B.TECH – ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech III Semester(2022-23)

Python For Data Analytics

Course Objective:

To be able to use python programming for solving data Analytics problems.

Course Outcomes:

After completion of this course, the candidate will be able to :

1. How to install python software and IDEs
2. Gain knowledge in the area of Data Analytics

UNIT-I: Introduction to Python:

Python Installation with various IDE's 4.1 Python data Types 4.2 Control Structure 4.3 Functions.
Data Analysis & visualization –using numpy, panda matplotlib, scipy etc.

UNIT-II : Introduction to probability

Introduction to probability, Probability Distributions - I Probability Distributions - II ,Probability Distributions – III, Python Demo for Distributions ,Sampling and Sampling Distribution ,Distribution of Sample Means, population, and variance ,Confidence interval estimation: Single population ,Confidence interval estimation: Single population - II

UNIT-III: Regressions

Linear regression and multiple regression , Prediction of Regression Model Residual Analysis ,Concepts of MLE and Logistic regression

UNIT-IV: Clustering

ROC and Regression Analysis Model Building, c^2 Test and introduction to cluster analysis, Clustering analysis

UNITV: Data visualization

Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot

B.TECH – ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech IV Semester(2022-23)
RASPBERRY PI AND ITS PERIPHERALS

Course Objective:

To develop the background knowledge and core expertise of an embedded system design.

Course Outcomes:

After completion of this course, the candidate will be able to :

1. Interface different sensors and actuators with rpi
2. Understand the various python commands for rpi.

UNIT-I: Overview of Raspberry Pi:
Introduction to Raspberry Pi, Comparison of various Rpi Models, Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi , On-board components of Rpi.

UNIT-II : Booting up RPi- operating System and Linux Commands, Linux- Introduction, Architecture, File System, Raspbian Operating System - Introduction, Tools like Leaf pad Editor, Installing Raspbian on Pi, First boot and Basic Configuration of Pi, Popular Linux Commands**.**

UNIT-III: RPi using Python and Sensing Data using Python: Introduction, Python vs. Other Languages, Applications of Python.

UNIT-IV: Understanding Python Interpreted Languages: Variables, Keywords, Operators and Operands, Data Types in Python, Importing Libraries, Flow Control, Conditional Statement, Loops

UNITV: Sensors Interfacing: Temperature and Humidity Sensor DHT11, Motion Sensor PIR), Obstacle detection using Ultrasonic sensor, etc. Communicating using RPi- GSM interfacing, Accessing on-board Wi-Fi, Connecting Database with RPi

Texts/ References:

1. Programming the Raspberry Pi, Second Edition: Getting Started with Python 2nd Edition by Simon Monk McGraw Hill Professional, 04-Jun-2021 - Technology & Engineering - 208 pages

2. Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux 1st Edition by Derek Molloy, wiley publications 2016.

3. The Computer Programming Bible: A Step by Step Guide On How To Master From The Basics to Advanced of Python, C, C++, C#, HTML Coding Raspberry Pi3 by C.P.A Inc 2020.

4. Raspberry Pi IoT Projects: Prototyping Experiments for Makersby John C. Shovic, APress 2016

B.TECH – ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech V Semester(2022-23)
IoT Using Arduino

COURSE OBJECTIVES

• Understand the fundamentals of IoT and Arduino platforms.
• Interface sensors and actuators with Arduino.
• Develop IoT applications using communication technologies.
• Connect Arduino-based systems to cloud platforms.
• Design and implement real-world IoT projects.

COURSE OUTCOMES

CO1: Explain IoT architecture and Arduino fundamentals.
CO2: Interface sensors and actuators with Arduino.
CO3: Develop Arduino-based applications.
CO4: Implement IoT communication and cloud connectivity.
CO5: Design and deploy simple IoT projects.

UNIT I: Introduction to IoT and Arduino

• Overview of IoT
• IoT Architecture and Functional Blocks
• Applications of IoT
• Arduino Uno Architecture
• Arduino IDE Installation and Configuration
• Digital and Analog I/O Basics

UNIT II : Sensors and Actuators Interfacing

• Temperature, Light, Ultrasonic and IR Sensors
• LEDs, Buzzer, Relay Interfacing
• Servo and DC Motor Control

UNIT III: Arduino Programming and Communication

• Variables, Data Types and Operators
• Control Structures
• Functions and Libraries
• UART, I2C and SPI Communication

• LCD Interfacing

UNIT IV: IoT Connectivity and Cloud Platforms

• ESP8266/NodeMCU
• MQTT and HTTP Protocols
• ThingSpeak and Blynk Platforms
• Remote Monitoring and Control

UNIT V: IoT Applications and Mini Project
• Smart Home Automation
• Smart Agriculture
• Smart Energy Monitoring
• IoT Security Basics
• Mini Project Development

B.TECH – ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech VI Semester(2022-23)

FUNDAMENTALS OF MIMO WIRELESS

Course Objective:

The main objective of the course is to

1. To make students familiar with fundamentals of wireless communication systems.

2. To understand the diversity and spatial multiplexing phenomenon in MIMO system.

3. To understand the receiver system design for MIMO.

4. To become familiar with OFDM and MIMO-OFDM systems.

Course Outcomes:

After completion of this course, the candidate will be able to:

1. Emerging issues for implementing MIMO wireless channels.

2. Different fading channel distributions in multipath wireless channel.

3. OSTBC design for multiple antenna system.

4. Computation of performance parameters of MIMO wireless system

UNIT-I: Overview of Probability and Stochastic Processes:

Probability distributions, Statistical averages and Random variables, Binomial distribution, Chi-square distribution, Rayleigh distribution, Rice distribution, Nakagami m-distribution, Central limit theorem, etc.

UNIT-II : Overview of Wireless Channel and Fading:

Multi-path and Time-varying channel impulse response, Inter-Symbol-Interference, Narrowband fading, Envelope and power distribution, Level-crossing Rate and Average fading duration, Wideband fading, slow and fast fading, Delay Spread and Coherence

Bandwidth, Doppler Spread and Channel Coherence Time, Rayleigh fading, Rician fading, m-Nakagami fading

UNIT-III: MIMO-I: Diversity: Temporal diversity, Frequency diversity, Spatial diversity, Multiplexing gain, Diversity gain, Analysis of receiver diversity, Combining schemes : Selection, Threshold, Maximal ratio, Equal gain, Transmitter diversity: with and without channel state information, Alamouti scheme, Diversity Analysis.

UNIT-IV: MIMO-II: Principles: Multi-antenna system and its advantages, MIMO channel and signal model, MIMO channel capacity, MIMO system model, Analysis of BER of multiple antenna system with diversity, Zero-forcing receiver; drawbacks, MIMO-MMSE receiver, properties and advantages

UNITV: Applications of MIMO and OFDM: Long term evolution (LTE) and WiMAX; features, OFDMA, Channel dependent scheduling, Resource allocation, Puncturing, H-ARQ, Frequency shift transmit diversity, Network architecture, frame structure, Protocol stack.

Texts/ References:

1. Goldsmith, Andrea, “Wireless Communications”, Cambridge University press (2005).

2. Rakhesh. S. Kshetrimayum: “Fundamentals of MIMO Wireless Communications”, Cambridge University press, 2017

3. Haykin, Simon, “An introduction to analog and digital communications” John Wiley & Sons.

4. Space-Time coding: theory and Practice, Hamid Jafarkhani, Cambridge University Press, 2005.

5. MIMO: From Theory to Implementation, ALain Sibille, Claude Oestges, and Alberto Zanella, Academic Press, 2013.