VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN

ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.).

(*Affiliated to Periyar University, Approved by AICTE & Re-Accredited with 'A+' Grade by NAAC*)

PG AND RESEARCH DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS

B.Sc. COMPUTER SCIENCE

SYLLABUS & REGULATIONS

FOR CANDIDATES ADMITTED FROM 2024-25 ONWARDS

UNDER AUTONOMOUS & OBE PATTERN

VIVEKANANDHA EDUCATIONAL INSTITUTIONS
Angammal Educational Trust,
Elayampalayam, Tiruchengode (Tk.),
Namakkal (Dt.)

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN

[Autonomous]
SPONSORED BY: ANGAMMAL EDUCATIONAL TRUST.
An ISO 9001 : 2015 Certified Institution
Affiliated to Periyar University, Approved by AICTE and
Re-Accredited with 'A+' Grade by NAAC
Recognized under section 2(f) and 12(B) of UGC Act, 1956
Elayampalayam – 637 205.Tiruchengode,Namakkal Dt., Tamil Nadu

VIVEKANANDHA
EDUCATIONAL INSTITUTIONS

Dr. P. BABY SHAKILA, M.Sc., M.Phil., Ph.D., M.Ed., MBA,
Principal

VICAS/UG & PG BOS MEETING/OBE/2024 Date: 26.04.2024

BOARD OF STUDIES – MEETING NOTICE

I am, by direction, the state that the meeting of the Board of Studies in B.Sc., Computer Science & M.Sc Computer Science is scheduled to be held on 29.04.2024 through offline mode at 10.30 am in the PG and Research Department of Computer Science and Applications, Vivekanandha College of Arts and Sciences for Women [Autonomous].

AGENDA

1. To Frame & Submit the Syllabus of B.Sc., Computer Science & M.Sc Computer Science under Outcome Based Education (OBE) for the academic year 2024 – 2025 and thereafter.
2. To Prepare the Scheme of Examination, Question Paper Pattern, Model Question Paper, and List of Examiners, Question Paper Setters, etc. for the Academic Year 2024 – 2025.

I request you to make it convenient to attend the above meeting on 29.04.2024.

S.No	Composition	Name of the Member with Designation	Address with Mobile No & Mail ID	Remarks
1.	Chairman	Dr.K.Ramesh Head of the Department – CS&CA	Vivekanandha College of Arts and Sciences for Women(Autonomous),Elayampalayam, Tiruchengode. Cell: 9942711164 Mail:headcomputerscience@Vicas.org	
2.	University Nominee (B.Sc CS)	Dr.V.S.Anitha Sofia, Associate Professor	Department of Computer Applications(MCA) PSG College of Arts & Science, Coimbatore – 641014 Cell: 9976612802	
3.	University Nominee (M.Sc CS)	Dr.R.Senthikumar, Professor	Department of Computer Science, Dr.N.G.P Arts and Science College, Coimbatore. Cell: 9790189828.	
4.	Subject Expert (External)	Dr.R.Gunasundari Professor & Head	Department of Computer Applications, Karpagam Academy of Higher Education, Coimbatore. Mail: gunasoundar04@gmail.com Cell: 9843045553	
5.	Subject Expert (International)	Dr.M.Ashok kumar, Faculty	Department of Computer Science and Software Engineerimg, Sky line University Nigeria, Kano State, Nigeria. Mail: williamashok@gmail.com Cell: 9791983938	
6.	Industrialist	Mrs. Seena Zera Jacob HR Manager	Indocosmo IT Solutions, Kochu, Kerala Mail: seenazeran@gmail.com Cell: 7012756502	
7.	Alumnae	Mrs.S.Vidhya Senior Associate	Cognizant Technologies Solutions, Coimbatore. Mail: vidhyasampath11@gmail.com Cell:9840389938	
8.	Senior Faculty Members	Dr.P.Sumitra Associate Professor	Vivekanandha College of Arts and Sciences for Women(Autonomous),Elayampalayam, Tiruchengode. Cell: 7010989611 Mail: drsumitra@vicas.org	
		Mr.V.P.Muthukumar, Assistant Professor	Vivekanandha College of Arts and Sciences for Women(Autonomous),Elayampalayam, Tiruchengode. Cell: 9942176565 Mail: muthukumar@vicas.org	
		Mrs.M.Santha Assistant Professor	Vivekanandha College of Arts and Sciences for Women(Autonomous),Elayampalayam, Tiruchengode.Cell:9842750500 Mail:santha@vicas.org	

PRINCIPAL

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN

(AUTONOMOUS)

B.Sc (COMPUTER SCIENCE)

(Candidates admitted from 2024-2025 onwards)

REGULATIONS

I. SCOPE OF THE PROGRAMME

Bachelor of Computer Science can be considered to be one of the most prominent UG level programs in our country. This program mainly deals with the development of computer applications for the purpose of updating computer programming languages. B.Sc.[CS] also aims at creating strong knowledge of theoretical Information Technology subjects who can be employed in software development and testing units of industries. The course has a time period of 3 years with 6 semesters.

II. SALIENT FEATURES

- Regular conduct of guest lectures and seminars
- Campus recruitment
- Provides facilities such as Internet Access and In-House Library
- Provides Career Guidance for Post Graduate Courses like M.Sc, MCA and the Certifications in programming languages
- Conduct of Personality Development Program
- Visiting Faculties from Industries

III. OBJECTIVES OF THE PROGRAMME

The Course Objective of the B.Sc. Computer Science program is to provide advanced and in-depth knowledge of Information Technology and its applications to enable students pursue a professional career in Information and Communication Technology in related industry, business and research. The course designed to impact professional knowledge and practical skills to the students.

IV. ELIGIBILITY FOR ADMISSION

A Candidates seeking admission to the first year Degree course (B.Sc. Co m p u t e r Sc i e n c e) shall be required to have passed Higher Secondary Examination with Mathematics or Business Mathematics or Computer Science or Computer Applications or Computer Technology or Statistics (Academic Stream or Vocational Stream) as one of the subject under Higher Secondary Board of Examination, conducted by the Government of Tamilnadu or an examination accepted as equivalent there to by the syndicate, subject to such conditions as may be prescribed there to are permitted to appear and qualify for the B.Sc. Computer Science Degree Examination of Periyar Universityafter a course of study of three academic years.

V. DURATION OF THE PROGRAMME

- The course shall extend over a period of three academic years consisting of six semesters. Each academic year will be divided into two semesters. The First semester will consist of the period from July to November and the Second semester from December to April.
- The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University.

VI. CONTINUOUS INTERNAL ASSESSMENT (CIA)

The performance of the students will be assessed continuously and the Internal

ASSESSMENT MARKS **FOR THEORY PAPERS** WILL BE AS UNDER:

1	Average of Two Tests	-	05
2	Model Exam	-	10
3	Assignment	-	05
4	Attendance	-	05
	To	-	25

ASSESSMENT MARKS **FOR PRACTICAL PAPERS** WILL BE AS UNDER:

1	Model Exam	-	20
2	Observation Note	-	10
3	Attendance	-	10
	To	-	40

PASSING MINIMUM - EXTERNAL

THEORY	In the End Semester Examinations, the passing minimum shall be 40% Out of 75 Marks. (30 Marks)
PRACTICAL / MINI PROJECT	In the End Semester Examinations, the passing minimum shall be 40% Out of 60 Marks. (24 Marks)

VII. ELIGIBILITY FOR EXAMINATION

A candidate will be permitted to appear for the University Examination only on learning 75 % of attendance and only when her conduct has been satisfactory. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed.

DISTRIBUTION OF MARKS FOR ATTENDANCE:

ATTENDANCE PERCENTAGE	MARKS	
	THEORY	PRACTICAL
75-80	1	2
81-85	2	4
86-90	3	6
91-95	4	8
96-100	5	10

VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Successful candidates passing the Examination of Core Courses (Main & Allied Subjects) &Securing Marks.

a) 75 % and above shall be declared to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at first appearance itself.
b) 60% and above but below 75 % shall be declared to have passed the Examinations in First Class.
c) 50% & above but below 60% shall be declared to have passed the examinations in Second Class.
d) All the remaining successful candidates shall be declared to have passed the examinations in Third Class.
e) Candidates who pass all the examinations prescribed for the course at the First appearance itself and within a period of three Consecutive Academic years from the year of admission only will be eligible for University Rank.

IX. ELIGIBILITY FOR AWARD OF THE DEGREE

A candidate shall be eligible for the award of the Degree only if she has undergone theabove Degree for a period of not less than Three Academic years comprising of six semesters and passed the Examinations prescribed and fulfilled such conditions has have been prescribed therefore.

X. PROCEDURE IN THE EVENT OF FAILURE

If a candidate fails in a particular subject, she may reappear for the university examinationin the concerned subject in subsequent semesters and shall pass the examination.

XI. COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 2024-2025 (i.e.,) for the students who are to be admitted to the First year of the course during the Academic year 2024-25 and thereafter.

XII. TRANSITORY PROVISIONS

Candidates who were admitted to the UG course of study before 2023-2024 shall be permitted to appear for the examinations under those regulations for the period of Three years ie. Up to and inclusive of the Examinations of 2024-2025. Thereafter, they will be permitted to appear for the examinations only under the regulations then in force.

EVALUATION OF EXTERNAL EXAMINATIONS (EE)

QUESTION PAPER PATTERN – Theory	
Time duration: 3 Hours	**Max. Marks: 75**
PART- A: (10 x 1= 10)	Answer all the Questions Two Questions from each Unit
PART- B: (5x 7 = 35)	Answer all the questions One Question from each Unit (Either or Type)
PART- C: (3x 10 = 30)	Answer any **THREE** of the questions One Question from each Unit (3 Out of 5)
IN THE END SEMESTER EXAMINATIONS, THE PASSING MINIMUM SHALL BE 40% OUT OF 75 MARKS. (30 MARKS)	

QUESTION PAPER PATTERN – Practical	
Time duration: 3 Hours	**Max. Marks: 60**
1. One compulsory question from the given list of objectives	**30 Marks**
2. One either/or type question from the given list of objectives	**30 Marks**
IN THE END SEMESTER EXAMINATIONS, THE PASSING MINIMUM SHALL BE 40% OUT OF 60 MARKS. (24 MARKS)	

B.Sc CS CURRICULUM FOR ACADEMIC YEAR 2024 – 2025

COURSE PATTERN AND SCHEME OF EXAMINATIONS UNDER AUTONOMOUS OBE PATTERN

FOR THE CANDIDATES ADMITTED FROM THE YEAR 2024 – 2025

ONWARDS SEMESTER: I & II

SEM	PART	COURSE CODE	COURSE TITLE	Hrs	CREDIT	MARKS		
						CIA	EE	TOT
I	I	23U1LT01	FOUNDATION TAMIL I	6	3	25	75	100
	II	23U1LE01	FOUNDATION ENGLISH I	4	3	25	75	100
	III		NUMERICAL METHODS	4	3	25	75	100
	III	24U1CSC01	CORE I:COMPUTER FUNDAMENTALS AND PYTHON PROGRAMMING	5	4	25	75	100
	III	24U1CSCP01	CORE PRACTICAL I: PYTHON PROGRAMMING LAB	5	3	40	60	100
	IV	24U1CSAC01	INTRODUCTION TO HTML	2	2	25	75	100
	IV	23U2ENAC01	SOFT SKILL FOR EFFECTIVE COMMUNICATION	2	2	25	75	100
	IV		VALUE EDUCATION	2	2	25	75	100
	Total			30	22	215	585	800
II	I	23U2LT02	FOUNDATION TAMIL II	5	3	25	75	100
	II	23U2LE02	FOUNDATION ENGLISH II	5	3	25	75	100
	III		GENERIC /SPECIFIC ELECTIVE ALLIED II	4	3	25	75	100
	III	24U2CSC02	CORE :II DATA STRUCTURES USING JAVA	5	4	25	75	100
	III	24U2CSCP02	CORE PRAC :II DATA STRUCTURES USING JAVA LAB	5	3	40	60	100
	IV	23U2CSAC02	AECC2 :OFFICE AUTOMATION	2	2	25	75	100
	IV	24U2CSS01	HUMAN COMPUTER INTERACTION	2	2	25	75	100
	IV	23U2EVS01	ENVIRONMENTAL STUDIES	2	2	25	75	100
	Total			30	22	215	585	800

SEMESTER: III & IV

SEM	PART	COURSE CODE	COURSE TITLE	Hrs	CREDIT	MARKS		
						CIA	EE	TOT
III	I	23U3LT03	FOUNDATION TAMIL III	5	3	25	75	100
	II	23U3LE03	FOUNDATION ENGLISH III	5	3	25	75	100
	III		GENERIC /SPECIFIC ELECTIVE ALLIED III -	4	3	25	75	100
	III	24U3CSC03	CORE III: DATABASE MANAGEMENT SYSTEM USING MONGODB	5	4	25	75	100
	III	24U3CSCP03	CORE PRAC III :DATABASE MANAGEMENT SYSTEM USING MONGODB LAB	5	3	40	60	100
	IV	24U3CSDE_	DSE I:	4	3	25	75	100
	IV		NMEC	2	2	25	75	100
			Total	30	21	190	510	700
IV	I	23U4LT04	FOUNDATION TAMIL IV	5	3	25	75	100
	II	23U4LE04	FOUNDATION ENGLISH IV	5	3	25	75	100
	III		GENERIC /SPECIFIC ELECTIVE ALLIED IV	4	3	25	75	100
	III	24U4CSC04	CORE IV:DATA ANALYTICS USING HADOOP & HIVI	5	5	25	75	100
	III	24U4CSCP04	CORE PRAC IV:DATA ANALYTICS USING HADOOP & HIVI LAB	5	4	40	60	100
	III	24U4CSDE_	DSE II:	4	3	25	75	100
	IV		NMEC	2	2	25	75	100
			Total	30	23	190	510	700

SEMESTER: V & VI

SEM	Part	COURSE CODE	COURSE TITLE	Hrs	CREDIT	MARKS		
						CIA	EE	TOT
V	III	24U5CSC05	CORE V:MACHINE LEARNING USING PYTHON	5	4	25	75	100
	III	24U5CSCP05	CORE PRAC V: MACHINE LEARNING USING PYTHON LAB	4	3	40	60	100
	III	24U5CSC06	CORE VI:OPERATING SYSTEM WITH LINUX	5	4	25	75	100
	III	24U5CSDE_	DSE-III	5	4	25	75	100
	IV	24U5CSDE_	DSE-IV	5	4	25	75	100
	III	24U5CSCPR01	MINI PROJECT	4	3	40	60	100
	IV	24U5CSS03	SBEC I:PROFESSIONAL ETHICS	2	2	25	75	100
	V	24U5CSIN01	INTERNSHIP	-	1	-	-	-
			Total	30	25	205	495	700
VI	III	24U6CSC07	CORE VII: DATA SCIENCE USING R	5	4	25	75	100
	III	24U6CSCP06	CORE PRAC VI :DATA SCIENCE USING R LAB	5	4	40	60	100
	III	24U6CSC08	CORE VIII : CYBER SECURITY	5	5	25	75	100
	III	24U6CSDE_	DSE V:	4	4	25	75	100
	III	24U6CSDE_	DSE VI :	4	4	25	75	100
	IV	24U6CSS06	SBEC II :MICROSOFT POWER BI	2	2	25	75	100
	III	24U6CSCPR02	PROJECT WORK	5	3	40	60	100
	V	23U6CSEX01	EXTENSION ACTIVITIES	-	1	-	-	-
			Total	30	27	205	495	700
			Grand Total	180	140	1220	3180	4400

DISCIPLINE SPECIFIC ELECTIVES

Course Code	DSE	Course Name	Semester
24U3CSDE01	DSE – I	Microsoft Azure Fundamental AI 900	Semester: III
24U3CSDE02	DSE – I	Ui path - Automation Robotics	Semester: III
24U3CSDE03	DSE – I	Computer Networks	Semester: III

24U4CSDE04	DSE – II	Introduction to Artificial Intelligence	Semester: IV
24U4CSDE05	DSE – II	Internet Of Things	Semester: IV
24U4CSDE06	DSE – II	pervasive computing	Semester: IV
24U5CSDE07	DSE – III	Software Engineering	Semester: V
24U5CSDE08	DSE – III	Quantum computing	Semester: V
24U5CSDE09	DSE – III	Block Chain Technology	Semester: V
24U5CSDE10	DSE – IV	Web Application Development	Semester: V
24U5CSDE11	DSE – IV	Computer Graphics with multimedia	Semester: V
24U5CSDE12	DSE – IV	Compiler Design	Semester: V
24U6CSDE13	DSE – V	Big Data Analytics	Semester: VI
24U6CSDE14	DSE – V	Computational thinking	Semester: VI
24U6CSDE15	DSE – V	Neural networks and fuzzy logic	Semester: VI
24U6CSDE16	DSE – VI	Principles of Management	Semester: VI
24U6CSDE17	DSE – VI	Android Application Development	Semester: VI
24U6CSDE18	DSE – VI	Ethical Hacking	Semester: VI

Skill Based Elective Courses (SBEC) (Offer to Same Students)

Course Code	Course Name	Semester
24U2CSS01	HUMAN COMPUTER INTERACTION	SEMESTER II
24U2CSS02	SOCIAL MEDIA & SECURITY	SEMESTER II
24U5CSS03	PROFESSIONAL ETHICS	Semester: V
24U5CSS04	Privacy and security in online social media	Semester: V
24U5CSS05	Cryptography	Semester: V
24U6CSS06	MICROSOFT POWER BI	Semester: VI
24U6CSS07	Sentimental Analytics	Semester: VI
24U6CSS08	Computer vision	Semester: VI

SUBJECT TITLE	COMPUTER FUNDAMENTALS AND PYTHON PROGRAMMING	SEMESTER	I
SUBJECT CODE	24U1CSC01	SPECIALIZATION	NA
TYPE	CORE: THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

1. Students get basic knowledge of computer fundamentals.
2. Students learn about number systems and logic gates.
3. Students learn about Circuits and Operating System
4. Build basic programs using fundamental programming constructs like variables, conditional logic, looping, and functions
5. Work with user input to create fun and interactive programs

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Develop and execute simple Python programs	K1
CO2	Decompose a Python program into functions	K2,K4
CO3	Write simple Python programs using conditionals and looping for solving problems	K3
CO4	Represent compound data using Python lists, tuples, dictionaries etc.	K4
CO5	Read and write data from/to files in Python programs	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction to Computers**: Introduction – Characteristics – Generation of computers – Classification of digital computer system – Functions & Components of computer system - Input devices: Keyboard – mouse - OCR – OMR – Touch screen. Output Devices: Monitor – Printer: Dot matrix, laser printer.	12
II	**Memory and Storage**: Memory Basics, The RAM, The ROM, Programmable ROMs, The Flash Memory, Memory Expansion, Special Types of Memories, Magnetic and Optical Storage.	12
III	**Python programming language** - Literals - Variables and Identifiers - Operators - Expressions and Data types, Input / output. Text Files: Opening, reading and writing text files – String Processing- Exception Handling.	12
IV	**Control Structures:** Boolean Expressions - Selection Control - If Statement- Indentation in Python- Multi-Way Selection -Iterative Control- While Statement- Infinite loops- Definite vs. Indefinite Loops- Boolean Flag. String, List and Dictionary, Manipulations Building blocks of python programs, Understanding and using ranges.	12
V	**Functions:** Program Routines- Defining Functions- More on Functions: Calling Value-Returning Functions- Calling Non-Value-Returning Functions- Parameter Passing - Keyword Arguments in Python - Default Arguments in Python-Variable Scope. . Recursion: Recursive Functions.	12

LEARNING RESOURCES	
TEXT BOOKS	1. "Fundamentals of Computer Science & Communication Engineering". Alexis Leon, Mathew's Leon, Vikas Publishing house, New Delhi, 2012 (Unit I: Chapters 2, 3, 4, 6, 7, 8, 9 & 10) 2. "Digital Computer Fundamentals" Thomas C Bartee, 6th Edition TMH Publisher, New Delhi, 2011 (Unit II: Chapters 2 & 3). 3. Charles Dierbach, "Introduction to Computer Science using Python - A computational Problem solving Focus", Wiley India Edition, 2015.
REFERENCE BOOKS	1. Bartee, Thomas C, "Digital Computer Fundamentals", 6th Edition, TMH, 1995. 2. Mark Lutz, "Learning Python Powerful Object Oriented Programming", O'reilly Media 2018, 5th Edition. 3. Timothy A. Budd, "Exploring Python", Tata MCGraw Hill Education Private Limited 2011, 1 st Edition. 4. John Zelle, "Python Programming: An Introduction to Computer Science", Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1590282410
WEBSITE/LINK	1. http://bedford-computing.co.uk/learning/wp-content/uploads/2015/10/Introduction-to-Computer-Science-Using-Python.pdf 2. www.tutorialspoint.com/cprogramming/ 3. www.programiz.com/c – programming

MAPPING WITH PROGRAMME OUTCOMES

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	PYTHON PROGRAMMING LAB	SEMESTER	I
SUBJECT CODE	24U1CSCP01	SPECIALIZATION	NA
TYPE	CORE: PRACTICAL	L:T:P:C	5:0:0:4

LIST OF EXPERIMENTS

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a Python program using List, Tuples and List comprehensions.
4. Write a Python program using Control statements.
5. Write a Python program using Functions and String Operations.
6. Write a Python program using Text Files.
7. Write a Python program using Exceptional Handling.
8. Write a Python program using Inheritance.
9. Write a program to demonstrate working with dictionaries in python.
10. Write a python program to find factorial of a number using Recursion.

SUBJECT TITLE	INTRODUCTION TO HTML	SEMESTER	I
SUBJECT CODE	23U1CSAC01	SPECIALIZATION	NA
TYPE	CORE: THEORY	L:T:P:C	2:0:0:2

COURSE OBJECTIVE:

1.Understand the principles of creating an effective web page.
2. Become familiar with graphic design principles that relate to web design .
3.Implement these theories into practice.
4. Develop skills in analyzing the Social sites.
5. Understand how to plan and conduct user research related to web usability.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Prepare, Plan and Create a Web Site.	K1
CO2	Write syntactically correct HTML documents.	K2,K4
CO3	Comprehend and apply the principles of effective web design on webpages	K3
CO4	Design and develop web pages with HTML5.	K4
CO5	Build static websites.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	Understanding HTML - Setting Up the Document Structure - Formatting text by Using Tags - Using Lists and Backgrounds - Creating Hyperlinks and Anchors- Adding Images.	4
II	Introduction to Style Sheets - Formatting Text by using Style Sheets - Formatting Paragraphs by using Style Sheets.	4
III	Selecting a graphics format - Preparing graphics for web use - Inserting graphics - Arranging elements on the page - Controlling image size and Padding - Hyper linking from graphics - Utilizing Thumbnail graphics - Including alternate text for graphics.	4
IV	Creating Navigational Aids - Creating Tables - Formatting Tables.	4
V	Creating Division - based Layouts - Creating User Forms - Using Frames for layout - Incorporating Audio and Video..	4

LEARNING RESOURCES	
TEXT BOOKS	"Microsoft Step by Step HTML and XHTML", Faithe Wempen. PHI, 2009
REFERENCE BOOK	"Web design with HTML", C. Xavier, TMH Publisher, 2000
WEBSITE/LINK	www.w3schools.com/html www.w3schools.com/html/html_responsive.a636sp

MAPPING WITH PROGRAMME OUTCOMES

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	DATA STRUCTURES USING JAVA	SEMESTER	II
SUBJECT CODE	24U2CSC02	SPECIALIZATION	NA
TYPE	CORE: THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

1. To learn why Java is useful for the design of desktop and web applications.
2. To learn how to implement object-oriented designs with Java.
3. To impart the basic concepts of data structures and algorithms.
4. To acquaint the student with the basics of the various data structures and make the students knowledgeable in the area of data structures.
5. This course also gives insight into the various algorithm design techniques

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	To introduce the concepts of Data structures and to understand simple linear data structures	K1
CO2	Learn the basics of stack data structure, its implementation and application	K2,K4
CO3	Use the appropriate data structure in context of solution of given problem and demonstrate a familiarity with major data structures.	K3
CO4	To introduce the basic concepts of algorithms	K4
CO5	To give clear idea on algorithmic design paradigms like Dynamic Programming, Backtracking, Branch and Bound	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction to Java** - Java History – Java Features – Java and internet Overview of Java Language: Simple Java Program - Java Program Structure - Java Tokens - Java Statements - Java Virtual Machine - Command Line Arguments - Constants, Variables and Data Types.	12
II	**Operators and Expressions, Decision Making Statements, Classes and Objects:** Operators and Expressions - Decision Making and Branching - Decision Making and Looping - Classes, Objects and Methods: Introduction to Class - Defining a Class - Methods Declaration - Creating Objects - Accessing Class Members - Constructors - Method Overloading - Static Members - Nesting of Methods - Inheritance.	12
III	**Introduction To Data Structures:** Data Structures: Definition- Time & Space Complexity Arrays: Representation of arrays, Applications of arrays, sparse matrix and its representation. Linear list: Singly linked list implementation, insertion, deletion and searching operations on linear list Circular linked list: implementation, Double linked list implementation, insertion, deletion and searching operations.	12
IV	**Stacks:** Operations, array and linked representations of stack, stack applications, infix to postfix conversion, postfix expression evaluation, recursion implementation	12
V	**Queues, Trees & Graphs: Queues:** operations on queues, array and linked representations. Circular Queue: operations,, applications of queues. **Trees:** Definitions and Concepts- Representation of binary tree, Binary tree traversals (Inorder, Postorder , preorder). **Graphs:** Representation of Graphs- Types of graphs -Breadth first traversal – Depth first traversal- -Applications of graphs.	12

LEARNING RESOURCES	
TEXT BOOKS	1. Balagurusamy E., "Programming with Java", 6th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2019. 2.Ellis Horowitz , Sartaj Sahni, Susan Anderson Freed, Second Edition , "Fundamentals of Data in C", Universities Press 3.E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition ,"Fundamentals of Computer Algorithms " Universities Press
REFERENCE BOOKS	1. Schildt Herbert, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2018. 2. Paul Deitel, Harvey Deitel., "Java How to Program", 11th Edition, Pearson Education, 2018. 3. Seymour Lipschutz ,"Data Structures with C", First Edition, Schaum's outline series in computers, Tata McGraw Hill. 4. R.Krishnamoorthy and G.Indirani Kumaravel, Data Structures using C, Tata McGrawHill – 2008. 5. A.K.Sharma, Data Structures using C, Pearson Education India, 2011. G. Brassard and P. Bratley, "Fundamentals of Algorithms", PHI, New Delhi, 1997. 6.A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, "The design and analysis of Computer
WEBSITE/ LINK	1.https://www.tutorialspoint.com/data_structures_algorithms/tree_traversal.htm 2.https://www.geeksforgeeks.org/introduction-to-recursion-data-structure-and-algorithm-tutorials/ 3.https://www.geeksforgeeks.org/job-sequencing-problem/ 4.https://www.geeksforgeeks.org/hamiltonian-cycle/

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	DATA STRUCTURES USING JAVA LAB	SEMESTER	II
SUBJECT CODE	24U2CSCP02	SPECIALIZATION	NA
TYPE	CORE: PRACTICAL	L:T:P:C	5:0:0:4

List of Experiments

1. Create a Simple Program Using Array in Java.
2.Write a linear list program using Java
3. Implement the stack operations.
4. Implement the queue operations.
5.Create a Simple Program Using Java String.
6. Write a Java Program to Create Multi threading.
7. Write a Java Program to handle Exception Handling.
8. Program to demonstrate Applet structure and event handling.
9. Program to demonstrate I/O operations
10. Write a Java program to multiply two given matrices

SUBJECT TITLE	OFFICE AUTOMATION	SEMESTER	II
SUBJECT CODE	23U2CSAC02	SPECIALIZATION	NA
TYPE	AECC : THEORY	L:T:P:C	2:0:0:2

COURSE OBJECTIVE

- To Introduce Students the basic concepts of MS- Office application Word, Excel and PowerPoint.

CO NO	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the basic concept of MS-Word.	**K1**
CO2	Explore the concepts of Formatting the Documentation.	**K2**
CO3	Understanding the basic concept of MS-Excel.	**K3**
CO4	Apply the concepts of Formulas and Functions in Excel.	**K3**
CO5	Explore the concepts of Presentation.	**K3**

UNIT	SYLLABUS CONTENTS	LEVEL	NUMBER OF SESSIONS
I	**Introduction to MS-WORD**: Introduction-starting MS-Word - Creating a new word Document-Saving a word Document-Working with Styles-Applying Bulleted and Numbered List-Using Cut, Copy and Paste - Using Find, Replace and GO TO -Opening and Existing Word Document- Closing a Word Document.	**K3**	**4**
II	**Designing a Word Document:** Designing and Reviewing a Word Document: Setting Paragraph Indent and Spacing- Inserting Header and footer – Changing Page Setup Option.	**K3**	**4**
III	**Introduction to EXCEL**: Introduction-Creating a New Excel Workbook-Adding Data to Cells- Adding Data using Auto fill-Inserting cells Deleting cells- -Wrapping Text-Changing Formats.	**K3**	**4**
IV	**Working with Tables and Charts**: Working with Tables-Working with Charts- Changing the Chart Types-Changing the Chart Layout-Formulas and Functions: Working with Formula- Working with Functions.	**K4**	**4**
V	**Introduction to PowerPoint**: Creating a Presentation & Saving Presentation-Basics of a Presentation- Setting Up and Running a Slide Show-Slide Show Setup - Building Dynamic PowerPoint Presentation: Adding and Removing Animation Effects-Adding and Removing Transition Effects.	**K3**	**4**

LEARNING RESOURCES	
TEXT BOOKS	1. Kogent Solutions Inc.Office 2007 in Simple Steps – Dream Tech Press 2008 Edition.
REFERENCE BOOKS	1. Learning MS Office 2007 – Ramesh Bangia. 2. Microsoft Office 2007 Training Guide – Prof. Sathish Jain,M.Geetha,Kratia,BPB Publications.
WEB SITES / LINKS	**1.** https://support.office.com/en-us/article/training-office-basics. **2.** https://www.ursaminor.in/course/basics-of-microsoft-office. **3.** https://support.office.com/en-us/article/training-office-basics.

MAPPING WITH PROGRAMME OUTCOMES

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	S
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

Subject Title	HUMAN COMPUTER INTERACTION	Semester	II
Subject Code	24U2CSS01	Specialization	NA
Type	CORE: THEORY	L:T:P:C	2:0:0:2

COURSE OBJECTIVE:

1. Understand Fundamental HCI Concepts
2. Develop Skills in Designing User Interfaces
3. Apply User-Centered Design (UCD) Methodology

CO No.	CO Statement	Knowledge Level
CO1	Students will understand human cognitive processes, memory, emotions, and individual differences to enhance interaction design and usability.	K1
CO2	Students will understand computer hardware, including input devices, displays, memory, and paper, to improve system design and user interfaces.	K2, K4
CO3	Students will learn interaction models, ergonomic design, and interface styles to create effective user interfaces, including 2D/3D navigation and WIMP elements.	K3
CO4	Students will apply design principles, user focus, and iterative prototyping to create effective screen layouts and incorporate HCI in the software life cycle to improve usability and design rationale.	K1, K2
CO5	Students will analyze and apply design rules, principles, standards, and heuristics to enhance usability and interface effectiveness	K4

Unit	Contents	No. of Hrs
I	**The human:** Introduction - Input–Output channels - Human memory - Thinking: Reasoning and Problem Solving - Emotion - Individual differences. (1.1 to 1.5)	6
II	**The Computer:** Introduction - Text entry devices - Positioning, pointing and drawing - Display devices - Paper: printing and scanning – Memory. (2.1 to 2.8)	6
III	**The interaction:** Introduction - Models of interaction - Frameworks and HCI – Ergonomics: Design Focus: Industrial interfaces - Interaction styles: Design Focus: Navigation in 3D and 2D - Elements of the WIMP interface - Design Focus: Learning toolbars - Interactivity (3.1 to 3.7)	6
IV	**Interaction design basics:** What is design - The process of design - User focus – Screen design and layout - Iteration and prototyping. **HCI in the software process:** The software life cycle - Usability engineering - Iterative design and prototyping - Design rationale. (5.2 to 5.4, 5.7 to 5.8, 6.2 to 6.5)	6
V	**Design rules:** Introduction - Principles to support usability – Standards – Guidelines - Golden rules and heuristics - HCI patterns. (7.1 to 7.7)	6

Learning Resources	
Text book	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human -Computer Interaction", 3rd Edition, Pearson Education, 2004.
Reference book	Serengul Smith-Atakan, "Human-Computer Interaction: Basics and Practice", Bentham books.
Website / Link	https://www.tutorialspoint.com/human_computer_interface/index.htm

MAPPING WITH PROGRAMME OUTCOMES

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	S
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

TITLE	DATABASE MANGEMENT SYSTEM USING MONGODB	SEMESTER	III
SUBJECT CODE	24U3CSC03	SPECIALIZATION	NA
TYPE	CORE: THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

1. Understand the basic concepts of database management systems.
2. Apply SQL to find solutions to a broad range of queries.
3. Analyze a given database application scenario to use ER model for conceptual design of the database.
4. Apply normalization techniques to improve database design.
5. Gain practical skills to integrate MongoDB into real-world applications and deploy them effectively.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the basic concepts of database management systems.	K1
CO2	Apply SQL to find solutions to a broad range of queries.	K1, K2
CO3	Analyze a given database application scenario to use ER model for conceptual design of the database.	K2, K3
CO4	Apply normalization techniques to improve database design.	K4
CO5	Understand replication and sharding in MongoDB	K5

UNIT	CONTENTS	NO. OF HOURS
I	**Introduction:**Database System Applications – Purpose – View of Data – Data Models – Database Design and Database Engine – Database Architecture – Users and Administrators – Relational Model: Structure of Relational Databases- Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relational Algebra.	12
II	**SQL:** Introduction to SQL: SQL – Data Definition – Basic Structure – Basic Operations – Set Operations – Null Values and Aggregate Functions – Nested Sub Queries – Modification of Databases.	12
III	**Intermediate SQL and ER modeling:**Join Expressions – Views – Transactions – Integrity Constraints – Triggers – SQL – Data Types and Schemas – Authorization – Database Design and ER Model – ER Diagrams – Complex Attributes – Mapping Cardinalities – Primary Key – Extended ER Features.	12
IV	Features of Good Relational Designs - Functional Dependency - Atomic Domains and First Normal Form - Second Normal Form - Third Normal Form - Boyce-Codd Normal Form – Multi-valued Dependency and Fourth Normal Form - Join Dependency and FifthNormal Form.	12
V	Overview of mongodb :Introduction to Mongodb- installing mongodb- MongoDB Advantages- data modelling- create database- dropdatabase - data Types-Insert,query,update,delete document- rdbms where clause equivalents in mongo db- sharding-mongodbcloud.	12

LEARNING RESOURCES	
Text Books	1. Silberschatz Abraham, Korth Henry F., and Sudarshan S., "Database System Concepts", 7th Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2021.(Unit I-IV) 2.Topperworld Prime E-Book by Ganeshmalic.
Reference Books	1. Elmasri Ramez, Navathe Shamkant B, "Fundamentals of Database Systems", 7th Edition, Pearson, 2016. 2. 2.Ramakrishnan Raghu, Gehrke Johannes, "Database Management Systems", 3rd Edition, McGraw Hill Education, 2014. 3. MongoDB in action , second edition kyle banker, peter bakkum, shaun berch, douglas garred
Website/Link	1. https://www.mongodb.com 2. https://www.geeksforgeeks.org/mongodb/ 3. https://www.w3schools.com/mongodb/ 4. https://www.tutorialspoint.com/mongodb/

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04	PO05
CO1	S	S	S	S	M
CO2	S	M	M	L	S
CO3	M	M	L	M	L
CO4	M	L	M	S	S
CO5	L	M	S	S	S

S – Strong, M – Medium, L – Low

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SUBJECT TITLE	DATABASE MANGEMENT SYSTEM USING MONGODB LAB	SEMESTER	III
SUBJECT CODE	24U3CSCP03	SPECIALIZATION	CS
TYPE	CORE: PRACTICAL	L:T:P:C	5:0:0:3

LIST OF EXPERIMENTS

1	Execute Basic SQL statements for creating and managing tables using DDL.
2	Execute Basic SQL statements for creating and managing tables using DML.
3	Execute SQL expressions using SET operations.
4	Execute SQL expressions using Aggregate functions.
5	Develop SQL expressions using Join operations.
6	Implementation of different types of Operators in SQL.
7	Execute Triggers in SQL.
8	Write a MongoDB query to insert record in collection “customers”.
9	Write a MongoDB query to create a collection “customers” in mydatabase
10	Write a MongoDB query to update multiple documents with the update() method in collection “customers”.

SUBJECT TITLE	DATA ANALYTICS USING HADOOP AND HIVI	SEMESTER	IV
SUBJECT CODE	24U4CSC04	SPECIALIZATION	NA
TYPE	CORE: THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

- Understand the Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Understand Map Reduce Jobs
- Provide hands on Hadoop Ecosystem
- Apply analytics on Structured, Unstructured Data.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Identify Big Data and its Business Implications.	K1
CO2	Access and Process Data on Distributed File System	K2
CO3	Manage Job Execution in Hadoop Environment	K3
CO4	Analyze Infosphere Big Insights Big Data Recommendations.	K4
CO5	Develop Big Data Solutions using Hadoop Eco System	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	Classification of Digital Data, Introduction to Big Data: Characteristics of Data - Evolution of Big Data - Definition of Big data-Challenges with Big Data-What is Big Data ,Big Data Analytics : What is Big data Analytics-What Big data Analytics isn't-Classification of Analytics, Top challenges facing Big Data-Why is Big Data Analytics important? Data Science.	12
II	Why Hadoop? Why not RDBMS? RDBMS versus Hadoop,History of Hadoop, Hadoop overview, Processing data with Hadoop, Interacting with Hadoop Echo System, Hadoop Streaming, Hadoop pipes,	12
III	The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop filesystems - The Java interfaces, Data flow, Parallel copying with distcp, Hadoop archives, Hadoop I/O:Compression, Serialization, File-Based Data structures.	12
IV	Anatomy of a MapReduce Job Run, Failures, Job Scheduling, Shuffle and Sort,Task Execution,MapReduce Types and Formats, Map Reduce Features.	12
V	Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.	12

LEARNING RESOURCES	
TEXT BOOKS	1. Tom White "Hadoop:The Definitive Guide"Third Editon, O'reily Media, 2012. 2. Seema Acharya,Subhasini Chellappan,"Big Data Analytics" Wiley 2015.
REFERENCE BOOKS	1. Rathinaraja Jeyaraj, Ganeshkumar Pugalendhi, Anand Paul, **"**Big Data with Hadoop MapReduce: A Classroom Approach" 1st Edition, Kindle Edition 2. Sridhar Alla, "Big Data Analytics with Hadoop 3: Build highly effective analytics solutions to gain valuable insight into your big data",1st Edition, PackT publication
WEBSITE/LINK	https://hadoop.apache.org/docs/r1.2.1/hdfs_design.html

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

SUBJECT TITLE	DATA ANALYTICS USING HADOOP AND HIVI LAB	SEMESTER	IV
SUBJECT CODE	24U4CSCP04	SPECIALIZATION	NA
TYPE	CORE: THEORY	L:T:P:C	5:0:0:4

LIST OF EXPERIMENTS
1. Use the HDFS CLI to navigate directories, list files, and perform basic file operations.
2. Copy a large dataset from one directory to another within the same Hadoop cluster using distcp.
3. Write and execute a Map Reduce Program to count the occurrences of similar words in a file.
4. Write and execute a Map Reduce Program to search for a specific keyword in a file.
5. Write and execute a Map Reduce Program to sort data by student name.
6. Create an external table in Hive for storing data from a CSV file.
7. Create a table named employee with columns for id, name, age, and salary. Insert a few sample records into the employee table. Write and execute HiveQL queries to retrieve all records from theemployee table, Filter records to display employees with salaries above a certain threshold.
8. Write HiveQL queries to perform basic data manipulation operations like SELECT, INSERT, UPDATE, and DELETE.
9. Partition a Hive table based on a specific column such as date or category.
10. Bucket a Hive table to improve query performance on large datasets.
11.Perform inner, outer, left, and right joins between Hive tables

SUBJECT TITLE	MACHINE LEARNING USING PYTHON	SEMESTER	V
SUBJECT CODE	24U5CSC05	SPECIALIZATION	NA
TYPE	CORE : THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

1. Understand the basic syntax and semantics of the Python programming language.
2. Write and execute Python code to solve simple to moderately complex problems.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	To introduce students to the basic concepts and techniques of Machine Learning.	K1
CO2	To learn Decision trees, KNN and Ensemble Techniques.	K2,K4
CO3	To implement and apply machine learning algorithms to real-world applications.	K3
CO4	To understand the problems using various machine learning techniques.	K4
CO5	To study the recent machine learning software for solving practical problems.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Python Overview:** Introduction to Python-Features of Python- Programming in Python-Variable-Data Types-Keywords-Literals- Operators – Expressions-Type Conversion Functions-Comments-Input and Output Functions-Assignment Operators - Numeric Data Types and Character Sets.	12
II	**Functions And Modules:** Calling Functions - **Iteration:** For loop - Selection - Conditional Iteration - **Lists:** list operations, list slices, list methods. **Tuples:** tuple assignment, tuple as return value. **Dictionaries:** operations and methods. Reading data from different file formats.	12
III	**THE FUNDAMENTALS OF MACHINE LEARNING:** What Is Machine Learning?-Why Use Machine Learning?-Examples of Applications-Supervised / Unsupervised Learning - Batch and Online Learning - Instance-Based Versus Model-Based Learning- Main Challenges of Machine Learning.	12
IV	**SUPERVISED LEARNING :** Classification and Regression - Generalization, Overfitting, and Underfitting - Supervised Machine Learning Algorithms : k-Nearest Neighbors - Linear Models - Naive Bayes Classifiers **UNSUPERVISED LEARNING :** Types of Unsupervised learning - Challenges in Unsupervised Learning- Preprocessing and Scaling - Different Kinds of Preprocessing - Clustering - k-Means Clustering .	12
V	**IMPLEMENTING MACHINE LEARNING ALGORITHMS**: k –means Algorithm - steps to perform k-means Algorithm- How does k-mean algorithm work? – Pros & Cons – KNN versus k-means. Naïve Bayes Classification Algorithm.	12

LEARNING RESOURCES	
TEXT BOOKS	1. Kenneth A. Lambert, Martin Osborne, "Fundamentals of Python: First Programs, Cengage Learning", second edition, 2018 2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", Aurélien Géron, O'Reilly Media, 2019. 3. "Introduction to Machine Learning with Python ",Andreas C. Müller and Sarah Guido, O'Reilly Media,2017. 4. "Data Science and Machine Learning in R",Reema Thareja McGraw-Hill India, 2021.
REFERENCE BOOKS	1. 1. Dr. S. Suresh kumar, "Problem Solving and Python Programming" Charulatha Publications, 2018. 2. Tom M. Mitchell- Machine Learning - McGraw Hill Education, International Edition. 3. Introduction to Machine Learning, Alex Smola and S.V.N. Vishwanathan, Cambridge University Press ,2008 4. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press (23 April 2020).
WEBSITE/LINK	1. https://www.techtarget.com/searchenterpriseai/definition/supervised-learning 2. https://keremkargin.medium.com/nlp-tokenization-stemming-lemmatization-and-part-of-speech-tagging-9088ac068768 3. https://pianalytix.com/how-machine-learning-works-in-social-media-2/

MAPPING WITH PROGRAMME OUTCOMES

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	S
CO2	S	S	S	M
CO3	S	S	S	S
CO4	S	S	M	S
CO5	S	S	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	MACHINE LEARNING LAB	SEMESTER	V
SUBJECT CODE	24U5CSCP05	SPECIALIZATION	NA
TYPE	CORE: THEORY	L:T:P:C	4:0:0:4

LIST OF EXPERIMENTS
1. Write a python program using Control statements
2. Write a python program using Functions and String Operations
3. Write a python program using Text Files
4. Write a program to import the dataset
5. Write a program to train and Validation of dataset
6. Write a program to Implement the naïve Bayesian classifier
7. Write a program to Construct a Bayesian network considering medical data
8. Write a program using Logistic Regression and SVM
9. Write a program to Implement k-means clustering
10. Write a program to built an Artificial Neural Network by implementing the Back propagationalgorithm and test the same using appropriate data sets

SUBJECT TITLE	OPERATING SYSTEM WITH LINUX	SEMESTER	V
SUBJECT CODE	24U5CSC06	SPECIALIZATION	NA
TYPE	CORE: THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

1. To acquire the fundamental knowledge of the operating system architecture and its components
2. To know the various operations performed by the Linux operating system.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand various generations of Operating System and functions of Operating System.	K1
CO2	Understand the concept of program, process and thread and Analyse various CPU Scheduling Algorithms and compare their performance.	K2
CO3	Compare various Memory Management Schemes especially Paging and Segmentation in Operating System. Also apply various Page Replacement Techniques.	K3
CO4	Understand File Systems in Operating System like UNIX/Linux and Windows.	K4
CO5	Write shell scripts in Linux environment.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction to Operating system and Linux:** Operating System Fundamentals; Operating System structure, Types of Operating, Basic syntax for command, vi Editor. Structure Of Linux Operating System.	12
II	**Process and Threads**: Process concept; Process scheduling; Operations on processes; Concurrent Process; Overview of Threads; Multi-threading; CPU Scheduling concepts; Scheduling criteria; Scheduling algorithms	12
III	**Deadlock and Memory management**: Conditions for deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from deadlock, Swapping, Memory Protection, Memory allocation method, Paging, Segmentation, Demand Paging, Page replacement algorithm.	12
IV	**File System**: File Concept, File Attributes, Operations on Files, Types of file, Access Methods, Free-Space Management, Allocation methods, Directory structure, Logging In And Logging Out, Directory Structure.	12
V	**Shell script and Linux commands:** Shell and Shell Prompt, Creating alias for long command, Input/output Redirection, Listing files and directories: (ls command), cat command, wc command, Manipulating files and directories, Compressing files (gzip, gunzip commands), Archiving Files(tar), Managing disk space: df, du.	12

LEARNING RESOURCES	
TEXT BOOKS	1. Silberschatz, P.B. Galvin and G. Gagne, Operating System Concepts.9th Edition, New Delhi: Wiley India, 2011. 2. Shital Vivek Gaite, Operating System Concepts and Basic Linux Commands, Educreation Publishing,
REFERENCE BOOKS	3. Dietel et al, Operating System.3rd Edition. Pearson Education,2004. 4. A.S. Tanenbaum, Modern Operating Systems.3rd Ed, Prentice Hall,2007.
WEBSITE/LINK	https://maker.pro/linux/tutorial/basic-linux-commands-for-beginners https://spoken-tutorial.org/tutorial https://www.shellscript.sh/ https://www.javatpoint.com/linux-commands

MAPPING WITH PROGRAMME OUTCOMES

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

SUBJECT TITLE	DATA SCIENCE USING R	SEMESTER	VI
SUBJECT CODE	24U6CSC07	SPECIALIZATION	NA
TYPE	CORE: THEORY	L:T:P:C	5:0:0:5

COURSE OBJECTIVES:

1. Knowledge of basic nature of data.
2. To extract the useful information from Data.
3. Understanding of represent of data into meaningful information.
4. Understanding some basics of statistics.
5. How to handle tolerance in the Data.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand and critically assess available data using machine learning methods	K1
CO2	Learn the basic concepts and techniques of Data Science and discover trends in both structured and unstructured data.	K2,K4
CO3	Understand the concepts of supervised and unsupervised Learning.	K3
CO4	Analyze complex problems using advanced analytics tools.	K4
CO5	Use of large volume data by extracting useful information and patterns and provide predictive insights.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**INTRODUCTION TO DATA SCIENCE AND MACHINE LEARNING:** Defining a Data Scientist - Importance of Data Science - Data Science Life Cycle - Data Science Components - Applications of Data Science - Introduction to Artificial Intelligence - Data Science and Machine Learning - Data Analytics and Machine Learning - The Future of Machine Learning.	12
II	**THE DATA SCIENCE PROCESS:** Overview of Data Science process - Defining a Research goals and Creating a Project Charter - Retrieving data - Cleansing, integrating and Transforming Data - Exploratory data analysis - Presenting findings and Building applications on top of them.	12
III	**INTRODUCTION TO R:**The R Environment - History of R - Features of R - Importance of R - Advantages and Disadvantages of R - Installing R Studio - Simple R Program - The R Script File - operators in R - Variables in R - R Data Structures.	12
IV	**DECISION CONTROL , LOOPING STATEMENTS AND FUNCTIONS: Decision Control Statements:** The If Statement - The if…else Statement - The if…else Ladder - **Basic Loop Structures/Iterative Statements:** While Loop - for Loop - Nested Loops - Break Statements - Next Statements - Repeat Loop - Switch Statements - R Functions.	12
V	**GENERATING AND MANIPULATING DATA AND PACKAGES IN R :**Generating Random Numbers in R - Reading and Writing Data into Files - Binary Formats in R - Working With Files and Directories - Writing a Data Farmae to File - Reading Data From Excel - R Bulit in Functions - Introduction to R Packages - dplyr and tidyr Packages .	12

LEARNING RESOURCES	
TEXT BOOKS	1. Data Science and Machine Learning With R, Reema Thareja , McGraw Hill Education (India) Private Limited. 2. Introduction to Data Science , Davy Cielen,Arno D.B.Meysman andmohamed Ali Published by Dreamtech Press.
REFERENCE BOOKS	1. R Programming for Data Science, Roger D.Peng.
WEBSITE/LINK	https://www.tutorialspoint.com/r/index.htm https://www.javatpoint.com/r-tutorial https://www.geeksforgeeks.org/r-tutorial/

MAPPING WITH PROGRAMME OUTCOMES

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

SUBJECT TITLE	DATA SCIENCE USING R LAB	SEMESTER	VI
SUBJECT CODE	24U6CSCP06	SPECIALIZATION	NA
TYPE	CORE: PRACTICAL	L:T:P:C	5:0:0:4

LIST OF EXPERIMENTS

1. Download and install R-Programming environment and installbasic packages using

   install .packages () command in R.
2. Learn all the basics of R-Programming (Data types, VariablesOperators etc.)
3. Implement R-Loops with different examples.
4. Learn the basic of functions in R and implement with examples.
5. Implement data frames in R. Write a program to join columns androws in a data

   frame using c bind()and r bind() in R.
6. Implement different String Manipulation functions in R.
7. Implement different data structures in R (Vectors, Lists, DataFrames)
8. Write a program to read a csv file and analyze the data in the file in R
9. Create pie charts and bar charts using R.
10. Create a data set and do statistical analysis on the data using R.

SUBJECT TITLE	CYBER SECURITY	SEMESTER	VI
SUBJECT CODE	24U6CSC08	SPECIALIZATION	NA
TYPE	CORE : THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

1. Understanding Cyber Threat Landscape.
2. Foundations of Information Security.
3. Risk Assessment and Management:
4. Students will learn how to identify and assess cyber security risks within an organization, and implement risk management strategies to mitigate these risks effectively.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understanding of Cyber Threat Landscape	K1
CO2	Knowledge of Security Principles	K1,k2
CO3	Develop skills to assess and manage risks associated with cyber security	K2,k3
CO4	Develop the ability to communicate effectively about cyber security issues	K4
CO5	Embrace the ethical responsibilities inherent in cyber security practices	K4,k5

UNIT	CONTENTS	NO. OF HOURS
I	**Introduction to Information Systems** Introduction to Information Systems - Types of Information Systems- Development of Information Systems- Changing the Nature of Information Systems- Introduction to Information Security- Need for Information Security- Threats to Information Systems Cyber security and Security Risk Analysis	12
II	**Cyber security Application Security:** Application Security- Data Security Considerations: Backups- Archival- Security Technology- Intrusion Detection- Denial-of-Service (DOS) Attack- Security Threats- Security Threats to E-Commerce- Electronic Payment Systems	12
III	**Developing Secure Information Systems:** Secure Information System Development- Application Development Security- Information Security Governance and Risk Management –Security Issues in Hardware, Data Storage, and Downloadable Devices- Devices Physical Security of it Assets- Back-Up Security Measures	12
IV	**Information Security Policies, Standards, and Cyber Law:** Security Policies- Policy Review Process- Information Security Standards- Cyber Laws in India- Intellectual Property Law- Software Licenses	12
V	**Security of Emerging Technology:** Security of Big Data Analytics- Security of Cloud Computing- Security of Smart Grid- Security of Wireless Sensor Networks (WSNs).	12

LEARNING RESOURCES	
TEXT BOOKS	1. C.P. Gupta and K.K. Goyal. Cybersecurity: A Self-Teaching Introduction.ISBN: 978-1-68392-498-2 ,Copyright ©2019 by University Science Press (An imprint of Laxmi Publications Pvt. Ltd. All rightsreserved.)
REFERENCE BOOKS	1. **"Research Methods in Cybersecurity" by Greg White, Alan Rea, Dwayne Williams**: This book provides an overview of various research methods specifically tailored to cybersecurity, covering both qualitative and quantitative approaches. 2. **"Cybersecurity Research Methods: Concepts and Practice" by Feng Liu, Geraldine Clarebout, WeizhiMeng**: This book offers a comprehensive guide to research methods in cybersecurity, discussing various methodologies, tools, and techniques. 3. **"Handbook of Research on Digital Crime, Cyberspace Security, and Information Assurance" edited by Joel Samick**: While not solely focused on research methods, this handbook provides valuable insights into conducting research in digital crime and cybersecurity, covering a wide range of topics. 4. **"Cybersecurity: A Practical Guide to the Law of Cyber Risk" by Sherri Davidoff, Jonathan L. Sander**:
WEBSITE/LINK	1. https://www.sciencedirect.com/book/9780128053492/research-methods-for-cyber-security 2. https://books.google.co.in/books/about/Research_Methods_for_Cyber_Security.html? 3. https://books.google.co.in/books?hl=en&lr=&id=aRl2DQAAQBAJ&oi=fnd&pg=PP1&dq=cyber+security+reference+books+pdf&ots=SmTP0zOBz0&sig=Tn8vaD9qV-O8oqE2a8G5KNVbzwk&redir_esc=y#v=onepage&q&f=false

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04	PO05
CO1	M	M	S	S	M
CO2	L	L	S	S	M
CO3	S	S	S	S	L
CO4	S	S	S	M	L
CO5	L	L	S	M	L

S–Strong, M–Medium–Low

SUBJECT TITLE	MICROSOFT AZURE AI FUNDAMENTAL AI 900	SEMESTER	III
SUBJECT CODE	24U3CSDE01	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	4:0:0:3

COURSE OBJECTIVE:

- Describe considerations for fairness in an AI solution
- Describe considerations for reliability and safety in an AI solution
- Describe considerations for privacy and security in an AI solution
- Describe considerations for inclusiveness in an AI solution
- Describe considerations for transparency in an AI solution

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Describe Artificial Intelligence workloads and considerations	K1
CO2	Describe fundamental principles of machine learning on Azure	K2,K3
CO3	Describe features of computer vision workloads on Azure	K3,k4
CO4	Describe features of Natural Language Processing (NLP) workloads on Azure	K4
CO5	Describe features of conversational AI workloads on Azure	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction**, **Getting started with Microsoft Azure** :- What is Azure? - The new world: Azure Resource Manager - Role-Based Access Control - Subscription management and billing - Azure documentation and samples. **Azure App Service and Web Apps**:- App Service and App Service plans - Creating and deploying Web Apps - Configuring, scaling, and monitoring Web Apps.	12
II	**Azure Virtual Machines**:- What is Azure Virtual Machines? - Virtual machine models - Virtual machine components - Create virtual machines - Connecting to a virtual machine - Configuring and managing a virtual machine - Scaling Azure Virtual Machines.	12
III	**Azure Storage**:- Storage accounts - Storage services – Redundancy - Security and Azure Storage - Creating and managing storage.	12
IV	**Azure Virtual Networks**:- What is a virtual network (VNet)? - Network Security Groups - Cross-premises connection options - Point-to-site network.	12
V	**Databases**: - Azure SQL Database - Applications connecting to SQL Database - SQL Server in Azure Virtual Machines - Comparing SQL Database with SQL Server in Azure Virtual Machines - Database alternatives.	12

LEARNING RESOURCES	
TEXT BOOKS	• Michael Collier and Robin Shahan, "Fundamentals of Azure", 2nd Edition, Microsoft Azure Essential, 2016.
WEBSITE/LINK	1. https://learn.microsoft.com/en-us/training/modules/get-started-ai-fundamentals/ 2. https://learn.microsoft.com/en-us/azure-data-studio/quickstart-sql-database?toc=%2Fazure%2Fazure-sql%2Ftoc.json 3. https://github.com/alfredodeza/ai-fundamentals/blob/main/1-get-started-with-ai.md

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

SUBJECT TITLE	Ui PATH-AUTOMATION ROBOTICS	SEMESTER	III
SUBJECT CODE	24U3CSDE02	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	4:0:0:3

COURSE OBJECTIVE:

1. To understand basic concepts of RPA
2. To Describe IIPA, where it can be applied and how it implemented
3. To Describe the different types of variables, Control Flow and data manipulation techniques

CO No.	CO Statement	Knowledge Level
CO1	To Understand the basic concepts of RPA	K1
CO2	To Describe various components and platforms of RPA	K2,K4
CO3	To Describe the different types of variables, control flow and data manipulation techniques	K3
CO4	To Understand various control techniques and OCR in RPA	K4
CO5	To Describe various types and strategies to handle exception	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**RPA Foundations** What is RPA - Irlavors of RPA- History of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA - Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology-Programming Languages and Low Code- OCR-Databases-APls- Al-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 Devops-Flowcharts.	12
II	**RPA Platforms** : Components of RPA- RPA Platforms-About Ui Path-About 0B UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by step examples using the recorder	12
III	**Sequence, Flowchart, and Control Flow**-sequencing the workflow-Activities-Control flow, various types of loops, and decision making-Step-by step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope Collections- Arguments - Purpose and use-Data table usage with examples Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).	12
IV	**Taking Control of the Controls**- Finding and attaching windows-Finding the control- Techniques for waiting for a control- Act on controls - mouse and keyboard activities- Working with Ui Explorer-Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points.	12
V	**Exception Handling, Debugging, and Logging**- Exception handling-Common exceptions and ways to handle them- Logging and taking screenshots Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA	12

LEARNING RESOURCES	
TEXT BOOKS	1. Tom I'aulli, The Robotic Process Automation llandbook:A Guide to Implementing RPA Systems,2020,lSBN-13 (electronic):978-7-4842-5729-6, Publisher : A press 2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9787788470940
REFERENCE BOOKS	1. Frank Casale, Rebecca Dilla, Iieidi Jaynes,Lauren Livingston,"lntroduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation 2. Richard Murdoch, I{obotic Process Automation: Guide'Io Building Software llobots, Automate Repetitive Tasks & Become An RPA Consultant 3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
WEBSITE/LINK	https:/fivrvw.rripatl:.r:onr/r'pa/;'ol;otic-pl'occss-ailtt:r'r:irtiou

MAPPING WITH PROGRAMME OUTCOMES

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	COMPUTER NETWORKS	SEMESTER	III
SUBJECT CODE	24U3CSDE03	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	4:0:0:3

COURSE OBJECTIVE:

- To understand the concept of Data communication and Computer network
- To get a knowledge on routing algorithms.
- To impart knowledge about networking and inter networking devices.
- To gain the knowledge on Security over Network communication

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models	K1
CO2	To gain knowledge on Telephone systems and Satellite communications	K2,K4
CO3	To impart the concept of Elementary data link protocols	K3
CO4	To analyze the characteristics of Routing and Congestion control algorithms	K4
CO5	To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction** – Uses of Computer Network: Business-Home Applications-Mobile Users -Issues. Network Hardware -Network Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet.	12
II	**Physical Layer** – Guided Transmission Media-Wireless Transmission - Communication Satellites – Digital modulation and Multiplexing and Switching.	12
III	**Data Link Layer:** Design Issues – Error Detection and Correction. Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer: Channel Allocation Problem – Multiple Access Protocols – Bluetooth.	12
IV	**Network Layer** - Design Issues - Routing Algorithms - Congestion Control Algorithms –Network layer in the Internet.	12
V	**Transport Layer** - Services – Internet Transport Protocols (ITP)- Application layer: DNS-Electronic mail.	12

LEARNING RESOURCES	
TEXT BOOKS	A.S.Tanenbaum, "Computer Networks", 5th Edition, Prentice-Hall of India, 2011.
REFERENCE BOOKS	B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition, 2017.
WEBSITE/LINK	Web resources from NDL Library, E-content from open-source libraries

MAPPING WITH PROGRAMME OUTCOMES:

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	S
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	SEMESTER	IV
SUBJECT CODE	24U4CSDE04	SPECIALIZATION	NA
TYPE	ELECTIVE : THEORY	L:T:P:C	4:0:0:3

COURSE OBJECTIVE:

1. Study the concepts of Artificial Intelligence.
2. Learn the methods of solving problems using Artificial Intelligence.
3. Learn the knowledge representation techniques, reasoning techniques and planning
4. Introduce the concepts of Expert Systems and machine learning.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the informed and uninformed problem types and apply search strategies to solve them.	K1
CO2	Apply difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing	K2,K4
CO3	Design and evaluate intelligent expert models for perception and prediction from intelligent environment.	K3
CO4	Formulate valid solutions for problems involving uncertain inputs.	K4
CO5	Demonstrate and enrich knowledge to select and apply AI tools .	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	Basics of Artificial Intelligence: What is Artificial Intelligence- The AI Problem- The Underlying Assumption- AI Techniques- The level of the Model- criteria for success- Defining the Problem as a State Space Search- Production System- Problem Characteristics.	12
II	Heuristic Search Techniques: Issues in Design of Search Programs- Generate and Test- Hill climbing- Best-first search- Problem Reduction- Constraint satisfaction- Mean-ends Analysis	12
III	Knowledge Representation: Representation and Mappings- Approaches to knowledge representation- Issues in Knowledge Representation - Procedural Versus Declarative Knowledge- - Logic Programming -Forward Versus Backwand Reasoning-Matching,	12
IV	Symbolic and Statistical Reasoning: Introduction to Nonmonotonic Reasoning -Logics for Nonmonotonic Reasoning-Implementation Issues - Probability and Bayes Theorem-Certainty Factors and Rule-based Systems-Bayesian Networks-Dempster-Shafer Theory.	12
V	Game Playing, Planning, Understanding: The Minimax Search Procedure-Adding Alpha beta cut-off-Additional Refinement-Planning Overview, components of planning system-Nonlinear Planning Using Constraint Posting -Hierarchical Planning and Reactive System-What is Understanding-What Makes Understanding Hard-Understanding as Constraint Satisfaction.	12

LEARNING RESOURCES	
TEXT BOOKS	1. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair
REFERENCE BOOKS	1. Artificial Intelligence: A Guide to Intelligent Systems" by Michael Negnevitsky 2. "Artificial Intelligence: Structures and Strategies for Complex Problem Solving" by George F. Luger 3. Artificial Intelligence: Foundations of Computational Agents" by David L. Poole and Alan K. Mackworth.
WEBSITE/LINK	1. https://stanford-cs221.github.io/autumn2020/ 2.https://intellipaat.com/blog/tutorial/artificial-intelligence-tutorial/ 3. https://www.edureka.co/blog/knowledge-representation-in-ai/ 4. https://www.brainkart.com/article/Symbolic-Reasoning_8586/ 5.https://www.geeksforgeeks.org/game-playing-in-artificial-intelligence/

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	INTERNET OF THINGS	SEMESTER	IV
SUBJECT CODE	24U4CSDE05	SPECIALIZATION	CA
TYPE	ELECTIVE: THEORY	L:T:P:C	4:0:0:3

COURSE OBJECTIVE:

- To know about the IoT concepts.
- To understand the development of Internet of Things prototypes.
- To understand the concepts of sensing, actuation and communications.
- Students will be explored to the interconnection and integration of the physical and the cyber space.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Comprehend the essentials of IoT and its applications	K1
CO2	Analyze and understand the various IoT data link and network layer protocols.	K2,K4
CO3	Understand the concepts of IoT Architecture Reference model and IoT reference architecture.	K3
CO4	Demonstrate the operation of processing unit.	K4
CO5	Recognize the operation of parallel processing.	K4

UNIT	CONTENTS	NO.OF.SESSIONS
I	**FUNDAMENTALS OF IOT :** Introduction - Definition and Characteristics of IoT - Physical design - IoT Protocols - Logical design- IoT communication models, IoT Communication APIs - Enabling technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates - Domain specific IoTs - IoT Architectural view.	12
II	**ELEMENTS OF IOT :** IoT and M2M-difference between IoT and M2M Software Defined Networks-Network Function Virtualization-IoT systems management–Needs-NETCONF,YANG-IoT design methodology.	12
III	**IOT PROTOCOLS :** Sensors and actuators-Communication modules – Zigbee-LoRa-RFID-Wi-Fi-Power sources.	12
IV	**BUILDING IOT WITH CLOUD AND DATA ANALYTICS :** IoT platforms–Arduino–Raspberry Pi-Cloud Computing in IoT-Cloud Connectivity-Big Data Analytics - Data Visualization	12
V	**CHALLENGES IN IOT AND CASE STUDIES :** Security Concerns and Challenges – Real time applications of IoT – Home automation– Automatic lighting –Home intrusion detection–Cities–Smart parking –Environment –Weather monitoring system – Agriculture – Smart irrigation.	12

LEARNING RESOURCES	
TEXT BOOKS	1. Internet of Things - A Hands on Approach, Arsdeep Bahga & Vijay Mandisetti, 2015, ISBN : 9788173719547.
REFERENCE BOOKS	1. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI 2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer 3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
WEBSITE/LINK	1. http://internetofthingsagenda.techtarget.com/ 2. http://www.businessinsider.com/what-is-the-internet-of-things . http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	M
CO2	S	M	S	S
CO3	S	S	S	S
CO4	S	S	M	S
CO5	S	S	M	L

SUBJECT TITLE	PERVASIVE COMPUTING	SEMESTER	IV
SUBJECT CODE	24U4CSDE06	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	4:0:0:3

COURSE OBJECTIVE:

1. To introduce the characteristics, basic concepts and systems issues in pervasive computing.
2. To illustrate smart devices and architectures in pervasive computing.
3. To introduce intelligent systems and interactions in Pervasive computing.
4. To identify the trends and latest development of the technologies in the area.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Demonstrate fundamental concepts in pervasive computing	K1
CO2	Explain pervasive devices and decide appropriate one as per the need of real time applications	K2,K4
CO3	Classify and analyze context aware systems for their efficiency in different ICT systems.	K3
CO4	Illustrate intelligent systems and generic intelligent interactive applications.	K4
CO5	Design HCI systems in pervasive computing environment.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction To Pervasive Computing:** History, Principles, Characteristics, Problems/Issues & Challenges, And Advantages of Pervasive Computing Pervasive Computing Applications: Pervasive computing devices and interfaces, Device technology trends, Connecting issues and protocols.	12
II	**Smart Computing with Pervasive Computing Devices:** Smart Devices: CCI, Smart Environment: CPI and CCI, Smart Devices: iHCI and HPI, Wearable devices, Application and Requirements, Device Technology and Connectivity, PDA Device characteristics - PDA Based Access Architecture, Voice Enabling Pervasive Computing: Voice Standards, Speech Applications in Pervasive Computing.	12
III	**Context Aware Systems:** Introduction, Types of Context, Context Aware Computing and Applications, Modeling Context-Aware Systems, Mobility awareness, spatial awareness, temporal awareness: Coordinating and scheduling, ICT system awareness, Middleware Support	12
IV	**Intelligent Systems and Interaction:** Introduction, Basic Concepts, IS Architectures, Semantic KBIS, Classical Logic IS, Soft Computing IS Models, IS System Operations, Interaction Multiplicity, IS Interaction Design, Generic Intelligent Interaction Applications.	12
V	**Security issues in Pervasive Computing:** security model, authentication & authorization, access control, secure resource discovery, open issues. Pervasive computing security challenges & requirements: Privacy & trust issues, social & user interaction issues, solution for pervasive computing challenges, Role of Ethics in pervasive computing security:	12

LEARNING RESOURCES	
TEXT BOOKS	1. Stefan Poslad, "Ubiquitous Computing: Smart Devices: Environments and Interactions", Wiley Publication, Student Edition, ISBN 9788126527335. 2. Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtroff, Thomas Schack, " Pervasive Computing: Technology and Architecture of Mobile Internet Applications", Pearson Education, ISBN 9788177582802 3. Frank Adelstein, Sandeep K. S. Gupta, Golden G. Richard III, Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing" McGraw Hill Education, Indian Edition, ISBN 9780070603646
REFERENCE BOOKS	1. Sen Loke, "Context Aware Pervasive Systems; Architectures for new Breed of applications",Taylor and Fransis, ISBN 0-8493-7255-0 2. LaurnceYang, Evi Syukur, Seng Loke, "Handbook on Mobile and Ubiquitous Computing : Status and Perspectivel", CRC Press, 2013 ISBN 978-1-4398-4811-1 3. M. Haque and S. I. Ahamed, "Security in pervasive computing: Current status and open issues", Int. J. Netw. Secur., vol. 3, no. 3, pp. 203–214, 2006
WEBSITE/LINK	1. M. Hilty, ―Ubiquitous Computing in the Workplace: What Ethical Issues?‖ no. August, pp. 1–16, 2014, [Online].http://link.springer.com/bookseries/11156L. 2.https://web.uettaxila.edu.pk/CMS/SP2014/teMPCms/tutorial%5CFundamentalsOfMobilePer vasiveComputing.pdf 3.http://pervasivecomputing.se/M7012E_2014/material/Wiley.Ubiquitous.Computing.Smart.D evices.Environments.And.Interactions.May.2009.eBook.pdf 4.http://media.techtarget.com/searchMobileComputing/downloads/Mobile_and_pervasive_co mputing_Ch06.pdf

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

SUBJECT TITLE	SOFTWARE ENGINEERING	SEMESTER	V
SUBJECT CODE	24U5CSDE07	SPECIALIZATION	NA
TYPE	ELECTIVE : THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

1. Understanding the basic concepts of Software Engineering.
2. To Understanding about the various process models and Agile development.
3. Able to understand about the principles in software engineering and requirements.
4. Understanding clearly about the new methodologies used in modeling.
5. To easy recognize and find the way for Designing Models.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Gain basic knowledge of analysis and design of systems	K1
CO2	Ability to apply software engineering principles and techniques	K2
CO3	Model a reliable and cost-effective software system	K3
CO4	Ability to design an effective model of the system	K4
CO5	Perform Testing at various levels and produce an efficient system.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction to Software Engineering**: The evolving role of software, Changing Nature of Software, Software myths.**A Generic view of process:** Software engineering- A layered technology, a process framework, Process patterns, process assessment. Process models: The waterfall model, Incremental process models, Evolutionary process models, The Unified process, Agility and Agile Process model, Extreme Programming, Other process models of Agile Development and Tools	12
II	**Software Requirements:** Functional and non-functional requirements, User requirements,System requirements, Interface specification, the software requirements document. **Requirements engineering process:** Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. **System models:** Context Models, Behavioral models, Data models, Object models, structured methods. UML Diagrams.	12
III	**Design Engineering:** Design process and Design quality, Design concepts, the design model.**Creating an architectural design:** Software architecture, Data design, Architectural styles and patterns, Architectural Design. **Object-Oriented Design:** Objects and classes, An Object-Oriented design process, Designevolution. Performing **User interface design:** Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.	12
IV	**Testing Strategies**: A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging. **Product metrics:** Software	12

	Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance. **Metrics for Process and Products:** Software Measurement, Metrics for software quality.	
V	**Risk management:** Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan. **Quality Management:** Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, The Capability Maturity Model Integration (CMMI), Software reliability, The ISO 9000 quality standards..	**12**

LEARNING RESOURCES	
TEXT BOOKS	Software Engineering: A Practitioner's Approach Roger S. Pressman 20th Anniversary Edition FIFTH EDITION
REFERENCE BOOKS	Software Engineering, 10/e May 2017 by Ian Sommerville (Author) "Think Like A Programmer" by V. Anton Spraul
WEBSITE/LINK	https://spoken-tutorial.org/tutorial www.w3schools.com https://www.coursera.org

MAPPING WITH PROGRAMME OUTCOMES

	PO01	**PO02**	**PO03**	**PO04**
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	QUANTUM COMPUTING	SEMESTER	V
SUBJECT CODE	24U5CSDE08	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

- To understand the basic principles of quantum mechanics
- Quantum physics and computation

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	To understand quantum information processing	K1
CO2	Prove basic facts about quantum information channels	K2,K4
CO3	Analyze the behavior of basic quantum algorithms	K3
CO4	Implement simple quantum algorithms and information channels in the quantum circuit model	K4
CO5	Understand Error correction and fault-tolerant quantum computing.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction :** Overview of Traditional Computing : Circuit Model of Computation – Reversible Computation – Quantum Physics – Quantum Physics and Computation – Dirac Notation And Hilbert Spaces – Dual Vectors – Operators – The Spectral Theorem – Functions of Operators – Tensor Products – Schmidt Decomposition Theorem.	12
II	**Qubits & Quantum Model of Computation :** State of a quantum system – time evolution of a closed system – composite systems – measurement. Quantum model of computation: quantum circuit model – quantum gates – universal sets of quantum gates – unitary transformations.	12
III	**Quantum Algorithms :** Super dense Coding – Quantum Teleportation – Applications Of Teleportation – Probabilistic Versus Quantum Algorithms – Phase Kick-Back – The Deutsch Algorithm – The Deutsch- Jozsa Algorithm – Simon's Algorithm.	12
IV	**Quantum Algorithms :** Order - Finding Problem – Eigen value Estimation Approach to Order Finding – Shor's Algorithm for Order Finding – Finding Discrete Logarithms – Hidden Subgroups.	12
V	**Quantum Computational Complexity and Error Correction :**Computational Complexity – Black-Box Model – Lower Bounds for Searching – GeneralBlack-Box Lower Bounds – Polynomial Method – Block Sensitivity – Adversary Methods. Quantum Error Correction : Classical Error Correction – Classical Three-Bit Code – Fault Tolerance - Fault-Tolerant Quantum Computation.	12

LEARNING RESOURCES	
TEXT BOOKS	P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing", Oxford University Press, 1999.
REFERENCE BOOKS	V. Sahni, "Quantum Computing", Tata McGraw-Hill Publishing Company, 2007.
WEBSITE/LINK	https://www.javatpoint.com/what-is-quantum-computing https://www.geeksforgeeks.org/introduction-quantum-computing/ https://www.javatpoint.com/how-does-a-quantum-computer-works

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	M
CO2	S	M	S	S
CO3	S	S	S	S
CO4	S	S	M	S
CO5	S	S	M	L

S-Strong , M- Medium , L – Low

SUBJECT TITLE	BLOCK CHAIN TECHNOLOGY	SEMESTER	V
SUBJECT CODE	24U5CSDE09	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.	K1
CO2	Compare the advantages and disadvantages of various cloud computing platforms.	K2,K4
CO3	Program data intensive parallel applications in the cloud.	K3
CO4	Analyze the performance, scalability, and availability of the underlying cloud technologies and software.	K4
CO5	Solve a real-world problem using cloud computing through group collaboration.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Basics :** Distributed Database-Two General Problem-Byzantine General problem and Fault Tolerance-Hadoop Distributed File System- Distributed Hash Table- ASIC resistance- Turing Complete. â€¢ Cryptography: Hash function- Digital Signature - ECDSA- Memory Hard Algorithm- Zero Knowledge Proof.	12
II	**Block chain**: Introduction- Advantage over conventional distributed database-Block chain Network- Mining Mechanism-Distributed Consensus-Merkle Patricia Tree- Gas Limit-Transactions and Fee- Anonymity- Reward- Chain Policy- Life of Block chain application- Soft & Hard Fork- Private and Public block chain.	12
III	**Distributed Consensus** : Nakamoto consensus- Proof of Work-Proof of Stake- Proof of Burn- Difficulty Level- Sybil Attack-Energy utilization and alternate.	12
IV	**Cryptocurrency :** History- Distributed Ledger-Bitcoin protocols - Mining strategy and rewards-Ethereum - Construction-DAO-Smart Contract- GHOSTVulnerability- Attacks-Sidechain-Namecoin	12
V	**Cryptocurrency Regulation :** Stakeholders- Roots of Bit coin-Legal Aspects-Crypto currency Exchange- Black Market and Global Economy.	12

LEARNING RESOURCES	
TEXT BOOKS	1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
REFERENCE BOOKS	1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies 2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System 3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014. 4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts

MAPPING WITH PROGRAMME OUTCOMES

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	WEB APPLICATION DEVELOPMENT	SEMESTER	V
SUBJECT CODE	24U5CSDE10	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVES :

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

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Develop and publish Web pages using Hypertext Markup Language(HTML).	K2
CO2	Optimize page styles and layout with Cascading Style Sheets(CSS).	K3
CO3	Analyze and apply the role of languages to create a capstone	K4
CO4	Develop websites using client-side web programmings languages like HTML, DHTML, CSS, XML, JavaScript, and AJAX.	K4
CO5	Create web applications using forms and validation of form fields	K6

UNIT	CONTENTS
I	**HTML**-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line breaks. Emphasizing test- heading and horizontal rules-list-font size, face and color-alignment- links-tables-frames
II	**Graphics:** Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with HTML forms textbox, password, list box, combo box, text area, tools for building web page front page.
III	Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML). Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding.
IV	Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition, Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations.
V	**Ajax:** Introduction, advantages &disadvantages, Purpose of it, ajax based web application, alternatives of ajax. Java Script & AJAX: Introduction to array operators, making statements-date & time-mathematics- strings-Event handling-form properties. AJAX. Introduction to jQuery and AngularJS.

TEXTBOOKS	
1	Pankaj Sharma, “Web Technology”, Sk Kataria &SonsBangalore 2011.(UNIT I, II, III &IV).
2	Achyut S Godbole & Atul Kahate, “Web Technologies”, 2002, 2nd Edition. (UNIT V:AJAX).
REFERENCE BOOKS	
1.	Laura Lemay, Rafe Colburn , Jennifer Kyrnin, “Mastering HTML, CSS & Javascript Web Publishing”,2016.
2.	DT Editorial Services (Author), “HTML 5 Black Book (Covers CSS3, JavaScript,XML, XHTML, AJAX,PHP, jQuery)”, Paperback 2016, 2ndEdition.
3.	Purewal, Semmy. Learning Web App Development: Build Quickly with Proven JavaScript Techniques. "O'Reilly Media, Inc.", 2014.
WEB RESOURCES	
1.	https://www.w3schools.com/whatis/default.asp
2.	https://www.edureka.co/blog/web-development-tutorial/
3.	https://www.tutorialspoint.com/website_development/index.htm

MAPPING WITH PROGRAMME OUTCOMES:

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong M-Medium L-Low

SUBJECT TITLE	COMPUTER GRAPHICS WITH MULTIMEDIA	SEMESTER	V
SUBJECT CODE	24U5CSDE11	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

- The main objective of the course is to introduce students with fundamental concepts and theory of computer graphics.
- It presents the important drawing algorithms, polygon, clipping and 2D transformation curves and an introduction to 3D transformation.
- Familiarity with key algorithms for modeling and rendering graphical data
- Develop design and problem solving skills with application to computer graphics
- Gain experience in constructing interactive computer graphics programs

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Develop and execute simple graphics programs	K1
CO2	Apply and compare the algorithms	K2,K4
CO3	Clipping algorithms and transformations on 2D images	K3
CO4	To make use of fundamental concepts and formulate best practices	K4
CO5	Write action script for a particular problem.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	Introduction to Computer Graphics: Overview of computer graphics and its applications-History and evolution of computer graphics- Basic concepts: pixels, resolution, color models - Graphics software and hardware	12
II	2D Graphics: Coordinate systems and transformations - Drawing basic shapes: lines, circles, polygons - Color theory and manipulation - Bitmap vs. vector graphics	12
III	3D Graphics: Introduction to 3D graphics concepts - 3D modeling techniques: wireframe, surface, solid modeling - Lighting and shading models - Rendering techniques: ray tracing, rasterization	12
IV	Multimedia Fundamentals: Definition and characteristics of multimedia - Multimedia elements: text, images, audio, video - Multimedia file formats and compression techniques - Multimedia authoring tools and software	12
V	Multimedia Applications: Interactive multimedia: principles and design - Multimedia integration: combining text, graphics, audio, and video - Multimedia presentation tools and techniques Case studies and real-world applications	12

LEARNING RESOURCES	
TEXT BOOKS	1. Computer Graphics: Principles and Practice" by John F. Hughes, Andries van Dam, Morgan McGuire, David F. Sklar, James D. Foley, Steven K. Feiner, Kurt Akeley 2. "Multimedia: Making It Work" by Tay Vaughan
REFERENCE BOOKS	• "Computer Graphics: Principles and Practice", James D. Foley, Andries van Dam, Steven K. Feiner, John Hughes, Morgan McGuire, David F. Sklar, and Kurt Akeley and published by Addison–Wesley. • Donald Hearn M. Pauline Baker, Computer Graphics C Version, 2nd edition, Pearson Education, 2014. • "Introduction to Data Compression" by K Sayood

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

SUBJECT TITLE	COMPILER DESIGN	SEMESTER	V
SUBJECT CODE	24U5CSDE12	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

- To introduce the concept of compiler with in detail coverage of basic tasks, metrics, issues, and implication.
- To introduce the concept of Syntactic specification of programming languages.

CO No.	CO Statement	Knowledge Level
CO1	To develop skills in compiler basics and applications	K1
CO2	To Understand about specifications of programming languages in detail.	K2,K4
CO3	Able to know how to apply syntax directed translation.	K3
CO4	Explores about run time storage and phase errors.	K4
CO5	To provide knowledge in code optimization and code generation.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction to Compliers** : Compliers and Translator - Need of Translator - The structure of a Complier - Lexical analysis - Syntax analysis - Intermediate code generation -Optimization - Code generation - Complier writing tools. Finite automata and lexical Analysis: The role of the lexical analysis - A simple approach to the design of lexical analyzers- Regular expressions to finite automata - Minimizing the number of states of a DFA.	12
II	**The Syntactic specification of programming languages:** Context free grammars -Derivations and parse trees - Capabilities of context free grammars. Basic parsing techniques: Parsers - Shift reduce parsing - Operator precedence parsing - Top down parsing - Predictiveparsers.	12
III	**Syntax directed translation:** Intermediate code - Postfix notation - Parse trees and syntax trees - 3 address code - Quadruples and triples- Boolean expressions - Statements that alter the flow of control. Symbol tables: The contents of a symbol table - Data structures for symbol table - Representing scope	12
IV	**Run time storage administration:** Implementation of a simple stack allocation scheme -Implementation of block-structured languages. Error deduction and recovery: Errors - Lexical phase errors - Syntactic phase errors - Semantic errors.	12
V	**Introduction of code optimization:** The principle sources of optimization - Loop optimization - The DAG representation of basic blocks-Global data flow analysis. Code generation: Object programs - Problems in code generation-A simple code generator - Register allocation and assignment -Code generation from DAGâ€˜s-Peepholes optimization	12

LEARNING RESOURCES	
TEXT BOOKS	Principles of Complier Design by Alfred V.Aho, Jeffrey D.Ullman , Narosa Publications House.
REFERENCE BOOKS	Modern Compiler Design by David Galles, Fifth Edition 2012.
WEBSITE/LINK	http://www.w3schools.com/php/php_mysql_intro.asp. http://www.tutorialspoint.com/mysql/mysql-php-syntax.htm http://downloads.mysql.com/docs/apis-php-en.pdf

MAPPING WITH PROGRAMME OUTCOMES

	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	BIG DATA ANALYTICS	SEMESTER	VI
SUBJECT CODE	24U6CSDE13	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	4:0:0:4

COURSE OBJECTIVE:

1. Understand basic concepts and terminology of the Power BI service.
2. Find your content in dashboards, reports, and apps.
3. View and export data from dashboards and reports.
4. View filters that are used in a report.
5. Explain the relationship between dashboards and reports, visualizations, and tiles.
6. Display action menus for tiles and details for report visualizations.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understanding the basic concepts of data science and its functions	K1
CO2	Exploring cluster analysis methods	K2
CO3	Exploring big data from different perspective	K3
CO4	Understanding hadoop framework with HDFS concepts	K4
CO5	Process Data with MapReduce	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction:** Types of Digital Data: Classification of Digital Data. Introduction to Big Data: Characteristics of Data- Evolution of Big Data- Definition of Big Data- Challenges with Big Data-What is big Data? Why big Data?Traditional Business Intelligence versus Big Data-A Typical Data Warehouse Environment- A Typical Hadoop Environment.	12
II	**Big Data Analytics:** Where do we Begin? What is Big Data Analytics? What is Big Data Analytics? Classification of Analytics-Why Big Data Analytics Important? Challenges Facing Big Data-Data Science-Terminologies used in Big Data Environment-Basically Available Soft State Eventual consistency (BASE).	12
III	The Big Data Technology Landscape: NoSQL: Hadoop Where it is used? What is it? Types of NoSQL Databases- Why NoSQL - Advantages of NoSQL- What we miss with NoSQL? -Use of NoSQL in Industry- NoSQL Vendors- SQL vs NoSQL- NewSQL- comparision of SQL, NoSQL and NewSQL. Hadoop:Feature of Hadoop-Key Advantage of Hadoop-versions of Hadoop- Overview of Hadoop Ecosystem- Hadoop Distribution- Hadoop versus SQL- cloud Based Hadoop solution	12
IV	**Introducing Hadoop**-Why Hadoop?-why not RDBMS?- RDBMS vs Hadoop-Distributed Computing Challenges- History of Hadoop-Overview of Hadoop- Use Case of Hadoop- Hadoop Distribution- HDFS-Processing Data with Hadoop- Interacting with Hadoop Ecosystem.	12
V	**Introduction to MongoDB:** What is MongoDB? -Why MongoDB-Terms Used in RBDMS and MongoDB- Data Types in MongoDB-MongoDB Query Language.	12

LEARNING RESOURCES	
TEXT BOOKS	1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.
REFERENCE BOOKS	1. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies", John Wiley & Tom White, "Hadoop: The Definitive Guide", Reilly Publications, 2011. 2. Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012. 3. Russell Bradberry, Eric Blow, "Practical Cassandra A developers Approach", Pearson Education, 2014.
WEBSITE/LINK	1. https://www.webopedia.com/TERM/B/Big_data_analytics.html 2. https://www.simplilearn.com/data-science-vs-big-data-vs-data-analytics-article

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

SUBJECT TITLE	COMPUTATIONAL THINKING	SEMESTER	VI
SUBJECT CODE	24U6CSDE14	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	4:0:0:4

COURSE OBJECTIVE:

1. Convert real world situations to appropriate problem statements and identify the input, algorithmic approach involved and expected output.
2. Design solutions to mathematical problems following a top-down approach.
3. Argue on the appropriateness of solution developed with respect to complexity by eliminating redundant comparisons and swaps.
4. Apply suitable strategies on loop initials, iterations and terminations while implementing Algorithms.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	To explain importance of problem solving aspect.	K1
CO2	To develop understanding of computation for various applications	K2,K4
CO3	To design effective algorithm for various applications	K3
CO4	To explain array concepts	K4
CO5	To apply algorithms for stack, queue and Linked List	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction:** The problem solving aspect, Top down design, Implementation of algorithms, Program Specification, The Efficiency of Algorithms	12
II	Exchange the values of two variables - Counting - Summation of a set of number - factorial computation - Sine Function computation - Generation of the Fibonacci sequence - Reversing the digits of an integer - Base conversion - Character to number conversion.	12
III	Finding the square root of a number - The smallest divisor of an integer - The greatest common Divisor of two integers - Generating prime numbers - Computing the prime factors of an integer - Generation of Pseudo - random numbers - Raising a number to a large power - Computing the n-th Fibonacci number.	12
IV	Array Order Reversal-Finding the maximum number in a set- Removal of Duplicates from an ordered Array- Finding the k^{th} smallest element –Binary Search	12
V	Stack operations-Queue Addition and Deletion- Linked List search-Linked List insertion and Deletion- Binary Tree search	12

Learning Resources	
TEXT BOOKS	1. R.G.Dromey, How to solve it by computer - Pearson, 2011.
REFERENCE BOOKS	1. Kunth -Fundamental Algorithm ,Narosa Publishing House, 2003.
WEBSITE/LINK	1. https://en.wikipedia.org/wiki/Computational_thinking 2. https://www.coursera.org/learn/computational-thinking-problem-solving 3. https://www.bbc.co.uk/bitesize/guides/zp92mp3/revision/1

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

SUBJECT TITLE	NEURAL NETWORKS AND FUZZY LOGIC	SEMESTER	VI
SUBJECT CODE	24U6CSDE15	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	4:0:0:4

COURSE OBJECTIVE:

1. The main objective of this course is to provide the student with the basic understanding of neural networks and fuzzy logic fundamentals,
2. Program the related algorithms and Design the required and related systems.
3. Biological motivation to design intelligent systems and control
4. Study the learning strategies of Artificial Neural networks and their training algorithms

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Comprehend the concepts of feed forward neural networks	K1
CO2	Analyze the various feedback networks.	K2,K4
CO3	Understand the concept of fuzziness involved in various systems and fuzzy set theory.	K3
CO4	Comprehend the fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm	K4
CO5	Analyze the application of fuzzy logic control to real time systems.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction:** What is Neural Network-Human Brian-Models of a Neuron-Network Architecture-Knowledge Representation- AI& Neural Networks	12
II	**Learning Processes:** Introduction-Error-Correction Learning-Memory-Based Learning- Hebbian Learning-Competitive learning-Boltzmann Learning- learning with a Teacher - learning without a Teacher- learning Tasks	12
III	**Single Layer Perceptions:** Introduction –Adaptive Filtering Problem-Unconstrained Optimization Techniques-Linear Least Square Filters. Multilayer Perceptions: Introduction- Back propagation Algorithm - Back propagation and Differentiation.	12
IV	**Introduction:** What is Fuzzy Logic- History-Motivation-Why Using Fuzzy Logic for control. Basic Concept of Fuzzy Logic: Two Exemplary Problems-Fuzzy sets-Linguistic Variables-Fuzzy Rules	12
V	**Fuzzy Sets:** Classical sets-Fuzzy sets-Operation of fuzzy sets-Properties of Fuzzy Sets-Geometric Interpretation of fuzzy sets.	12

LEARNING RESOURCES	
TEXT BOOKS	1. Neural Network A Comprehensive Foundation- , Simon Haykin Mc Master University,Hamilyon, Ontario,Canada. [UNIT – I, II & III] 2. Fuzzy Logic intelligence , Control and information- John Yen Reza Langari , Center for fuzzy Logic,Robotics, and Intelligent Systems Texas A&M University. [UNIT – IV & V]
REFERENCE BOOKS	1. Neural Networks and Fuzzy System-dynamical System approach to machine intelligent, Bart Kosko University of Southern California 2. LauranceFausett, Englewood cliffs, N.J., "Fundamentals of Neural Networks", PearsonEducation, New Delhi, 2008
WEBSITE/LINK	1. ieeexplore.ieee.org 2. www.sciencedirect.com/

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

SUBJECT TITLE	PRINCIPLES OF MANAGEMENT	SEMESTER	VI
SUBJECT CODE	24U6CSDE16	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	4:0:0:4

COURSE OBJECTIVE:

1. Encouraging Innovation and Entrepreneurship.
2. Preparing for Global Management Challenges.
3. Promoting Lifelong Learning.
4. Preparing for Career Success.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understanding Management Concepts.	K1
CO2	Developing Analytical Skills.	K2
CO3	Exploring Organizational Behavior.	K3
CO4	Examining Managerial Functions.	K4
CO5	Understanding the Managerial Environment:	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Forms of Business Organizations and Ownership:** Sole Proprietorship, Partnership, Joint Stock Company, Public & Private undertakings, Government Companies. Management: Meaning & Definition of Management, Nature, Scope and its various functions. Evolution of management thoughts: classical and new classical systems, contingency approaches, Scientific management.	12
II	**Planning:** nature, purpose and functions, types of plan, Management by Objective (MBO), steps in planning. Decision Making: Meaning, Steps in Decision Making, Techniques of Decision Making. Strategic planning – concepts, process, importance and limitations; Growth strategies- Internal and external	12
III	**Organizing:** Concept, formal and informal organizations, task force, bases of departmentation, different forms of organizational structures, avoiding organizational inflexibility.	12
IV	**Authority:** definition, types, responsibility and accountability, delegation, decentralization v/s centralization, determinants of effective decentralization. Line and staff authority. Control: function, process and types of control, nature, process, significance and span of control. Direct control v/s preventive control.	12
V	**Trends and challenges**: Trends and challenges of management in global scenario, emerging issues in management: Introduction to Total Quality Management (TQM), Just in Time (JIT).	12

LEARNING RESOURCES	
TEXT BOOKS	1. Principles and practices of management: L. M. PRASAD (S. Chand publishers) 2. Essentials of Management: Koontz H. & Weihrich H. (Tata Mc Graw Hill Publishers
REFERENCE BOOKS	1. Management: Stephen Robbins (Pearson publishers) 2. VSP Rao & V H Krishna, Management, Excel books

MAPPING WITH PROGRAMME OUTCOMES

	PO01	**PO02**	**PO03**	**PO04**
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low

SUBJECT TITLE	ANDRIOD APPLICATION DEVELOPMENT	SEMESTER	VI
SUBJECT CODE	24U6CSDE17	SPECIALIZATION	NA
TYPE	ELECTIVE : THEORY	L:T:P:C	4:0:0:4

COURSE OBJECTIVE:

1. To understand the concept of Android Technology
2. To understand android web apps
3. To learn how to develop apps for Android
4. Android is a mobile operating system that powers all kinds of device

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	To know the basic concepts of Android and its components	K1
CO2	To understand different types of Android resources	K1,k2
CO3	Analyze Android application designing interfaces with layout and screening elements	K2,k3
CO4	Analyze the concept of Android Data and Storage API	K4
CO5	Implement Application with DDMS	K4,k5

UNIT	CONTENTS	NO. OF HOURS
I	**Introduction to Open Source** : What is Open Source - License Issues (MPL, GPL, and LGPL) and Open Source Vs Traditional Development Methodologies. Introduction to Android: Introducing Android - History of Mobile Software Development - Layers of Android - Android SDK - Kinds of Android Components - Building a Sample Android Application.	12
II	**Android Application** Design Essentials Anatomy of an Android Applications - Android Terminologies - Application Context - Actives - Services - Intents - Receiving and Broadcasting Intents - Android Manifest File and its common settings - ManagingApplication resources in a hierarchy - Working with different types of resources.	12
III	**Android Application Design Essentials:** User Interface Screen Elements - Designing User Interfaces with Layouts - Drawing and Working with Animation.	12
IV	**Using Common Android APIs :**Using Android Data and Storage APIs - Managing data using SQLite - Sharing Data between Applications with Content Providers - Using Android Networking APIs - Using Android Web APIs and Using Android Telephony APIs	12
V	**DDMS â€“ Debug and Other View : DDMS - Dalvik Debug Monitor Server - LogCat View - File explorer - Breakpoints and Debug**	12

LEARNING RESOURCES	
TEXT BOOKS	1. "Android Wireless Application Development", Lauren Darcey and Shane Conder, Pearson Education, 2nd Edition, 2011. 2. "Android in Action", W. Frank Ableson, Robi Sen, Chris King, Manning Publications Co., 2nd Edition, 2011.
REFERENCE BOOKS	1. "Android Essentials", Chris Haseman, A Press Publications, 2008. 2. "The Android Developers Cookbook Building Applications with the Android SDK", James Steele, Nelson To, Addison Wesley Publications, 2011.
WEBSITE/LINK	1. www.developer.android.com 2. 2 www.android.com 3 3. www.source.android.com

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04	PO05
CO1	M	M	S	S	M
CO2	L	L	S	S	M
CO3	S	S	S	S	L
CO4	S	S	S	M	L
CO5	L	L	S	M	L

S–Strong, M–Medium,L–Low

SUBJECT TITLE	ETHICAL HACKING	SEMESTER	VI
SUBJECT CODE	24U6CSDE18	SPECIALIZATION	NA
TYPE	ELECTIVE: THEORY	L:T:P:C	4:0:0:4

COURSE OBJECTIVE:

5. To understand the fundamental concepts of computer system, including hardware and software.
6. To Design, and analyze precise specifications of algorithms, procedures, and interaction behavior.
7. To apply the appropriate technologies, skills and tools in various fields of Computer Science.
8. To analyze impacts of computing on individuals, organization and society.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Plan a vulnerability assessment and penetration test for a network.	K1
CO2	Execute a penetration test using standard hacking tools in an ethical manner.	K2,K4
CO3	Report on the strengths and vulnerabilities of the tested network.	K3
CO4	Identify legal and ethical issues related to vulnerability and penetration testing.	K4
CO5	Be able to evaluate the security status of systems and suggest solutions for removing security vulnerabilities	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introduction to hacking, ports and protocols:** Hacking-Introduction to hacking-Types of hacking-Phases of hacking-protocols in hacking-Virtualization. Deep web-Introduction to Deep web-Dark Net-TOR (The Online Router).	12
II	**Scanning, Hacking and Foot Printing:** Scanning-What is scanning? Basics of scanning-Techniques of Scanning. System Hacking-Process of system Hacking-Password Cracking. Foot printing-Foot Printing types.	12
III	**Malwares, Viruses and Worms:** Malwares-Trojans-Working of Trojans. Virus-Introduction to virus-Working of Virus-Characteristics of Virus. Worms.	12
IV	**Social Engineering:** Social Engineering-Introduction to Social Engineering-Process of social engineering-Identity theft. Phishing-What are Phishing-phishing process-types of phishing Attacks.	12
V	**Cryptography and Stenography:** Cryptography: Cryptography-Digital Signature-Hash functions. Stenography-what is stenography-stenography process-Terms associated with stenography-Methods-Stenography tools	12

LEARNING RESOURCES	
TEXT BOOKS	1. Harsh Bothra, 2017,"Hacking:Be a Hacker with Ethics", Kindle edition, Kanna Publishing.
REFERENCE BOOKS	1. Roger A Grimes, 2017,"Hacking the Hacker", John Wiley & Sons. 2. Michael Gregg, 2017, Certified Ethical Hacker (CEH), Second Edition, Pearson IT Certification version 9.
WEBSITE/LINK	3. ieeexplore.ieee.org 4. www.sciencedirect.com/

MAPPING WITH PROGRAMME OUTCOMES

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong , M- Medium , L – Low

SUBJECTTITLE	PROFESSIONAL ETHICS	SEMESTER	V
SUBJECTCODE	24U5CSS02	SPECIALIZATION	NA
TYPE	SBEC - THEORY	L:T:P:C	2:0:0:2

COURSE OBJECTIVE:

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Know the Nature and Scope of Business Ethic	K1
CO2	Understanding Professional ethic	K1,k2
CO3	o analyze the basics of Corporate Social Responsibility	K2,k3
CO4	To applyEthical values in India	K4
CO5	Embrace the ethical responsibilities inherent in cyber security practices	K4,k5

UNIT	CONTENTS	NO. OF HOURS
I	Introduction - Scope of Business Ethics - Religion and Ethics - Types of Ethics - Sources of Business Ethics - Factors Influencing Business Ethics - Importance of Business Ethics.	4
II	Introduction - professional ethics - ethical problems faced by managers - new skill required for managers - managing ethical conduct in modern times.	4
III	Principles of corporate governance - issues involved in corporate governance - theories of corporate governance - CSR - introduction - Various dimensions - argument for and against CSR.	4
IV	Religious foundations of ethics - Hinduism - Buddhism - Jainism - Ethical Values of Gandhi, Vivekananda, Aurobindo and Tagore.	4
V	Personal ethics - marketing ethics - technology ethics - environmental ethics.	4

LEARNING RESOURCES	
TEXT BOOKS	1. 1R.Nandagopal, Ajithsankar.R.N, "Indian Ethos and Values in Management", Tata Mac Graw Hill education Private Ltd, New Delhi, 2011 2. S.Prabakaran, "Business Ethics and Corporate Governance", Excel books (2010), First Edition.
REFERENCE BOOKS	1. 1.Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004 2. 2.Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics â€“ Concepts and Cases", Cengage Learning, 2009. 3. 3.John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003 4. 4.Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers" Oxford UniversityPress, Oxford, 2001. 5. 5.Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013
WEBSITE/LINK	1. 1 www.onlineethics.org 2. 2 www.nspe.org 3. 3 www.globalethics.org 4. 4 www.ethics.org 5. 5https://www.slideshare.net/SethuramanPlayMankatha/professional-ethics-15084927

MAPPING WITH PROGRAMME OUTCOMES:

	PO01	PO02	PO03	PO04	PO05
CO1	M	M	S	S	M
CO2	L	L	S	S	M
CO3	S	S	S	S	L
CO4	S	S	S	M	L
CO5	L	L	S	M	L

S–Strong, M–Medium–Low

SUBJECT TITLE	MICROSOFT POWER BI	SEMESTER	VI
SUBJECT CODE	24U6CSS05	SPECIALIZATION	NA
TYPE	SBEC: THEORY	L:T:P:C	2:0:0:2

COURSE OBJECTIVE:

1. Understand basic concepts and terminology of the Power BI service.
2. Find your content in dashboards, reports, and apps.
3. View and export data from dashboards and reports.
4. View filters that are used in a report.
5. Explain the relationship between dashboards and reports, visualizations, and tiles.
6. Display action menus for tiles and details for report visualizations.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand Power BI concepts like Microsoft Power BI desktop layouts, BI reports, dashboards, and Power BI DAX commands and functions	K1
CO2	Gain a competitive edge in creating customized visuals and deliver a reliable analysis of vast amount of data using Power BI	K2
CO3	Learn how to experiment, fix, prepare and present data quickly and easily	K3
CO4	Create a sales analysis report and a project management report	K4
CO5	Form relationships in your data model and learn data visualization best practices	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	**Introducing Power BI:** Features of Power BI-Building Blocks of Power BI- Power BI tools-Installing the power BI Desktop App. **Connecting to Data Sources:** Getting data from Excel Files: Using Power BI Desktop – Using the Power BI Online Service. Getting data from a SQL server Database.	12
II	**Creating Datasets:** Creating A Dataset From A Single Data source- Creating A Dataset From A Multiple Data sources- Refreshing Data In A Dataset	12
III	**Data Munging with Power Query:** Transforming, Cleansing, and Filtering Data- Merging Data- Appending Data- Splitting Data- Unpivoting Data- Grouping and Aggregating Data- Inserting Calculated Columns. Creating the Data Model	12
IV	**Creating Reports with Power BI Desktop:** Creating Tables and Matrices- Constructing Bar, Column, and Pie Charts- Building Line and Scatter Charts- Creating Map-Based Visualizations- Linking Visualizations in Power BI- Drilling Through Visualizations	12
V	**Publishing Reports and Creating Dashboards in the Power BI Portal:** Create a user-friendly model- Publish Power BI Desktop files to the Power BI Service-Add tiles to a dashboard-Share dashboards -Refresh data in published reports.	12

LEARNING RESOURCES	
TEXT BOOKS	1. 1."Beginning Microsoft Power BI" A Practical Guide to Self-Service Data Analytics ,Third Edition ,**Dan Clark,** Camp Hill, PA, USA, SBN-13 (pbk): 978-1-4842-5619-0 2. "Introduction to Microsoft Power BI" M.O. Cuddley is a Microsoft Certified professional with a Microsoft Certified Solutions Expert (MCSE) certification in Business Intelligence. 3. 3."Introducting to Microsoft Power BI" PUBLISHED BY Alberto Ferrari and Marco Russo Microsoft Press A division of Microsoft Corporation One Microsoft Way Redmond, Washington. ISBN: 978-1-5093-0228-4
REFERENCE BOOKS	1. 1."Power BI for Beginners": A Step-by-Step Training Guide Using Best Practice Methodologies 2020 Theta Systems Limited. 2. 2. Learn Power BI by Greg Deckler A beginner's guide to developing interactive business intelligence solutions using Microsoft Power BI Published by Packt Publishing Ltd. Livery Place 35 Livery Street Birmingham B3 2PB, UK. ISBN 978-1-83864-448-2.
WEBSITE/LINK	1. Power BI for Beginners - 2020.pdf (windows.net) 2. Learn Power BI 3. INTRODUCTION TO MICROSOFT POWER BI: BRING YOUR DATA TO LIFE! (projanco.com) 4. powerbi-intro.pdf 5. Microsoft_Press_ebook_Introducing_Power_BI_PDF_mobile (2).pdf 6. Beginning Microsoft Power BI, 3rd Edition.pdf

MAPPING WITH PROGRAMME OUTCOMES:

	PO01	PO02	PO03	PO04
CO1	S	S	S	-
CO2	S	M	M	S
CO3	S	L	L	M
CO4	M	S	M	S
CO5	S	L	S	S

S-Strong, M- Medium, L – Low