MARUDHAR KESARI JAIN COLLEGE FOR WOMEN

(AUTONOMOUS)

Vaniyambadi–635751

Department of Data Science

for

Undergraduate Programme

Bachelor of Data Science

From the Academic Year 2024-25

CONTENT

1. Preamble
2. Programme Outcomes
3. Programme Specific Outcomes
4. Eligibility for Admission
5. Methods of Evaluation and Assessments
6. Skeleton & Syllabus

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE EDUCATION

Preamble

Bachelor of Data Science is a 3 – Year Undergraduate programme spread over six semesters. The course is designed to achieve a high degree of technical skills in problem solving and modern application development. The course develops requisite professional skills and problem solving abilities for pursuing a successful career in software industry and forms the required basics for pursuing higher studies in Data Science.

PROGRAMME OUTCOMES (PO)

Programme	**B.Sc. Data Science**
Programme Code	**US03**
Duration	**3years[UG]**
Programme Outcomes	**PO1:** Acquire knowledge in Data Science to apply the knowledge in their day-to-day life for betterment of self and society. **PO2:** Develop critical, analytical thinking and problem-solving skills. **PO3:** Develop research related skills in defining the problem, formulate and test the hypothesis, analysis, interpret, and draw conclusion from data. **PO4:** Address and develop solutions for societal and environmental needs of local, regional and national development. **PO5:** Work independently and engage in lifelong learning and enduring proficient progress. **PO6:** Provoke employability and entrepreneurship among students along with ethics and communication skills. **PO7:** Understand the importance of ethical behavior in business contexts and be able to recognize and address ethical dilemmas they may encounter in their professional careers. **PO8:** Prepared for lifelong learning and professional development, including the ability to adapt to changes in technology, business practices, and economic conditions throughout their careers.

Programme Specific Outcomes:	**PSO1:** Able to apply data analytical skills that rely on mathematical and statistical methods to solve problems in a data-driven world. **PSO2:** Able to analyze and interpret complex data to produce actionable insights. **PSO3**: Able to understand the nuances of data analytical skills to evolve innovative ideas and communicate the social relevance and impact of their analytical findings.

Eligibility for Admission:

Candidate seeking admission to the first year of the UG Degree Course should have passed the Higher Secondary Course Examination (Academic or Vocational) conducted by the Govt. of Tamilnadu with Mathematics / Business Mathematics / Statistics / Computer Science as a subject or an Examination of any otherUniversityacceptedasequivalenttheretobytheSyndicatesubjecttosuchotherconditionsasmay be prescribed. Such candidates shall be permitted to take the B.Sc. Degree Examination of this University after the completion of the Course of three Academic Years in this University /Colleges affiliated to this University and shall qualify for the B.Sc. Degree.

Methods of Evaluation and Assessment

Methods of Evaluation		
Internal Evaluation		25 Marks
External Evaluation	End Semester Examination	75 Marks
	Total	**100 Marks**
Methods of Assessment		
Recall(K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend(K2)	MCQ, True/False, Short essays, Concept explanations, short summary or overview	
Application(K3)	Suggest idea / concept with examples, suggest formulae, solve problems, Observe, Explain	
Analyze(K4)	Problem-solving questions, finish a procedure in many steps, Differentiate Between various ideas, Map knowledge	
Evaluate(K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create(K6)	Check knowledge in specific or off beat situations, Discussion, Debating or Presentations	

I SEMESTER

Code	Course Title	Hours				
		L	T	P	S	C
24UFTA11	Tamil – 1	4	1	0	0	3
24UFEN11	English–1	4	1	0	0	3
24UDSC11	CC–1 Python Programming	3	1	2	0	5
24UDSC12P	CC - 2 Python Programming Lab	0	0	4	0	3
24UMAA11	EC - 1 AL (Choose one from the list) Numerical Methods –I Statistical Method and its Application-I	3	1	0	0	3
24UDSS11	SEC–1 Event Management	1	0	1	0	2
24UDSS12P	SEC–2 Hands on Training on Excel	1	0	1	0	2
24UDSF11	FC Digital Computer Fundamental	1	1	0	0	2
					30	23

II SEMESTER

Code	Course Title	Hours				
		L	T	P	S	C
24UFTA21	Tamil-2	4	1	0	0	3
24UFEN21	English – 2	4	1	0	0	3
24UDSC21	CC–3 Data Structure and Algorithm using python	3	1	2		5
24UDSC22P	CC-4 Data Structure and Algorithm using Python Lab	0	0	4	0	2
24UMAA25	EC - 2 AL (Choose one from the list) Numerical Methods –II Statistical Method and its Application-II	3	1	0	0	4
24UMAA25P	EC-3 Numerical Method Lab	0	0	2	0	2
24UDSS21	SEC-3 Web Technology	1	0	1	0	2
24UAEC21	AEC–1 Life Skill for Yoga	1	1	0	0	2
					30	23

III SEMESTER

Code	Course Title	Hours				
		L	T	P	S	C
24UFTA31	Tamil – 3	4	1	0	0	3
24UFEN31	English–3	4	1	0	0	3
24UDSC31	CC– 5 Fundamental of Data Science with Python	3	1	2	0	5
24UDSC32P	CC-6 Fundamental of Data Science With Python Lab	0	0	4	0	2
24UMAA32	EC –4 AL Statistical Methods and its Applications-I	3	1	0	0	4
24UDSA31 24UDSA32	EC - 5 **Generic** Operating System / RDBMS	0	0	2	0	2
24UDSS31P	SEC-4 RDBMS Lab	1	0	1	0	2
24UAEC31	AEC–2 Human Values and Professional Ethics	1	1	0	0	2
					30	23

IV SEMESTER

Code	Course Title	Hours				
		L	T	P	S	C
24UFTA41	Tamil – 4	4	1	0	0	3
24UFEN41	English–4	4	1	0	0	3
24UDSC41	CC– 7 Machine Learning	3	1	2	0	5
24UDSC42P	CC- 8 Machine Learning Lab	0	0	4	0	2
24UMAA41	EC - 6 AL Statistical Methods and its Application-II	3	1	0	0	4
24UMAA42P	EC-7 AL Statistical Methods and its Application Lab	0	0	2	0	2
24UDSS41	SEC –5 UI/UX Designing	1	0	1	0	2
24UAEC41	AEC–3 Environmental Studies	1	1	0	0	2
					30	23

V SEMESTER

Code	Course Title	Hours				
		L	T	P	S	C
24UDSC51	CC-9 Big Data Analytics	4	1	0	0	5
24UDSC52P	CC- 10 Big Data Analytics Lab	0	0	4	0	3
24UDSC53	CC –11 Artificial Intelligence	2	1	1	0	4
24UDSC54P	CC-12 Artificial Intelligence Lab	0	0	3	0	2
24UDSE51 24UDSE52	EC –8 Social Media Analytics / Cyber Security	4	1	0	0	4
24UDSE53 24UDSE54	EC– 9 Deep Learning / Software Project Management	4	1	0	0	4
24UAEC51	AEC – 4 Gender Equality and Social Inclusion	1	1	0	0	2
24UDSIN51	Internship	0	0	0	0	2
24UCSIK51	*IKS*-Exploring Game Design for Cultural Heritage	0	0	0	2	0
					30	26

VI SEMESTER

Code	Course Title	Hours				
		L	T	P	S	C
24UDSC61	CC–13 Data Visualization	4	1	0	0	4
24UDSC62P	CC–14 Data Visualization Lab	0	0	5	0	3
24UDSC63P	CC - 15–Project	0	0	0	5	4
24UDSE61 24UDSE62	EC –10 Linear Algebra / Artificial Neural Networks	4	1	0	0	4
24UDSE63 24UDSE64	EC –11 Cloud Computing / Natural Language Processing	4	1	0	0	4
24UDSP61	PEC– 1 Power BI	1	1	0	0	2
24UDSL61	SLC–1 Open Source Software Technologies	0	0	0	3	2
					30	23

Students must complete at least one online course (MOOC) from platforms like SWAYAM, NPTEL, or Nanmudalvan within the fifth semester. Additionally, engaging in a specified Self-learning Cours e is mandatory to qualify for the degree, and successful participation will be acknowledged with an extra credit of 2*.

Part–1 & 2	Tamil & English	8	SEC	Skill Elective Course	5
CC	Core Course	15	FC	Foundation Course	1
EC-AL	Elective Course– Applied	7	AEC	Ability Enhancement Course	4
EC	Elective Course -Major	4	SLC	Self-Learning Course	1

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC11	**PYTHON PROGRAMMING**	**Core**	**3**	**1**	**2**	**0**	**5**	**6**	**25**	**75**	**100**

Learning Objectives	
LO1	To make students understand the concepts of Python programming.
LO2	To apply the OOPs concept in PYTHON programming.
LO3	To impart knowledge on demand and supply concepts
LO4	To make the students learn best practices in PYTHON programming
LO5	To know the costs and profit maximization

Unit	Content	Hours
1	Basics of Python Programming: History of Python-Features of Python- Literal-Constants-Variables - Identifiers–Keywords- Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. Python Arrays: Defining and Processing Arrays – Array methods.	14
2	Control Statements: Selection/Conditional Branching statements: if,if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. Jump Statements: break, continue and pass statements.	14
3	Functions: Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. Function Arguments: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. Python Strings: String operations-Immutable Strings-Built-in String Methods and Functions-String Comparison. Modules: import statement- The Python module – dir() function – Modules and Namespace – Defining our own modules.	14
4	Lists: Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. Dictionaries: Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	14

5	Python File Handling: Types of files in Python - Opening and Closing files-Reading and Writing files: write() and write lines() methods-append() method – read() and readlines() methods – with keyword – Splitting words– File methods - File Positions- Renaming and deleting files.	**14**

CO	Course Outcomes
CO1	Learn the basics of python, Do simple programs on python, Learn how to use an array.
CO2	Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.
CO3	Concept of function, function arguments, Implementing the concept strings in various application, Significance of Modules, Work with functions, Strings and modules.
CO4	Work with List, tuples and dictionary, Write program using list, tuples and dictionary.
CO5	Usage of File handlings in python, Concept of reading and writing files, Do programs using files.

Textbooks:	
1	Reema Thareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press.
2	Dr. R. Nageswara Rao, "Core Python Programming", First Edition, 2017, Dream tech Publishers.
3	Introduction to Computer Programming with Python by Harris Wang Publisher: Athabasca University Press (September, 2023
4	Introduction to Python Programming by Udayan Das, et al. Publisher: OpenStax
5	Python Basics: A Practical Introduction to Python 3 Revised and Updated 4th Edition David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler Copyright © Real Python (realpython.com), 2012–2020
Reference Books:	
1	VamsiKurama, "Python Programming: A Modern Approach", Pearson Education.
2	Mark Lutz, "Learning Python", Orielly.
3	Adam Stewarts, "Python Programming", Online.
4	Fabio Nelli, "Python Data Analytics", A Press.
5	Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.
Web resources:	
1	https://www.programiz.com/python-programming
2	https://www.guru99.com/python-tutorials.html
3	https://www.w3schools.com/python/python_intro.asp
4	https://www.geeksforgeeks.org/python-programming-language/
5	https://en.wikipedia.org/wiki/Python_(programming_language)

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	2	2
CO2	3	3	3	3	3	3	3	2	3	2	2
CO3	3	3	3	3	3	3	3	2	3	2	3
CO4	3	3	3	3	3	3	3	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	12	15	12	12
Average	3	3	3	3	3	3	3	2	3	2	2

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

1ST YEAR: FIRST SEMESTER

CourseCode	CourseName	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC12P	**PYTHON LAB**	**Practical**	**0**	**0**	**4**	**0**	**3**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	Be able to design and program Python applications.
LO2	Be able to create loops and decision statements in Python.
LO3	Be able to work with functions and pass arguments in Python.
LO4	Be able to build and package Python modules for reusability.
LO5	Be able to read and write files in Python.

Program	Content	Hours
1	Program using variables, constants, I/O statements in Python.	60
2	Program using Operators in Python.	
3	Program using Conditional Statements.	
4	Program using Loops.	
5	Program using Jump Statements.	
6	Program using Functions.	
7	Program using Recursion.	
8	Program using Arrays.	
9	Program using Strings.	
10	Program using Modules.	
11	Program using Lists.	
12	Program using Tuples.	
13	Program using Dictionaries.	
14	Program for File Handling.	

CO	Course Outcomes
CO1	Demonstrate the understanding of syntax and semantics
CO2	Identify the problem and solve using PYTHON programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of PYTHON language to solve the problem in an efficient way.
CO5	Develop a PYTHON program for a given problem and test for its correctness.

Textbooks:	
1	Reema Thareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press.
2	Dr. R. Nageswara Rao, "Core Python Programming", First Edition, 2017, Dream tech Publishers.
3	Introduction to Computer Programming with Python by Harris Wang Publisher: Athabasca University Press (September, 2023
4	Introduction to Python Programming by Udayan Das, et al. Publisher: OpenStax
5	Python Basics: A Practical Introduction to Python 3 Revised and Updated 4th Edition David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler Copyright © Real Python (realpython.com), 2012–2020
Reference Books:	
1	Vamsi Kurama,"Python Programming: A Modern Approach", Pearson Education.
2	Mark Lutz,"Learning Python",Orielly.
3	Adam Stewarts, "Python Programming",Online.
4	Fabio Nelli,"Python Data Analytics",A Press.
5	Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.
Web resources:	
1	https://www.programiz.com/python-programming
2	https://www.guru99.com/python-tutorials.html
3	https://www.w3schools.com/python/python_intro.asp
4	https://www.geeksforgeeks.org/python-programming-language/
5	https://en.wikipedia.org/wiki/Python_(programming_language)

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	3	3	3	3	3	3	2	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	14	15	15	15	14	15	15	14	15	15
Average	3	2	3	3	3	2	3	3	2	3	3

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

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSS11	**FUNDAMENTALS OF INFORMATION TECHNOLOGY**	**Core**	**1**	**0**	**1**	**0**	**2**	**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	Content	Hours
1	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**
2	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**
3	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**
4	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**

5	Operating System: Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	**6**

CO	Course Outcomes
CO1	Understand the fundamentals of computer, hardware, software and Programming.
CO2	Understand the use of computer organization
CO3	Understand the storage fundamentals and its uses
CO4	Develop MS Office applications knowledge and skills
CO5	know basic components of an operating systems

Textbooks:	
1	Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
2	Computer Fundamentals, A. Goel, 2010, Pearson Education.
3	Fundamentals of Computers, P. K.Sinha & P. Sinha, 2007, BPB Publishers.
4	Introduction of Information System ALEXISLEON,
5	Introduction to Information Technologyby V. Rajaraman third edition, PHI Publishers.
Reference Books:	
1	IT Tools, R.K. Jain, Khanna Publishing House
2	Introduction to Information Technology, Satish Jain, Ambrish Rai & Shashi Singh, PaperbackEdition, BPB Publications, 2014.
3	Computer Basics Absolute Beginner's Guide, Windows 11 Edition: Now Covers Windows 11 Paperback – Import, 4 August 2022
4	Computer Basics: For A Literate Living Paperback – 1 January 2017by Bittu Kumar
5	Computer Fundamentals, A. Goel, 2010, Pearson Education.
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 and Programme Specific Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	3	3	3	3	2	2
CO2	3	3	3	3	3	3	3	2	3	2	2
CO3	3	3	3	3	3	3	3	2	3	2	3
CO4	3	3	3	3	3	3	3	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	12	15	12	12
Average	3	3	3	3	3	3	3	2	3	2	2

3 – Strong, 2- Medium, 1- Low

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSS12P	**HANDS ON TRAINING ON EXCEL**	**Practical**	**0**	**0**	**2**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	Identify the different components of the Excel worksheet.
LO2	Construct formulas to manipulate numeric data in an Excel Worksheet
LO3	Set up the chart function of Excel to represent numeric data in multiple formats.
LO4	Differentiate between formulas and functions in Excel.
LO5	Access and manipulate data using the database functions of Excel.

Unit	Content	Hours
1	Excel Worksheets and Workbooks: Labeling and Naming Worksheets and Workbooks, Adding, Deleting and Saving Worksheets and Workbooks, Reposition Worksheets, Inserting, Deleting, and Renaming Worksheets, CopyWorksheets, Printing a Workbook, Formatting a Worksheet, Adding Elements to aWorkbook, Protecting Worksheet and Workbook	60
2	Import external data, Creating a Table, Sorting Data into a Table, Data Validation,Consolidation1 - Defining Names in MS Excel, Macros: View Macros, Record Macros	
3	Formulas and Functions: Creating a Formula, Formula Auditing, Meaning and Advantages of functions, Insert function, Use relative References, MathematicalFunctions, Statistical Functions, Date & Time Functions	
4	Charts: Chart elements: Titles, legend, data labels, creating a New Chart,Formatting the Chat, Types of charts, Using Chart Template	
5	PivotTables: Creating a Pivot Table, Filtering and Sorting a Pivot Table, Using Slicers to manipulate Pivot Tables, Creating a Pivot Chart2 - Filtering Data: Creating a Custom Auto Filter, Using an Advanced Filter. Data Group, Ungroup and Subtotals- Range names and Filter date	

CO	Course Outcomes
CO1	Demonstrating the basic mechanics and navigation of an Excel spreadsheet.
CO2	Using clip art to enhance ideas and information in Excel worksheets.
CO3	Learning formulas, creating charts and graphs that can easily explain or simplify complex information or data.
CO4	Working knowledge of organizing and displaying large amounts and complex data.
CO5	Analyzing data using Pivot Tables and Pivot Charts.

Textbooks:	
1	"Microsoft Excel 2019 Step by Step" by Curtis Frye
2	"Excel 2019 Bible" by Michael Alexander, Richard Kusleika, and John Walken bach
3	MICROSOFT EXCEL 2019: DATA ANALYSIS&BUSINESS MODEL Paperback – 11 October 2019by L. Winston Wayne (Author)
4	Microsoft Excel Formulas & Functions for Dummies, 5ed Paperback – 1 November2020by Ken Bluttman (Author)
5	Mastering Advanced Excel Paperback – 21 July 2023by Ritu Arora (Author)
Reference Books:	
1	"Microsoft Excel Data Analysis and Business Modeling" by Wayne L. Winston:
2	Excel 2019 All-in-One For Dummies" by Greg Harvey:
3	Statistical Analysis with Excel for Dummies, 4ed Paperback – 1 December 2020by Joseph Schmuller (Author)
4	Excel for Beginners By M.L. Humphrey
Webresources:	
1	https://www.academia.edu/42074058/Excel_2019_BIBLE2.https://ptgmedia**.pearsoncmg.com/images/9780735681019/samplepages/9780735681019.pdf**
2	https://w3schools.com/Excel
3	https://excel-practice-online.com
4	https://www.zuaneducation.com/blog/best-resources-to-learn-excel-online/
5	https://www.udemy.com/course/excel-crash-course-full-tutorial

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	2	3	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	14	15	15	14	15	15	15	15	15	15	14
Average	2	3	3	2	3	3	3	3	3	3	2

3 – Strong, 2- Medium, 1- Low

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSF11	**DIGITAL COMPUTER FUNDAMENTAL**	**Core**	**1**	**1**	**0**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	Identify the logic gates and their functionality.
LO2	Perform number conversions from one system to another system.
LO3	Design basic electronic circuits (combinational circuits).
LO4	Understand the fundamental concepts of computers, algorithms, flowcharts and problem solving techniques.
LO5	Apply the basic knowledge of mathematical factoring methods to model an algorithm, flowchart for a given problem.

Unit	Content	Hours
1	Divisibility, LCM, HCF- Numbers, Decimals, Fractions, Powers -Profit, Loss -Simple interest and Compound interest -Speed, Distance, Time.	**6**
2	Coding -Decoding, Series-missing number, odd one out, Cause and Effect, Direction and Ranking, Blood relations.	**6**
3	NUMBER SYSTEM AND CODES: Decimal Numbers, Binary Numbers, Decimal to Binary Conversions, Binary Arithmetic, 1's and 2's complements of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed numbers, Hexadecimal Numbers, Octal Numbers, DigitalCodes, Error Detection Codes.	**6**
4	LOGIC GATES: The Inverter, The AND gate, The OR gate, The NAND gate, NOR gate, TheExclusive–OR gate and Exclusive-NOR gate; Boolean Algebra and Logic Simplification – BooleanOperations and Expressions, Laws and Rules, DeMorgan's Theorems, Boolean Expressions andTruth Tables, The Karnaugh Map, SOP minimizations.	**6**
5	Factoring Methods: Finding the square root of a number, the smallest Divisor of an integer, the greatest common divisor of two integers, computing the prime factors of an integer, raising a number to a large power.	**6**

CO	Course Outcomes
CO1	Appreciate and understand the differences between hardware and software.
CO2	Analyze a given problem and develop an algorithm to solve the problem.
CO3	Improve upon a solution to a problem.
CO4	An ability to understand and appreciate Boolean algebraic expressions to digital design
CO5	Apply the basic knowledge of mathematical factoring methods to model an algorithm, flowchart for a given problem.

Textbooks:	
1	Quantitative Aptitude For All Competitive Exams by Dr. R.S. Aggarwal.
2	R.G.Dromey, "How to Solve it by Computer", Pearson Education India, 2008.
3	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introductionto Algorithms", 3rd Edition, The MIT Press Cambridge, Massachusetts London, England,2008.
4	Floyd, Thomas L, "Digital Computer Fundamentals", 10 th Edition, University Book Stall, 1997.
5	Malvino, Paul Albert and Leach, Donald P, "Digital Computer Fundamentals", 3 rd Edition, TMH, 1995.
Reference Books:	
1	Steven S. Skiena, "The Algorithm Design Module", 2nd Edition, Springer-Verlag LondonLimited, 2008.
2	Donald E. Knuth, The Art of Computer Programming", Volume 1: FundamentalAlgorithms, 3rd Edition, Addison Wesley Longman, 1997.
3	Donald E. Knuth, The Art of Computer Programming", Volume 2: SeminumericalAlgorithms, 3rd Edition, Addison Wesley Longman, 1998.
4	Greg Perry and Dean Miller, "C programming Absolute Beginner's Guide", 3rd edition,Pearson Education, Inc, 2014.
5	Bartee, Thomas C, "Digital Computer Fundamentals", 6th Edition, TMH, 1995.
Web resources:	
1	http://algorithmsforinterviews.com "Algorithms for Interviews"
2	https://www.geeksforgeeks.org/computer-fundamentals-tutorial/
3	https://www.tutorialspoint.com/computer_fundamentals/computer_websites.html
4	https://www.indiabix.com/
5	https://www.tutorialspoint.com/basics_of_computers/basics_of_computers_useful_resources.html

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	2	2
CO2	3	3	3	3	3	3	3	2	3	2	2
CO3	3	3	3	3	3	3	3	2	3	2	3
CO4	3	3	3	3	3	3	3	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	12	15	12	12
Average	3	3	3	3	3	3	3	2	3	2	2

3 – Strong, 2- Medium, 1- Low

1ST YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC21	**DATA STRUCTURE AND ALGORITHM**	**Core**	**3**	**1**	**2**	**0**	**5**	**6**	**25**	**75**	**100**

Learning Objectives	
LO1	To Understand the concept of ADTs
LO2	To learn linear Data Structure-lists, Stack, queues
LO3	To Understand the concept of ADTs
LO4	To learn linear Data Structure-lists, Stack, queues
LO5	To Understand the concept of graph ADTs

Unit	Content	Hours
1	Abstract Data Types (ADTs)- List ADT-array-based implementation-linked list implementation singly linked lists-circular linked lists-doubly-linked lists-applications of lists- All operations-Insertion-Deletion-Merge - Polynomial Manipulation.	14
2	Stack ADT-Operations- Applications- Evaluating arithmetic expressions–Conversion of infix to postfix expression-Queue ADT-Operations- Circular Queue- Priority Queue- deQueue applications of queues.	14
3	Tree ADT-tree traversals-Binary Tree ADT-expression trees-applications of trees-binary search tree ADT- Heap-Applications of heap.	14
4	Definition- Representation of Graph- Types of graph-Breadth first traversal – Depth first traversal- Applications of graphs.	14
5	Searching: Linear search-Binary search- Sorting: Bubble sort-Selection sort-Insertion sort- Hashing: Hash functions-Separate chaining- Open Addressing-Rehashing Extendible Hashing.	14

CO	Course Outcomes
CO1	Understand the concept of ADT
CO2	Able to Design, implement, and analyze linear data structures, such as lists, queues, and stacks, according to the needs of different applications
CO3	Implement various tree structures to problem
CO4	Implement various graph structures to problem
CO5	Critically analyze the various sorting algorithms

Textbooks:	
1	Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", An Indian Adaptation, John Wiley Sons Inc., 2021.
2	"Data Structures and Algorithms in Python" by Michael T. Goodrich, Roberto Tamassia, and Michael H. Gold wasser
3	"Problem Solving with Algorithms and Data Structures using Python" by Brad Miller and David Ranum.
4	Reema Thareja, Python Programming using Problem Solving Approach, First Edition, Oxford Higher Education.
5	"Data Structures and Algorithms with Python" by Kent D. Lee and Steve Hubbard.
Reference Books:	
1	Dr.Basant Agarwal; Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7", Packt Publishing, 2018.
2	Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms in the Python Language", A press, 2014
3	Data Structures and Algorithms Using Python, Rance D. Necaise, JOHN WILEY & SONS, INC.
4	Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011.

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	3	3	3	3	2	2
CO2	3	3	3	3	2	3	3	2	2	3	3
CO3	3	2	3	3	3	3	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	2	3	3
CO5	3	2	3	3	3	3	3	3	3	2	2
Total	15	12	15	15	13	15	15	13	13	12	12
Average	3	2	3	3	3	3	3	3	3	2	2

3 – Strong, 2- Medium, 1- Low

1ST YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC22P	**DATA STRUCTURE AND ALGORITHM USING PYTHON LAB**	**Practical**	**0**	**0**	**4**	**0**	**2**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	To Understand the concept of ADTs
LO2	To learn linear Data Structure-lists, Stack, queues
LO3	To Understand the concept of linked list
LO4	To learn about the priority queue and sorting
LO5	To Understand the concept of tree and graph traversal

Unit	Content	Hours
1	Create a Python Program to Implement Singly Linked List	48
2	Create a Python Program to Implement Doubly Linked List	
3	Create a Python Program for Stack Implementation	
4	Create a Python Program for Queue Implementation	
5	Create a Python Program to implement tree traversal techniques	
6	Create a Python Program for Queue Implementation	
7	Write a Python program to demonstrate Breadth first search (BFS) algorithm	
8	Write a Python program to demonstrate Depth first search (DFS) algorithm	
9	Write a Python program to demonstrate Binary Search	
10	Write a Python Program to demonstrate the Bubble Sort	

CO	Course Outcomes
CO1	To Implement ADT for Linear Data Structure
CO2	Able to Apply the different Linear, Non-Linear data structures to the problems
CO3	Implement various tree structures to problem
CO4	Implement various graph structures to problem
CO5	Critically analyze the various sorting algorithms

Textbooks:	
1	"Problem Solving in Data Structures and Algorithms using Python" by Hemant Jain.
2	"Data Structures and Algorithms in Python" by Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser
3	"Problem Solving with Algorithms and Data Structures using Python" by Brad Miller and David Ranum.
4	ReemaThareja, Python Programming using Problem Solving Approach, First Edition, Oxford Higher Education.
5	"Data Structures and Algorithms with Python" by Kent D. Lee and Steve Hubbard.
Reference Books:	
1	Dr.Basant Agarwal; Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7", Packt Publishing, 2018.
2	Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms in the Python Language", A press, 2014
3	Data Structures and Algorithms Using Python, Rance D. Necaise, JOHN WILEY & SONS, INC.
4	Rance D. Necaise, "Data Structures and Algorithms Using Python", JohnWiley & Sons, 2011.

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	3	3	3	3	2	2
CO2	3	3	3	3	2	3	3	2	2	3	3
CO3	3	2	3	3	3	3	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	2	3	3
CO5	3	2	3	3	3	3	3	3	3	2	2
Total	15	12	15	15	13	15	15	13	13	12	12
Average	3	2	3	3	3	3	3	3	3	2	2

3 – Strong, 2- Medium, 1- Low

1ST YEAR: SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSS21	**Web Technology**	**SEC-3**	**1**	**0**	**1**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the concept of web design
LO2	To understand various concepts in HTML
LO3	To understand the basics of CSS
LO4	To understand the basic concepts of XML
LO5	To develop dynamic web pages with usage of server-side scripting PHP

Unit	Content	Hours
1	**Introduction and Web Design:** Introduction to Internet, WWW and Web 2.0,History of WWW, Web protocols and Web servers, Web Browser Architecture, Web Design-Principles and Web site structure.	6
2	**HTML** Basics of HTML, HTML Tags and attributes, Meta tags, Character entities, hyperlink, lists, tables, images, forms, divs, XHTML -Basic structure of XHTML, Creating Links with the Element.	6
3	**CSS:** Basics of CSS, CSS properties for manipulating texts, background, colors, Gradients, Shadow Effects, borders, margins, paddings, transformations, transitions and animations, etc., CSS box modal , Positioning systems of CSS, CSS media queries.	6
4	**XML** Introduction to XML, Defining XML tags, their attributes and values, Document type definition, XML Schemas, Document Object model, XHTML Parsing XML Data – DOM and SAX parsers in java	6
5	**PHP** Introduction to PHP and its syntax, combining PHP and HTML, understanding PHP code blocks like Arrays, Strings, Functions, looping and branching, file handling, processing forms on server side, cookies and sessions.	6

CO	Course Outcomes
CO1	Develop Web pages using HTML
CO2	Develop Web pages using HTML, CSS and XML
CO3	Design dynamic web pages using Javascript
CO4	To design web page using javascript and XML
CO5	Create web application using PHP

Text books:	
1	Thomas A.Powell: HTML & XHTML" Fourth Edition, The Complete Reference
2	Ivan Bayross: Web enabled commercial application development using HTML,JavaScript,DHTML and PHP" 4th Edition
3	Robert W. Sebesta: Programming the World Wide Web, Eighth Edition, Pearson education, 2015.
4	Dayley Brad, Dayley Brendan,"AngularJS, JavaScript, and jQuery All in One", Sams Teach Yourself 1st Edition, Kindle Edition, 2015..
5	Deitel,nieto,Lin,Sandhu-"XML How to program"-Pearson.
Reference Books:	
1	M. Srinivasan: Web Programming Building Internet Applications, 3 rdEdition, Wiley India, 2009.
2	Jeffrey C. Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, 7thImpression, 2012.
3	Chris Bates: Web Technology Theory and Practice, Pearson Education, 2012.
4	Raj Kamal: Internet and Web Technologies, McGraw Hill Education.
5	Ryan Benedetti, Ronan Cranley, Head First jQuery - A Brain-Friendly Guide, O'Reilly Media

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	3	3	3	3	2	2
CO2	3	3	3	3	2	3	3	2	2	3	3
CO3	3	2	3	3	3	3	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	2	3	3
CO5	3	2	3	3	3	3	3	3	3	2	2
Total	15	12	15	15	13	15	15	13	13	12	12
Average	3	2	3	3	3	3	3	3	3	2	2

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC31	**FUNDAMENTAL OF DATA SCIENCE WITH PYTHON**	**Core**	**3**	**1**	**2**	**0**	**5**	**6**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the data science fundamentals and process.
LO2	To learn to describe the data for the data science process.
LO3	To learn to describe the relationship between data.
LO4	To utilize the Python libraries for Data Wrangling..
LO5	To present and interpret data using visualization libraries in Python

Unit	Content	Hours
1	Data Science: Benefits and uses – facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model– presenting findings and building applications – Data Mining – Data Warehousing – Basic Statistical descriptions of Data	14
2	Types of Data – Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores	14
3	Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression – regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations – regression towards the mean	14
4	Basics of Numpy arrays –aggregations –computations on arrays – comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables	14
5	Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting – Geographic Data with Basemap – Visualization with Seaborn.	14

CO	Course Outcomes- The students will be able to
CO1	Understand data science fundamental and follow the correct process for applying data science.
CO2	Represent and understand data in different formats and analyse it.
CO3	Infer new information from the data using different analysis techniques.
CO4	Gather, collect, and transform raw data into useful formats with Python libraries.
CO5	Apply Python libraries to visualize and study data.

Text books:	
1	David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
2	Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units II and III)
3	Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Units IV and V)
4	Avrim Blum, John Hopcroft, Ravindran Kannan, "Foundations of Data Science", Cambridge Press, 2020
Reference Books:	
1	Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press,2014.
2	Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units II and III)
3	Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Units IV and V)
Web resources:	
1	https://rkabacoff.github.io/datavis/IntroGGPLOT.html

Mapping with Programme Outcomes:

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	1	1	2	2	2	2
CO2	2	2	2	3	2	-	-	2	2	3	2
CO3	2	2	2	3	1	-	-	2	2	3	3
CO4	3	3	3	3	1	-	-	2	3	3	2
CO5	2	3	3	3	2	1	1	3	3	3	3
Total	12	12	10	14	8	2	2	11	12	14	12
Average	2	2	2	3	2	0.5	0.5	2	2	3	2

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

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC32P	**FUNDAMENTAL OF DATA SCIENCE WITH PYTHON LAB**	**Practical - V**	**0**	**0**	**4**	**0**	**2**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	Students will be able to demonstrate the installation and setup of the R Programming Environment.
LO2	Students will acquire the ability to work with R Data types effectively in program development
LO3	Students will develop proficiency in utilizing various R Data Structures for problem-solving.
LO4	Students will enhance their programming logic by effectively applying R Packages in real-world scenarios
LO5	Students will gain skills in analyzing datasets using the extensive capabilities of R programming.

Program	Content	Hours
1	Working with Numpy arrays	6
2	Working with Pandas data frames	6
3	Develop python program for Basic plots using Matplotlib	6
4	Develop python program for Frequency distributions	6
5	Develop python program for Variability	6
6	Develop python program for Averages	6
7	Develop python program for Normal Curves	6
8	Develop python program for Correlation and scatter plots	6
9	Develop python program for Correlation coefficient	6
10	Develop python program for Simple Linear Regression	6
	Total	60

CO	Course Outcomes-On Completion of Course the Students will able to
CO1	The show the installation of R Programming Environment.
CO2	Utilize and R Data types for developing programs
CO3	Make use of different R Data Structures.
CO4	Develop programming logic using R Packages.
CO5	Analyze the data sets using R programming capabilities

Text books:	
1	JaredP. Lander ,R for Everyone: Advanced Analytics and Graphics, 2nd Edition**,** Pearson Education, 2018.
2	S.R.ManiSekharandT.V.SureshKumar,ProgrammingwithR,1st
Reference Books:	
1	The Comprehensive R Archive Network-https://cran.r-project.org.
2	R for Data Science by Hadley Wickham and Garrett Grolemund , 2017 , Published by O Reilly Media, Inc.
Web resources:	
1	https://rkabacoff.github.io/datavis/IntroGGPLOT.html

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	1	1	2	3	2	2
CO2	2	2	2	3	2	-	-	2	3	3	2
CO3	2	2	2	3	2	-	-	2	2	3	3
CO4	3	3	3	3	1	-	-	2	3	3	2
CO5	3	3	3	3	2	1	1	3	3	3	3
Total	10	12	12	15	9	2	2	11	14	14	12
Average	2	2	2	3	2	0.5	0.5	2	3	3	2

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

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UMAA32	**STATISTICAL METHODS AND ITS APPLICATIONS -I**	**Elective-IV**	**3**	**1**	**0**	**0**	**4**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	Scope and diagrammatic representation of data
LO2	To know about Measures of Location
LO3	To gain knowledge on Measures of Dispersion
LO4	To understand the concept of Skewness
LO5	To understand the relationship between variables and forecasting the future values

Unit	Content	Hours
1	Introduction - Scope and Limitations of Statistical Methods – Classification of Data –Tabulation of Data- Diagrammatic and Graphical Representation of Data.	12
2	Measures of Location: Arithmetic Mean, Median, Mode, and Their Properties.	12
3	Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation.	12
4	Measures of Skewness : Karl Pearson's, Bowley's, and Kelly's and Coefficient of Skewness .	12
5	Correlation: Karl Pearson – Spearman's Rank Correlation	12

CO	Course Outcomes
CO1	Understand the statistical methods measures of location
CO2	Understand the statistical methods measures of dispersion
CO3	Apply the statistical methods of dispersion and location
CO4	Understand the concept of Skewness.
CO5	Understand the relationship between variables and fore casting the future values

Text books:	
1	Fundamental of Mathematical Statistics - S. C. Gupta & V. K. Kapoor - Sultan Chand
2	Fundamental of Applied Statistics - S. C. Gupta & V. K. Kapoor - Sultan Chand
3	Statistical Methods - Snedecor G.W.& Cochran W. G. oxford & +DII
4	Elements of Statistics - Mode. E. B. - Prentice Hall
5	Statistical Methods- Dr. S. P. Gupta -Sultan Chand & Sons
Reference Books:	
1	Gupta S.P. (2001), Statistical Methods, Sultan Chand & Sons, New Delhi.
2	Gupta. S. C. and Kapoor. V. K. Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi
3	Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.
4	Sancheti D. C. And Kapoor. V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.
5	Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi
Web resources:	
1	https://nptel.ac.in/courses/111107105

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	-	-	2	3	3	2
CO2	3	3	3	3	3	-	-	2	3	3	3
CO3	3	3	2	3	2	1	2	2	2	3	2
CO4	2	3	3	3	3	2	2	3	3	3	3
CO5	2	2	3	3	3	1	1	3	3	3	2
Total	13	13	14	15	13	4	5	12	14	15	12
Average	2.6	2.6	2.8	3	2.6	0.8	1	2.4	2.8	3	2.4

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSE31	**OPERATING SYSTEM**	**Elective-V**	**1**	**0**	**1**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the fundamental concepts and role of Operating System.
LO2	To learn the Process Management and Scheduling Algorithms.
LO3	To understand the Memory Management policies.
LO4	To gain insight on I/O and File management techniques.
LO5	Analyze resource management techniques

Unit	Content	Hours
1	Introduction- views and goals – Operating System Services – User and Operating System interface - System Call- Types of System Calls– Operating System Design and Implementation - Operating System Structure. Process Management: Process concept-Process Scheduling-Operations on Processes-Interprocess Communication. **Threads**: Types of threads	**6**
2	Process Scheduling: Basic Concepts-Scheduling Criteria Scheduling Algorithm Multiple Processor Scheduling CPU Scheduling. Synchronization: The Critical-Section Problem Synchronization Hardware–Semaphores-Classic Problem of Synchronization.	**6**
3	Deadlocks: Deadlock Characterization- Methods for Handling Deadlocks- Deadlock Prevention-Deadlock Avoidance-Deadlock Detection-Recovery from Deadlock.	**6**
4	Memory-Management Strategies: Swapping - Contiguous Memory Allocation Segmentation- Paging - Structure of the Page Table. Virtual-Memory Management: Demand Paging- Page Replacement-Allocation of Frames-Thrashing.	**6**
5	Storage Management: File System- File Concept - Access Methods-Directory and Disk Structure -File Sharing- Protection. Allocation Methods-Free-Space Management-Efficiency and Performance–Recovery.	**6**

CO	Course Outcomes
CO1	Define OS with its view and goals and services rented by it Design of Operating System with its structure. Message through Inter process communication.
CO2	Describe the allocation of process through scheduling algorithms. Define critical section problems and its usage. Prevention of multiple process executing through the concept of semaphores.
CO3	Describe the concept of Mutual exclusion, Deadlock detection and agreement protocols for deadlock prevention and its avoidance.
CO4	Analyze the strategies of Memory management schemes and the usage of Virtual memory. Apply Replacement algorithms to avoid thrashing.
CO5	Brief study of storage management. Categorize the methods to allocate files for proper protection.

Text books:	
1	A.Silberschatz P .B. Galvin, Gange. "Operating System Concepts", Ninth Edition, 2013, Addison Wesley Publishing Co.
2	P.Rizwan Ahmed, Operating System, Margham Publications, Chennai.2018
Reference Books:	
1	Anderw S Tanenbaum, Albert S. Woodhull," Operating System Design and Implementation", prentice - Hall
2	William Stallings, " Operating Systems Internals and Design Principles", Pearson, 2018,9th Edition.
3	Operating Systems: A Spiral Approach– Elmasri, Carrick, Levine, TMH Edition
4	Operating System Concepts (2nd Ed) by James L. Peterson, Abraham Silberschatz, Addison –Wesley.
5	Operating Systems Design & implementation Andrew S. Tanenbam, Albert S. Woodhull Pearson.
Web resources:	
1	https://www.guru99.com/operating-system-tutorial.html
2	https://www.mygreatlearning.com/blog/what
3	https://en.wikipedia.org/wiki/Operating_system
4	https://www.geeksforgeeks.org/what-is-an-operating-system/
5	http://www.cs.kent.edu/~farrell/osf03/oldnotes/2.th-edition.pdf

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	2	-	2	3	2	2
CO2	3	3	2	2	2	-	2	2	3	3	2
CO3	3	3	3	2	2	1	1	3	3	3	2
CO4	3	3	2	3	3	2	1	3	3	3	3
CO5	2	2	2	2	2	1	1	3	3	3	2
Total	14	13	10	11	11	6	5	13	15	14	11
Average	3	3	2	2	2	1	1	3	3	3	2

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSE32	**RDBMS**	**Elective-V**	**1**	**0**	**1**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	Purpose and advantages of database systems.
LO2	Introduce the fundamental concepts of relational models.
LO3	Develop proficiency in Structured Query Language (SQL) for data definition and manipulation.
LO4	Teach the principles of database design, including normalization techniques.
LO5	To learn and understand to write queries using SQL, PL/SQL.

Unit	Content	Hours
1	**Introduction to Databases:** Purpose and advantages of database systems. Three-level architecture: internal, conceptual, and external views. Data models: hierarchical, network, and relational. Database languages: DDL, DML, and DCL. Database users and administrators.	**6**
2	**Relational Model:** Structure of relational databases. Relational algebra: selection, projection, union, set difference, Cartesian product, and join operations. Relational calculus: tuple and domain calculus. Integrity constraints: domain, entity, referential, and key constraints.	**6**
3	**SQL:** Basic SQL queries: SELECT, INSERT, UPDATE, DELETE. Advanced SQL features: nested queries, joins, views, and indexes. Data control commands: GRANT and REVOKE. Transaction control commands: COMMIT, ROLLBACK, and SAVEPOINT.	**6**
4	Database Design: Entity-Relationship (E-R) model: entities, attributes, relationships, and E-R diagrams. Mapping E-R diagrams to relational schemas. Normalization: 1NF, 2NF, 3NF, and Boyce-Codd Normal Form (BCNF). Functional dependencies and their role in normalization.	**6**

5	PL/SQL: A Programming Language: Fundamentals - Comments – Data Types – Variable Declaration – Assignment operation –Arithmetic operators. Control Structures: Control Structures – Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements.	**6**

CO	**Course Outcomes –On completion of this course, the student will be**
CO1	Understand the fundamental concepts and architecture of database systems.
CO2	Apply relational algebra and calculus for query formulation.
CO3	Design and implement relational databases using SQL.
CO4	Develop normalized database schemas to eliminate data redundancy.
CO5	Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions

Text books:	
1	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition
2	Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016
Reference Books:	
1	Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition
2	Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition
3	P.Rizwan Ahmed, RDBMS, Margham Publications, 2016
Web resources:	
1	Web resources from NDL Library, E-content from open-source libraries

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	3	2	1	2	3	2	2
CO2	3	3	3	2	2	2	1	2	3	3	2
CO3	3	2	3	2	2	1	1	3	3	3	2
CO4	3	3	2	2	2	1	-	2	3	2	3
CO5	3	2	2	3	3	1	2	3	3	2	3
Total	15	12	13	11	12	7	4	12	15	12	12
Average	3	2	3	2	2	1	1	2	3	2	2

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSS31P	**RDBMS LAB**	**SEC - IV**	**0**	**0**	**2**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	To learn the basics of Blockchain and apply cryptographic algorithms.
LO2	To design, build, and deploy smart contracts and distributed applications.
LO3	To deploy Private Blockchain and smart contracts on Ethereum.
LO4	To understand and deploy cryptocurrencies and their functions in applications.
LO5	To implement Blockchain for various use cases.

Program	Content	Hours
1	Create a database table, add constraints (primary key, unique, check, not null), insert rows, update, and delete rows using SQL DDL and DML commands.	2
2	Create a set of tables, add foreign key constraints, and incorporate referential integrity.	2
3	Query the database tables using different 'WHERE' clause conditions and implement aggregate functions.	2
4	Query the database tables using sub queries and simple join operations.	2
5	Query the database tables using natural, equi, and outer joins.	2
6	Write user-defined functions and stored procedures in SQL.	2
7	Write SQL triggers for insert, delete, and update operations in a database table.	2
8	Trigger	2
9	**Cursor** Student Mark Analysis Using Cursor	2
10	**Application** Library Management system	2
		20

CO	Course Outcomes-On Completion of Course the Students will able to
CO1	Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models..
CO2	Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.
CO3	Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML).
CO4	Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.
CO5	Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions.

Text books:	
1	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition.
2	Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016
Reference Books:	
1	Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition
2	Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition
Web resources:	
1	Web resources from NDL Library, E-content from open-source libraries

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	2	1	2	3	2	2
CO2	3	3	3	3	1	2	1	2	3	3	2
CO3	3	3	3	3	2	1	1	3	3	3	2
CO4	3	2	3	3	2	1	-	2	3	3	3
CO5	3	3	2	3	2	1	2	3	3	2	3
Total	15	13	14	14	8	7	4	12	15	13	12
Average	3	3	3	3	2	1	1	2	3	3	2

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

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC41	**MACHINE LEARNING**	**Core**	**3**	**1**	**2**	**0**	**5**	**6**	**25**	**75**	**100**

Learning Objectives	
LO1	To define the concept of Machine Learning and explain how it differs from traditional programming.
LO2	To compute and interpret error metrics such as Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) to evaluate regression model performance.
LO3	To compute the principle of the k-Nearest Neighbors (kNN) algorithm and its role in classification tasks.
LO4	To define the concept of Dimensionality Reduction and understand the Principal Component Analysis (PCA) technique for feature reduction.
LO5	Illustrate the learning process in reinforcement learning, including exploration and exploitation strategies.

Unit	Content	Hours
1	**Introduction to Machine Learning** What is Machine Learning?-Applications of ML in Real Life-Types of Learning – Supervised, Unsupervised, Semi-supervised, Reinforcement-Machine Learning Workflow-Data Collection and Preparation-Handling Missing Data and Outliers-Feature Scaling and Normalization-Model Evaluation Metrics (Accuracy, Confusion Matrix, Precision, Recall)	14
2	**Supervised Learning (Regression)** Concept of Supervised Learning- Linear Regression – Simple and Multiple-Polynomial Regression-Error Metrics – MSE, RMSE-Logistic Regression (Binary Classification)-Decision Boundary Concept- Case Study: Predicting Student Performance.	14
3	**Supervised Learning (Classification)** Concept of Classification -k-Nearest Neighbors (kNN) - Decision Trees-Random Forest (Concept only) - Naïve Bayes Classifier -Overfitting and Model Generalization.	14
4	**Unsupervised Learning** Introduction to Clustering -K-Means Clustering Algorithm - Hierarchical Clustering (Basics)- Distance Measures (Euclidean, Manhattan)-Dimensionality Reduction – Introduction to PCA- Applications of Clustering-Association Rule Learning – Apriori Algorithm (Concept)	14
5	**Introduction to Reinforcement Learning** Introduction- Difference between supervised, unsupervised, and reinforcement learning- Agent and Environment - States, Actions, and Rewards- How an agent learns through feedback- The Learning Process- **Q-Learning Basics:** Introduction to Q-learning -Understanding the Q-table- RL in marketing and recommendation systems	14

CO	Course Outcomes- The students will be able to
CO1	Understand the ML process and dataset preparation.
CO2	Learn to build and evaluate regression models.
CO3	Understand and apply classification algorithms
CO4	Learn unsupervised methods for data grouping and pattern finding.
CO5	Understand the basic concepts and components of reinforcement learning,

Text books:	
1	**"Introduction to Machine Learning with Python"** – Andreas C. Müller & Sarah Guido, O'Reilly Media.
2	**"Machine Learning"** – Tom M. Mitchell, McGraw Hill.
3	**"Python Machine Learning By Example"** – Yuxi (Hayden) Liu, Packt Publishing.
4	Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2015
5	Hal Daumé III, "A Course in Machine Learning", 2017 (freely available online)
Reference Books:	
1	**"Hands-On Machine Learning with Scikit-Learn & TensorFlow"** – Aurélien Géron, O'Reilly
2	**"Fundamentals of Machine Learning for Predictive Data Analytics"** – John D. Kelleher et al., MIT Press.
3	Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First
4	Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
5	Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer,
Web resources:	
1	https://www.ibm.com/think/topics/machine-learning
2	https://www.coursera.org/learn/machine-learning
3	https://www.datacamp.com/blog/introduction-to-unsupervised-learning
4	https://www.slideshare.net/slideshow/4mlunitivbayesian-learningpptx/259270077
5	https://www.sciencedirect.com/science/article/pii/S2405844018332067

Mapping with Programme Outcomes:

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	3	3	2	3	3	3	2
CO3	3	3	3	3	3	3	2	3	3	2	3
CO4	3	3	2	3	3	3	2	3	3	3	3
CO5	3	3	2	3	3	2	2	3	3	3	3
Total	15	15	13	15	15	14	11	15	15	14	13
Avera ge	**3**	**3**	**2.6**	**3**	**3**	**2.8**	**2.2**	**3**	**3**	**2.8**	**2.6**

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

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC42P	**MACHINE LEARNING LAB**	**Practical**	**0**	**0**	**4**	**0**	**2**	**4**	**25**	**75**	**100**

Learning Objectives	
LO1	Understand the step-by-step process of implementing machine learning models using Python.
LO2	Apply data preprocessing techniques such as cleaning, encoding, and normalization on real-world datasets
LO3	Implement basic supervised and unsupervised learning algorithms using Python libraries
LO4	Evaluate model performance using suitable metrics and visualize the results effectively.
LO5	Develop confidence in building simple, end-to-end machine learning projects and presenting findings

Program	Content	Hours
1	Loading and Exploring Datasets (CSV, Excel)	4
2	Data Cleaning – Handling Missing & Categorical Data	4
3	Simple Linear Regression Model	4
4	Multiple Linear Regression	4
5	Logistic Regression for Binary Classification	4
6	Decision Tree Classifier on Iris Dataset	4
7	k-Nearest Neighbors Classifier	4
8	K-Means Clustering on Customer Data	4
9	Principal Component Analysis (PCA) Visualization	4
10	Mini Project – End-to-End ML Model (Regression or Classification)	4
	Total	40

CO	Course Outcomes-On Completion of Course the Students will able to
CO1	Load, explore, and preprocess datasets using Python for machine learning tasks.
CO2	Implement and test regression and classification models using scikit-learn.
CO3	Apply unsupervised learning techniques like K-Means and PCA to analyze patterns in data.
CO4	Assess model accuracy and visualize model outputs using Python plotting libraries.
CO5	Design and execute a mini project demonstrating the complete machine learning workflow — from data preparation to model evaluation.

Text books:	
1	Andreas C. Müller and Sarah Guido, Introduction to Machine Learning with Python, O'Reilly Media
2	Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press
3	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer
4	Sebastian Raschka, Vahid Mirjalili, Python Machine Learning, Packt Publishing, 3rd Edition
5	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media, 3rd Edition
Reference Books:	
1	Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2	Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3	Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
4	Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
5	Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, 2009 (freely available online)
Web resources:	
1	https://www.ibm.com/think/topics/machine-learning
2	https://www.coursera.org/learn/machine-learning
3	https://www.datacamp.com/blog/introduction-to-unsupervised-learning
4	https://www.slideshare.net/slideshow/4mlunitivbayesian-learningpptx/259270077
5	https://www.sciencedirect.com/science/article/pii/S2405844018332067

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	3	3	2	3	3	3	2
CO3	3	3	3	3	3	3	2	3	3	2	3
CO4	3	3	2	3	3	3	2	3	3	3	3
CO5	3	3	2	3	3	2	2	3	3	3	3
Total	15	15	13	15	15	14	11	15	15	14	13
Average	**3**	**3**	**2.6**	**3**	**3**	**2.8**	**2.2**	**3**	**3**	**2.8**	**2.6**

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

2nd YEAR: FOURTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA		Total
24UDSS41	**UI/UX Designing**	**Elective-V**	**1**	**0**	**1**	**0**	**2**	**2**	**25**		**100**

Learning Objectives	
LO1	Understand and describe the **5 stages of design thinking**: Empathize, Define, Ideate, Prototype, and Test.
LO2	Identify and use basic research and analysis tools such as **FigJam**
LO3	Understand the principles of **visual communication** in designing graphical interfaces.
LO4	Explore and utilize **UX design tools** like Figma and understand features like navigation, interactions, buttons, and component libraries.
LO5	Identify and utilize various **UI elements** in high-fidelity wireframes (visual design, buttons, text fields, etc.).

Unit	Content	Hours
1	**Design Thinking Fundamentals** Introduction to Design thinking – Concept, Purpose, 5 stages of design thinking – Empathize, Define, Ideate, Prototype, Test, Introduction to User Interface / User Experience (UI/UX) – Definition of Design with respect to digital media, User Interface, User experience, Difference between UI and UX. History of UX. Need of UI and UX	**6**
2	**User Requirements and its Analysis** Introduction to research and analysis tool (freeware) such as FigJam- User requirements – Definition, Types of user research - Qualitative research, Quantitative research. Tools to collect user requirements – personal observation, interviews, questionnaire, User/ Expert reviews.	**6**
3	**User Interface Design** Storyboarding, User journey mapping - Gestalt principles of design - Aesthetics in UI design - Using Light, Color and Contrast Effectively in UI Design - Introduction to any freeware design tool such as Figma - Visual Communication Design - effective visual communication for graphical user interface	**6**
4	**User Experience Design Tool** Introduction to User Experience design - UX design open source tool such as - Figma features – Navigations, interactions, Buttons Creating library- Gamification, micro-animation - Creating visual identity of the project – design system, design theme	**6**

5	**Prototyping and Testing** Introduction to Wireframing - Purpose of wireframing, Types – low fidelity, medium fidelity, high fidelity- Basics of sketching, Creating low fidelity wireframes, medium fidelity and high fidelity in Figma.	**6**

CO	**Course Outcomes- The Students are able to**
CO1	Explain the concept and purpose of **Design Thinking**.
CO2	Apply different tools for collecting user data: **observations, interviews, questionnaires, and expert/user reviews**.
CO3	Apply principles of **visual communication design** to build effective graphical interfaces.
CO4	Use Figma (or other open-source tools) for UX design, including features like **navigation, interaction design, button creation, and component libraries**.
CO5	Apply basic **sketching techniques** and create various levels of wireframes using **Figma**.

Text books:	
1	Jesse James Garrett The Elements of User Experience: User-Centered Design for the Web and Beyond New Riders Publishing.
2	Falk Uebernickel, Li Jiang,Walter Brenner, Britta Pukall,Therese Naef Design Thinking: The Handbook World Scientific Publishing Co Pte Ltd
3	Fabio Staiano Designing and Prototyping Interfaces with Figma Packt Publishing Ltd
4	The Elements of User Experience: User-Centered Design for the Web and Beyond — Jesse James GarrettDesign Thinking for Beginners.
5	Interaction Design: Beyond Human-Computer Interaction (5th Ed.) — Helen Sharp, Yvonne Rogers & Jenny Preece
Reference Books:	
1	The Design of Everyday Things — Don Norman
2	Don't Make Me Think, Revisited: A Common-Sense Approach to Web Usability Steve Krug
Web resources:	
1	https://aim.gov.in/pdf/Design_Thinking.pdf
2	https://www.ideou.com/pages/design-thinking-resources
3	https://www.figma.com/resource-library/what-is-design-thinki
4	https://youtu.be/XT152i5asdQ?si=jPdLFFExnaZO8NRs

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	1	2	3	2	2
CO2	2	3	3	3	2	2	1	3	3	3	2
CO3	3	3	3	3	3	2	1	3	3	3	3
CO4	3	3	3	3	3	2	1	3	3	3	3
CO5	3	3	3	3	3	2	1	3	3	3	3
Total	14	15	14	14	13	9	5	14	15	14	13
Average	**2.8**	**3.0**	**2.8**	**2.8**	**2.6**	**1.8**	**1.0**	**2.8**	**3.0**	**2.8**	**2.6**

3 – Strong, 2- Medium, 1- Low

THIRD YEAR-FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC51	Big Data Analytics	CC-9	4	1	0	0	5	5	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 and the integration of large amounts of data.
LO4	To analyze data by utilizing clustering and classification algorithms.
LO5	Explain and Analyse the Big Data using Map-reduce programming in both Hadoop and Spark framework.

Unit	Content	Hours
1	**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.	15
2	**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.	15
3	**Pig and Hive:** Applications on Big Data Using Pig and Hive–Data processing operators in Pig–Hive services–Hive QL–Querying Data in Hive -Fundamentals of HBase and ZooKeeper.	15
4	**Mongo DB:** No SQL databases: Mongo DB: Introduction–Features-Data types-Mongo DB Query language-CRUD operations Arrays & Functions Mongo DB: Count– Sort– Limit– Skip – Aggregate – Map Reduce. Cursors–Indexes- Mongo Import–Mongo Export.	15
5	**Spark Framework:** Overview of Spark–Hadoop vs Spark–Cluster Design–Cluster management – performance, Application Programming interface (API): Spark Context, Resilient Distributed Datasets, Creating RDD, RDD Operations, Saving RDD - Lazy Operation – Spark Jobs.	15

CO	**Course Outcomes, The Students will be able to**
CO1	Understand Big Data and its analytics in there AI world
CO2	Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm.
CO3	Analyze the Big Data framework like Hadoop and NOSQL to efficiently store and process Big Data to generate analytics.
CO4	Design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics.
CO5	Implement Big Data Activities using Hive.
Text books:	
1	Seema Acharya & Subhasini Chellappan, Big Data and Analytics, Wiley, 2020.
2	Michael Minelli, Michelle Chambers, and Ambiga Dhiraj (2013), Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, John Wiley &Sons
Reference Books:	
1	JeffreyAven,(2018),DataAnalyticswithSPARKusingPython,Pearson,Addison-Wesley Data & Analytics Series.
2	TomWhite(2014),Hadoop:TheDefinitiveGuide,O'ReillyPublications,4thEdition
3	NoSQL Distilled:A Brief Guide to the Emerging World of Polyglot Persistence–Pramod J. Sadalage & Martin Fowler, Addison-Wesley, 2013.
4	LearningSpark:Lightning-FastBigDataAnalysis–HoldenKarauetal.,O'ReillyMedia, 2nd Edition, 2020.
Web Resources:	
1	https://nptel.ac.in/courses/106104189
2	https://spark.apache.org/docs/latest/
3	https://hadoop.apache.org/docs/
4	https://hadoop.apache.org/docs/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	2	2	3	3	2
CO2	3	3	3	3	2	3	2	2	3	3	2
CO3	3	3	3	3	2	2	2	2	3	3	2
CO4	3	3	3	3	2	3	2	2	3	3	2
CO5	3	3	3	3	3	3	2	2	3	3	2
Total	15	14	15	15	12	14	10	10	15	15	10
Average	3	3	3	3	2.4	2.8	2	2	3	3	2

3–Strong, 2-Medium,1-Low

THIRD YEAR –FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC52P	Big Data Analytics Lab	CC-10	0	0	4	0	3	4	25	75	100

Learning Objectives

LO1	To provide grounding in big data technology.
LO2	To learn map reduce analytics using Hadoop /Spark and related tools.
LO3	To work with map reduce applications.
LO4	To understand the working environment of Pig and Hive for processing the structured and unstructured data.
LO5	To understand the usage of Hadoop/Spark related tools for Big Data Analytics.

Unit	Content	Hours
1	Understanding different Hadoop modes. Startup scripts, Configuration files.	60 Hours
2	Hadoop / Spark Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files.	
3	Implement of Matrix Multiplication with Hadoop Map Reduce/Spark	
4	Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.	
5	Implementation of K-means Clustering using Map Reduce.	
6	Generation of Frequent Item set using MapReduce.	
7	Hive: Architecture, Data mode ling and datatypes	
8	HBase: HMaster, Region Server and Zookeeper.	
9	Application of Recommendation Systems using Hadoop/mahout libraries.	
10	Mahout machine learning library to facilitate the knowledge build up in big data analysis	

CO	**Course Outcomes, The students will be able to**
CO1	Understand Big Data and its analytics in the real world.
CO2	Analyze the Big Data framework like Hadoop to efficiently store and process Big Data to generate analytics.
CO3	Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm.
CO4	Design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics.
CO5	Implement Big Data Activities using Hive.
Textbooks:	
1	Seema Acharya & Subhasini Chellappan, Big Data and Analytics, Wiley, 2020.
2	Michael Minelli, Michelle Chambers, and Ambiga Dhiraj (2013), Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, John Wiley & Sons
References Books:	
1	Jeffrey Aven,(2018),Data Analytics with SPARK using Python, Pearson, Addison-Wesley Data & Analytics Series.
2	Tom White(2014), Hadoop: The Definitive Guide,O'Reilly Publications, 4th Edition
3	No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence– Pramod J. Sadalage & Martin Fowler, Addison-Wesley, 2013.
4	Learning Spark: Lightning-Fast Big Data Analysis – Holden Karauetal.,O'Reilly Media, 2nd Edition, 2020.
Web Resources	
1	https://nptel.ac.in/courses/106104189
2	https://spark.apache.org/docs/latest/
3	https://hadoop.apache.org/docs/
4	https://hadoop.apache.org/docs/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	_	_	2	_	3	2	3
CO2	2	2	2	3	_	3	2	_	3	3	3
CO3	2	2	2	3	3	2	2	3	3	2	2
CO4	_	1	_	2	3	2	3	_	3	3	2
CO5	_	2	_	1	2	3	2	2	3	2	2
Total	7	10	6	11	8	10	11	5	15	12	12
Average	1.4	2	1.2	2.2	1.6	2	2.2	1	3	2.4	2.4

3–Strong, 2-Medium,1-Low

THIRD YEAR-FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC53	**Artificial Intelligence**	**CC-11**	**2**	**1**	**1**	**0**	**4**	**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 Knowledge Representation
LO4	Introduce the concept of Software Agents
LO5	Understand about AI applications

Unit	Content	Hours
1	**Introduction:** Introduction–Definition–Future of Artificial Intelligence–Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems. Agentic AI: Types-Building AI Agent-AI Agent Framework-Multi Agent Systems-Agent-to-Agent communication	12
2	**Problem Solving Methods:** Problem solving Methods–Search Strategies-Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games–Alpha–Beta Pruning–Stochastic Games	12
3	**Knowledge Representation:** First Order Predicate Logic–Prolog Programming – Unification –Forward Chaining – Backward Chaining– Resolution –Knowledge Representation–Ontological Engineering-Categories and Objects–Events–Mental Events and Mental Objects–Reasoning Systems for Categories–Reasoning with Default Information.	12
4	**Software Agents:** Architecture for Intelligent Agents–Agent communication–Negotiation and Bargaining–Argumentation among Agents–Trust and Reputation in Multi-agent systems.	12
5	**Applications:** AI applications–Language Models–Information Retrieval-Information Extraction– Natural Language Processing –Machine Translation–Speech Recognition –Robot–Hardware –Perception–Planning–Moving	12

CO	Course Outcomes, The students will be able to
CO1	Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents.
CO2	Understands each techniques and gaming theory
CO3	The students will earn to apply knowledge representation techniques and problem solving strategies to common AI applications.
CO4	Student should be aware of techniques used f or classification and clustering.
CO5	Student should aware of basics of patterned cognition and steps required forit.

Text books:

1	Elaine Rich, Kevin Knight (2008),Shivsankar B Nair, Artificial Intelligence, Third Edition, TataMc Graw Hill Publication
2	P.Rizwan Ahmed, Artificial Intelligence, Margham Publications,Chennai,2012

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.

Web resources:

1	https://www.geeksforgeeks.org›software-engineering

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	2	2	3	3	2
CO2	3	3	3	3	2	3	2	2	3	3	2
CO3	3	3	3	3	2	2	2	2	3	3	2
CO4	3	3	3	3	2	3	2	2	3	3	2
CO5	3	2	3	3	3	3	2	2	3	3	2
Total	15	14	15	15	13	14	10	10	15	15	10
Average	3	2.8	3	3	2.6	2.8	2	2	3	3	2

3–Strong, 2-Medium,1-Low

THIRD YEAR-FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC54P	**Artificial Intelligence Lab**	**CC-12**	**0**	**0**	**3**	**0**	**2**	**3**	**25**	**75**	**100**

Learning Objectives	
LO1	To understand the potential benefits of using AI in knowledge-sharing and management
LO2	To Learn automation of knowledge management tasks using AI Tools
LO3	To study how AI is role in data analysis and decision-making
LO4	To explore ways to integrate AI applications into existing knowledge management systems
LO5	To Integrate AI with existing knowledge management systems

Unit	Content	Hours
1	Write a python program to implement Breadth First Search Traversal	45 Hours
2	Write a python program to implement Water Jug Problem	
3	Write a python program to remove punctuations from the given string	
4	Write a python program to sort the sentence in alphabetical order	
5	Write a program to implement Hang man game using python.	
6	Write a program to implement Tic-Tac-Toe game using python.	
7	Write a python program to remove stop words for a given passage from a text file using NLTK	
8	Write a python program to implement stemming for a given sentence using NLTK.	
9	Write a python program to POS(Parts of Speech)tagging for the give sentence using NLTK.	
10	Write a python program to for Text Classification for the give sentence using NLTK	

CO	Course Outcomes, The Students will be able to
CO1	Implement python code to understand the concept to AI
CO2	Implement different AI Techniques
CO3	Application of AI techniques in practical Life
CO4	Use of Natural Language Tool Kit in Python
CO5	Demonstrate integration of NLTK with Python code
Text books:	
1	ElaineRich,KevinKnight(2008),ShivsankarBNair,ArtificialIntelligence,Third Edition ,Tata Mc Graw Hill Publication
2	P.Rizwan Ahmed, Artificial Intelligence, Margham Publications,Chennai,2012
Reference Books:	
1	Russel S, Norvig P (2010),Artificial Intelligence : A Modern approach, Third Edition, Pearson Education
Web Resources:	
1	http://www.digimat.in/nptel/courses/video/106106126/L37.html
2	http://digimat.in/nptel/courses/video/106102220/L08.html

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	2	2	3	3	3	3	2	2
CO3	2	2	1	3	3	3	2	2	1	3	3
CO4	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	3	3	3	2	3	3	3	3	3
Total	14	14	13	14	14	12	14	14	13	14	14
Average	2.8	2.8	2.6	2.8	2.8	2.4	2.8	2.8	2.6	2.8	2.8

3–Strong,2-Medium,1-Low

THIRDYEAR- FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSE51	Social Media Analytics	EC-8	4	1	0	0	4	5	25	75	100

Learning Objectives	
LO1	Understand the importance of marketing analytics for forward looking and systematic allocation of marketing resources
LO2	Know how to use marketing analytics to develop predictive marketing dashboard for organization
LO3	Recognize challenges in dealing with data sets in marketing.
LO4	Identify and apply appropriate algorithms for analyzing the social media and web data
LO5	Make choices for a model for new machine learning tasks.

Unit	Content	Hours
1	**Marketing Analytics:** Introduction to marketing research, Research design setup, Qualitative research, Quantitative research, Concept development, scale development, Exploring Data, Descriptive Statistics. Product analytics- features, attributes, benefits, Price analytics, Promotion analytics, Channel analytics, Multiple Discriminate analysis.	15
2	**Customer Analytics:** Customer Analytics, Analyzing customer satisfaction, Prospecting and Targeting the Right Customers, Covariance and Correlation analysis, Developing Customers, Retaining Customers, Customer lifetime value case, Factor analysis. Market Segmentation & Cluster Analysis, Scatter plots & Correlation Analysis, Linear Regression, Model Validation & Assessment, Positioning analytics, Cross tabulation.	15
3	**Social Media Analytics (SMA) Module1:** Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas Network fundamentals and models: The social networks perspective- nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks-Information visualization.	15
4	**Social Media Analytics (SMA) Module2:** Introduction-parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis.	15
5	**Web Analytics and making connections:** Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity. Web analytics tools: Click stream analysis, A/ B testing, online surveys, Web crawling and Indexing.	15

CO	Course Outcomes, The Students will be able to
CO1	Critically evaluate the key analytical frameworks and tools used in marketing. Apply key marketing theories, frameworks and tools to solve marketing problems.
CO2	Utilize information of a firm's external and internal marketing environment to identify and prioritize appropriate marketing strategies.
CO3	Exercise critical judgment through engagement and reflection with existing marketing literature and new developments in the marketing environment.
CO4	Critically evaluate the marketing function and the role it plays in achieving organizational success both in commercial and non- commercial settings.
CO5	Evaluate and act upon the ethical and environmental concerns linked to marketing activities.
Textbooks:	
1	Digital Marketing Analytics: Making Sense of Consumer Data in a Digital World, Chuck Hemann & Ken Burbary, Pearson, ISBN 9780789750303
2	Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Eric Siegel, Pearson.
Reference Books:	
1	Marketing Analytics: A practical guide to real marketing science, Mike Grigs by, Kogen Page, ISBN 9780749474171
2	Cutting Edge Marketing Analytics: Real World Cases and Data Sets for Handson Learning,Raj Kumar Venkatesan, Paul Farris, RonaldT. Wilcox.
3	Marketing Metrics, Bendle, Farris, Pferfery, Reibstein
Web Resources:	
1	https://www.coursera.org/learn/uva-darden-market-analytics
2	https://www.wrike.com/marketing-guide/marketing-analytics/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	2	2	3	3	2
CO2	3	3	2	3	2	2	3	2	3	3	2
CO3	3	2	3	3	3	2	3	3	3	3	2
CO4	3	2	3	2	3	3	3	3	3	3	2
CO5	2	3	3	3	3	3	3	3	3	3	3
Total	14	13	14	14	14	13	14	13	15	15	10
Average	2.8	2.6	2.8	2.8	2.8	2.6	2.8	2.6	3	3	2.2

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSE52	Cyber Security	EC-8	4	1	0	0	4	5	25	75	100

Learning Objectives	
LO1	Understand various block cipher and stream cipher models
LO2	Describetheprinciplesofpublickeycryptosystems,hashfunctionsanddigitalsignature
LO3	To learn about the fundamentals of Cyber Security
LO4	To know about the privacy and authentication concepts
LO5	To get knowledge on how Cyber security works in business

Unit	Content	Hours
1	**Introduction to Security:** Data Encryption Standard-Block cipher principles-block cipher modes of operation- Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm.	15
2	**Fundamentals of Cyber Security:** How Hackers Cover Their Tracks- Fraud Techniques- Threat Infrastructure- Techniques to Gain a Foothold (Shell code, SQL Injection, Malicious PDF Files)- Misdirection, Reconnaissance, and Disruption Methods.	15
3	**Public Key Cryptography and Hash Algorithms:** Principles of public key crypto systems-The RSA algorithm-Key management- Diffie Hellman Key exchange-Hash functions-Hash Algorithms (MD5, Secure Hash Algorithm)	15
4	**Planning for Cyber Security:** PrivacyConcepts-PrivacyPrinciplesandPolicies-AuthenticationandPrivacy-Data Mining - Privacy on the Web- Email Security-Privacy Impacts of Emerging Technologies.	15
5	**Cyber Security Management:** Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster – Legal Issues – Protecting programs and Data – Information and the law–Rights of Employees and Employers –Emerging Technologies –The Internet of Things-Cyber Warfare.	15

CO	Course Outcomes, The Students will be able to
CO1	Implement basic security algorithms required by any computing system.
CO2	Analyze the vulnerabilities in any computing system and hence be able to design a security Solution
CO3	Analyze the possible security attacks in complex realtime systems and their effective Counter measures
CO4	Differentiate various governing bodies of cyber laws
CO5	Impart various privacy policies for an organization
Text books:	
1	William Stallings, "Cryptography and Network Security", Pearson Education, 6th edition, 2013.
2	Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5thEdition, Pearson Education, 2015.
Reference Books:	
1	Graham,J.Howard,R.,Olson,R.,CyberSecurityEssentials,CRCPress,2011.
2	GeorgeK.Kostopoulous,CyberSpaceandCyberSecurity,CRCPress,2013.
Web Resources:	
1	https://www.w3schools.com/cybersecurity/
2	https://www.geeksforgeeks.org

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	3	2	3	3	2	2
CO2	3	3	3	2	3	3	2	2	3	3	2
CO3	3	3	2	3	3	2	2	3	3	3	2
CO4	3	2	3	2	2	3	3	2	3	2	3
CO5	3	2	2	2	3	3	2	2	3	2	2
Total	15	12	13	11	12	14	11	12	15	12	11
Average	3	2.4	2.6	2.2	2.4	2.8	2.2	2.4	3	2.4	2.2

3–Strong, 2-Medium, 1-Low

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSE53	Deep Learning	EC-9	4	1	0	0	4	5	25	75	100

Learning Objectives

LO1	Describe how neural networks learn and how training works
LO2	Identify the key concepts of deep learning architectures.
LO3	Implement basic models using Tensor Flow.
LO4	Classify the concept of CNN, RNN, and other deep network types
LO5	Solve simple problems in vision, speech, and NLP using deep learning.

Unit	Content	Hours
1	**Introduction To Deep Learning:** Historical Trends in Deep Learning, Why DL is Growing, Artificial Neural Network, Non-linear classification example using Neural Networks: XOR/XNOR, Single/Multiple Layer Perception, Feed Forward Network, Deep Feed- forward networks, Stochastic Gradient–Based learning, Hidden Units, Architecture Design, Back- Propagation.	15
2	**Convolution Neural Network (CNN):** Introduction to CNNs and their applications in computer vision, CNN basic architecture, Activation functions-sigmoid, tanh, ReLU, Soft max layer, Types of pooling layers, Training of CNN in Tensor Flow, various popular CNN architectures: VGG, Google Net, Res Net etc, Dropout, Normalization, Data augmentation.	15
3	**Recurrent Neural Network (RNN):** Introduction to RNNs and their applications in sequential data analysis, Back propagation through time (BPTT), Vanishing Gradient Problem, gradient clipping Long Short Term Memory (LSTM) Networks, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.	15
4	**Generative Adversarial Networks (GANS**): Generative models, Concept and principles of GANs, Architecture of GANs (generator and discriminator networks), Comparison between discriminative and generative models, Generative Adversarial Networks (GANs), Applications of GANs.	15
5	**Auto-Encoders:** Auto-encoders, Architecture and components of auto-encoders (encoder and decoder), Training an auto-encoder for data compression and reconstruction, Relationship between Auto encoders and GANs, Hybrid Models: Encoder- Decoder GANs.	15

CO	Course Outcomes, The Student will be able to
CO1	Understand the basic concepts and techniques of Deep Learning and the need of Deep Learning techniques in real-world problems.
CO2	Apply CNN algorithm sand the way to evaluate performance of the CNN architectures.
CO3	To Sequential data modeling using RNNs, LSTMs, and techniques to handle vanishing gradients.
CO4	Analysis the principles, architecture, and applications of GANs for generative modeling.
CO5	Understand the structure and applications of auto encoders for data compression and reconstruction.
Text Books:	
1	Deep Learning: An MIT Press Book by Ian Good fellow and Yoshua Bengio Aaron Courville
2	Michael Nielson, Neural Networks and Deep Learning, Determination Press,2015.
3	Satish Kumar, networks: A classroom Approach,TataMcGraw-HillEducation,2004.
Reference Books:	
1	Deep Learning with Python, Francois Chollet, Manningpublications,2018
2	Advanced Deep Learning with Keras, Rowel Atienza, PACKT Publications,2018
Web resources:	
1	https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2	https://nptel.ac.in/courses/106105215

Mapping with programme outcomes and programme specific outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1	1	1	2	2	1
CO2	3	3	2	2	3	1	1	1	3	2	2
CO3	3	3	2	2	3	1	1	1	3	3	2
CO4	2	3	2	2	2	1	1	1	2	3	2
CO5	2	2	2	2	2	1	1	1	2	2	3
TOTAL	13	13	9	10	12	5	5	5	12	12	10
AVG	2.6	2.6	0.6	0.6	2.4	0.3	0.3	0.3	2.4	2.4	0.6

3–Strong, 2-Medium, 1-Low

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSE54	**Software Project Management**	**EC-9**	**4**	**1**	**0**	**0**	**4**	**5**	**25**	**75**	**100**

Learning Objectives	
LO1	To define and highlight importance of software project management.
LO2	To formulate and define the software management metrics & strategy in managing projects
LO3	To familiarize in Software Project planning
LO4	Understand to apply software testing techniques in commercial environment
LO5	To define and highlight importance of Quality requirements

Unit	Content	Hours
1	**Introduction to competencies**: product development techniques - management skills - product development life cycle - software development process and models - the SEI CMM - international organization for standardization.	15
2	**Managing domain processes:** project selection models - project portfolio management - financial processes - selecting a project team - goal and scope of the software project -project planning - creating the work breakdown structure - approaches to building a WBS - project milestones - work packages - building a WBS for software.	15
3	**Tasks and Activities:** Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed	15
4	**Project Management Resource Activities:** Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling.	15
5	**Quality:** Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study	15

CO	Course Outcomes, The Students will be able to
CO1	Knowledge gained to train software project managers
CO2	Apply software project management methodologies.
CO3	Able to create comprehensive project plans
CO4	Evaluate and mitigate risks associated with software development process
CO5	Understand the principles and concepts of project management
Text books:	
1	"Software Project Manangement" ,6th edition, bob Hughes, Mike Cotterel, Rajib Mall, McGraw-Hill, 2018
2	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, "Quality Software Project management", Pearson Education Asia 2002
Reference Books:	
1	PankajJalote, "Software Project Management in Practice", Addison Wesley 2002.
2	Hughes, "Software Project Management", Tata McGraw Hill 2004, 3rd Edition.
Web resources:	
1	https://www.geeksforgeeks.org/software-engineering/software-engineering-software-project-management-spm/
2	https://nptel.ac.in/courses/106105218

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	1	1	1	_	_	2	2	_	1	1	2
CO2	2	3	_	2	3	3	3	_	1	2	1
CO3	_	_	2	3	3	2	2	2	2	2	2
CO4	1	2	2	2	2	3	2	3	1	1	2
CO5	2	2	2	2	3	3	3	2	1	1	2
Total	6	8	7	9	11	13	12	7	6	7	9
Average	1.2	1.6	1.4	1.8	2.2	2.6	2.4	1.4	1.2	1.4	1.8

3–Strong, 2-Medium, 1-Low

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSIN51	**Internship**		**0**	**0**	**0**	**0**	**2**	**0**	**25**	**75**	**100**

Learning Objectives	
LO1	Understand professional work ethics, performance, and adaptability in a work environment.
LO2	Understand organizational and time management skills required in professional settings.
LO3	Understand interpersonal relationships and teamwork in an organization.
LO4	Understand documentation and presentation of internship work.
LO5	Exercise computational thinking over the entire software life cycle

Internship / Industrial Training:

The students to undergo 2 weeks of Internship / Industrial Training in the Industry

Sno	Area of Work	Maximum Marks
1	a) Work Related performance – Work Attitude/ Academic preparation/ problem solving ability/ Adaptability / Overall Attendance / Progress towards learning goals	**10**
	b) Organizational skills – Time management skills / Planning skills/ communication skills	**20**
	c) Relationship with others – Willingness to cooperate with co-works/ Ability to work with supervisor / Acceptance of constructive comments / Ability to take direction	**20**
2	Internship Report / Viva Voce Examination	**25**
	Total	**75**

*** CIA Marks =25 marks (Internship Review 1, Review2 and Review 3)**

CO	Course Outcomes-On completion of this course, students will be
CO1	Demonstrate effective work attitude, problem-solving ability, and progress toward learning goals.
CO2	Apply planning, communication, and time management skills in completing assigned tasks.
CO3	Exhibit teamwork, cooperation, and ability to accept feedback and guidance.
CO4	Prepare and present internship reports effectively and perform well in viva voce examination.
CO5	Apply best practices of IT industries by working in the Product or service domain.

Guidelines for internship

- Internship should be of 2 weeks duration.
- A student is expected to find internship by himself or herself. However, the institution should assist their students in getting internship in good organizations.
- The home institution cannot be taken as the place of internship.
- Internship can be on any topic covered in the syllabus mentioned in the syllabus, not restricted to the specialization.
- Internship can be done, in one of the following, but not restricted to, types of organizations:
  - ✓ Software development firms
  - ✓ Hardware/ manufacturing firms
  - ✓ Any small scale industries, service providers like banks
  - ✓ Clinics/ NGOs/professional institutions like that of CA, Advocate etc
  - ✓ Civic Depts like Ward office/post office/police station/ punchayat.

Guidelines for making Internship Report:

A student is expected to make a report based on the internship he or she has done in an organization. It should contain the following:

Certificate: A certificate in the prescribed Performa (given in appendix 1) from the organization where the internship done.

Evaluation form: The form filled by the supervisor or to whom the intern was reporting, in the prescribed Performa (given in appendix 2).

Title: A suitable title giving the idea about what work the student has performed during the internship.

Description of the organization: A small description of 1 to 2 pages on the organization where student has interned

Description about the activities done by the section where the intern has worked: A description of 2

to 4 pages about the section or cell of the organization where the intern actually worked. This should give an idea about the type of activity a new employee is expected to do in that section of the organization.

Description of work allotted and actually done by the intern: A detailed description of the work allotted and actual work performed by the intern during the internship period. Intern may give a weekly report of the work by him or her if needed. It shall be of around 7 to 10 pages.

Self assessment: A self assessment by the intern on what he or she has learnt during the internship period. It shall contain both technical as well as inter personal skills learned in the process. It shall be of around 2 to 3 pages.

The internship report may be around 20 to 30 pages and this needs to be submitted to the external examiner at the time of examination.

THIRD YEAR: FIFTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UCSIK51	Exploring Game Design for Cultural Heritage	IKS	0	0	0	2	0	2	25	75	100

Learning Objectives

LO1	To Learn about the Game Design and Development
LO2	To know how to integrate Indian Culture into Game
LO3	To Explore and Develop 2D or 3D environment in Indian Culture
LO4	To get knowledge in Testing and Development in games
LO5	To create a Prototype for Gaming Techniques

Unit	Content	Hours
1	**Introduction to Game Design and Development**: Game Design Fundamentals - Key concepts game mechanics, storylines, player interaction, and aesthetics – Introduction to game engines (Unity, Godot, Unreal Engine): Choosing the right tool for your project. The Game Development Process-Game Genres and Their Application to Cultural Narratives-Exploring different game genres: action, adventure, puzzle, RPG	6
2	**Integrating Indian Culture into Game Design:** Story telling in Games-integrate Indian mythology, history, and folklore into compelling game narratives - Designing interactive storylines - Creating playable characters inspired by mythological figures (e.g., warrior avatars, gods, orsages)-Designing NPCs(non-playable characters)to represent cultural heroes, historical figures, ordeities.	6
3	**Game Development Tools and Techniques:** Introduction to Unity, Go dot, or Unreal Engine-Setting up your game engine – Building basic 2D or 3D environments based on Indian cultural themes - Art and Audio for Cultural Representation - Designing textures, models, and animations inspired by Indian visual art.	6
4	**Testing and Deployment:** Debugging and testing games-Exporting Games for PC , Console, and Mobile Platforms-Publishing on app stores and gaming platforms.	6
5	**Prototyping and Play testing:** Prototyping and Iteration -Creating a simple game prototype that incorporates Indian cultural elements. Polishing the Prototype- Final touches: UI/UX design, animations, sound, and improving game play flow	6

CO	Course Outcomes, The Students will be able to
CO1	Understand the fundamentals of game design and development.
CO2	Create interactive digital experiences that integrate aspects of Indian culture.
CO3	Develop a simple game prototype using game engines like Unity or Godot.
CO4	Exploring the games in mobile Platforms
CO5	Explore the role of video games in UI/UX Design, animations
Text books:	
1	The Art of Game Design: A Book of Lenses by Jesse Schell 3rd edition,2019
2	Rules of Play: Game Design Fundamentals by Katie Salen and Eric Zimmerman,2004
Reference Books:	
1	Indian Mythology: A Captivating Guide to the Myths of India by M.K.Ghosh,2020
2	The Penguin History of Early India: From the Origins to AD1300 by Romila Thapar,2002
Web resources:	
1	https://gamedeigning.org/learn/character-design/
2	https://nptel.ac.in/courses/10610230/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3
CO3	3	3	3	3	2	2	3	3	3	3	3
CO4	3	3	3	3	2	3	3	2	3	3	3
CO5	3	2	3	3	3	3	3	2	3	3	3
Total	15	14	15	15	12	14	15	13	15	15	15
Average	3	2.8	3	3	2.4	2.8	3	2.6	3	3	3

3–Strong, 2-Medium,1-Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC61	Data Visualization	CC-13	4	1	0	0	4	5	75	25	100

Learning Objectives	
LO1	Understand the fundamentals of visualization concepts and its importance.
LO2	Understand essential design principles to design and develop effective visualizations.
LO3	Understand planning and visual analytics through advanced visualization techniques.
LO4	To create instant based learning
LO5	To apply advanced learning

Unit	Content	Hours
1	**Visualization Fundamentals:** Introduction to data visualization-Need for data visualization and its definition-Tools for Visualizing Data-Methods of visualizing data- Overview of modern visualization tools - working with various data formats - Basic chart types.	15
2	**Data Visualization For Human Perception:** The Human Brain and Data Visualization-Cognitive vs Perceptual Design Distinction- Introduction of Effective and Ineffective Visuals-Types of Visualizations and its examples- Practicing Good Ethics in Data Visualization-Ineffective Visuals and improvements-Visual Perception and Cognitive Principles-Strategic Use of Pre-Attentive Attributes-De-Cluttering.	15
3	**Exploratory Analysis:** Introduction-Exploratory and Explanatory Analysis - Identifying Outliers-Constructing a Control Chart-Design For Purpose-Data, Relationships, and Design-Static Versus Interactive Visualizations-Multiple, Connected View, Language, Labelling, and Scales- Visual Lies and Cognitive Bias- Case Study.	15
4	**Visual Analytics And Planning:** Basics of Visual Analytics -Charts- Colors, Shapes, and Sizes-Dual Line Charts-Bar Charts, Line Graphs, Pie Charts- Scatter Plots, Gantt Charts, Bubble Charts- Histograms, Bullet Charts, Heat Maps and Highlight Tables -Dates-Discrete vs. Continuous Dates- Basics of table calculations-Maps. Introduction to Planning and Preproduction for Visualizations-A Design Checklist-understanding Stakeholders-Prioritizing, Optimizing, and Designing	15
5	**Dashboard:** Dashboard Design Principles-Hierarchies, Actions, Filters, and Parameters-Creating Dashboards. The Story of the data-The Art of Storytelling (Past, Present, and Future)- Storytelling and the Human Brain-Bringing Data to Life-Emotion Modulators-Framing and Format-False Narratives and Data Storytelling-Preparation of the Story Points – Case Study	15

CO	Course Outcomes, The Students will be able to
CO1	Understand foundational visualization concepts
CO2	Demonstrate visualizations principles to enhance data visualization
CO3	Analyze and apply essential design principles to data exploration and visualization
CO4	Design appropriate charts, tables, maps and dashboards
CO5	Effectively create and tell a story based on visualized data

Text books:

1	Colin Ware and Kaufman M,, Visual thinking for design‖, Morgan Kaufmann Publishers, 2008
2	BenFry,"Visualizingdata",O'Reily,2007

Reference Books:

1	Chakrabarti, S, ―Mining the web: Discovering knowledge from Hypertext data , Morgan Kaufman Publishers, 2003.
2	Chakrabarti,S,―Mining the web: Discovering knowledge from hyper text data―,Morgan Kaufman Publishers,2003.
3	Beginning Data Science in R-Data Analysis, Visualization, and Modelling for the DataScientist-ThomasMailund–Apress-2017

Web resources:

1	https://www.coursera.org/learn/data-visualization-tableau?specialization=data-visualization
2	Essential Design Principles for Tableau: https://www.coursera.org/learn/dataviz-design?specialization=data-visualization
3	Visual Analytics with Tableau :https://www.coursera.org/learn/dataviz-visual-analytics?specialization=data-visualization
4	Data Visualization withTableauProject:https://www.coursera.org/learn/dataviz-project

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	2	2	3	3	3
CO2	3	3	3	3	2	3	2	2	3	3	3
CO3	3	3	3	3	3	3	2	2	3	3	3
CO4	3	3	2	3	3	3	3	2	3	3	2
CO5	3	3	3	3	3	2	3	2	3	3	2
Total	15	15	14	15	14	14	12	10	15	15	13
Average	3	3	2.8	3	2.8	2.8	2.4	2	3	3	2.6

3–Strong, 2-Medium,1-Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC62P	Data Visualization Lab	CC-14	0	0	5	0	3	5	75	25	100

Learning Objectives	
LO1	Understand the importance of data visualization for business intelligence and decision making.
LO2	Know approaches to understand visual perception
LO3	Learn about categories of visualization and application areas
LO4	Familiarize with the data visualization tools
LO5	Gain knowledge of effective data visuals to solve workplace problems

Unit	Content	Hours
1	Create Pie chart for Sales and Sales % by Country (sorted in descending order). using excel	75 Hours
2	Create Bar chart for Sales by Country by Year (rounded to nearest thousand and sorted by Grand Total). using excel	
3	Basic Visualization Line plots, Area plots, Histograms, Bar charts, Pie charts, Box plots, Scatter plots in Python	
4	Basic Visualization like Scatter plots, Line plots, Box plots, Histograms, Bar charts using R	
5	Connecting to Data and preparing data for visualization in Tableau	
6	Data Aggregation and Statistical functions in Tableau	
7	Create a Basic Dashboards in Tableau for category of sales across months in a year, region is the field added	
8	Design a symbol map to represent population or sales distribution across different cities.	
9	Creating Interactive Visualizations in Tableau for Sales by Ship Mode by Country (rounded to the nearest dollar and sorted by First Class).	
10	A college wants to share student performance dashboards with faculty members. Deploy and share the dashboard using Tableau.	

CO	Course Outcomes, The Students will be able to
CO1	Use Python, R and Tableau for data visualization
CO2	Apply data visuals to convey trends in data over time using tableau
CO3	Construct effective data visualsto solve workplace problems
CO4	Explore and work with different plotting libraries
CO5	Learn and create effective visualizations
Text books:	
1	Data visualization with python: create an impact with meaningful data insights using interactive and engaging visuals, Mario Dobler, Tim Grobmann, Packet Publications, 2019
2	Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master, Ryan Sleeper, Oreilly Publications, 2018
Web resources:	
1	https://www.tableau.com/products/public/download
2	https://mrcet.com/downloads/digital_notes/csit/csit_r22_data%20visualization.pdf

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	2	3	2	3	3	3
CO2	3	3	2	3	2	2	3	2	3	3	2
CO3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	2	3	3	3	3	3	3	3	2
CO5	3	3	2	3	3	3	3	2	3	3	2
Total	15	15	11	15	13	12	15	12	15	15	12
Average	3.0	3.0	2.2	3.0	2.6	2.4	3	2.4	3	3	2.4

3–Strong, 2-Medium,1-Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSC63P	Project	CC-15	0	0	5	0	4	5	25	75	100

Learning Objectives	
LO1	Advance from an intellectually curious student to a creator/maker and an industry professional
LO2	Apply verbal and written communication skills to explain technical problem solving techniques and solutions to an increasingly diverse and global audience
LO3	Collaborate within and across disciplinary boundaries to solve problems
LO4	Apply mathematical and /or statistical methods to facilitate problem solving.
LO5	Exercise computational thinking over the entire software life cycle

Unit	Content	Hours
	The Candidates have to undergo a Minimum of 1 50 Hours of Project Work during the Course of Study either in an IT Industry / Public or Private Sector Organization / Research Institutes/Institution itself. TheCandidatesneedtoidentifyandanalyzerealworldproblemsontheselected project domain. During the course of study, the Candidates need to Develop, Design, Test, etc., the Applications as per the directions by the Guide. Then the Candidates have to prepare and submit the manuscript to the Project Work as a Report as per the requirements of the Institution / Department for Evaluation. The submission of the Project Report will be done at the end of the Semester for PresentationandViva-VoceduringthePracticalExaminationsoftheSemester.The Passing Minimum for Project Work is 50%. If the Candidate fails to score 50%in the ProjectWork, the Candidate has to improve it during then extra Attempt. A Faculty Member from the Department will act as a Guide to Supervise and Monitor the progress of the Candidates during the course of Project Work. The Faculty Member will act as the Internal Examiner during the course of Project Work as well as at the time of conducting the Viva-Voce Examination. The Internal Marks for the Project Work will be awarded by the concerned Guide / Internal Examiner. The Internal and External Examiners shall both evaluate the Project Report, Presentation and conduct the Viva-Voce Examination.	75 Hours

	INTERNAL MARKS AWARDED FOR THE PROJECT WORK-25Marks
	Zeroth Review - Selection of the Project Title Review1 - 5 Marks Review2 - 10 Marks Review3 - 10 Marks
	EXTERNAL MARKS AWARDED FOR THE PROJECT WORK-75Marks
	Evaluation of the Project Report – 25Marks Presentation – 25Marks Viva-Voce Examination – 25Marks

CO	Course Outcomes, The Students will be able to
CO1	Show leadership skills and learn time management
CO2	Identify various tools to be applied to as specific problem
CO3	Evaluate the reports
CO4	Take part in a team as well as manage it to deliver stunning outcomes
CO5	Assess and develop the individual skill stop resent and organize projects

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	15	15	15	15
Average	3	3	3	3	3	3	3	3	3	3	3

3–Strong, 2-Medium,1-Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSE61	Linear Algebra	EC-10	4	1	0	0	4	5	25	75	100

Learning Objectives	
LO1	To understand linear programming methods.
LO2	To understand Dynamic programming approach.
LO3	To understand concepts basics concepts of Linear Algebra
LO4	To understand concepts of vector spaces and matrices
LO5	To understand the applications of Linear Algebra in Machine Learning

Unit	Content	Hours
1	Vector spaces – Subspaces – Linear Combinations and linear span- Systems of Linear equations – Homogenous Equations – Non-homogenous Equations – Elementary Matrices – Row reduced -Echelon form.	15
2	Linear Dependence and Linear independence–Bases–Dimensions	15
3	Lineartransformations,nullspacesandranges–Matrixrepresentationofalinear transformation –invertibility and isomorphisms – dual spaces	15
4	Eigen values, eigen vectors, diagonalizability– invariant subspaces– Cayley–Hamilton theorem	15
5	Inner products and norms–Gram Schmidt Orthogonalization Process-Orthogonal complements	15

CO	Course Outcomes, The student will be able to
CO1	Acquire a detailed knowledge about vector spaces and subspaces
CO2	Understand the concepts of Linear Dependence, Linear Independence, Bases and Dimension of basis
CO3	Build the concept of Linear Transformations, their Matrix representation and the notion of dual spaces
CO4	FindtheEigenvaluesandEigenvectors,toapplytheconceptsfordiagonalisation
CO5	Analysis about Inner product and norms and to apply Gram Schmidt Orthogonalization Process to problems on inner product spaces
Text books:	
1	Linear Algebra - Stephen H Friedberg, Arnold J Insel and Lawrence E Spence, 5thedition (2018) Pearson
Reference Books:	
1	I.N.Herstein,TopicsinAlgebra,WileyEasternLtd.SecondEdition,2006.
2	N.S.Gopalakrishnan,UniversityAlgebra,NewAgeInternationalPublications,WileyEasternLtd.
3	John B. Fraleigh, First course in Algebra, Addison Wesley.
Web resources:	
1	https://nptel.ac.in
2	https://geeksforgeeks/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	1	2	3	2	2
CO2	3	2	3	3	3	3	1	2	3	2	2
CO3	3	3	2	3	3	3	1	2	3	3	2
CO4	3	3	3	3	3	3	1	2	3	3	3
CO5	3	3	3	3	3	3	1	2	3	3	3
Total	15	14	14	15	15	15	5	10	15	13	12
Average	3	2.8	2.8	3	3	3	1.0	2.0	3	2.6	2.4

3–Strong, 2-Medium,1-Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSE62	**Artificial Neural Networks**	**EC-10**	**4**	**1**	**0**	**0**	**4**	**5**	**25**	**75**	**100**

Learning Objectives

LO1	Understand the basic concepts of artificial neural networks, including models, activation functions, and learning algorithms.
LO2	Build the different types of learning methods such as supervised, unsupervised, and Hebbian learning.
LO3	Apply single-layer perception models for pattern recognition and simple classification problems.
LO4	Analyze multi-layer perception networks and implement backpropagation for training neural networks.
LO5	Understand deep learning concepts and identify applications of CNNs, RNNs, and other deep neural network architectures.

Unit	Content	Hours
1	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, Perception Learning Algorithm, Perception Convergence Theorem.	15
2	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitivelearning,Boltzmannlearning,creditassignmentproblem,Learningwithand without teacher, learning tasks, Memory and Adaptation	15
3	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.	15
4	Multi-Layer Perception 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	15
5	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neo cognition, Deep Convolution Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzmann Machines, Training of DNN and Applications	15

CO	Course Outcomes, The Students will be able to
CO1	Understand the basics of artificial neural networks and its architecture.
CO2	Understand the various learning algorithms and their applications.
CO3	Identifytheappropriateneuralnetworkmodeltoaparticularapplication.
CO4	Apply the selected neural network model to a particular application.
CO5	Analyze the performance of the selected neural network.
Text books:	
1	Neural Networks A Classroom Approach-Satish Kumar, Mc Graw Hill-Second Edition.
2	"Neural Network- A Comprehensive Foundation"- Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999.
3	B.YegnanarayanaArtificialneuralnetworkPHIPublication.2005
Reference Books:	
1	ArtificialNeuralNetworks-B.Yegnanarayana,PHI,NewDelhi1998.
2	KevinL.Priddy,PaulE.Keller–Artificialneuralnetworks:AnIntroduction-SPIEPress,2005
3	MohammadH.Hassoun–Fundamentalsofartificialneuralnetworks-MITPress,1995
Web resources:	
1	https://www.pvpsiddhartha.ac.in/dep_cse/lect_note/32/ml/ML%20UNIT-II.pdf
2	https://www.geeksforgeeks.org/deep-learning/artificial-neural-networks-and-its-applications/
3	https://abit.edu.in/wp-content/uploads/2019/11/CMT_Artificial-Neutral-Networks.pdf

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	2	2	2	3	2	2
CO2	3	2	3	2	3	3	2	2	3	3	2
CO3	3	3	2	2	3	3	2	2	3	3	2
CO4	2	3	3	3	2	3	2	2	3	3	3
CO5	3	2	3	3	3	3	2	3	3	3	3
Total	14	13	14	12	14	14	10	11	15	14	12
Average	2.8	2.6	2.8	2.4	2.8	2.8	2.0	2.2	3.0	2.8	2.4

3-Strong, 2-Medium,1-Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSE63	Cloud Computing	EC-11	4	1	0	0	4	5	25	75	100

Learning Objectives	
LO1	Learning fundamental concepts and Technologies of Cloud Computing.
LO2	Learning various cloud service types and their uses and pitfalls.
LO3	To learn about Cloud Architecture and Application design.
LO4	To know the various aspects of application design, benchmarking and security on the Cloud.
LO5	To learn the various Case Studies in Cloud Computing.

Unit	Content	Hours
1	**Introduction to Cloud Computing:** Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications. **Cloud Concepts and Technologies:** Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing.	15
2	**Cloud Services :**Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage - Microsoft Assessment - Microsoft Planning Toolkit- IBM: Cloud Models - IBM **Smart Cloud Database Services:** Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service **Application Services:** Application Runtimes and Frameworks - Queuing Services - Email Services - Notification Services - Media Services Content Delivery Services: Amazon Cloud Front - Windows Azure Content Delivery Network	15
3	**Cloud Application Design:** Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications **Cloud Application Design Methodologies**: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data **Storage Approaches:** Relational Approach (SQL), Non Relational Approach (NoSQL).	15
4	**Cloud Application Benchmarking and Tuning**: Introduction to Benchmarking– Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping.	15
5	**Case Studies:** Cloud Computing for Healthcare – Cloud Computing for Energy Systems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.	15

CO	Course Outcomes, The students able to,
CO1	Understand the fundamental concepts and Technologies in Cloud Computing.
CO2	Able to understand various cloud service types and their uses and pitfalls.
CO3	Able to understand Cloud Architecture and Application design.
CO4	Understand the various aspects of application design, benchmarking and security in the Cloud.
CO5	Understand various Case Studies in Cloud Computing.
Text books:	
1	Arshdeep Bahga, Vijay Madisetti, Cloud Computing – A Hands On Approach, Universities Press (India) Pvt. Ltd., 2018
Reference Books:	
1	Anthony T Velte, Toby J Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Tata McGraw-Hill, 2013.
2	Barrie Sosinsky, Cloud Computing Bible, Wiley India Pvt. Ltd., 2013.
3	David Crookes, Cloud Computing in Easy Steps, Tata McGraw Hill, 2015.
Web resources:	
1	https://onlinecourses.nptel.ac.in/noc26_cs55/preview
2	https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	2	2	2	1	2	3
CO2	3	3	2	2	3	3	3	2	2	2	3
CO3	2	3	2	3	3	2	2	3	3	3	2
CO4	2	2	3	2	2	3	1	2	2	3	3
CO5	2	2	2	2	3	3	3	2	2	2	3
Total	12	12	10	11	12	13	11	11	10	12	14
Average	2.4	2.4	2	2.2	2.4	2.6	2.2	2.2	2	2.4	2.8

3 – Strong, 2- Medium, 1- Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSE64	Natural Language Processing	EC-11	4	1	0	0	4	5	25	75	100

Learning Objectives	
LO1	To understand approaches to syntax and semantics in NLP.
LO2	To learn natural language processing and to learn how to apply basic algorithms in this field.
LO3	To understand approaches to discourse, generation, dialogue and summarization within NLP.
LO4	To get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.
LO5	To understand current methods for statistical approaches to machine translation.

Unit	Content	Hours
1	**Introduction:** Natural Language Processing tasks in syntax, semantics, and pragmatics– Issue- Applications – The role of machine learning– Probability Basics–Information theory – Collocations – N – gram Language Models– Estimating parameters and smoothing – Evaluating language models.	15
2	**Word level and Syntactic Analysis:** Word Level Analysis : Regular Expressions-Finite- State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes – Part – of Speech Tagging . Syntactic Analysis: Context-free Grammar - Constituency-Parsing-Probabilistic Parsing.	15
3	**Semantic analysis and Discourse Processing:** Semantic Analysis: Meaning Representation – Lexical Semantics – Ambiguity – Word Sense Disambiguation Supervised –Dictionary based and Unsupervised Approaches . Discourse Processing: cohesion - Reference Resolution – Discourse Coherence and Structure.	15
4	**Natural Language Generation:** Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages – Machine Translation Approaches- Translation involving Indian Languages.	15
5	**Information retrieval and lexical resources: Information Retrieval :** Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval–valuation Lexical Resources: World Net Frame Net Stemmers - POSTagger- Research Corpora SSAS.	15

CO	Course Outcomes, The Student will be able to
CO1	Understand fundamentals of NLP including syntax, semantics, pragmatics, probability, and language models.
CO2	Apply word-level and syntactic analysis techniques such as POS tagging, parsing, and finite-state models.
CO3	Analyzesemanticmeaninganddiscourseprocessingincludingambiguityresolutionandcoherence.
CO4	Demonstrate knowledge of Natural Language Generation and Machine Translation with focus on Indian languages.
CO5	ApplyInformationRetrievaltechniquesandutilizelexicalresourceslikeWordNetandcorpora.
Text books:	
1	Daniel Jurafsky, James H. Martin, "Speech & language processing", Pearson publications. Allen, James. Natural language understanding Pearson,1995.
2	Steven Bird, Ewan Kleinand Edward Loper,—Natural Language Processing with Python, First Edition,OReillyMedia,2009.
3	Lawrence Rabiner And Biing-Hwang Juang," Fundamentals Of Speech Recognition", Pearson Education,2003.
Reference Books:	
1	Breck Baldwin, —Language Processing with Java and Ling Pipe Cook book, Atlantic Publisher, 2015.
2	RichardMReese,—NaturalLanguageProcessingwithJava,OReillyMedia,2015.
3	PierreM.Nugues,"AnIntroductiontoLanguageProcessingwithPerlandProlog",Springer
4	Roland R. Hausser, "Foundations of Computational Linguistics: Human- Computer Communication in Natural Language", Paper back, MIT Press, 2011.
Web resources:	
1	https://nptel.ac.in/courses/106106211
2	https://www.techtarget.com/searchenterpriseai/definition/natural-language/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	3	3	3	3	3	2	3	3	3
CO3	3	3	2	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	14	14	15	15	15	15	14	14	15	15
Avera ge	3	2.8	2.8	3	3	3	3	2.8	2.8	3	3

3–Strong,2-Medium,1-Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSP61	Power BI	PEC	1	1	0	0	2	2	25	75	100

Learning Objectives	
LO1	To Learn a New too of Power Bi Basics Functions
LO2	To Learn about the power query and Data Modeling Techniques
LO3	To explore knowledge on DAX Operations
LO4	To know how to create a Dashboard
LO5	To explore knowledge on integrating PowerBi and Excel

Unit	Content	Hours
1	**Power BI Desktop Basics**: Understanding the Power BI interface - Connecting to different data sources: Excel / CSV, SQL Server / Database, Web / PDF / SharePoint - Understanding fields, tables, and data types - Renaming, duplicating, and formatting tables/columns	6
2	**Power Query (Data Transformation)** - Introduction - Removing rows/columns, filtering data - Changing data types - Replacing errors or null values - Splitting and merging columns - Grouping and summarizing data - Merging Queries (Joins) - Appending Queries (Union) - Creating custom columns with M language (basic) Data Modeling: Creating relationships between tables - One-to-many, many-to-one relationships - Star schema vs Snowflake schema - Managing relationships view	6
3	**DAX (Data Analysis Expressions):** Calculated columns vs. Measures - Basic and advanced DAX functions: Aggregation, logical, text, and date functions - Time intelligence and filter functions. Data Visualization & Reporting: Creating interactive reports - Visual formatting, interactions, bookmarks, and tooltips - Drill-down and drill - through functionality.	6
4	**Power BI Service (Cloud Operations):** Publishing reports from Desktop to Service - Creating Dashboards, Apps, and Workspaces - Setting up data refreshing (Data Gateways) - Sharing reports and collaborating - Row -Level Security (RLS).	6
5	**Integration & Automation**: Power BI + Excel integration - Power BI + Power Automate (basic workflows) - Using Python or R scripts (optional) - Embedding Power BI reports on websites Applications: Sales performance dashboard - HR analytics (employee attrition)	6

CO	Course Outcomes, The Students will be able to
CO1	Understand and explain the components, architecture, and functionalities of Power BI for business intelligence applications.
CO2	Connect, transform, and clean data from multiple sources using Power Query Editor.
CO3	Apply DAX functions to create calculated columns, measures, and perform advanced data analysis.
CO4	Create a Effective Dashboard and publish and share the reports
CO5	Develop interactive dashboards and reports, and publish, share, and manage them using Power BI Service.
Textbooks:	
1	Microsoft Power BI Complete Reference – Devin Knight, Brian Knight, Mitchell Pearson
Reference Books:	
1	Learn Power BI – Greg Deckler
2	Microsoft Power BI Cookbook – Brett Powell
Web resources:	
1	https://learn.microsoft.com/en-us/power-bi
2	https://www.geeksforgeeks.org/power-bi/power-bi-tutorial/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	2	1	_	2	3	3
CO2	2	2	2	1	3	2	1	_	2	2	3
CO3	3	1	_	2	2	1	2	3	3	1	2
CO4	1	1	_	2	1	1	2	3	3	3	2
CO5	1	3	3	_	1	3	1	2	1	2	2
Total	10	9	7	6	10	9	7	8	11	11	12
Average	2	1.8	1.4	1.2	2	1.8	1.4	1.6	2.2	2.2	2.4

3 – Strong, 2- Medium, 1- Low

THIRD YEAR: SIXTH SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24UDSL61	**Open Source Software Technologies**	**SLC**	**0**	**0**	**0**	**3**	**2**	**3**	**75**	**25**	**100**

Learning Objectives	
LO1	Able to Acquire and understand the basic concepts in Java, application of OOPS concepts.
LO2	Acquire knowledge about operators and decision-making statements.
LO3	To Identify the significance and application of Classes, arrays and interfaces and analyzing java arrays
LO4	Understand about the applications of OOPS concepts and analyze overriding and packages through java programs
LO5	Can Create window-based programming using applet and graphics programming

Unit	Content	Hours
1	Open Source – open source vs. commercial software – What is Linux – Free Software – Where I can use Linux - Linux kernel – Linux distributions.	9
2	Introduction Linux Essential Commands – File System concept – Standard Files –The Linux Security Model – Introduction to Unix – Unix Components Unix Files – File Attributes and Permission – Standard I/O – Redirection – Pipes and Filters – Grep and Stream Editor	9
3	Introduction - Apache Explained – Starting, Stopping and Restarting Apache – Modifying the Default configuration – Securing Apache – Set user and Group	9
4	My SQL: Introduction to My SQL – The show databases and table – The USE command –Create Database and Tables – Describe Table – Select, Insert, Update and Delete statement database.	9
5	Introduction –PHP Form processing – Database Access with PHP – My SQL Functions – Inserting Records – Selecting Records – Deleting Records – Update Records	9

CO	Course Outcomes, The Student will be able to
CO1	Acquire and understand the basic concepts in Java, application of OOPS concepts.
CO2	Acquire knowledge about operators and decision-making statements.
CO3	Identify the significance and application of Classes, arrays and interfaces and analyzing java arrays
CO4	Understand about the applications of OOPS concepts and analyze overriding and packages through java programs.
CO5	Create window-based programming using applet and graphics programming
Textbooks:	
1	James Lee and Brent Ware "Open Source Web Development with LAMP using
2	LINUX, Apache, MySQL, Perl and PHP", Dorling Kindersley (India) Pvt. Ltd, 2008
Reference Books:	
1	Eric Rosebrock, Eric Filson, "Setting up LAMP: Getting Linux, Apache, MySQL and PHP and orking together", John Wiley and Sons, 2004.
2	Anthony Butcher , "Teach Yourself MySQL in 21 days", 2nd Edition, Sams Publication.
3	Rich Bower, Daniel Lopez Ridreejo, Alian Liska , "Apache Administrator's Handbook", Sams Publication.
4	Tammy Fox, "RedHat Enterprise Linux 5 Administration Unleashed", Sams Publication
5	Naramore Eligabette, Gerner Jason, Wrox Press, Wiley Dreamtech Press, "Beginning PHP5,Apache, MySQL Web Development", 2005.
Web resources:	
1	Introduction to Open-Source and its benefits - GeeksforGeeks
2	https://www.bing.com/

Mapping with Programme Outcomes and Programme Specific Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PS03
CO1	3	2	2	2	2	2	3	_	3	3	3
CO2	2	2	2	2	2	2	3	_	3	2	3
CO3	2	3	3	2	3	2	3	3	3	2	3
CO4	1	3	3	3	3	3	3	3	3	2	3
CO5	2	_	3	3	3	3	3	3	3	2	3
Total	10	10	13	12	13	12	15	9	15	11	15
Average	2	2	2.6	2.4	2.6	2.4	3	1.8	3	2.2	3

3 – Strong, 2- Medium, 1- Low