ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN (w.e.f.2023-24)
B.Sc., Data Science (Programme Structure)

Sem.	Part	Course Code	Courses	Title of the Paper	T/P	Credit	Hours/ Week	Max. Marks		
								Int.	Ext.	Total
I	I	2311T	T/OL	தமிழ் இலக்கிய வரலாறு-I /Other Languages -I	T	3	6	25	75	100
	II	2312E	E	General English - I	T	3	6	25	75	100
	III	23BDS1C1	CC-I	Programming in C	T	4	5	25	75	100
		23BDS1P1	CC-II	Practical – Programming in C Lab	P	4	4	25	75	100
		--	Generic Elective (Allied)	Allied – I C Programming (for other departments)	T	3	3	25	75	100
				Allied I Practical C Programming Lab (for other departments)	P	2	2	25	75	100
	IV	23BDS1S1	SEC -I	Fundamentals of Information Technology	T	2	2	25	75	100
		23BDS1FC	Foundation Course-	Quantitative Aptitude	T	2	2	25	75	100
				Total		**23**	**30**	**200**	**600**	**800**
II	I	2321T	T/OL	தமிழ் இலக்கிய வரலாறு-2 /Other Languages-II	T	3	6	25	75	100
	II	2322E	E	General English – II	T	3	6	25	75	100
	III	23BDS2C1	CC-III	Python Programming	T	4	5	25	75	100
		23BDS2P1	CC-IV	Practical – Python Programming Lab	P	4	4	25	75	100
		--	Generic Elective (Allied)	Allied - II Office Automation (for other departments)	T	3	3	25	75	100
				Allied II Practical Office Automation Lab (for other departments)	P	2	2	25	75	100
	IV	23BDS2S1	SEC -II	Open Source Software Technologies	T	2	2	25	75	100
		23BDS2S2	SEC-III	Introduction to HTML	T	2	2	25	75	100
				Naan Mudhalvan Course						
				Total		**23**	**30**	**200**	**600**	**800**
III	I	2331T	T/OL	**தமிழக வரலாறும் பண்பாடும்** / Other Languages-III	T	3	6	25	75	100
	II	2332E	E	General English – III	T	3	6	25	75	100
	III	23BDS3C1	CC-V	Data Science	T	4	5	25	75	100
		23BDS3P1	CC-VI	Data Science Lab	P	4	4	25	75	100
		--	Generic Elective (Allied)	Allied III Theory– Operations Research (for other departments)	T	3	3	25	75	100
				Allied III Practical - Operations Research Lab (for other departments)	P	2	2	25	75	100
		23BDS3S1	SEC-IV	E-Commerce	T	2	2	25	75	100
		233AT/ 23BDS3S2	SEC-V	Adipadai Tamil/ Enterprise Resource Planning	T	2	2	25	75	100
				Naan Mudhalvan Course						

				Total		**23**	**30**	**200**	**600**	**800**
IV	I	2341T	T/OL	**தமிழும் அறிவியலும்**/ Other Languages -IV	T	3	6	25	75	100
	II	2342E	E	General English – IV	T	3	6	25	75	100
	III	23BDS4C1	CC-VII	Object Oriented Programming with Java	T	4	4	25	75	100
		23BDS4P1	CC-VIII	Object Oriented Programming with Java Lab	P	3	3	25	75	100
		--	Generic Elective (Allied)	Allied – IV Theory Internet and Web Design	T	3	3	25	75	100
				Allied – IV Practical Internet and Web Design Lab	P	2	2	25	75	100
	IV	23BDS4S1	SEC-VI	Advanced Excel	T	2	2	25	75	100
		234AT/ 23BDS4S2	SEC-VII	Adipadai Tamil/ PHP Programming	T	2	2	25	75	100
		23BES4	E.V.S	Environmental Studies	T	2	2	25	75	100
				Naan Mudhalvan Course						
				Total		**24**	**30**	**225**	**675**	**900**

V	III	23BDS5C1	CC-IX	Relational Database Management System	T	4	5	25	75	100
		23BDS5C2	CC-X	RDBMS Lab using Oracle	T	4	5	25	75	100
		23BDS5C3	CC-XI	Machine Learning	T	4	5	25	75	100
		23BDS5P1	CC-XII	Machine Learning Lab	P	4	5	25	75	100
		23BDS5E1	DSE-I	Big Data Analytics	T	3	4	25	75	100
		23BDS5E2	DSE-II	Artificial Neural Networks	T	3	4	25	75	100
	IV	23BVE5		Value Education	T	2	2	25	75	100
		23BDS5I		Internship/Industrial Visit/ Field Visit		2	-	25	75	100
				Naan Mudhalvan Course						
				Total		**26**	**30**	**200**	**600**	**800**
VI		23BDS6C1	CC-XIII	Artificial Intelligence	T	4	6	25	75	100
		23BDS6D	CC-XIV	Dissertation		8	12	25	75	100
		23BDS6E1	DSE-III	Computing Intelligence	T	3	5	25	75	100
		23BDS6E2	DSE-IV	Analytics for Service Industry	T	3	5	25	75	100
		23BDS6S1		Extension Activity		1	-	-	-	-
			PCS	Essential Reasoning and Quantitative Aptitude	T	2	2	25	75	100
				Naan Mudhalvan Course						
				Total		**21**	**30**	**125**	**375**	**500**
				Grand Total		**140**	**--**	**1150**	**3450**	**4600**

1. TOL-Tamil/Other Languages,
2. E – English

- CC-Core course
- Generic Elective (Allied)
- SEC-Skill Enhancement Course
- FC-Foundation Course
- DSE – Discipline Specific Elective

Allied Subjects offered by other departments to B.Sc. Data Science students

Semester I : Allied I: Theory : Numerical Methods with Applications
Allied I Practical : Numerical Methods with Applications Lab
Semester II: Allied II: Theory: Ancillary Mathematics – II
Allied II Practical : Ancillary Mathematics – II Lab
Semester III: Allied III: Theory: Statistics - I
Allied III : Practical: Statistics – I Lab
Semester IV: Allied IV: Theory: Statistics - II
Allied IV : Practical: Statistics – II Lab

Allied Subjects offered by B.Sc. Data Science department to other department students

Semester I : Allied I: Theory : Database Management System
Allied I Practical : Database Management System Lab
Semester II: Allied II: Theory: Office Automation
Allied II Practical : Office Automation Lab
Semester III: Allied III: Theory: Operations Research
Allied III : Practical: Operations Research Lab
Semester IV: Allied IV: Theory: Internet and Web Design
Allied IV : Practical: Internet and Web Design Lab

Semester I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BDS1C1	**PROGRAMMING IN C**	Core Theory	5	-	-	-	4	5	25	75	100

Learning Objective	
LO1	To familiarize the students with the Programming basics and the fundamentals of C, Data types in C, Mathematical and logical operations.
LO2	To understand the concept using if statements and loops
LO3	This unit covers the concept of Arrays and Functions
LO4	This unit covers the concept of Structurs and unions and Preprocessors
LO5	To understand the concept of implementing pointers.

	Contents	**No. of Hours**
UNIT I	**Overview of C**: Importance of C, sample C program, C program structure, executing C program. Constants, Variables, and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration of variables, Assigning values to variables---Assignment statement, declaring a variable as constant, as volatile. **Operators and Expression**: Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special operators, arithmetic expressions, operator precedence, type conversions, mathematical functions **Managing Input and Output Operators**: Reading and writing a character, formatted input, formatted output.	15
UNIT II	**Decision Making and Branching**: Decision making with If, simple IF, IF ELSE, nested IF ELSE , ELSE IF ladder, switch, GOTO statement. **Decision Making and Looping**: While, Do-While, For, Jumps in loops.	15
UNIT III	**Arrays**: Declaration and accessing of one & two-dimensional arrays, initializing two-dimensional arrays, multidimensional arrays. **Functions**: The form of C functions, Return values and types, calling a function, categories of functions, Nested functions, Recursion, functions with arrays, call by value, call by reference, storage classes-character arrays and string functions.	15
UNIT IV	**Structures and Unions**: Defining, giving values to members, initialization and comparison of structure variables, arrays of structure, arrays within structures, structures within structures, structures and functions, unions. **Preprocessors**: Macro substitution, file inclusion.	15
UNIT V	**Pointers:** definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor, pointers and arrays, pointers and functions, pointers and structures.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	

CO1	Remember the program structure of C with its syntax and semantics	PO1,PO3,PO5
CO2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2,PO3,PO6
CO3	Apply the programming principles learnt in real-time problems	PO3,PO4,PO5
CO4	Analyze the various methods of solving a problem and choose the best method	PO4,PO5,PO6
CO5	Code, debug and test the programs with appropriate test cases	PO5,PO6
Text Book		
1	E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.	
Reference Books		
1.	Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.	
2.	Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998	
3.	YashavantKanetkar, Let Us C, Eighteenth Edition, BPB Publications,2021	
Web Resources		
1.	https://codeforwin.org/	
2.	https://www.geeksforgeeks.org/c-programming-language/	
3.	http://en.cppreference.com/w/c	
4.	http://learn-c.org/	
5.	https://www.cprogramming.com/	

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3
CO 2	3	3	3	2	3	3
CO 3	2	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	2
Weight age of course contributed to each PSO	14	15	14	14	15	13

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BDS1P1	**PROGRAMMING IN C LAB**	Core Practical	-	-	4	-	4	4	25	75	100

Course Objective	
LO1	To familiarize the students with the Programming basics and the fundamentals of C, Datatypes in C, Mathematical and logical operations.
LO2	To understand the concept using if statements and loops
LO3	This unit covers the concept of Arrays and Functions
LO4	This unit covers the concept of Structurs and unions and Preprocessors
LO5	To understand the concept of implementing pointers and files

UNIT	List of Excercises	No. of Hours	Course Objectives
UNIT I	**Variables, Data types, Constants and Operators** 1.Evaluation of expression ex: ((x+y) ^2 * (x+z))/w 2.Temperature conversion problem (Fahrenheit to Celsius) 3.Program to convert days to months and days (Ex: 364 days = 12 months and 4 days) 4.Solution of quadratic equation 5.Salesman salary (Given: Basic Salary, Bonus for every item sold, commission on the total monthly sales)	6	
UNIT II	**Decision making Statements** 6.Maximum of three numbers 7.Calculate Square root of five numbers (using gototatement) 8.Pay-Bill Calculation for different levels of employee (Switch statement) 9. Fibonacci series 10.Floyds Triangle 11.Pascal's Triangle	6	
UNIT III	**Arrays, Functions and Strings** 12.Prime numbers in an array 13.Sorting data (Ascending and Descending) 14.Matrix Addition and Subtraction 15.Matrix Multiplication 16.Function with no arguments and no return values 17.Function that convert lower case letters to upper case 18. Factorial using recursion. 19.Perform String Operations using Switch Case.	6	
UNIT IV	**Structures and Macros** 20.Structure that describes a Hotel (name, address, grade, avg room rent, number of rooms) Perform some operations (list of hotels of a given grade etc.) 21. Using Pointers in Structures. 22.Cricket team details using Union. 23.Write a macro that calculates the max and min of two numbers 24.Nested macro to calculate Cube of a number.	6	
UNIT V	**Pointers and Files** 25.Evaluation of Pointer expressions 26.Function to exchange two pointer values 27.Creation, insertion and deletion in a linked list 28.Program to read a file and print the data.	6	

	29.Program to receive a file name and a line of text as command line arguments and write the text to the file 30. Program to copy the content of one file to another file.	
	Total	**30**
Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Remember the program structure of C with its syntax and semantics	PO1,PO3,PO5
2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2,PO3,PO6
3	Apply the programming principles learnt in real-time problems	PO3,PO4
4	Analyze the various methods of solving a problem and choose the best method	PO4,PO5,PO6
5	Code, debug and test the programs with appropriate test cases	PO4,PO6
Text Book		
1	E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.	
Reference Books		
1.	Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.	
2.	Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998	
3.	Yashavant Kanetkar, Let Us C, Eighteenth Edition, BPB Publications,2021	
Web Resources		
1.	https://codeforwin.org/	
2.	https://www.geeksforgeeks.org/c-programming-language/	
3.	http://en.cppreference.com/w/c	
4.	http://learn-c.org/	
5.	https://www.cprogramming.com/	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	3	3
CO 3	3	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weight age of course contributed to each PSO	14	15	14	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS1S1	FUNDAMENTALS OF INFORMATION TECHNOLOGY	SEC –I	2	-	-	I	2	25	75	100

Learning Objectives	
LO1	Understand basic concepts and terminology of information technology.
LO2	Have a basic understanding of personal computers and their operation
LO3	Be able to identify data storage and its usage
LO4	Get great knowledge of software and its functionalities
LO5	Understand about operating system and their uses

UNIT	Contents	No. Of. Hours
UNIT I	**Introduction to Computers:** Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer	6
UNIT II	**Basic Computer Organization:** Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.	6
UNIT III	**Storage Fundamentals:** Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives	6
UNIT IV	**Software:** Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w	6
UNIT V	**Operating System:** Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	6
	TOTAL HOURS	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.	PO1, PO2, PO3, PO4, PO5, PO6

CO2	Develop organizational structure using for the devices present currently under input or output unit.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of storing data in computer using two header namely RAM and ROM with different types of ROM with advancement in storage basis.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with different software, Write program in the software and applications of software.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Anoop Mathew, S. Kavitha Murugeshan (2009), " Fundamental of Information Technology", Majestic Books.	
2	Alexis Leon, Mathews Leon," Fundamental of Information Technology", 2nd Edition.	
3	S. K Bansal, "Fundamental of Information Technology".	
Reference Books		
1.	Bhardwaj Sushil Puneet Kumar, "Fundamental of Information Technology"	
2.	GG WILKINSON, "Fundamentals of Information Technology", Wiley-Blackwell	
3.	A Ravichandran , "Fundamentals of Information Technology", Khanna Book Publishing	
Web Resources		
1.	https://testbook.com/learn/computer-fundamentals	
2.	https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html	
3.	https://www.javatpoint.com/computer-fundamentals-tutorial	
4.	https://www.tutorialspoint.com/computer_fundamentals/index.htm	
5.	https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS1FC	QUANTITATIVE APTITUDE	Skill Enhancement (Foundation Course)	2	-	-	-	2	25	75	100

Learning Objectives: (for teachers:what they have to do in the class/lab/field)

- Toimprovethequantitativeskillsofthestudents
- Topreparethestudentsforvariouscompetitiveexams

CO1**:**To gain knowledge on LCM and HCF and its related problems
CO2:To get an idea of age, profit and loss related problem solving.
CO3:Able to understand time series simple and compound interests
CO4**:**Understanding the problem related to probability, and series
CO5**:**Able to understand graphs, charts

Units	Contents	Required Hours
UNIT I	Numbers- HCF and LCM of numbers-Decimal fractions- Simplification-Square roots and cube roots- Average- problems on Numbers	6
UNIT II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership- Chain rule.	6
UNIT III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms – Area-Volumeandsurfacearea-races and Games of skill.	6
UNIT IV	Permutationandcombination-probability-TrueDiscount-BankersDiscount - Height and Distances-Odd man out & Series.	6
UNIT V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs- Piecharts-Linegraphs	6
	TOTAL HOURS	30

Text Book:
"QuantitativeAptitude",R.S.AGGARWAL.,S.Chand&CompanyLtd.,
Webresources: Authentic Web resources related to Competitive examinations

MAPPING TABLE						
CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	3
CO2	3	3	3	3	3	3
CO3	3	2	2	2	3	3
CO4	3	3	2	3	3	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	13	13	13	14	15

Semester II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BDS2C1	**PYTHON PROGRAMMING**	Core Theory	5	-	-	-	4	5	25	75	100

Learning Objective	
LO1	To recall and understand the features of python programming language
LO2	To illustrate various programming constructs used in python
LO3	To understand the object oriented concepts in python
LO4	To apply various language constructs to write simple programs in python
LO5	To distinguish the various constructs used in python.

	Contents	**No. of Hours**
UNIT I	Introduction to Python: Features of Python - How to Run Python - Identifiers – Reserved Keywords - Variables – Comments in Python - Indentation in Python – Multi-Line Statements - Multiple Statement Group (Suite) - Quotes in Python – Input, Output and Import Functions - Operators. Data Types and Operations: Numbers – Strings – List – Tuple – Set – Dictionary – Data type conversion.	15
UNIT II	Flow Control: Decision Making – Loops – Nested Loops – Types of Loops. Functions: Function Definition – Function Calling - Function Arguments - Recursive Functions - Function with more than one return value.	15
UNIT III	Modules and Packages: Built-in Modules - Creating Modules - import Statement – Locating Modules - Namespaces and Scope - The dir() function - The reload() function - Packages in Python - Date and Time Modules. File Handling- Directories in Python.	15
UNIT IV	Object-Oriented Programming: Class Definition - Creating Objects - Built-in Attribute Methods - Built-in Class Attributes- Destructors in Python – Encapsulation - Data Hiding – Inheritance - Method Overriding- Polymorphism.	15
UNIT V	Exception Handling: Built-in Exceptions-Handling ExceptionsException with Arguments - Raising Exception - User-defined Exception - Assertions in Python. Regular Expressions: The match() function - The search() function - Search and Replace - Regular Expression Modifiers: Option Flags-Regular Expression Patterns Character Classes-Special Character Classes - Repetition Cases - findall() method – compile() method.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Remember the program structure of Python with its syntax and semantics	PO1,PO3,PO5
CO2	Understand the programming principles in Python (data types, operators, branching and looping, arrays, functions and files)	PO2,PO3,PO6
CO3	Apply the programming principles learnt in real-time problems	PO3,PO4,PO5
CO4	Analyze the various methods of solving a problem and choose the best method	PO4,PO5,PO6
CO5	Code, debug and test the programs with appropriate test cases	PO5,PO6

Text Book	
1	Jeeva Jose and P. Sojan Lal, “Introduction to Computing and Problem Solving with PYTHON”, Khanna Book Publishing Co.

Reference Books	
1	Mark Summerfield. ― Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2	Martin C. Brown, ―PYTHON: The Complete Reference‖, McGrawHill, 2001
3	Wesley J. Chun, "Core Python Programming", Prentice Hall Publication, 2006.
4	Timothy A Budd, "Exploring Python", Tata McGraw Hill, New Delhi, 2011
5	Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly Media, 2016.
6	Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O Reilly Publishers, 2016
7	Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
Web Resources	
1.	https://www.python.org/about/gettingstarted/
2.	https://www.w3schools.com/python/
3.	https://www.programiz.com/python-programming

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	2	3	3
CO 3	2	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	2
Weight age of course contributed to each PSO	14	15	14	14	15	13

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BDS2P1	**PYTHON PROGRAMMING LAB**	Core Practical	-	-	4	-	4	4	25	75	100

Course Objective	
LO1	To write, test, and debug simple Python programs.
LO2	To implement Python programs for decision making and iterations.
LO3	To represent data collections using Python lists, tuples, and dictionaries
LO4	To understand and create modules
LO5	To understand exception handling features

		No. of Hours
UNIT I	**1.** Write python program to print Hello World **2.** Write a python program to print a number is positive/negative using if-else. **3.** Write a python program to find largest number among three numbers **4.** Create a list and perform the following methods a) insert() b) remove() c) append() d) len() e) pop() f) clear() **5.** Write a python program to find the length of list **6.** Write a python program to find the smallest and largest number in the list	6
UNIT II	**7.** Write a python program to print list of numbers using range and for loop **8.** Write a python code to print the sum of natural numbers using while loop **9.** Write a python program to print the factorial of given number? **10.** Write a python program to find the sum of all numbers stored in a list using for loop?	6
UNIT III	**11.** Using a numpy module create an array and check the following: a) Type of array b) Axes of array c) Shape of array d) Type of elements in array **12.** Using a numpy module create array and check the following: a) List with type float b) 3 x 4 array with all zeros c) Create tuple using array elements d) Display Random values	6
UNIT IV	**13.** Write python program and define your own function. Call that function to display HelloWorld message. **14.** Write python program and define your own function to pass a string parameter and display it by calling the function defined. **15.** Write a python program to open a file and write "hello world" into it. **16.** Write a python program to add the content "hi python programming" into the existing file. **17.** Write a python program to read the contents of a file.	6

UNIT V	**18.** Write a program to double a given number and add two numbers using lambda(). **19.** Write a program to filter only even numbers from a given list using filter(). **20.** Write a program double all the items in the list using map() **21.** Write a program to find sum of the numbers in a list using reduce(). **22.** Write a python program to handle the Division by zero exception. **23.** Write a python program to demonstrate multiple exception blocks with a single try block.	6
Text Books		
1. Martin C. Brown, —PYTHON: The Complete Reference‖, McGrawHill, 2001		
Web Resources		
https://bugs.python.org/file47781/Tutorial_EDIT.pdf https://static.realpython.com/python-basics-sample-chapters.pdf		
https://www.w3schools.com/python/		
CO		
1	Write simple programs using control structures, functions and strings	
2	Develop programs using tuples, lists, sets and dictionary	
3	Write simple programs using Constructors, Method overloading and inheritance	
4	Develop programs using files and regular expressions	
5	Write simple programs using packages and exception handling	

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	3	3
CO 3	3	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weight age of course contributed to each PSO	14	15	14	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

Semester II – Skill Based Elective for B.Sc. Data Science

CourseCode	CourseTitle	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
23BDS2S1	**Open Source Software Technologies**	**SEC-II**	2	-	-	-	2	2	25	75	100

Course Objective	
C1	AbletoAcquireandunderstandthebasicconceptsinJava,applicationofOOPSconcepts.
C2	Acquire knowledge about operators and decision-making statements.
C3	To Identify the significance and application of Classes, arrays and interfaces and analyzing java arrays
C4	UnderstandabouttheapplicationsofOOPSconceptsandanalyzeoverridingandpackages through java programs.
C5	CanCreatewindow-basedprogrammingusingappletandgraphicsprogramming.

	Details	**No.of Hours**	**CO**
UNIT I	OpenSource–opensourcevs.commercialsoftware–What isLinux?–FreeSoftware–WhereIcanuseLinux?-Linuxkernel–Linuxdistributions.	6	C1
UNIT II	IntroductionLinuxEssentialCommands–FileSystemconcept–StandardFiles–TheLinuxSecurityModel–IntroductiontoUnix–UnixComponentsUnix Files –	6	C2
UNIT III	Introduction - Apache Explained – Starting, Stopping and RestartingApache – Modifying the Default configuration – Securing Apache – Setuserand Group	6	C3
UNIT IV	**MySQL:**IntroductiontoMySQL–Theshowdatabasesandtable–TheUSEcommand–CreateDatabaseandTables – DescribeTable –	6	C4
UNIT V	**Introduction** –PHP Form processing – Database Access with PHP –MySQL, MySQLFunctions – Inserting Records – Selecting Records –Deleting Records–Update Records.	6	C6
	Total	**30**	

CourseOutcomes		**ProgrammeOutcome**
CO	Oncompletion ofthiscourse,students will	
1	Acquireandunderstandthebasic conceptsin Java, applicationofOOPSconcepts.	PO1
2	Acquire knowledge about operators and decision-makingstatements.	PO1,PO2
3	Identifythesignificance andapplication ofClasses, arrays andinterfacesand analyzingjavaarrays	PO4,PO6
4	UnderstandabouttheapplicationsofOOPSconceptsand analyze overriding and packages through javaprograms.	PO4,PO5,PO6
5	Create window-based programming using applet andgraphicsprogramming.	PO3,PO8

TextBook	
1	JamesLee andBrentWare“OpenSourceWebDevelopment withLAMP using
2	LINUX,Apache,MySQL,PerlandPHP”,DorlingKindersley(India)Pvt.Ltd,2008.

ReferenceBooks	
1.	EricRosebrock,EricFilson,“SettingupLAMP:GettingLinux,Apache, MySQLandPHPand working together”, JohnWileyand Sons, 2004.

2.	2.AnthonyButcher,"TeachYourselfMySQLin21days",2ndEdition,SamsPublication.
3.	3.RichBower,DanielLopezRidreejo,AlianLiska,"ApacheAdministrator'sHandbook",SamsPublication.
4.	4. Tammy Fox, "RedHat Enterprise Linux 5 Administration Unleashed", SamsPublication.
5.	5.NaramoreEligabette, GernerJason,WroxPress,WileyDreamtechPress,"Beginning PHP5, Apache,MySQLWebDevelopment",2005.
WebResources	
1.	IntroductiontoOpen-Sourceanditsbenefits-GeeksforGeeks
2.	https://www.bing.com/

MAPPINGTABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**3**	**2**	**3**	**2**
CO2	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage ofcourse contributedtoeach PSO	**13**	**13**	**14**	**14**	**15**	**13**

Semester II – Skill Based Elective for B.Sc. Data Science

Course Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS2S2	**INTRODUCTION TO HTML**	SEC-III	2	-	-		2	25	75	100

LearningObjectives	
LO1	To familiarize with internet and web page concepts
LO2	To understand and use basic tags in HTML
LO3	To create list and hyperlinks on web page
LO4	To create and handle table contents on web page
LO5	To create frames and manage screen space

	Contents	**No.Of. Hours**
UNIT I	Introduction: Web Basics: What is Internet–Web browsers–What is Webpage –HTML Basics: Understanding tags.	**6**
UNIT II	Tags for Document structure (HTML, Head, Body Tag). Block level text elements:Headingsparagraph(<p>tag)–Fontstyleelements:(bold,italic,font, small, strong, strike, bigtags)	**6**
UNIT III	Lists: Types of lists: Ordered, Unordered–Nesting Lists–Other tags: Marquee, HR,BR –Using ages–Creating Hyperlinks.	**6**
UNIT IV	Tables: Creating basic Table, Table elements, Caption–Table and cell alignment–Rowspan, Colspan–Cell padding.	**6**
UNIT V	Frames: Frameset–Targeted Links–No frame–Forms: Input, Textarea, Select, Option.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	Oncompletionofthiscourse,studentswill	
CO1	understand the use of internet and web pages	PO1,PO2,PO3, PO4, PO5, PO6
CO2	be able to create web pages with basic formatting tags	PO1,PO2,PO3, PO4, PO5, PO6
CO3	be able to display contents on web page in various list formatting and connect pages with hyperlinks	PO1, PO2, PO3, PO4, PO5, PO6
CO4	be able to create tables with colourful formatting and weblinks	PO1, PO2, PO3, PO4, PO5, PO6
CO5	be able to manage multiple contents with frame creation	PO1, PO2, PO3, PO4, PO5, PO6

Text and Reference Books

1 "MasteringHTML5 and CSS3MadeEasy", TeachUCompInc.,2014.

2	ThomasMichaud,“FoundationsofWebDesign:IntroductiontoHTML&CSS”, 2013
WebResources	
1	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2	https://www.w3schools.com/html/default.asp
3	https://www.dcpehvpm.org/E-Content/BCA/BCA-II/Web%20Technology/the-complete-reference-html-css-fifth-edition.pdf

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	3	3	3	3	3
CO 2	3	3	2	3	3	3
CO 3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	2	3	3
Weightageofcourse contributed to each PSO	14	15	14	14	15	15

S-Strong-3 M-Medium- 2 L-Low-1

SECOND YEAR –SEMESTER- III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS3C1	**DATA SCIENCE**	**CC-V**	5	-	-	III	4	25	75	100

Learning Objectives	
LO1	To understand the basic concepts of Data Science
LO2	To understand the principles of algorithms, flowchart and source code
LO3	To acquire a solid foundation in Python.
LO4	To visualize data using plots in python
LO5	To understand and handle database and visualize.

UNIT	**Contents**	**No. Of. Hours**
UNIT I	**Introduction to Data Science** Introduction: Data Science - Big Data and Data Science hype – getting past the hype - Datafication - Current landscape of perspectives - Skill sets needed - Statistical Inference - Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA – Applications of Data Science - Data Science in Business - Business Intelligence vs Data Science– Data Analytics Life Cycle - Machine Learning	**15**
UNIT II	**Introduction to Python** Features of Python - How to Run Python – Identifiers- Reserved Keywords- Variables - Comments in Python - Indentation in Python - Multi-Line Statements- Input, Output and Import Functions- Operators. Data Types and Operations: Numbers -Strings -List -Tuple - Set -Dictionary - Mutable and Immutable Objects - Data Type Conversion. Flow Control: Decision Making- Loops-Nested Loops-Control Statements- Types of Loops-List Comprehensions-Set Comprehensions-Dictionary Comprehensions-Nested Dictionaries.	**15**
UNIT III	**Functions** Function Definition - Function Calling - Function Arguments - Anonymous Functions (Lambda Functions) - Recursive Functions - Modules and Packages: Built-in Modules - Creating Modules - import Statement- Namespaces and Scope - The dir() function - The reload() function -Packages in Python - Date and Time Modules – Numpy Libraries and Data Manipulation Using Pandas	**15**
UNIT IV	**File Handling and Object Oriented Programming** Opening a File- Closing a File - Writing to a File - Reading from a File - File Methods - Renaming a File - Deleting a File - Directories in Python. Regular Expressions. Class Definition - Creating Objects - Built-in Attribute Methods - Built-in Class Attributes - Destructors in Python – Encapsulation - Data Hiding – Inheritance-Method Overriding – Polymorphism - Exception Handling	**15**
UNIT V	**Database Programming and Visualizations** Connecting to a Database - Creating Tables - INSERT Operation - UPDATE Operation - DELETE Operation - READ Operation - Transaction Control -Disconnecting from a Database - Exception Handling in Databases - GUI Programming – CGI Programming- Data Visualizations using Matplotlib – histograms, bar charts, pie charts.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	To explain the basic concepts of data science and its application	PO1, PO2, PO3, PO4, PO5, PO6

CO2	To explain the Features of Python To demonstrate Control Statements and Looping Statements	PO1, PO2, PO3, PO4, PO5, PO6
CO3	To understand Python Functions To create and illustrate Numpy Libraries To perform Data Manipulation using Pandas.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	To understand the File Concepts Apply Exception Handling Techniques	PO1, PO2, PO3, PO4, PO5, PO6
CO5	To Create and manipulate Database To create Data Visualization using Mat plot lib	PO1, PO2, PO3, PO4, PO5, PO6

	Textbooks
1	Doing Data Science**,** Straight Talk From The Frontline**, Cathy O'Neil and RachelSchutt, O'Reilly** (2014)
2	Big Data Analytics, paperback 2nd ed., **Seema Acharya, SubhasiniChellappan, Wiley**
3	**Dr. Jeeva Jose (2018) ,**Taming Python By Programming, Khanna Publishers
4	**Jake Vanderplas,** Python Data Science Handbook: Essential Tools for Working with Data1st Edition.
	Reference Books
1.	LjubomirPerkovic(2012),Introduction to Computing Using Python: An Application DevelopmentFocus, John Wiley & Sons
2.	John V Guttag(2013), Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press.
3	Kenneth A. Lambert(2012), Fundamentals of Python: First Programs, Cengage Learning

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	2	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	2	3	3	3	3	3
Weightage of course contributed to each PSO	14	14	15	15	15	15

S-Strong-3 M-Medium-2 L-Low-1

Semeser III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS3P1	DATA SCIENCE LAB	CC VI	-	Fr	4	III	4	25	75	100

OBJECTIVES:
To build websites and software, automate tasks, and conduct data analysis.Open Source andCommunity Development.

LIST OF PROGRAMS	Required Hours
1. Demonstrate the working of "id" and "type" functions. **2.** Find all prime numbers within a given range. **3.** Print n terms of Fibonacci series using iteration. **4.** Demonstrate use of slicing in string. **5.** Compute the frequency of the words from the input. The output should output after sorting thekey alphanumerically. **6.** Write a program that accepts a comma separated sequence of words as input and prints thewords in a comma-separated sequence after sorting them alphabetically. **7.** Demonstrate use of list & related functions. **8.** Demonstrate use of Dictionary & related functions. **9.** Demonstrate use of tuple & related functions. **10.** Implement stack using list. **11.** Implement queue using list. **12.** Read and write from a file. **13.** Copy a file. **14.** Demonstrate working of classes and objects. **15.** Demonstrate class method & static method. **16.** Demonstrate constructors. **17.** Demonstrate inheritance. **18.** Demonstrate aggregation/composition. **19.** Create a small GUI application for insert, update and delete in a table. **20.** Bar charts, histograms and PIE charts	**60**

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	2	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	2	3	3	3	3	3
Weightage of course contributed to each PSO	14	14	15	15	15	15

S-Strong-3 M-Medium-2 L-Low-1

Semester III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS3S1	**E-COMMERCE**	**SEC IV**	2	-	-	III	2	25	75	100

Learning Objectives	
LO1	Understanding of the foundations and importance of E-commerce
LO2	Understanding of retailing in E-commerce by in terms of branding and pricing strategies and determining the effectiveness of market research.
LO3	Assess the Internet trading relationships including Business to Consumer, Business- to-Business, Intra-organizational.
LO4	Knowing key features of Internet, Intranets and Extranets and how they relate to each other.
LO5	Understanding legal issues and privacy in E-Commerce.

UNIT	**Contents**	**No. Of. Hours**
UNIT I	**E-Commerce:** E-Commerce Framework – E-Commerce and Media Convergence – The anatomy of E-commerce applications - E-Commerce Consumer Applications - E- Commerce Organization Applications.	**6**
UNIT II	**The Internet:** The Internet Terminology – NSFNET – Architecture and Components– National Research and Education Network – Internet Governance – An overview of Internet Applications. The Business of Internet Commercialization: Telco/Cable/Online companies - National Independent ISPs – Regional level ISPs – Local level ISPs.	**6**
UNIT III	**E-Commerce and the World Wide Web:** Architectural Framework for E-commerce – WWW as the architecture – Technology behind the web – Security and the web.	**6**
UNIT IV	**Electronic Payment Systems:** Types of Electronic Payment Systems – Digital token Electronic Payment Systems – Credit Card Based Electronic Payment Systems – Risk and Electronic Payment Systems. Electronic Data Interchange: Legal, Security and Privacy issues.	**6**
UNIT V	**Advertising and Marketing on the Internet:** E-Commerce Catalogs – Information Filtering – Consumer Data Interface – Emerging tools. Software Agents: Characteristics and Properties of Software Agents – Technology behind Software Agents - Applets, Browsers, and Software Agents.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Demonstrate E-Commerce Frameworks. Distinguish E-Commerceand media Convergence. Illustrate E-Commerce Applications.	PO1, PO2, PO3, PO4, PO5, PO6
	Describe the E-Commerce Networks and Research Networks,	PO1, PO2, PO3,

CO2	Analyze the Internet Commercialization	PO4, PO5, PO6
CO3	Evaluate the E-Commerce how incorporate the Internet, Constructthe Web Security	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Distinguish the different payment system. Illustrate the data interchange	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understanding the Advertising and Marketing on the Internet,Describe Software Agents	PO1, PO2, PO3, PO4, PO5, PO6

	Textbooks
1	**Ravi Kalakota& Andrew Whinston,** "*Frontiers of Electronic-Commerce*", AddisonWesley.
	Reference Books
1.	**EfraimTurvanJ.Lee, David Kug and Chung**, "Electronic Commerce", Pearson Education,Asia.
2.	**Manlyn Greenstein and Miklos**, "Electronic Commerce", TMH.
	Web Resources
1.	https://www.the-reference.com/en/expertise/creation-and.../e-commerce
2.	https://en.wikipedia.org/wiki/E-commerce
3.	https://www.tutorialspoint.com/e_commerce/index.htm

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	2	2	3	3
CO 4	3	3	3	3	3	3
CO 5	3	2	3	3	2	3
Weightage of course contributed to each PSO	15	14	14	14	14	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS3S2	Enterprise Resource Planning	SEC V	2	-	-	-	2	25	75	100

Learning Objectives:(for teachers: what they have to do in the class/lab/field)

- Understand the concept of ERP and the ERP model; define key terms; identify the levelsof ERP maturity.
- To integrate business processes; define and analyze a process; create a process map and improve and/or simplify the process; apply the result to an ERP implementation.
- To know the elements of a value chain, and explain how core processes relate; identify how the organizational infrastructure supports core business processes; explain the effect of a new product launch on the three core business processes

Course Outcomes: (for students: To know what they are going to learn)

CO1: Understand the basic concepts of ERP.
CO2: Identify different technologies used in ERP
CO3: Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules
CO4: Discuss the benefits of ERP
CO5: Apply different tools used in ERP

Units	Contents	Required Hours
Unit I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP, ERP Vendors; Benefits & Limitations of ERP Packages.	6
Unit II	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration.	6
Unit III	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain.	6
Unit IV	ERP Implementation Basics, , ERP implementation Strategy, ERP Implementation Life Cycle ,Pre- Implementation task,Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.	6
Unit V	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into or-ganizational culture. Using ERP tool: either SAP or ORACLE format to case study.	6

Learning Resources:

- **Recommended Texts**
  1. Enterprise Resource Planning – Alexis Leon, Tata McGraw Hill.
- **Reference Books**
  1. Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
  2. Enterprise Resource Planning – Ravi Shankar & S. Jaiswal , Galgotia

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**3**	**3**	**2**	**2**	**2**
CO2	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**2**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**13**	**15**	**15**	**14**	**14**	**13**

SubjectCode	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS4C1	OBJECT ORIENTED PROGRAMMING WITH JAVA	CCVII	4	-	-	IV	4	25	75	100

Learning Objectives	
LO1	Object Oriented Programming with Java.
LO2	Apply the OOPs concept in JAVA programming.
LO3	Become proficient programmers through the java programming language.
LO4	Give insight into real world applications.
LO5	Get the attentions of users in user interface using graphics

UNIT	Contents	No. Of. Hours
UNIT I	**Introduction:** Introduction to Java-Features of Java-Object Oriented Concepts-Software Evolution – Software Development, SDLC Models – SDLC steps – Software Testing – Software Quality – Lexical Issues-Data Types – Variables – Arrays – Operators – Control Statements – Classes – Objects –Constructors – Overloading method – Access control – static and fixed methods – Inner classes – Inheritance-Overriding Methods-Using super-Abstract class.	15
UNIT II	**Packages & Threads:** Packages-Access Protection- Importing Packages-Interfaces-Exception Handling-Throw and Throws- Thread-Synchronization-Messaging- RunnableInterface-Inter thread communication-Deadlock-suspending,resuming and stopping threads-Multithreading	15
UNIT III	**Input/Output & Collection API:** I/O Streams-File Streams- String Objects-String Buffer-Char Array – Java Utilities-Collections interface – Collection classes-Enumeration – Vector–Stack –Hash tables – String class.	15
UNIT IV	**Networking:** Networking –Networking basics – java and the Net – Inet Address- TCP/IP Client Sockets –URL- URLConnection – TCP/IP Server Sockets – Datagrams.	15
UNIT V	**Graphical User Interface in Java:** Working with windowsusing AWT Classes – Class Hierarchy of Window and Panel – AWT controls – Layout Managers – Menus- Menu bars - DialogBoxes- File Dialog- Applets-Lifecycle of Applet-Types of Applets-Event handling-Applet tags - JDBC and connecting to Databases – CRUD operations.	15
	TOTAL HOURS	75

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Use the syntax and semantics of java programming language and basic concepts of OOP.	PO1, PO2, PO3, PO4, PO5, PO6

CO2	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Apply the concepts of Multithreading and Exception handling toDevelop efficient and error free codes.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Design event driven GUI and web related applications which mimic the real word scenario	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Build the internet-based dynamic applications using the conceptof applets	PO1, PO2, PO3, PO4, PO5, PO6

	Textbooks
1	**P.Naughton and H.Schildt**(1999), Java 2 (The Complete Reference), Third Edition,Tata MCGraw Hill Edition
2	**K.K. Aggarwal &Yogesh Sing** (2008), Software Engineering, Revised Third Edition, NewAge International Publishers.
	Reference Books
1.	Cay S. Horstmann, Gary Cornell(2012), Core Java 2 Volume I, Fundamentals- Ninth Edition Addision Wesley
2.	K.Arnold and J.Gosling, The Java Programming Language- Second Edition, ACM Press/Addison-Wesley Publishing Co. New York
	Web Resources
1.	https://www.w3schools.com/java/java_oop.asp#:~:text=OOP%20provides%20a%20clear%20structure,code%20and%20shorter%20development%20time
2.	https://www.geeksforgeeks.org/object-oriented-programming-oops-concept-in-java/
3.	https://www.javatpoint.com/java-oops-concepts
4.	https://www.coursera.org/learn/object-oriented-java
5.	https://docs.oracle.com/javase/tutorial/java/concepts/index.html

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	2	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	2	3
Weightage of course contributed to each PSO	15	15	14	15	14	15

S-Strong-3 **M-Medium-2 L-Low-1**

Semester IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS4P1	**OBJECT ORIENTED PROGRAMMING WITH JAVA LAB**	**CC VIII**	-	-	3	IV	3	25	75	100

Learning Objectives:

1. Use an integrated development environment to write, compile, run, and test simpleobject-oriented Java programs.
2. Read and make elementary modifications to Java programs that solve real-worldproblems.
3. Be able to create an application using string concept.
4. Be able to create a program using files in application.
5. Be able to create an Applet to create an application.

	Required Hours
Lab Exercises: 1. Program using Class and Object. 2. Program using Constructors. 3. Program using Command-Line Arguments. 4. Program using Random Class. 5. Program using Vectors. 6. Program using String Tokenizer Class. 7. Program using Interface. 8. Program using all forms of Inheritance. 9. Program using String class. 10. Program using String Buffer class. 11. Program using Exception Handling. 12. Implementing Thread based applications 13. Program using Packages. 14. Program using Files. **Applets:** 15. Working with Colors and Fonts. 16. Parameter passing technique. 17. Drawing various shapes using Graphical statements. 18. Usage of AWT components and Listener in suitableapplications.	**60**

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	2	3	3	2	3
Weightage of course contributed to each PSO	15	14	14	15	14	14

S-Strong-3 M-Medium-2 L-Low-1

Semester IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS4S1	**ADVANCED EXCEL**	**SEC - VI**	2	-	-	2	2	25	75	100

Course Objective	
C1	Handle large amounts of data
C2	Aggregate numeric data and summarize into categories and subcategories
C3	Filtering, sorting, and grouping data or subsets of data
C4	Create pivot tables to consolidate data from multiple files
C5	Presenting data in the form of charts and graphs

UNIT	**Details**	**No. ofHours**
UNIT I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	6
UNIT II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data -Sorting tables	6
UNIT III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	6
UNIT IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- WhatIf Analysis - Goal Seek- Data Tables- Scenario Manager.	6
UNIT V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	6
	Total	30

Text Book	
1	Ritu Arora (2023) Mastering Advanced Excel, BPB publishers
Reference Book	
1.	Ken Bluttman (2020), Microsoft Excel Formulas $ Functions, 5th Edition, Learning Made Easy, Wiley
Web Resources	
1.	https://www.tutorialspoint.com/advanced_excel/index.htm
2	https://www.yashada.org/yashada_2019/pdfs/e_library_cit/excel_Microsoft_Excel_2010_intermediate_YASHADA%20_June_2014%20(2).pdf
3	https://sunsreynat.wordpress.com/wp-content/uploads/2014/06/excel-2010-advanced.pdf
4	https://www.w3schools.com/excel/index.php

MAPPING TABLE

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**2**	**3**	**2**
CO3	**3**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contributedto each PSO	**15**	**12**	**14**	**13**	**14**	**13**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23BDS4S2	PHP Programming	SEC-VII	2	-	-	-	2	2	25	75	100

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To learn the basic web concepts and to create rich internet applications that use most recent client-side programming technologies.
- To learn the basics of HTML, DHTML, XML, CSS, Java Script and AJAX.

Course Outcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Ability to Develop and publish Web pages using Hypertext Markup Language(HTML).

CO2: Ability to optimize page styles and layout with Cascading Style Sheets(CSS).

CO3: Ability to Understand, analyze and apply the role of languages to create acapstone

CO4: Website using client-side web programming languages like HTML, DHTML, CSS, XML, JavaScript, and AJAX

CO5: Able to understand the concept of jQuery and AngularJS

Units	Contents	Required Hours
Unit I	HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size, face and color-alignment- links-tables-frames	6
Unit II	Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page	6
Unit III	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML).	6
Unit IV	JavaScript: Client side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops andrepetition.	6
Unit V	Ajax: Introduction, advantages &disadvantages, Purpose of it, ajax based web application, alternatives of ajax Java Script & AJAX: Introduction to array-operators, making statements-date & time-mathematics- strings-Event handling-form properties. AJAX. Introduction to jQuery and AngularJS	6

Learning Resources:

- **Recommended Texts**

1. Pankaj Sharma, "*Web Technology*", Sk Kataria &SonsBangalore, 2011.(UNIT I, II, III &IV).
2. Achyut S Godbole & Atul Kahate, "*Web Technologies*", 2002, 2nd Edition. (UNIT V:AJAX)

- **Reference Books**

1. Laura Lemay, Rafe Colburn , Jennifer Kyrnin, *"Mastering HTML, CSS & Javascript WebPublishing*",2016.
2. DT Editorial Services (Author), "*HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)*", Paperback 2016, 2ndEdition.

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**14**	**13**	**14**	**13**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS5C1	**RELATIONAL DATABASE MANAGEMENT SYSTEM**	**CC IX**	5	-	-	V	4	25	75	100

Learning Objectives	
LO1	To understand the different issues involved in the design and implementation of a database system.
LO2	To study the physical and logical database designs, database modeling, relational,
	hierarchical, and network models
LO3	To understand and use data manipulation language to query, update, and manage a database
LO4	To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency,
LO5	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

UNIT	**Contents**	**No. Of. Hours**
UNIT I	**Introduction:** Database System-Characteristics of Database Management Systems- Architecture of Database Management Systems-Database Models-System Development Life Cycle-Entity Relationship Model.	**18**
UNIT II	**Relational Database Model:** Structure of Relational Model-Types of keys. Relational Algebra: Unary operations-Set operations-Join operations. Normalization: Functional Dependency- First Normal form-Second Normal Form-Third Normal form- Boyce-Codd Normal Form-Fourth Normal Form.	**18**
UNIT III	**SQL:** Introduction. Data Definition Language: Create, alter, drop, rename and truncate statements. Data Manipulation Language: Insert, Update and Delete Statements. Data Retrieval Language: Select statement. Transaction Control Language: Commit, Rollback and Savepoint statements. Single row functions using dual: Date, Numeric and Character functions. Group/Aggregate functions: count, max, min, avg and sum functions. Set Functions: Union, union all, intersect and minus. Subquery: Scalar, Multiple and Correlated subquery. Joins: Inner and Outer joins.Defining Constraints: Primary Key, Foreign Key, Unique, Check, Not Null.	**18**
UNIT IV	PL/SQL: Introduction-PL/SQLBasic-Character Set- L/SQL Structure – SQL Cursor-Subprograms-Functions- Procedures.	**18**
UNIT V	Exception Handling: Introduction-Predefined Exception- User Defined Exception-Triggers-Implicit and Explicit Cursors-Loops in Explicit Cursor.	**18**
	TOTAL HOURS	**90**

Course Outcomes		Programme Outcomes
CO1	To demonstrate the characteristics of Database ManagementSystems. To study about the concepts and models of database. To impart the concepts of System Development Life Cycle and E-R Model.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	To classify the keys and the concepts of Relational Algebra.To impart the applications of various Normal Forms Classification of Dependency.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	To elaborate the different types of Functions and Joins and their applications. Introduction of Views, Sequence, Index and Procedure.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Representation of PL-SQL Structure. To impart the knowledge of Sub Programs, Functions andProcedures.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Representation of Exception and Pre-Defined Exception. To Point out the Importance of Triggers, Implicit and ExplicitCursors.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	**Pranab Kumar Das Gupta and P. Radha Krishnan,** "Database Management System Oracle SQL and PL/SQL", Second Edition, 2013, PHI Learning PrivateLimited.	
Reference Books		
1	**RamezElmasri and Shamkant B. Navathe**, "*Fundamentals of Database Systems*", Seventh Edition, Pearson Publications.	
2	**Abraham Silberschatz, Henry Korth, S. Sudarshan**, "*Database System Concepts*", Seventh Edition, TMH.	
	Web Resources	
1	http://www.amazon.in/DATABASE-MANAGEMENT-SYSTEM-ORACLE-SQLebook/dp/B00LPGBWZ0#reader_B00LPGBWZ0	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	2
CO 2	3	3	3	2	3	3
CO 3	3	3	3	3	3	3
CO 4	2	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	15	14	15	14

S-Strong-3M-Medium-2 L-Low-1

Semester V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS5C2	**RDBMS LAB USING ORACLE**	**CCX**	-	-	5	V	4	25	75	100

Learning Objectives:

1. To explain basic database concepts, applications, data models, schemas andinstances.
2. To demonstrate the use of constraints and relational algebra operations
3. Describe the basics of SQL and construct queries using SQL.
4. To emphasize the importance of normalization in databases
5. To facilitate students in Database design

LAB EXERCISES:

SQL:

1. DDL commands.
2. Specifying constraints-Primary Key, Foreign Key, Unique, Check, Not Null.
3. DML commands.
4. Set Operations.
5. Joins.
6. Sub-queries.

PL/SQL:

7. Control Constructs.
8. Exception Handlers.
9. Implicit Cursor.
10. Explicit Cursor.
11. Procedures.
12. Functions.
13. Triggers.
14. TCL Commands usage (Commit, Rollback, Savepoint)

	Course Outcomes
CO	On completion of this course, students will
CO1	To demonstrate the characteristics of Database Management Systems.To study about the concepts and models of database. To impart the concepts of System Development Life Cycle and E-R Model.
CO2	To classify the keys and the concepts of Relational Algebra.To impart the applications of various Normal Forms Classification of Dependency.
CO3	To elaborate the different types of Functions and Joins and their applications. Introduction of Views, Sequence, Index and Procedure.
CO4	Representation of PL-SQL Structure. To impart the knowledge of Sub Programs, Functions and Procedures.
CO5	Representation of Exception and Pre-Defined Exception. To Point out the Importance of Triggers, Implicit and Explicit Cursors.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	2
CO 2	3	3	3	2	3	3
CO 3	3	3	3	3	3	3
CO 4	2	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	15	14	15	14

S-Strong-3 M-Medium-2 L-Low-1

Semester V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS5C3	**MACHINE LEARNING**	**CC XI**	5	-	-	V	4	25	75	100

Learning Objectives	
LO1	To Learn about Machine Intelligence and Machine Learning applications
LO2	To implement and apply machine learning algorithms to real-world applications
LO3	To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems
LO4	To create instant based learning
LO5	To apply advanced learning

UNIT	Contents	No. Of. Hours
UNIT I	**Introduction Machine Learning** - Difference between AI, Machine Learning and Big data. Supervised and unsupervised learning, parametric vs non-parametric models, parametric models for classification and regression- Linear Regression, Logistic Regression, Naïve Bayes classifier, simple non-parametric classifier-K-nearest neighbour, support vector machines	**15**
UNIT II	**Neural networks and genetic algorithms** Neural Network Representation – Problems – Perceptions – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.	**15**
UNIT III	**Bayesian and computational learning** Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	**15**
UNIT IV	**Instant based learning** K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.	**15**
UNIT V	**Advanced learning** Recommendation systems – opinion mining, sentiment analysis. Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q- Learning – Temporal Difference Learning.	**15**
	TOTAL HOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Appreciate the importance of visualization in the data analyticssolution	PO1, PO2, PO3, PO4,PO5, PO6
CO2	Apply structured thinking to unstructured problems	PO1, PO2, PO3, PO4,PO5, PO6
CO3	Understand a very broad collection of machine learning algorithmsand problems	PO1, PO2,PO3, PO4,PO5, PO6
CO4	Learn algorithmic topics of machine learning and mathematicallydeep enough to introduce the required theor	PO1, PO2,PO3, PO4,PO5, PO6

CO5	Develop an appreciation for what is involved in learning from data.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	Tom M. Mitchell (2013), Machine Learning, McGraw-Hill Education (India) Private Limited
2	Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville(2015) "Deep learning", MIT Press
Reference Books	
1.	EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2	Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	2	3
CO 3	3	3	3	3	3	3
CO 4	3	3	2	3	3	3
CO 5	3	3	3	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

S-Strong-3 M-Medium-2 L-Low-1

Semester V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS5P1	**MACHINE LEARNINGLAB**	**CC XII**	-	-	5	-	4	25	75	100

Learning Objectives:
To apply the concepts of Machine Learning to solve real-world problems and to implementbasic algorithms in clustering & classification applied to text & numeric data

LAB EXERCISES	Required Hour
1. Solving Regression & Classification using Decision Trees 2. Root Node Attribute Selection for Decision Trees using Information Gain 3. Bayesian Inference in Gene Expression Analysis 4. Pattern Recognition Application using Bayesian Inference 5. Bagging in Classification 6. Bagging, Boosting applications using Regression Trees 7. Data & Text Classification using Neural Networks 8. Using Weka tool for SVM classification for chosen domain application 9. Data & Text Clustering using K-means algorithm 10. Data & Text Clustering using Gaussian Mixture Models	**75**

Course Outcomes	
CO	On completion of this course, students will
CO1	Effectively use the various machine learning tools
CO2	Understand and implement the procedures for machine learning algorithms
CO3	Design Python programs for various machine learning algorithms
CO4	Apply appropriate datasets to the Machine Learning algorithms
CO5	Analyze the graphical outcomes of learning algorithms with specific datasets

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	2
CO 2	3	3	3	2	3	3
CO 3	3	3	3	3	3	3
CO 4	2	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	15	14	15	14

S-Strong-3 M-Medium-2 L-Low-1

Semester V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS5E1	**BIG DATA ANALYTICS**	**DSE-I**	4	-	-	-	3	25	75	100

Learning Objectives	
LO1	To know the fundamental concepts of big data and analytics..
LO2	To explore tools and practices for working with Big data
LO3	To learn about stream computing.
LO4	To know about the research that requires the integration of large amounts of data
LO5	To analyze data by utilizing clustering and classification algorithms.

UNIT	Contents	No. Of. Hours
UNIT I	**Big data Introduction :** Big Data introduction - definition and taxonomy - Big data value for the enterprise - The Hadoop ecosystem - Introduction to Distributed computing- Hadoop ecosystem – Hadoop Distributed File System (HDFS) Architecture - HDFS commands for loading/getting data - Accessing HDFS through Java program.	**12**
UNIT II	**Map reduce :** Introduction to Map Reduce frame work - Basic Map Reduce Programming: - Advanced Map Reduce programming: Basic template of the Map Reduce program, Word count problem- Streaming in Hadoop- Improving the performance using combiners- Chaining Map Reduce jobs- Joining data from different sources.	**12**
UNIT III	**Pig and Hive :** Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - Fundamentals of HBase and ZooKeeper.	**12**
UNIT IV	**Mongo DB :** No SQL databases: Mongo DB: Introduction – Features - Data types - Mongo DB Query language - CRUD operations – Arrays - Functions: Count – Sort – Limit – Skip – Aggregate - Map Reduce. Cursors – Indexes - Mongo Import – Mongo Export.	**12**
UNIT V	**Cassandra:** Introduction – Features - Data types – CQLSH - Key spaces - CRUD operations – Collections – Counter – TTL - Alter commands - Import and Export - Querying System tables.	**12**
	TOTAL HOURS	**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Understand Big Data and its analytics in the real world	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Analyze the Big Data framework like Hadoop and NOSQL to efficientlystore and process Big Data to generate analytics.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Design and Implementation of Big Data Analytics using pig and spark tosolve data intensive problems and to generate analytics.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Implement Big Data Activities using Hive.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	JSeema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.	
2	Ramesh Sharda, Dursun Delen, Efraim Turban (2018), Business Intelligence, Pearson Education Services Pvt Ltd.	
Reference Books		
1.	Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies", John Wiley & Sons, Inc., 2013.	
2.	Tom White, "Hadoop: The Definitive Guide", O"Reilly Publications, 2011.	
3.	Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012.	
4.	Russell Bradberry, Eric Blow, "Practical Cassandra A developers Approach",Pearson Education, 2014.	
Web Resources		
1.	https://www.techtarget.com/searchbusinessanalytics/definition/big-data-analytics	
2.	https://www.coursera.org/articles/big-data-analytics	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	15	15	12	14

S-Strong-3 M-Medium-2 L-Low-1

Semester V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS5E2	**ARTIFICIAL NEURAL NETWORKS**	**DSE-II**	4	-	-	-	3	25	75	100

Learning Objectives:

The objective of this course is to teach the basics of artificial neural networks, learningprocess, single layer and multi-layer perceptron networks.

Course Outcomes:

CO1: Understand the basics of artificial neural networks and its architecture.

CO2: Understand the various learning algorithms and their applications.

CO3: Identify the appropriate neural network model to a particular application.

CO4: Apply the selected neural network model to a particular application.

CO5: Analyze the performance of the selected neural network.

Units	Contents	Required Hours
Unit I	Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms-Error correction - Gradient Descent Rules, Perceptron Learning Algorithm, Perceptron Convergence Theorem.	**1 2**
Unit II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation	**12**
Unit III	Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, learning in continuous perception, Limitation of Perception.	**12**
Unit IV	Multi-Layer Perceptron Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm	**12**
Unit V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neo cognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzmann Machines, Training of DNN and Applications	**12**

Learning Resources:

- **Recommended Texts**

  1. Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- SecondEdition.

  2. "Neural Network- A Comprehensive Foundation"- Simon Haykins, Pearson PrenticeHall, 2nd Edition, 1999.

- **Reference Books**

  1. Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	2	3	2
CO 2	3	2	3	2	3	3
CO 3	3	3	2	2	3	3
CO 4	2	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	14	13	14	12	14	14

S-Strong-3 M-Medium-2 L-Low-1

Semester VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS6C1	**ARTIFICIAL INTELLIGENCE**	**CC XV**	6	-	-	VI	4	25	75	100

Learning Objectives	
LO1	Describe the concepts of Artificial Intelligence
LO2	Understand the method of solving problems using Artificial Intelligence
LO3	Understand natural language processing
LO4	Introduce the concept of Expert system, Fuzzy logic
LO5	Understand about operating system and their uses

UNIT	**Contents**	**No. Of. Hours**
UNIT I	**Introduction to Artificial Intelligence** What is Artificial Intelligence? AI Technique, Representation of a problem as State space search, production systems, Problem characteristics, Production System characteristics – Issues in the design of search programs, Heuristic Search Techniques - Generate & Test Hill Climbing, Best First search, Problem reduction, Constraint satisfaction, Means-End Analysis	**15**
UNIT II	**Knowledge Representation** Approaches and issues in knowledge representation – Using Predicate Logic – Representing simple facts in logic – Representing Instance and ISA relationship – Computable functions and predicates – resolution – Natural deduction - Representing knowledge using rules –Procedural versus declarative knowledge – Logic programming - Forward versus backward reasoning – Matching – Control Knowledge - Symbolic reasoning under uncertainty - Logics for Nonmonotonic reasoning – Implementation Issues – Augmenting a problem solver – Implementation: Depth first search, Breadth first search	**15**
UNIT III	**Statistical Reasoning** Probability and Bayes‟ Theorem - Certainty factors and rule-based systems- Bayesian networks – Dempster - Shafer Theory - Weak slot-filler structure - Semantic nets – frames. Strong slot-filler structure- Conceptual dependency – Scripts – CYC – Syntatic – Semantic spectrum of Representation – Logic and slot-and-filler structure – Other representational Techniques	**15**
UNIT IV	**Game Playing, Planning & NLP** Minimax search procedure-Adding alpha-beta cutoffs- Additional Refinements – Iterative Deepening – Reference on specific games Planning - Components of a Planning system – Goal stack planning – Nonlinear planning using constraint posting- Hierarchical planning – Reactive systems. Natural Language Processing - Syntactic Analysis, Semantic Analysis, Discuses and Pragmatic Processing – Statistical Natural Language processing	**15**
UNIT V	**Learning & Advanced Topics in AI** What is learning? – Rote learning – Learning by taking advice – Learning in problem solving – Learning from examples: Induction – Explanation based learning – Discovery – Analogy – Formal learning theory - Neural Net learning and Genetic learning - Expert System: Representation-Expert System shells-Knowledge Acquisition. Fuzzy logic system – Crisp sets – Fuzzy sets – Fuzzy terminology – Fuzzy logic control – Sugeno style of Fuzzy inference processing – Fuzzy Hedges – Neuro Fuzzy systems.	**15**

	TOTAL HOURS	**75**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Design user interfaces to improve human–AI interaction and real-time decision-making. Evaluate the advantages, disadvantages, challenges, and ramifications of human–AI augmentation.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Extract information from text automatically using concepts and methods from natural language processing (NLP), including stemming, n-grams, POS tagging, and parsing	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	**Elaine Rich, Kevin Knight** (2008), Shivsankar B Nair, Artificial Intelligence, Third Edition, Tata McGraw Hill Publication	
Reference Books		
1.	**Russel S, Norvig P** (2010), Artificial Intelligence : A Modern approach,Third Edition, Pearson Education	
2.	**Dan W Patterson** (2007), Introduction to Artificial Intelligence and Expert System, Second Edition, Pearson Education Inc.	
3.	**Jones M**(2006), Artificial Intelligence application Programming, Second Edition, Dreamtech Press	
4.	**Nilsson** (2000), Artificial Intelligence : A new synthesis, Nils J Harcourt Asia PTE Ltd.	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	2	3	3	3	3
CO 3	3	3	2	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	14	14	15	15	15

S-Strong-3 M-Medium-2 L-Low-1

Semester VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS6E1	**COMPUTING INTELLIGENCE**	**DSE**	5	-	-	-	3	25	75	100

Learning Objectives:

- To provide strong foundation on fundamental concepts in Computing Intelligence
- To apply basic principles of Artificial Intelligence and solutions that require problem solving, influence, perception, knowledge representation and learning

Course Outcomes:

CO1: Describe the fundamentals of artificial intelligence concepts and searching techniques.

CO2: Develop the fuzzy logic sets and membership function and defuzzification techniques.

CO3: Understand the concepts of Neural Network and analyze and apply the learningtechniques

CO4: Understand the artificial neural networks and its applications

CO5: Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs.

Units	Contents	Required Hours
Unit I	Introduction to AI: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth First and Depth First – Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing.	**12**
Unit II	Fuzzy Logic Systems: Notion of fuzziness – Operations on fuzzy sets – T-norms and other aggregation operators – Basics of Approximate Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inferencing – Defuzzification – Fuzzy Clustering – fuzzy rule-based classifier.	**12**
Unit III	Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.	**12**
Unit IV	**Artificial Neural Networks:** Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	**12**
Unit V	**Genetic Algorithm:** Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm.	**12**

Learning Resources:

Recommended Texts

1. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", 2nd Edition,Wiley India Pvt. Ltd.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence - A Modern Approach", 2nd Edition, Pearson Education in Asia.
3. S. Rajasekaran, G. A. Vijayalakshmi, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications", PHI.

Reference Books

1. F. Martin, Mc neill, and Ellen Thro, "Fuzzy Logic: A Practical approach", AP Professional, 2000. Chin Teng Lin, C. S. George Lee," Neuro-Fuzzy Systems", PHI.
2. Chin Teng Lin, C. S. George Lee," Neuro-Fuzzy Systems", PHI.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	2	3	2
CO 2	3	2	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	15	14	15	11	14	14

S-Strong-3 M-Medium-2 L-Low-1

Semester VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23BDS6E2	**ANALYTICS FOR SERVICE INDUSTRY**	**DSE**	5	-	-	-	3	25	75	100

Learning Objectives	
LO1	Recognize challenges in dealing with data sets in service industry.
LO2	Identify and apply appropriate algorithms for analyzing the healthcare, Human resource, hospitality and tourism data.
LO3	Make choices for a model for new machine learning tasks.
LO4	To identify employees with high attrition risk.
LO5	To Prioritizing various talent management initiatives for your organization.

UNIT	**Contents**	**No. Of. Hours**
Unit I	**Healthcare Analytics :** Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting HER Challenges-Phenotyping Algorithms. Biomedical Image Analysis and Signal Analysis- GenomicData Analysis for Personalized Medicine. Review of Clinical PredictionModels.	**12**
Unit II	**Healthcare Analytics Applications :** Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer- Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.	**12**
Unit III	**HR Analytics:** Evolution of HR Analytics, HR information systems and data sources, HR Metric and HR Analytics, Evolution of HR Analytics; HR Metrics and HR Analytics; Intuition versus analytical thinking; HRMS/HRIS and data sources; Analytics frameworks like LAMP, HCM:21(r) Model.	**12**
Unit IV	**Performance Analysis:** Predicting employee performance, Training requirements, evaluating training and development, Optimizing selection and promotion decisions.	**12**
Unit V	**Tourism and Hospitality Analytics:** Guest Analytics – Loyalty Analytics – Customer Satisfaction – Dynamic Pricing – optimized disruption management – Fraud detection in payments.	**12**
	TOTAL HOURS	**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Understand and critically apply the concepts and methods ofbusiness analytics	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Identify, model and solve decision problems in different settings.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Create viable solutions to decision making problems.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Instill a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Chandan K. Reddy and Charu C Aggarwal, "Healthcare data analytics", Taylor & Francis, 2015.	
2	Edwards Martin R, Edwards Kirsten (2016),"Predictive HR Analytics: Mastering the HR Metric", Kogan Page Publishers, ISBN-0749473924	
3	Fitz-enzJac (2010), "The new HR analytics: predicting the economic value of your company's human capital investments", AMACOM, ISBN-13: 978-0-8144-1643-3	
4	RajendraSahu, Manoj Dash and Anil Kumar. Applying Predictive Analytics Withinthe Service Sector.	
Reference Books		
1.	Hui Yang and Eva K. Lee, "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley, 2016	
2.	Fitz-enzJac, Mattox II John (2014), "Predictive Analytics for Human Resources",Wiley, ISBN- 1118940709.	
Web Resources		
1.	https://www.ukessays.com/essays/marketing/contemporary-issues-in-marketing-marketing-essay.php	
2.	https://yourbusiness.azcentral.com/examples-contemporary-issues-marketing-field- 26524.html	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	3	3
CO 3	3	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	15	14	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

<table>
<tr><td>Title of the Course</td><td colspan="6">ESSENTIAL REASONING AND QUANTITATIVE APTITUDE</td></tr>
<tr><td>Paper Number</td><td colspan="6">Professional Competency Skill</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">PCS</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Sub. Code
23BDS6S1</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">1</td><td>1</td><td colspan="2">-</td><td>2</td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">• Develop Problem solving skills for competitative examinations
• Understand the concepts of averages , simple interest , compound interest</td></tr>
<tr><td>UNIT-I:</td><td colspan="6">Quantitative Aptitude: Simplifications=averages-Concepts –problem-Problems on numbers-Short cuts- concepts –Problems</td></tr>
<tr><td>UNIT-II:</td><td colspan="6">Profit and Loss –short cuts-Concepts –Problems –Time and work - Short –uts -Concepts -Problems.</td></tr>
<tr><td>UNIT-III:</td><td colspan="6">Simple interest –compound interest- Concepts- Prolems</td></tr>
<tr><td>UNIT-IV:</td><td colspan="6">Verbal Reasoning : Analogy- coding and decoding –Directions and distance –Blood Relation</td></tr>
<tr><td>UNIT-V:</td><td colspan="6">Analytical Reasoning :Data sufficiency
Non-Verbal Reasoning : Analogy ,Classification and series</td></tr>
<tr><td></td><td colspan="6"></td></tr>
<tr><td>Skills acquired from this course</td><td colspan="6">Studnets relating the concepts of compound interest and simple interest</td></tr>
<tr><td>Recommended Text</td><td colspan="6">1.”Quantitative Aptitude” by R.S aggarwal ,S.Chand & Company Ltd 2007</td></tr>
<tr><td></td><td colspan="6"></td></tr>
<tr><td>Website and e-Learning Source</td><td colspan="6">https://nptel.ac.in</td></tr>
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