M), Medchal Dist., Hyderabad, Telangana-501301

B.Tech. (Minor)

Offered by

Department
of
ELECTRONICS & COMMUNICATION ENGINEERING

R19 - COURSE STRUCTURE & SYLLABUS

III YEAR I-SEMESTER

S. No	Course Code	Course Title	Mode of Learning	Credits
1	19MIO31T1	Introduction to IOT and Applications	conventional	3
2	19MIO31L1	IOT lab		1.5

III YEAR II-SEMESTER

S. No	Course Code	Course Title	Mode of Learning	Credits
1	19MIO32T1	Sensor Technologies	conventional	3
2	19MIO32T2	Smart Technologies	conventional	3

IV YEAR I- SEMESTER

S. No	Course Code	Course Title	Mode of Learning	Credits
1	19MIO41T1	Programming language for IOT	conventional	3
2	19MIO41L1	IOT Automation with Rasberry PI lab	conventional	1.5

IV YEAR II-SEMESTER

S. No	Course Code	Course Title	Mode of Learning	Credits
1	19MIO42T1	Fog and Edge Computing for IOT	conventional	3

19MIO31T1: Introduction to Internet of Things and Applications

B.Tech (IOT). III Year I Sem.

L	T	P	C
3	0	0	3

UNIT I

Introduction, IoT Components, Characteristics of IoT, IoT technologies, Issues and Challenges of IoT, IoT Architecture, IoT Impact, IoT Network Architecture and Design, The Core IoT Functional Stack

UNIT II

M2M to IoT an architectural overview, IoT reference model, main design principles and need capability, Physical Design of IoT – IoT Protocols, IoT communication models, Domain Specific IoT, IoT applications– Home, City, Environment, Energy, Retail, Agriculture, Industry, health

UNIT III

IoT -Logical Design using Python, Introduction, Installing Python, Python Data types and data Structures, Control Flow, Python Modules, Functions, Packages, File Handling, Data and Time operations. Classes, Python Packages of Interest for IoT.

UNIT IV

IoT Physical Devices and End Points What is an IoT Device?, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Other IoT Devices.

UNIT V

IoT Physical Servers and Cloud Based Services, Types of Cloud Computing, Software as a service(Saas), Platform as a service (PaaS), Infrastructure as a service (IaaS), Anything as a service(XaaS) , Virtualization In Cloud Computing and Types, Virtualization benefits , Issues in Cloud Computing, Characteristics of Cloud Computing.

TEXT BOOKS

1. Arshdeep Bahga and Vijai Madisetti, A Hands-on Approach Internet of Things, Universities Press, 2015.

2. Gastón C. Hillar, Internet of Things with Python, Packt Publishing Ltd.

REFERENCE BOOKS

1. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by Francis daCosta, ISBN: 978-1-4302-5740-0, 2013

2. Architecting the Internet of Things, by Dieter Uckelmann, Mark Harrison and Florian Michahelles, ISBN: 978-3-642-19157-2, 2011.

19MIO31L1: Internet of Things Lab

B.Tech (IOT). III Year I Sem. **L T P C**
3 0 0 3

List of Experiments

1. Getting started with IoT (Arduino)

2. Getting started with IoT (Raspberry Pi)

3. Write an Arduino sketch to blink LED light for a particular interval of time

4. Write an Arduino sketch to measure the distance of a certain object.

5. Write an program to send the humidity and temperature data to cloud (Think Speak)

6. Write a program to alert the user through SMS and email notification if humidity is greater than a threshold value using Think speak cloud.

7. Connect a PIR sensor to GPIO pins of raspberry Pi performance measurement determine the range of the sensor.

8. Write a python program for random (Error) data deletion in data set

9. Write a python program for client server communication

10. Write program to blink LED light using raspberry Pi

19MIO32T1: Sensor Technologies

B.Tech (IOT). III Year II Sem. **L T P C**
3 0 0 3

Course Objectives:

1. To identify and expose the students to the central elements in the design of communication Protocols for the WSNs.
2. To disseminate the design knowledge in analyzing the specific requirements for applications in WSNs
3. To get the perception of sensor networks, design and implementation issues, and solutions.
4. To associate, hardware platforms and software frameworks used to realize Sensor network
5. To learn about Tiny OS for WSN and IoT

Course Outcomes:

1. Assess the applicability and limitations of communication protocols for a real time WSN application.
2. Confirms the behavior of mobile ad hoc networks (MANETs) and correlates the infrastructure based networks.
3. Proactive in understating the routing protocols function and their implications
4. Able to establish networks with an attempt to reduce issue of broadcast and flooding techniques.
5. Familiarize the protocol, design requirements, suitable algorithm to meet the industrial requirement.

Unit 1:

Network for embedded systems: RS232, RS485, SPI, I2C, CAN, LIN, FLEXRAY.
Embedded wireless communication and Protocols: Bluetooth, Zigbee, Wi-Fi, Wireless LAN and PAN.

Unit 2:

Wireless sensor network (WSN): Characteristic of Sensor Networks, Sensor node architecture, Physical layer and Transceiver design considerations in, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, and Antenna considerations.

Unit 3:

WSN (Medium access control): Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts, Contention Based protocols, Schedule-based protocols - SMAC – BMAC, Traffic-adaptive medium access protocol (TRAMA), The IEEE 802.15.4 MAC protocol.

Unit 4:

Sensor Network Architecture: Data Dissemination, Flooding and Gossiping-Data gathering Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles for WSNs- Gateway Concepts, Need for gateway, Internet Communication, WSN Tunnelin

Unit 5:

IP based WSN: Circuit switching, packet switching, concept of IPV4, IPV6, 6LOWPAN and IP, IP based WSN, 6LOWPAN based WSN.

Tiny OS: Tiny OS for WSN and IoT, M2M communication.

Text Books:

1. Holger Karl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks” 2011, 1st ed., John Wiley & Sons, New Jersey.

2 Jun Zheng, Abbas Jamalipour, “Wireless Sensor Networks: A Networking Perspective”, 2014, 1st ed., Wiley-IEEE Press, USA.

Reference Books:

1. Waltenegus W. Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", 2014, 1st ed., John Wiley & Sons, New Jersey.

2 Ian F. Akyildiz, Mehmet Can Vuran, "Wireless Sensor Networks", 2011, 1st ed., John Wiley & Sons, New Jersey.

3 Zach Shelby, Carsten Bormann, "6LoWPAN: The Wireless Embedded Internet", 2009, 1st ed., John Wiley & Sons, New Jersey

19MIO32T2: SMART TECHNOLOGIES

L	T	P	C
3	0	0	3

Course Objectives:

1. Provides a detailed description of the integral aspects of 'smart technologies' and their evolution to their current state.
2. Discusses the potential use of Internet of things (IoT) in reducing counterproductive work behaviours and identifying some of the challenges that organizations might face while implementing IoT in its systems.
3. Presents case studies using easy-to-understand language to explain the breadth and scope of application areas.

UNIT – I

Smart Technologies—Scope and Applications, Cutting-Edge Digitization Challenges in Vehicle Cyber- Physical Systems and Cyber security, Big Data Analytics as an Enabler in Smart Governance for the Future Smart Cities

UNIT – II

Digital Masters: Blueprinting Digital Transformation, UAVs/Drones-Based IoT Services, Role of Cyber Security in Drone Technology

UNIT – III

Bitcoins as an Implementation of Blockchain and Its Convergence with Internet of Things, Tomorrow's AI-Enabled Banking, Exploring Connected Cars

UNIT – IV

Vehicular Cyber security Through Intrusion Detection and Prevention Architecture, Mechanism Protecting Vehicle-to-Vehicle Communication, Advanced Driver Assistance Systems

UNIT – V

Cyber care—Role of Cyber Security in Healthcare Industry, Smart Agriculture: A Tango Between Modern IoT-Based Technologies and Traditional Agriculture Techniques, Importance of Being 'NICE' While Developing IoT-Based Smart Farming Solutions: A Case Study About 'NICE' Labs

TEXT BOOK:

1. Smart Technologies-Scope and Applications by K. B. Akhilesh, Dietmar P. F. Möller, Springer publications, 2020

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R19-COURSE STRUCTURE & SYLLABUS

IV Year(Sem I & Sem II)

19MIO41T1: PROGRAMMING LANGUAGES FOR IOT

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Course Objectives:

1. This program aims to train students to be equipped with a solid theoretical foundation, systematic professional knowledge and strong practical skills in the Raspberry Pi.
2. The course focuses on higher-level operating systems, advanced networking, user interfaces, multimedia and uses more computing intensive IoT applications as examples using Raspberry Pi running Linux as the platform of choice

Course Outcomes:

1. Appreciate the development technology for IoT
2. Familiar with Basic Concepts of Linux
3. Design real time IoT Devices and Familiar with basic foundations of Python Programming and libraries
4. Comprehend the basic concepts of Mobile Cloud Computing

UNIT – I

Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, implications of an operating system on the behavior of the Raspberry Pi as an IoT device, booting Raspberry Pi 3, Downloading an Operating System, format an SD card and booting the OS, Basics of Linux and its use, main features including navigating the file system and managing processes, text based user interface through the shell, overview of the graphic user interface for Raspian Linux distribution.

UNIT – II

Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operates 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.

UNIT – III

Communication with devices through the pins of the Raspberry Pi, RPi.GPIO library, Python Functions, setting up the pins, General purpose IO Pins, Protocol Pins, GPIO Access, applying digital voltages, and generating Pulse Width Modulated signals, Tkinter Python library, accessing pins through a graphic user interface

UNIT – IV

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs. Web Server – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API. Connecting to APIs

UNIT - V

IoT Design using Raspberry Pi IoT Applications based on Pi, LAMP Web-server, GPIO Control over Web Browser, Creating Custom Web Page for LAMP, Communicating data using on-board module, Home automation using Pi, Node-RED, MQTT Protocol, Using Node-RED Visual Editor on Rpi

TEXT BOOKS:

1. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", January 2012, McGraw Hill Professional.
2. Raspberry Pi with Java: Programming the Internet of Things (IoT) (Oracle Press) 1st Edition.
3. The official raspberry Pi Projects Book, https://www.raspberrypi.org/magpiissues/Projects_Book_v1.pdf

REFERENCE BOOKS:

1. Eben Upton and Gareth Halfacree, "Raspberry Pi User Guide", August 2016, 4th edition, John Wiley & Sons.
2. Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", Feb 2014, JohnWiley & Sons.
3. Michael Margolis, "Arduino Cookbook", First Edition, March 2011, O'Reilly Media, Inc.

19MIO41L1: IOT AUTOMATION WITH RASPBERRY PI LAB

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Course Objectives:

1. To introduce the raspberry PI platform, that is widely used in IoT applications

2. To introduce the implementation of distance sensor on IoT devices

Course Outcomes

1. Ability to introduce the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor

2. Get the skill to program using python scripting language which is used in many IoT devices

List of Experiments:

Using Raspberry Pi

1. Calculate the distance using a distance sensor

2. Basic LED functionality

3. Calculate temperature using a temperature sensor

4. Build an alarmed motion sensor

5. Make printer wireless

6. Add a power button to Raspberry pi

7. Build a network game server

8. Make music with sony Pi

9. Interface Pi Camera module with Raspberry Pi

10. Installing OS on Raspberry Pi

a) Installation using Pilmager

b) Installation using image File

19MIO42T1: Fog and Edge Computing for IOT

B.Tech (IOT): IV Year II Sem.

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UNITI

Introduction to Edge Computing**:** Scenario's and Use cases-Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models-Edge, Fog andM2M. Introduction to Fog Computing: Fog Computing, Characteristics, Application Scenarios, Issues and challenges. Fog Computing Architecture**:** Communication and Network Model, Programming Models, Fog Architecture for smart cities, health care and vehicles. Fog Computing Communication Technologies**:** Introduction, IEEE802.11, 4G, 5Gstandards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.

UNITII

IoT Architecture and Core IoT Modules-A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edgearchitecture, Role of an architect, Understanding Implementations with examples-Example usecase and deployment, Case study-Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

UNITIII

Fog computing requirements when applied to IoT: Scalability, Interoperability, Fog-IoT architectural model, Challengeson IoT Stack Model via TCP/IP architecture, Data Management, filtering event Management, Device Management, cloudification, virtualization, security and privacy issues. Integrating IoT, Fog, cloud Infrastructures: Methodology, integrated C2F2TLiterature by modeling technique by use –case Scenario, Integrated C2F2TLiterature by metrics

UNITIV

Implementation of Microcomputer Raspberry Pi and device Interfacing, Edge to Cloud Protocols-Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT datatypes, MQTT communication formats, MQTT3.1.1 working example. Exploiting Fog Computing in Health Monitoring: An Architecture of a Health Monitoring IoT-Based System with Fog Computing, Fog Computing Services in Smart E-Health Gateways, Discussion of Connected Components.

UNITV

Edge computing with Raspberry Pi, Industrial and Commercial IoT and Edge, Edge computing and solutions. Software Defined Networking and application in Fog Computing: Open Flow Protocol, Open Flow Switch, SDN in Fog Computing, Home Network using SDN.

TEXTBOOKS

1. IoTandEdgeComputingforArchitects-SecondEdition,byPerryLea,Publisher:PacktPublishing,2020, ISBN: 9781839214806
2. RaspberryPi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322.

REFERENCES

1. Fogand Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019, ISBN: 9781119524984.
2. DavidJensen,"BeginningAzureIoT**EdgeComputing**:ExtendingtheCloudtotheIntelligent **Edge**, MICRO SOFTAZURE