B.Tech. Minor in Internet of Things III year I semester syllabus (2021-22)

Year/Semester	Theory (3 Credits, 3 Hours)	Laboratory (3 Credits, 3 Hours)	Total Credits
III - I Semester	Python Programming	Python Programming Laboratory	4.5
III - II Semester	1. Introduction to IoT 2. Smart Technologies	--	6
IV - I Semester	Programming Languages for IoT	IoT Automation with Raspberry-PI Laboratory	4.5
IV - II Semester	Fog & Edge Computing for IoT	--	3
		Total Credits	**18**

PYTHON PROGRAMMING

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

L	T	P	C
3	0	0	3

Course Objectives: This course will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python.
- Build Web Services and introduction to Network and Database Programming in Python.

Course Outcomes: The students should be able to:

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- 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

FILES: File Objects, File Built-in Function [open()], File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution, Persistent Storage Modules, Related Modules

Exceptions: Exceptions in Python, Detecting and Handling Exceptions, Context Management, *Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, *Creating Exceptions, Why Exceptions (Now)?, Why Exceptions at All?, Exceptions and the sys Module, Related Modules

Modules: Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module Built-in Functions, Packages, Other Features of Modules

UNIT - III

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 - IV

GUI Programming: Introduction, Tkinter and Python Programming, Brief Tour of Other GUIs, Related Modules and Other GUIs

WEB Programming: Introduction, Wed 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 – V

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

Textbook

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.

PYTHON PROGRAMMING LAB

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

L	T	P	C
0	0	3	1.5

Prerequisites: Students should install Python on Linux platform.

Course Objectives:

- To be able to introduce core programming basics and 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 the high-performance programs designed to strengthen the practical expertise.

Course Outcomes:

- Student should be able to understand the basic concepts scripting and the contributions of scripting language
- Ability to explore python especially the object oriented concepts, and the built in objects of Python.
- Ability to create practical and contemporary applications such as TCP/IP network programming, Web applications, discrete event simulations

List of Programs:

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
4. Write a python script to print the current date in the following format "Sun May 29 02:26:23 IST 2017"
5. Write a program to create, append, and remove lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a Python program to convert temperatures to and from Celsius, Fahrenheit.

   [Formula: c/5 = f-32/9]
10. Write a Python program to construct the following pattern, using a nested for loop

```
*
* *
* * *
* * * *
* * * * *
* * * *
* * *
* *
*
```

11. Write a Python script that prints prime numbers less than 20.
12. Write a python program to find factorial of a number using Recursion.
13. Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides).
14. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
15. Write a python program to define a module and import a specific function in that module to another program.
16. Write a script named **copyfile.py**. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
17. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
18. Write a Python class to convert an integer to a roman numeral.
19. Write a Python class to implement pow(x, n)
20. Write a Python class to reverse a string word by word.

B.Tech. Minor in Artificial Intelligence & Machine Learning (AIML) - III year I semester syllabus (2021-22)

Year/Semester	**Theory** (*Which is not studied in regular B. Tech. course*)	**Laboratory** **(**3 Hours, 1.5 Credits)	**Total Credits**
III - I Semester	Foundations of Artificial Intelligence **(**3 Hours, 3 Credits)	Artificial Intelligence Laboratory	4.5
III - II Semester	Artificial Intelligence Applications **(**4 Hours, 4 Credits)	--	4
IV - I Semester	(Either online through MOOCS or off-line Class) Machine Learning **OR** Deep Learning **(**3 Hours, 3 Credits)	(The corresponding Laboratory) Machine Learning Laboratory **OR** Deep Learning Laboratory	4.5
IV - II Semester	**Any one of the following subjects:** 1. Robotics Process Automation 2. Natural Language Processing 3. Game theory 4. Computer Vision & Robotics 5. Speech & Video Processing Soft Computing	--	3
IV-II Semester	Mini Project	--	2
		Total Credits	**18**

FOUNDATIONS OF ARTIFICIAL INTELLIGENCE

B.Tech. AI&ML (Minor) III Year I Sem.

L	T	P	C
3	0	0	3

Course Objective:

1. To review and strengthen important mathematical concepts required for AI & ML.
2. Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

Course Outcomes: After completion of course, students would be able to:

1. Design and implement machine learning solutions to classification, regression andclustering problems.
2. Evaluate and interpret the results of the different ML techniques.
3. Design and implement various machine learning algorithms in a range of Real-worldapplications.

UNIT - I

Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming,

UNIT - II

Mathematical foundations: Matrix Theory and Statistics for Machine Learning.
Idea of Machines learning from data, Classification of problem – Regression and Classification, Supervised and Unsupervised learning.

UNIT - III

Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.

UNIT - IV

Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.

UNIT - V

Discussion on clustering algorithms and use-cases centered around clustering and classification.

TEXT BOOKS:

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011.
2. Yuxi (Hayden) Liu, “Python Machine Learning by Example”, Packet PublishingLimited, 2017.

REFERENCE BOOKS:

1. Anindita Das Bhattacharjee, “Practical Workbook Artificial Intelligence and SoftComputing for beginners, Shroff Publisher-X team Publisher.
2. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
4. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.

Corresponding Online Resources:

1. Artificial Intelligence, https://swayam.gov.in/nd2_cec20_cs10/preview.

ARTIFICIAL INTELLIGENCE LABORATORY

B.Tech. AI&ML (Minor) III Year I Sem.

L	T	P	C
0	0	3	1.5

1. Basic programs in Python to get familiarize various programming structures.
2. Implementation of logical rules in Python.
3. Using any data apply the concept of:

a. Liner regression
b. Gradient decent
c. Logistic regression

4. Perform and plot overfitting in a data set.
5. Implementation of KNN classification algorithm.
6. Implementation of k-means clustering algorithm.
7. Explore statistical methods for machine learning.

B.Tech. Minor in Cyber Security - III year I semester syllabus (2021-22)

Year/Semester	Theory	Laboratory (3 Hours, 1.5 Credits)	Total Credits
III - I Semester	Principles of Information Security (3 Credits, 3 Hours)	Principles of Information Security Lab	4.5
III - II Semester	Foundations of Cyber Security (4 Credits, 4 Hours)	--	4
IV - I Semester	(Either online through MOOCS or off-line Class) Ethical Hacking **OR** Digital Forensics (3 Credits, 3 Hours)	(The corresponding Lab) Ethical Hacking Lab **OR** Digital Forensics Lab	4.5
IV - II Semester	**Any one of the following subjects:** (3 Credits, 3 Hours) 1. Security Incident & Response Management 2. Mobile Security 3. IoT Security 4. Blockchain Technologies 5. Authentication Techniques Cloud Security	--	3
IV-II Semester	Mini Project	--	2
		Total Credits	**18**

PRINCIPLES OF INFORMATION SECURITY

B.Tech. Cyber Security (Minor) III Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites

1. A Course on "Mathematics".

Objectives

1. To understand the fundamentals of Computer Networks.
2. To understand the fundamentals of Cryptography.
3. To understand various Symmetric and Asymmetric encryption algorithms.
4. To understand Mathematics of Cryptography, IDS and Firewalls.
5. To apply algorithms used for message Integrity and Authentication.

Outcomes

1. Demonstrate the knowledge of Computer Networks, Cryptography, Information security concepts and applications.
2. Ability to apply security principles in system design.

UNIT - I

Introduction to Computer Networks, Network hardware, Network software, OSI and TCP/IP Reference models, Security attacks, Security Services and Mechanisms.

UNIT - II

Integer Arithmetic, Modular Arithmetic, Traditional Symmetric Key Ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES).

UNIT - III

Mathematics of Cryptography: Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Asymmetric Cryptography: Introduction, RSA Cryptosystem, Rabin Cryptosystem,
Elliptic Curve Cryptosystem,

UNIT - IV

Message Integrity and Message Authentication: Message Authentication Code (MAC), SHA-512 - Digital Signatures.

UNIT - V

Security at the Application Layer: PGP and S/MIME. Security at Transport Layer: SSL and TLS. - Principles of IDS and Firewalls.

TEXT BOOKS:

1. Computer Networks, Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI.
2. Cryptography & Network Security by Behrouz A. Forouzan. Special Indian Edition, TMH.

REFERENCE BOOK:

1. Network Security Essentials (Applications and Standards), William Stallings Pearson Education.

PRINCIPLES OF INFORMATION SECURITY LAB

B B.Tech. Cyber Security (Minor) III Year I Sem.

L	T	P	C
0	0	3	1.5

Prerequisites

A Course on "Mathematics

Objectives

1. To apply algorithms on various Symmetric and Asymmetric encryption algorithms.
2. To demonstrate IDS Tools
3. To apply algorithms used for message Integrity and Authentication

Lab Exercises

1. Write a program to perform encryption and decryption using the followingsubstitution ciphers.
2. Caeser cipher
3. Play fair cipher
4. Hill Cipher
5. Write a program to implement the DES algorithm.
6. Write a program to implement RSA algorithm.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Working with sniffers for monitoring network communication (Wireshark).
9. Configuring S/MIME for email communication.
10. Using Snort, perform real time traffic analysis and packet logging.

TEXT BOOKS:

1. "Cryptography and Network Security" by William Stallings 3rd Edition, PearsonEducation.
2. "Applied Cryptography" by Bruce Schneier.

REFERENCE BOOK:

1. Cryptography and Network Security by Behrouz A. Forouzan.

B.Tech. Minor in Data Science - III year I semester syllabus (2021-22)

Year/Semester	Theory	Laboratory (3 Hours, 1.5 Credits)	Total Credits
III - I Semester	Introduction to Data Science (3 Hours, 3 Credits)	R Programming Laboratory	4.5
III - II Semester	Data Science Applications (4 Hours, 4 Credits)	--	4
IV - I Semester	(Either online through MOOCS or off-line Class) Data Wrangling and Visualization **OR** Big Data Analytics (3 Hours, 3 Credits)	(The corresponding Laboratory) Data Wrangling and Visualization **OR** Big Data Analytics	4.5
IV - II Semester	**Any one of the following subjects:** (which is not studied in regular B. Tech. course) 1. Exploratory Data Analysis 2. Mining Massive Databases 3. Social Network Analysis 4. Predictive Analytics 5. Web & Social Media Analytics 6. Video Analytics (3 Hours, 3 Credits)	--	3
IV-II Semester	Mini Project	--	2
		Total Credits	**18**

INTRODUCTION TO DATA SCIENCE

B.Tech. Data Science (Minor) III Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- Learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
- Understand the basic types of data and basic statistics
- Identify the importance of data reduction and data visualization techniques

Course Outcomes: After completion of the course, the student should be able to

- CO-1: Understand basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data
- CO-2: describe the data using various statistical measures
- CO-3: utilize R elements for data handling
- CO-4: perform data reduction and apply visualization techniques.

UNIT-I: Introduction

What is Data Science? - Big Data and Data Science hype – and getting past the hype - Datafication - Current landscape of perspectives - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model – Over fitting.

Basics of R: Introduction, R-Environment Setup, Programming with R, Basic Data Types.

UNIT-II: Data Types & Statistical Description

Types of Data: Attributes and Measurement, What is an Attribute? The Type of an Attribute, The Different Types of Attributes, Describing Attributes by the Number of Values, Asymmetric Attributes, Binary Attribute, Nominal Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes.

Basic Statistical Descriptions of Data: Measuring the Central Tendency: Mean, Median, and Mode, Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation, and Inter-quartile Range, Graphic Displays of Basic Statistical Descriptions of Data.

UNIT-III

Vectors: Creating and Naming Vectors, Vector Arithmetic, Vector sub setting,

Matrices: Creating and Naming Matrices, Matrix Sub setting, Arrays, Class.

Factors and Data Frames: Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered Factors, Comparing Ordered Factors, Introduction to Data Frame, sub setting of Data Frames, Extending Data Frames, Sorting Data Frames.

Lists: Introduction, creating a List: Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors

UNIT-IV

Conditionals and Control Flow: Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements.

Iterative Programming in R: Introduction, While Loop, For Loop, Looping Over List.

Functions in R: Introduction, writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R.

UNIT-V:

Data Reduction: Overview of Data Reduction Strategies, Wavelet Transforms, Principal Components Analysis, Attribute Subset Selection, Regression and Log-Linear Models: Parametric Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation.

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
2. **Jiawei Han**, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
3. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
2. Brain S. Everitt, “A Handbook of Statistical Analysis Using R”, Second Edition, 4 LLC, 2014.
3. Dalgaard, Peter, “Introductory statistics with R”, Springer Science & Business Media, 2008.
4. Paul Teetor, “R Cookbook”, O’Reilly, 2011.

R PROGRAMMING LABORATORY

B.Tech. Data Science (Minor) III Year I Sem.

L	T	P	C
0	0	3	1.5

1. R Environment setup: Installation of R and RStudio in Windows
2. Write R commands for
   i. Variable declaration and retrieving the value of the stored variables,
   ii. Write an R script with comments,
   iii. Type of a variable using class () Function.
3. Write R command to
   i. illustrate summation, subtraction, multiplication, and division operations on vectors using vectors.
   ii. Enumerate multiplication and division operations between matrices and vectors in R console
6. Write R command to
   i. Illustrate the usage of Vector sub setting& Matrix sub setting
   ii. Write a program to create an array of 3×3 matrixes with 3 rows and 3 columns.
   iii. Write a program to create a class, object, and function
7. Write a command in R console
   i. to create a tshirt_factor, which is ordered with levels 'S', 'M', and 'L'. Is it possible to identify from the examples discussed earlier, if blood type 'O' is greater or less than blood type 'A'?
   ii. Write the command in R console to create a new data frame containing the 'age' parameter from the existing data frame. Check if the result is a data frame or not. Also R commands for data frame functions *cbind*(), rbind(), sort()
8. Write R command for
   i. Create a list containing strings, numbers, vectors and logical values
   ii. To create a list containing a vector, a matrix, and a list. Also give names to the elements in the list and display the list also access the list elements
   iii. To add a new element at the end of the list and delete the element from the middle display the same
   iv. To create two lists, merge two lists. Convert the lists into vectors and perform addition on the two vectors. Display the resultant vector.
9. Write R command for
   i. logical operators—AND (&), OR (|) and NOT (!).
   ii. Conditional Statements
   iii. Create four vectors namely patientid, age, diabetes, and status. Put these four vectors into a data frame patientdata and print the values using a for loop& While loop
   iv. Create a user-defined function to compute the square of an integer in R
   v. Create a user-defined function to compute the square of an integer in R
   vi. Recursion function for a) factorial of a number b) find nth Fibonacci number
10. Write R code for i) Illustrate Quick Sort ii) Illustrate Binary Search Tree
11. Write R command to
    i. illustrate Mathematical functions & I/O functions
    ii. Illustrate Naming of functions and sapply(), lapply(), tapply() &mapply()
12. Write R command for
    i. Pie chart& 3D Pie Chart, Bar Chart to demonstrate the percentage conveyance of various ways for traveling to office such as walking, car, bus, cycle, and train
    ii. Using a chart legend, show the percentage conveyance of various ways for traveling to office such as walking, car, bus, cycle, and train.
       a. Walking is assigned red color, car – blue color, bus – yellow color, cycle – green color, and train – white color; all these values are assigned through *cols and lbls variables and the legend function.*
       b. *The fill parameter is used to assign colors to the legend.*
       c. Legend is added to the top-right side of the chart, by assigning
    iii. Using box plots, Histogram, Line Graph, Multiple line graphs and scatter plot to demonstrate the relation between the cars speed and the distance taken to stop, Consider the parameters data and *x* Display the *speed* and *dist parameter of Cars data set using x and data parameters*

TEXT BOOK:

1. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

B.Tech. Minor in Innovation and Entrepreneurship (I&E) - III year I semester syllabus (2021-22)

Year/Semester	Theory (3 Hours, 3 Credits)	Laboratory (3 Hours 1.5 Credits)	Total Credits
III - I Semester	Innovation and Design Thinking	Design thinking and Ideation Laboratory	4.5
III - II Semester	Foundations of Entrepreneurship (4 Credits, 4 Hours)	--	4
IV - I Semester	Business Ideation and Lean Startup	B-Plan Development Laboratory	4.5
IV - II Semester	**Any ONE of the following subjects:** 1. Product Development 2. Market Research 3. Engineering Design Process 4. Financial and Legal Aspects of Business 5. Start-up Management 6. Entrepreneurial Marketing 7. Technology Entrepreneurship 8. Small Business Development 9. Intellectual Property Rights (*if not studied in regular course*)	--	3
IV-II Semester	Mini Project (Either on New Venture Establishment **OR** Launch of Marketable product **OR** Patent Publishing)	--	2
		Total Credits	**18**