VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD
B.TECH. MINOR IN INTENET OF THINGS

TENTATIVE COURSE STRUCTURE AND SYLLABUS
(Applicable from the academic year 2021-2022)

V SEMESTER (III YEAR I SEMESTER)   **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19MC1IN01	Programming in Python	3	0	0	3	3
19MC2IN01	Programming in Python Laboratory	0	0	3	3	1.5
	Total	**3**	**0**	**3**	**6**	**4.5**

VI SEMESTER (III YEAR II SEMESTER)   **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19MC1IN02	IoT Fundamentals and Architecture	3	0	0	3	3
19MC1IN03	Smart Technologies	3	0	0	3	3
	Total	**6**	**0**	**0**	**6**	**6**

VII SEMESTER (IV YEAR I SEMESTER)   **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19MC1IN04	Programming Languages for IoT	3	0	0	3	3
19MC2IN02	IoT Automation using Raspberry-PI Laboratory	0	0	3	3	1.5
	Total	**3**	**0**	**3**	**6**	**4.5**

VIII SEMESTER (IV YEAR II SEMESTER)   **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19MC1IN05	Fog and Edge Computing for IoT	3	0	0	3	3
	Total	**3**	**0**	**0**	**3**	**3**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. Minor (IOT) V Semester	L	T/P/D	C
	3	0	3

(19MC1IN01) PROGRAMMING IN PYTHON

COURSE OBJECTIVES:
- To understand Regular expressions in Python
- To implement Object Oriented Programming concepts in Python
- To build Web Services and introduction to Network and Database Programming in Python
- To design and learn to create Web widgets using GUI and work with data structures

COURSE OUTCOMES: After completion of course, the students should be able to
CO-1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions
CO-2: Interpret the concepts of Object-Oriented Programming as used in Python and demonstrate proficiency in handling exceptions
CO-3: Develop and Analyze Python Programing using core data structures like Regular Expressions
CO-4: Develop and Analyze GUI based applications and implement exemplary applications related to Network Programming, Web Services and Databases in Python

UNIT – I:
Python Basics, Objects- Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types
Numbers - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules
Sequences - Strings, Lists, and Tuples, Mapping and Set Types

UNIT – II:
Python OOPS Concepts: Python Inheritance, Python polymorphism, Python abstraction, Python Encapsulation, Python Classes and objects, Python methods, Classes and Objects, Class Method and Self Argument. The __Init__Method, Class Variables and Object Variables, The _Del__Method, Public and Private Data Members, Private Methods, Built-in Functions to Check, Get, Set and Delete Class Attributes, Garbage Collection (Destroying Objects).

UNIT – III:
Exception Handling in Python: Introduction, Handling Exception, Multiple Except Blocks and Multiple Exceptions, Finally Block. Modules: Modules and Files, Namespaces, Importing Modules, Importing Module Attributes Module Built-in Functions, Packages, Other Features of Modules.

UNIT – IV:
Regular Expressions: Introduction, Special Symbols and Characters, Res and Python

Multithreaded Programming: Introduction, Threads and Processes, Python, Threads, and the Global Interpreter Lock, Thread Module, Threading Module, Related Modules

UNIT – V:
GUI Programming: Introduction, Tkinter programming, Tkinter widgets, Frame, Button, Label, Entry, Brief Tour of Other GUIs.
WEB Programming: Introduction, Architecture, CGI environment variable, GET and POST methods, Cookies, File upload, Web Surfing with Python, Creating Simple Web Clients, Advanced Web Clients, CGI-Helping Servers Process Client Data, Building CGI Application
Advanced CGI, Web (HTTP) Servers

UNIT – VI:
Database Programming: Introduction, Python Database Application Programmer's Interface (DB-API), Object Relational Managers (ORMs), Related Modules.

TEXT BOOKS:
1. Core Python Programming, Wesley J. Chun, 2nd Edition, Pearson
2. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, 2nd Edition, Pearson Education, 2010
3. Think Python: How to Think Like a Computer Scientist, Allen B. Downey, 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

REFERENCES:
1. Data Structures and Algorithms, A. V. Aho, J. E. Hopcroft, and J. D. Ullman, Pearson Education, 1st Edition Reprint 2003
2. Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Charles Dierbach, Wiley India Edition, 2013
3. Practical Programming: An Introduction to Computer Science using Python 3, Paul Gries, Jennifer Campbell and Jason Montojo, 2nd Edition, Pragmatic Programmers, LLC, 2013

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. Minor (IOT) V Semester

L	T/P/D	C
0	3	1.5

(19MC2IN01) PROGRAMMING IN PYTHON LABORATORY

COURSE OBJECTIVES:
- To understand program design with functions using Python programming language
- To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques
- To understand Web Scraping using Python
- To understand the high-performance programs designed to strengthen the practical expertise

COURSE OUTCOMES: After completion of course, the students should be able to
CO-1: Develop the python scripts using regular expressions
CO-2: Explore python especially the object-oriented concepts, and the built-in objects of Python
CO-3: Develop GUI Application using Python tkinter
CO-4: Create practical and contemporary applications such as Web applications, discrete event simulations

LIST OF PROGRAMS:

OOPS programs

1. Python program to calculate student grade
2. Python example to implement destructor and constructors using __del__() and __init__()
3. Python example to implement Getters and Setters in a class
4. Python - Implement Abstraction using Abstract class
5. Python - Implement Interface using class
6. Python - Create Employee Class with Constructor and Destructor
7. Example of single inheritance in Python
8. Python program to illustrate Single Inheritance
9. Example of multiple inheritance in Python
10. Example of Multilevel Inheritance in Python
11. Example of Hierarchical Inheritance in Python
12. Using Regular Expressions, develop a Python program to
    a) Identify a word with a sequence of one upper case letter followed by lower case letters.
    b) Find all the patterns of "1(0+)1" in a given string.
    c) Match a word containing 'z' followed by one or more o's. Prompt the user for input.
13. GUI&DB
    a) Design a GUI based calculator to perform arithmetic operations like addition, subtraction, multiplication and division. (Hint: Expression Calculator using tk)
    b) Design a GUI based application to convert temperature from Celsius to Fahrenheit.

c) Write a python program to perform various database operations (create, insert, delete, update).
14. GRAPHICS
   a) Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Use object-oriented approach.
   b) Design a Python program using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.

TEXT BOOKS:
1. Core Python Programming, Wesley J. Chun, 2nd Edition, Pearson
2. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, 2nd Edition, Pearson Education, 2010
3. Think Python: How to Think Like a Computer Scientist, Allen B. Downey, 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

REFERENCES:
1. Data Structures and Algorithms, A. V. Aho, J. E. Hopcroft, and J. D. Ullman, Pearson Education, 1st Edition Reprint 2003
2. Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Charles Dierbach, Wiley India Edition, 2013
3. Practical Programming: An Introduction to Computer Science using Python 3, Paul Gries, Jennifer Campbell and Jason Montojo, 2nd Edition, Pragmatic Programmers, LLC, 2013

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. Minor (IOT) VI Semester	L	T/P/D	C
	3	0	3

(19MC1IN02) IOT FUNDAMENTALS AND ARCHITECTURE

COURSE OBJECTIVES:
- To introduce terminology, technology and its applications
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web-based services on IoT devices

COURSE OUTCOMES: After completion of course, the students should be able to
CO-1: Understand IoT value chain structure (device, data cloud), application areas and technologies involved
CO-2: Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules
CO-3: Implement basic IoT applications on embedded platform
CO-4: Understand building blocks of Internet of Things and characteristics

UNIT – I:
Introduction to Internet of Things: Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT – II:
IoT and M2M- Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT – III:
IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi-Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.

UNIT – IV:
Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors.

UNIT – V:
Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor

UNIT – VI:

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

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

REFERENCES:

1. Learning Internet of Things, Peter Waher, Ovidiu Vermesan, Packt Publishing, 2015
2. Internet of Things – From Research and Innovation to Market Deployment, Peter Friess, River Publishers, 2014
3. Actuators and Their Interfaces, N. Ida, Sensors, SciTech Publishers, 2014

B.Tech. Minor (IOT) VI Semester	L	T/P/D	C
	3	0	3

(19MC1IN03) SMART TECHNOLOGIES

COURSE OBJECTIVES:
- To provide a detailed description of the integral aspects of smart technologies and their evolution to their current state
- To discuss 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
- To present case studies using easy-to-understand language to explain the breadth and scope of application areas

COURSE OUTCOMES: After completion of course, the student should be able to
CO-1: Explain importance, scope and applications of Smart Technologies
CO-2: Implement Drones an IoT based services and block chain technologies
CO-3: Provide solutions for real world IoT applications like vehicle cyber security
CO-4: Understand the importance of cyber care and develop IoT-Based Smart Farming Solutions

UNIT – I:
Smart Technologies: Scope and Applications, Cutting-Edge Digitization Challenges in Vehicle Cyber Physical Systems and Cybersecurity, 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 Cybersecurity 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.

UNIT – VI:
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, K. B. Akhilesh, Dietmar P. F. Möller, Springer, 2020

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. Minor (IOT) VII Semester

L	T/P/D	C
3	0	3

(19MC1IN04) PROGRAMMING LANGUAGES FOR IOT

COURSE OBJECTIVES:
- To provide training with a solid theoretical foundation, systematic professional knowledge and strong practical skills in the Raspberry Pi
- To focus 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.
- To learn basic programming instructions on Raspberry PI
- To understand IoT design using Raspberry PI

COURSE OUTCOMES: After completion of course, the student should be able to
CO-1: Appreciate the development technology for IoT
CO-2: Familiar with Basic Concepts of Linux
CO-3: Design real time IoT Devices and Familiar with basic foundations of Python Programming and libraries
CO-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.

UNIT – III:
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 – IV:
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 – V:

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 – VI:

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

REFERENCES:

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. Minor (IOT) VII Semester	**L**	**T/P/D C**
	0	**3 1.5**

(19MC2IN02) IOT AUTOMATION WITH RASPBERRY PI LABORATORY

COURSE OBJECTIVES:
- To introduce the raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of distance sensor on IoT devices
- To understand installation of OS in Raspberry PI
- To use raspberry PI for implementing alarmed motion sensor

COURSE OUTCOMES: After completion of course, the student should be able to
CO-1: Introduce the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor
CO-2: Program using python scripting language which is used in many IoT devices
CO-3: Implement alarmed motion sensor using Raspberry PI
CO-4: Install Operating System in Raspberry PI

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

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

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