Value Added Courses (VAC)

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2501CS04	Internet of Things	FC			1	1	100	-	100	-
2501UC11	Employability skills -1	FC			3	0	100	-	100	-
2501UC13	Employability skills -2	FC			3	0	100	-	100	ES-1
2501CS02	Data Analysis Using Python	IC			2	2	50	50	100	PPSC
2501UC14	Employability skills -3	IC			3	0	100	-	100	ES-2
2501UC15	Employability skills -4	IC			3	0	100	-	100	ES-3
2501UC16	Employability skills -5	AC			3	1	100	-	100	ES-4
2501AC06	Advanced Data Structures & Algorithm	AC	2		1	0	100	-	100	DS
	Total		**2**		**19**	**04**				

Data Analysis using Python

(Common to CE, EEE, ME, ECE, CSE, IT, AIML, CSE(DS), PT & Min.E)

	L	T	P	C
Course Code:2501CS02	**0**	**0**	**2**	**2**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Make use of control statements and data structures to solve problems
CO2: Apply OOPs concepts and files to develop applications.
CO3: Explain the data collection, management and storage for processing using Numpy
CO4: Make use of Pandas to create and manipulate data structures like Series and DataFrames.
CO5: Create plots using Matplotlib library for better visualization.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	1		2			1	1		1
CO2	1	2	3		2			1	1		1
CO3	1	3	2		2			1	1		1
CO4	1	2	3		2			1	1		1
CO5	1	2	3		2			1	1		1

Unit-I

Introduction: History of Python, Applications of Python,Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation, Operators and Expressions, Control Flow- if, if-elif-else, for, while, break, continue, Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions, Defining Functions, Calling Functions, Passing Arguments.

1.1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
1.2) Write a program that uses a for loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89.
1.3) Split a string into array of characters in Python.
1.4) write a Python program to get the largest number from a list.
1.5) Write a Python program to calculate the nth Fibonacci number using a function.

Unit-II

Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support Design with Classes: Objects and Classes, Data modeling Examples,Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, Userdefined Exceptions.

2.1) Write a Python program that defines a Car class with attributes like make, model, and year, and methods like start() to start the car and stop() to stop it.
2.2) Write a Python program that demonstrates inheritance by creating a base class Animal and derived classes like Dog, Cat, etc., each with their specific behaviors.
2.3) Define a base class called Animal with a method make_sound(). Implement derived classes like Dog, Cat, and Bird that override the make_sound() method to produce different sounds. Demonstrate polymorphism by calling the method on objects of different classes.
2.4) Write a Python program that demonstrates error handling using the try-except block to handle division by zero.

Unit-III

Numpy: Introduction to numpy, creating arrays, using arrays and scalars, Indexing Arrays, Array transposition, Universal array function, Array Processing, Array Input and Output, Examples.

3.1) Write a NumPy program using methods – info, add, array, all, greater, greater_equal, less and less_equal,equal, allclose, zeros, ones, linspace, tolist.
a. To get help on the add function
b. To test whether none of the elements of a given array is zero.
c. To create an element-wise comparison (greater, greater_equal, less and less_equal, equal, equal within a tolerance) of two given arrays.
3.2) Write a NumPy program using NumPy methods - max, min, argmax, argmin, argmax, repr, count, bincount, unique.
a. To extract all numbers from a given array which are less and greater than a specified number.
b. To find the indices of the maximum and minimum numbers along the given axis of an array.

Unit-IV

Pandas: Exploring Data using Series, Exploring Data using DataFrames, Index objects, Re index, Drop Entry, Selecting Entries, Data Alignment, Rank and Sort, Summary Statistics, Data Munging in Python using Pandas, Index Hierarchy, Example Problem.

4.1) Pandas DataSeries:
i)Write a Pandas program to create and display a one-dimensional array-like object containing an array of data using Pandas module.
ii)Write a Pandas program to convert a Panda module Series to Python list and it's type.
4.2) Pandas DataFrames:
Consider Sample Python dictionary data and list labels:
exam_data = {'name': ['Anastasia', 'Dima', 'Katherine', 'James', 'Emily','Michael', 'Matthew', 'Laura', 'Kevin', 'Jonas'],
'score': [12.5, 9, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],
'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']

i)Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels.
ii)Write a Pandas program to change the name 'James' to 'Suresh' in name column of the DataFrame.
iii)Write a Pandas program to insert a new column in existing DataFrame. iv)Write a Pandas program to get list from DataFrame column headers. v)Write a Pandas program to get list from DataFrame column headers.

Unit-V

Introduction to Matplotlib: Introduction to Matplotlib Library, Plotting Data: Line Plots, Scatter Plots, Customizing Plots, Common Types of Plots Bar Charts: Simple Bar Plot, Horizontal Bar Plot, Advanced Plot Customizations.

5.1) Create a series of plots to analyze a given dataset.
5.2) Generate a subplot layout with various plot types (scatter, line, bar).
5.3) Visualize time-series data and customize axis labels and date formats.
5.4) Create a 3D plot.

Additional Practice:

1.Write a program to find the greatest number that can be formed by using given set of numbers.

2. Write a Python program to create a simple calculator GUI application using functions for arithmetic operations.

3) Write a Python program to build a todo list GUI application with functions for adding, deleting, and updating tasks.

3.Save a multi-page PDF with different visualizations.

Reference Books:

1. Python for Everybody Exploring Data in Python 3, Charles Russell Severance, SueBlumenberg. ISBN:978-153051120
2. Code with Python: Suresh Sundaradasu,S.Rama Sree ISBN: 978-9355017574
3. Python Programming, Dr.Maganti Venkatesh,Monelli Ayyavaraiah,Niveditha Ravindra
   Pandey, NeethumolSabu,Charulatha Publications ISBN:978-93-5577-695-6
4. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, Wes McKinney, O'Reilly Media,**ISBN:** 978-1491957660

Web Links:

1. https://www.hackerrank.com/
2. https://www.codechef.com/
3. https://www.topcoder.com/
4. https://code-cracker.github.io/

Internet of Things

(Common to EEE, ME, ECE, CSE, IT, AIML, CSE(DS), PT & Min.E)

	L	T	P	C
Course Code: 2501CS04	**0**	**0**	**1**	**1**

Course Outcomes:

At the end of the course, student will be able to:

- **CO1:** Identify and select appropriate sensors, actuators, and boards (Arduino/Pi) for specific tasks.
- **CO2:** Execute digital and analog interfacing of peripherals with embedded platforms.
- **CO3:** Develop control algorithms and decision-making logic for real-time automation.
- **CO4:** Configure cloud platforms and APIs for data transmission and visualization.
- **CO5:** Design and build functional end-to-end IoT prototypes for real-world applications.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	1			1						
CO2	2	2	1		2						
CO3	1	2	2	1							
CO4	1	1		1	2						1
CO5	1	2	2	2	2	1	1	1	2	2	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		
CO5		

Practice:

1. Study of Arduino UNO and Raspberry Pi boards including architecture, pin configuration, power supply, communication interfaces and development environments.
2. Study of commonly used sensors and actuators such as temperature sensor, moisture sensor, LDR, ultrasonic sensor, IR sensor, PIR sensor, LED and motor. Identify their working principles and applications.
3. Design and implement basic digital input–output operations using Arduino by controlling LED/buzzer.
4. Interface an analog sensor (LDR) with Arduino and display sensor values on Serial Monitor.
5. Interface a digital sensor (Ultrasonic sensor) with Arduino and display measured values on Serial Monitor.
6. Develop conditional logic using Arduino to control LED or buzzer based on sensor threshold values.
7. Interface a servo motor with Arduino and control its angular position based on sensor input to demonstrate automatic gate or smart irrigation model.

8. Design and implement a multi-sensor monitoring system using Arduino to read analog and digital sensors simultaneously and display results on Serial Monitor.
9. Create a cloud platform account, explore available IoT services and register a device (Thing) on the platform.
10. Demonstration of IoT based system to upload sensor data to cloud platform and visualize the received data in graphical form.

Additional Practice (Any 2 from the following)

1. **Smart Lighting System**: Design a lighting system that automatically turns ON/OFF or dims lights based on human movement or surrounding light conditions to demonstrate energy saving.
2. **Intelligent Traffic Control System**: Develop an automated traffic signal system for busy roads with priority control for emergency vehicles (such as ambulances).
3. **Smart Parking System**: Create a sensor-based parking system to detect available slots and provide parking guidance or remote monitoring.
4. **Air Pollution Monitoring System**: Build an IoT-based setup using gas or environmental sensors to measure air quality and indicate whether pollution levels are safe or dangerous.
5. **Bluetooth-Based Actuator Control**: Control motors or other actuators connected to a development board using Bluetooth communication.

Reference Books:

1 An Introduction to Internet of Things, Connecting devices, Edge Gateway and Cloud with Applications, Rahul Dubey, Cengage, 2019. ISBN: 9789353501020
2 Adrian McEwen, Designing the Internet of Things, Wiley Publishers. ISBN:978-1118430620
3 IoT Fundamentals, Networking Technologies, Protocols and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetette, rob Barton, Jerome Henry, CISCO, Pearson, 2018. ISBN:9789386873743
4 Internet of Things, by Vengalapudi Appala Konda and Prof. Sangareddy B. Krutakoti, Scientific International Publishing House, First Edition, 2024. ISBN: 978-93-6132-958-6.

Web Links:

1 https://iotvirtuallab.github.io/vlab/Experiments/index.html
2 https://onlinecourses.nptel.ac.in/noc21_cs17/preview
3 https://www.electronicsforu.com/electronics-projects/internet-of-things-iot
4 https://www.coursera.org/specializations/iot
5 https://projecthub.arduino.cc/
6 https://www.edureka.co/iot-certification-training

Employability Skills- I

(CE,EEE,ME,ECE,CSE,IT,AIML,CSE(DS),PT,Min.E&Agri.E)

	L	T	P	C
Course Code:2501UC11	**0**	**0**	**3**	**0**

Aptitude:

Number System, LCM & HCF, Ratio and Proportion, Averages

Reasoning:

Number Series, Letter Series, Number Analogy, Letter Analogy, Odd Man Out, Logical Sequence of Words.

Verbal:

Introduction to soft skills, how to improve communication? Parts of Speech, Mind your language towards better English, Vocabulary Expansion

Text Books:

1. Quantitative Aptitude –Dr. R. S. Aggarwal, S CHAND, **ISBN** · 9789355012326.

2. A Modern Approach to Verbal and Non-Verbal Reasoning – Dr. R. S. Aggarwal, **ISBN**-13. 978-9352832163.

3. Quick Learning Objective General English – Dr. R. S. Aggarwal, S CHAND, **ISBN**-13. 978-8121922111.

Reference Books:

1. Quantitative Aptitude – Abhijit Guha Mc Graw Hill Publications, **ISBN-13**9789389957426.

2.How To Crack Test of Reasoning Verbal , Non-Verbal & Analytical – Jaikishan and Premkishan,Arihant Publications, NEW EDITION 2024,**ASIN : B0CRQ9BVBC**.

3. A New Approach to Objective English – R. S. Dhillon DGP Publications, ISBN-13: **978-8186651032**.

Web Links:

1. www.indiabix.com

2. www.bankersadda.com

Employability Skills- II

(CE,EEE,ME,ECE,CSE,IT,AIML,CSE(DS),PT,Min.E&Agri.E)

	L	T	P	C
Course Code:2501UC13	**0**	**0**	**3**	**0**

Aptitude:

Problems on Ages, Partnership, Percentages, Profit and Loss

Reasoning:

Coding and Decoding, Ranking Test, Alphabet Test, Direction Test

Verbal:

Written communication skill practice, Grammatical use, Concept of 4 step method for presentation, Present Tense

Text Books:

1. Quantitative Aptitude –Dr. R. S. Aggarwal, S CHAND, **ISBN** · 9789355012326.

2. A Modern Approach to Verbal and Non-Verbal Reasoning – Dr. R. S. Aggarwal, **ISBN**-13. 978-9352832163.

3. Quick Learning Objective General English – Dr. R. S. Aggarwal, S CHAND, **ISBN**-13. 978-8121922111.

Reference Books:

1. Quantitative Aptitude – Abhijit Guha Mc Graw Hill Publications, **ISBN-13**9789389957426.

2.How To Crack Test of Reasoning Verbal , Non-Verbal & Analytical – Jaikishan and Premkishan,Arihant Publications, NEW EDITION 2024,**ASIN : B0CRQ9BVBC**.

3. A New Approach to Objective English – R. S. Dhillon DGP Publications, ISBN-13: **978-8186651032**.

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2. www.bankersadda.com

Employability Skills- III

(CE,EEE,ME,ECE,CSE,IT,AIML,CSE(DS),PT,Min.E&Agri.E)

	L	T	P	C
Course Code:2501UC14	**0**	**0**	**3**	**0**

Aptitude:

Simple Interest, Compound Interest, Time and Work, Pipes and Cisterns

Reasoning:

Blood Relations, Calendar, Clocks, Cubes and Dice, Coded Inequalities

Verbal:

Grammar in use, Group discussion, Reading Comprehension, Past Tense, Future Tense

Text Books:

1. Quantitative Aptitude –Dr. R. S. Aggarwal, S CHAND, **ISBN** · 9789355012326.

2. A Modern Approach to Verbal and Non-Verbal Reasoning – Dr. R. S. Aggarwal, **ISBN**-13. 978-9352832163.

3. Quick Learning Objective General English – Dr. R. S. Aggarwal, S CHAND, **ISBN**-13. 978-8121922111.

Reference Books:

1. Quantitative Aptitude – Abhijit Guha Mc Graw Hill Publications, **ISBN-13**9789389957426.

2.How To Crack Test of Reasoning Verbal , Non-Verbal & Analytical – Jaikishan and Premkishan,Arihant Publications, NEW EDITION 2024,**ASIN : B0CRQ9BVBC**.

3. A New Approach to Objective English – R. S. Dhillon DGP Publications, ISBN-13: **978-8186651032**.

Web Links:

1. www.indiabix.com

2. www.bankersadda.com

Employability Skills- IV

(CE,EEE,ME,ECE,CSE,IT,AIML,CSE(DS),PT,Min.E&Agri.E)

	L	T	P	C
Course Code:2501UC15	**0**	**0**	**3**	**0**

Aptitude:

Time, Speed and Distance, Problems on Trains, Boats and Streams, Mensuration - I, Mensuration - II

Reasoning:

Venn Diagrams, Syllogisms, Non - Verbal Reasoning, Seating Arrangement

Verbal:

Grammatical use, Self-introduction, Letters, E-Mail & Report writing, Error correction, Effective Communication

Text Books:

1. Quantitative Aptitude –Dr. R. S. Aggarwal, S CHAND, **ISBN** · 9789355012326.

2. A Modern Approach to Verbal and Non-Verbal Reasoning – Dr. R. S. Aggarwal, **ISBN**-13. 978-9352832163.

3. Quick Learning Objective General English – Dr. R. S. Aggarwal, S CHAND, **ISBN**-13. 978-8121922111.

Reference Books:

1. Quantitative Aptitude – Abhijit Guha Mc Graw Hill Publications, **ISBN-13**9789389957426.

2.How To Crack Test of Reasoning Verbal , Non-Verbal & Analytical – Jaikishan and Premkishan,Arihant Publications, NEW EDITION 2024,**ASIN : B0CRQ9BVBC**.

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2. www.bankersadda.com

Employability Skills- V

(Common to CE, EEE, ME, ECE, CSE, IT, AIML, CSE(DS), PT & Min.E)

	L	T	P	C
Course Code:2501UC16	**0**	**0**	**3**	**1**

Aptitude:

Permutations and Combinations, Probability, Data Interpretation, Logarithms, Statistics

Reasoning:

Puzzle Tests, Eligibility Test, Data Sufficiency, Statements – Arguments, Statements – Assumptions, Statements - Course of Action, Statements - Conclusions

Verbal:

Interview skills, Grammar in use, Interpersonal Skills, Negotiation Skills, Social Skills, Problem-Solving Skills, Time Management Skills

Text Books:

1. Quantitative Aptitude –Dr. R. S. Aggarwal, S CHAND, **ISBN** · 9789355012326.

2. A Modern Approach to Verbal and Non-Verbal Reasoning – Dr. R. S. Aggarwal, **ISBN**-13. 978-9352832163.

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1. Quantitative Aptitude – Abhijit Guha Mc Graw Hill Publications, **ISBN-13**9789389957426.

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2. www.bankersadda.com

Advanced Data Structures & Algorithm

	L	T	P	C
Course Code:2501AC06	**2**	**0**	**1**	**0**

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Analyze the algorithms efficiency and hashing techniques for searching.

CO2: Illustrate the concepts of search trees and operations of Priority Queues.

CO3: Analyze the algorithms of Divide & Conquer and Greedy paradigms.

CO4: Analyze the algorithms of Dynamic Programming paradigm.

CO5: Design the algorithms of Backtracking and Brach & Bound paradigms.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-
CO3	1	2	1	2	-	-	-	-	-	-	-
CO4	2	2	2	1	-	-	-	-	-	-	-
CO5	2	1	1	2	-	-	-	-	-	-	-

UNIT – I

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.

Hashing: Introduction to Static Hashing, Hash Tables, Hash Functions, Different Hash Functions, Collision Resolution Techniques, Dynamic Hashing.

Practice:

1. Write a program to implement collision resolution techniques of Hash data structure.

UNIT – II

AVL Trees – Creation, Insertion, Deletion operations and Applications.

B-Trees – Creation, Insertion, Deletion operations and Applications

Priority Queues (Heaps): Introduction, Binary Heaps-Model and Simple Implementation, Basic Heap Operations, Other Heap Operations, Applications of Priority Queues

Practice:

1. Write a program to implement AVL tree operations
2. Write a program to implement Max heap and min heap operations

UNIT – III

Divide and Conquer: The General Method, Binary Search, Merge Sort, Quick Sort.

Greedy Method: The General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths.

Practice:

1. Write a program to sort the given list of elements using Merge sort technique using divide and conquer approach.
2. Write a program to implement Single Source Shortest Paths using greedy approach.

UNIT – IV

Dynamic Programming: The General Method, Single Source Shortest Paths– General Weights (Bellman Ford Algorithm), All-pairs shortest paths, Optimal Binary Search Trees, 0/1 Knapsack, Travelling Salesperson problem

Practice:

1. Write a program to implement 0/1 Knapsack problem using Dynamic Programming approach.
2. Write a program to implement all pairs shortest path problem using Dynamic Programming approach.

UNIT – V

Backtracking: The General Method, N-Queens Problem, Sum of Subsets problem, Graph Coloring, Hamiltonian cycles.

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem.

Practice:

1. Write a program to implement N-Queens problem using backtracking algorithm.
2. Write a program to implement Travelling Salesperson problem using branch and bound approach.

Text Books:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2nd Edition Universities Press.
2. Computer Algorithms in C++, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran,2nd Edition University Press.

Reference Books:

1. Data Structures and program design in C, Robert Kruse, 2nd Edition Pearson Education Asia.
2. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison - Wesley.
4. Data Structures using C & C++: Langsam, Augenstein &Tanenbaum, Pearson

Web Links:

1. https://archive.nptel.ac.in/courses/106/102/106102064/
2. https://archive.nptel.ac.in/courses/106/106/106106131/
3. http://peterindia.net/Algorithms.html