B.Sc. (DATA SCIENCE)

Semester Pattern Syllabus (CBCS) : w. e. f. : Academic Year : 2020-21

(With Mathematics Combination)

Year	Semester	Theory / Practical	Paper Title	Work Load (Hrs/Week)	# Credits	Marks
I	FIRST	**Paper - I (DSC - A)**	**Fundamentals of Information Technology**	4	4	100
		Practical – 1	Fundamentals of Information Technology (Lab)	*3*	*1*	*50*
	SECOND	**Paper - II (DSC - B)**	**Problem solving and Python Programming**	4	4	100
		Practical – 2	Problem solving and Python Programming (Lab)	*3*	*1*	*50*
II	THIRD	**SEC – 1**	**University Specified**	2	2	50
		SEC – 2	**Mini Project**	2	2	50
		Paper - III (DSC - C)	**Data Engineering with Python**	4	4	100
		Practical – 3	Data Engineering with Python (Lab)	*3*	*1*	*50*
	FOURTH	**SEC – 3**	**University Specified**	2	2	50
		SEC – 4	**Mini Project**	2	2	50
		Paper - IV (DSC - D)	**Machine Learning**	4	4	100
		Practical – 4	Machine Learning (Lab)	*3*	*1*	*50*
III	FIFTH	**Paper – V (A) (DSE - A)**	**Natural Language Processing**	*4*	*4*	*100*
		Paper – V (B) (DSE - A)	**No SQL Data Bases**	4	4	100
		Practical – 5(A)	Natural Language Processing (Lab)	*3*	*1*	*50*
		Practical – 5(B)	No SQL Data Bases (Lab)	*3*	*1*	*50*
		Paper VI - GE	*Data Structures and Algorithms*	*4*	*4*	*100*
	SIXTH	**Paper – VII (A) (DSE - B)**	**Big Data**	4	4	100
		Paper- VII (B) (DSE - B)	**Deep Learning**	4	4	100
		Practical – 7(A)	Big Data (Lab)	*3*	*1*	*50*
		Practical – 7(B)	Deep Learning (Lab)	*3*	*1*	*50*
		Paper VIII (Project)	***Major Project***	*4*	*4*	*100*

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B.Sc. I Year I Semester (CBCS) : Data Science Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - I)

Paper – I : Fundamentals of Information Technology

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Objectives:

1. **To deal with the basic concepts of computers.**
2. **To discuss about the computer hardware, its components and basic computer architecture.**
3. **To understand the basic computer software including the operating system and its concepts.**
4. **To introduce the software development process**
5. **To introduce the basic concept of programming**

Outcomes:

Students should be able to

1. Identify the components of a computer and their functions.
2. Understand the concept of networking, LAN, Internet, and working of www.
3. Understand the notion of problem solving using computer by programming
4. Understand the notion of Software Project and the Process of software development

Unit-I

Data and Information: Introduction, Types of Data, Simple Model of a Computer, Data Processing Using a Computer, Desktop Computer [Reference 1]

Acquisition of Numbers and Textual Data: Introduction, Input Units, Internal Representation of Numeric Data, Representation of Characters in Computers, Error-Detecting Codes [Reference 1]

Unit-II

Data Storage: Introduction, Storage Cell, Physical Devices Used as Storage Cells, Random Access Memory, Read Only Memory, Secondary Storage, Compact Disk Read Only Memory (CDROM), Archival Store [Reference 1]

Central Processing Unit: Introduction, Structure of a Central Processing Unit, Specifications of a CPU, Interconnection of CPU with Memory and I/O Units, Embedded Processors [Reference 1]

Unit-III

Computer Networks: Introduction, Local Area Network (LAN), Applications of LAN, Wide Area Network (WAN), Internet, Naming Computers Connected to Internet, Future of Internet Technology [Reference 1]

Input Output Devices: Introduction, Keyboard, Video Display Devices, Touch Screen Display, E-Ink Display, Printers, Audio Output [Reference 1]

Computer Software: Introduction, Operating System, Programming Languages, Classification of Programming Languages, Classification of Programming Languages Based on Applications [Reference 1]

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Unit-IV

The Software Problem: Cost, Schedule, and Quality, Scale and Change [Reference 2]
Software Processes: Process and Project, Component Software Processes, Software Development Process Models [Reference 2]
Programming Principles and Guidelines: Structured Programming, Information Hiding, Some Programming Practices, Coding Standards [Reference 2]

References

1. V Rajaraman. Introduction to Information Technology, 3rd Edition, PHI Learning Private Limited, 2018
2. Pankaj Jalote. Concise Introduction toSoftware Engineering, Springer, 2011

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(With Mathematics Combination)

(Examination at the end of Semester - I)

Practical - 1 : Fundamentals of Information Technology (Lab)

[3 HPW :: 1 Credit :: 50 Marks]

Objective

The main objective of this laboratory is to familiarize the students with the basic hardware and software in computers

Exercises

1. Assembly and disassembly of a system box and identifying various parts inside the system box to recognize various parts of a typical computer system
2. Assembly and disassembly of peripheral devices- keyboard and mouse and study of their interface cables, connectors and ports.
3. Installation of Operating Systems-Windows and Linux
4. Disk defragmentation using system tool.
5. Procedure of disk partition and its operation (Shrinking, Extending, Delete, Format).
6. Installing and uninstalling of device drivers using control panel.
7. Working practice on windows operating system and Linux operating system: creating file, folder. Copying, moving, deleting file, folder
8. User Account creation and its feature on Windows Operating System and Changing resolution, color, appearances, and Changing System Date and Time.
9. Installation and using various wireless input devices (Keyboard/Mouse/Scanners etc.,)under Windows/Linux.
10. Study of various types of memory chips and various types of hard disk drives, partition and formatting of hard disk.
11. Installation of scanner, modem and network cards in Windows/Linux.
12. Assembly and disassembly of printer, installing a printer, taking test page, and using printer under Windows/Linux.
13. Installation of application software's – Office Automation, Anti-Virus.
14. Demonstrate the usage of Word and Power point in Windows and Linux
15. Configure Internet connection, Email Account creation, reading, writing and sending emails with attachment.

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B.Sc. I Year II Semester (CBCS) : Data Science Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - II)

Paper – II : Problem Solving and Python Programming

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Objectives

The main objective is to teach Computational thinking using Python.

- To know the basics of Programming
- To convert an algorithm into a Python program
- To construct Python programs with control structures.
- To structure a Python Program as a set of functions
- To use Python data structures-lists, tuples, dictionaries.
- To do input/output with files in Python.
- To construct Python programs as a set of objects.

Outcomes:

On completion of the course, students will be able to:

1. Develop algorithmic solutions to simple computational problems.
2. Develop and execute simple Python programs.
3. Develop simple Python programs for solving problems.
4. Structure a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries.
6. Read and write data from/to files in Python Programs

Unit-I

Introduction to Computing and Problem Solving: Fundamentals of Computing – Computing Devices – Identification of ComputationalProblems – Pseudo Code and Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms.

Introduction to Python Programming: Python Interpreter and InteractiveMode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements,Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: The if, The if…else,The if…elif…else Decision Control Statements, Nested if Statement, The while Loop, The for Loop, The continue and break Statements.

Unit-II

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

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Unit-III

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; Illustrative programs: selection sort,
insertion sort, mergesort, histogram.

Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

Unit-IV

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance The Polymorphism.

Functional Programming: Lambda. Iterators, Generators, List Comprehensions.

References:

1. Introduction to Python Programming. Gowrishankar S., Veena A. CRC Press, Taylor & Francis Group, 2019
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition,Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)

Suggested Reading:

1. Learning To Program With Python. Richard L. Halterman. Copyright © 2011
2. Python for Everybody, Exploring Data Using Python 3. Dr. Charles R. Severance. 2016

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(Examination at the end of Semester - II)

Practical - 2 : Problem Solving and Python Programming (Lab)

[3 HPW :: 1 Credit :: 50 Marks]

Objective

The main objective of this laboratory is to put into practice computational thinking. The students will be expected to write, compile, run and debug Python programs to demonstrate the usage of

- variables, conditionals and control structures
- functions (both recursive and iterative)
- basic data types as well as compound data structures such as strings, lists, sets, tuples, dictionaries
- object-oriented programming

Installing Python and Setting up the Environment

Python interpreter can be downloaded for Windows/Linux platform using the link below:

Exercises

I. Programs to demonstrate the usage of operators and conditional statements

1. Write a program that takes two integers as command line arguments and prints the sum of two integers.
2. Program to display the information:
   Your name, Full Address, Mobile Number, College Name, Course Subjects
3. Program to find the largest number among 'n' given numbers.
4. Program that reads the URL of a website as input and displays contents of a webpage.

II. Programs to demonstrate usage of control structures

5. Program to find the sum of all prime numbers between 1 and 1000.
6. Program that reads set of integers and displays first and second largest numbers.
7. Program to print the sum of first 'n' natural numbers.
8. Program to find the product of two matrices.
9. Program to find the roots of a quadratic equation

III. Programs to demonstrate the usage of Functions and Recursion

10. Write both recursive and non-recursive functions for the following:
    a. To find GCD of two integers
    b. To find the factorial of positive integer
    c. To print Fibonacci Sequence up to given number 'n'
    d. To convert decimal number to Binary equivalent

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11. Program with a function that accepts two arguments: a list and a number 'n'. It should display all the numbers in the list that are greater than the given number 'n'.
12. Program with a function to find how many numbers are divisible by 2, 3,4,5,6 and 7 between 1 to 1000

IV. Programs to demonstrate the usage of String functions

13. Program that accept a string as an argument and return the number of vowels and consonants the string contains.
14. Program that accepts two strings S1, S2, and finds whether they are equal are not.
15. Program to count the number of occurrences of characters in a given string.
16. Program to find whether a given string is palindrome or not

V. Programs to demonstrate the usage of lists, sets, dictionaries, tuples and files.

17. Program with a function that takes two lists L1 and L2 containing integer numbers as parameters. The return value is a single list containing the pair wise sums of the numbers in L1 and L2.

18. Program to read the lists of numbers as L1, print the lists in reverse order without using reverse function.

22. Write a program that combine lists L1 and L2 into a dictionary.

19. Program to find mean, median, mode for the given set of numbers in a list.

20. Program to find all duplicates in the list.

21. Program to o find all the unique elements of a list.

22. Program to find max and min of a given tuple of integers.

23. Program to find union, intersection, difference, symmetric difference of given two sets.

24. Program to display a list of all unique words in a text file

25. Program to read the content of a text file and display it on the screen line wise with a line number followed by a colon

26. Program to analyze the two text files using set operations

27. Write a program to print each line of a file in reverse order.

VI. Programs to demonstrate the usage of Object Oriented Programming

28. Program to implement the inheritance

29. Program to implement the polymorphism

VII. Programs to search and sort the numbers

30. Programs to implement Linear search and Binary search

31. Programs to implement Selection sort, Insertion sort

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B.Sc. (DATA SCIENCE)

Theory Question Paper Pattern

w.e.f: Academic Year: 2020-21

(With Mathematics Combination)

Time: 3 hours] [Max. Marks: 80

Section - A

Answer any EIGHT questions. All questions carry equal marks. (8Qx4m=32)

1. From Unit I
2. From Unit I
3. From Unit I
4. From Unit II
5. From Unit II
6. From Unit II
7. From Unit III
8. From Unit III
9. From Unit III
10. From Unit IV
11. From Unit IV
12. From Unit IV

Section - B

Answer ALL questions. All questions carry equal marks. (4Qx12m=48)

13. a) From Unit I
    (or)
    b) From Unit I

14. a) From Unit II
    (or)
    b) From Unit II

15. a) From Unit III
    (or)
    b) From Unit III

16. a) From Unit IV
    (or)
    b) From Unit IV

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