VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(Autonomous)
[AN ISO 9001 : 2015 CERTIFIED INSTITUTIONS]
Affiliated to Periyar University, Approved by AICTE &Re-Accredited with 'A+' Grade by NAAC,
Recognized under section 2(f) & 12(B) of UGC Act, 1956)
ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.)

PG & RESEARCH DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS

BCA

(Bachelor of Computer Applications)

FOR CANDIDATES ADMITTED FROM 2024 – 2025

ONWARDS UNDER AUTONOMOUS – CBCS & OBE PATTERN

Date: 29-04-2024

University Nominee **Subject Expert** **Board Chairman**

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

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)

BCA (BACHALOR COMPUTER APPLICATIONS)
(Candidates admitted from 2024-2025 onwards)

REGULATIONS

I. SCOPE OF THE PROGRAMME

The IT boom and the rapid growth in science and technology have opened up new vistas of job opportunities. The college offers Bachelor of Computer Applications which seeks to equip the learners to meet the spiraling demand of the IT industry. It provides special training in computer application of software's. The syllabus has been designed at a level equal to that of professional courses. Focus is also on developing soft skills of the students.

II. SALIENT FEATURES

- Qualified and Experienced team of faculty members with varied experience in areas of Computer Architecture, Artificial Intelligence, Mobile and Computer Networks, Graphics and Image Processing and Database Management System
- Motivating of students enhanced with immense expertise, massive technical exposure & structured creative initiatives.
- Industrial visits to various renowned companies are arranged to give an exposure to the students
- Students are taught by using Audio Visual aids like OHP's & LCD Projectors and modern E-learning
- Course is specially designed for a higher level Career Placement
- Project work is included in the syllabus to enhance conceptual, analytical & deductive skills

III. OBJECTIVES OF THE PROGRAMME

- To produce a highly qualified professionals impart of both theoretical and practical knowledge in computer systems and its application.
- To produce fully skilled and trained manpower capable of solving the software & hardware problems, and discovering software solutions related to business organizations.
- To provide an in-depth knowledge of specific sub-disciplines chosen by the students as areas of special interest in the form of elective courses.
- The BCA Program is aimed at providing a platform to the students to enhance their skills in various fields of Computer Science & Information Technology like Hardware, Software development, Networking, Database Management & IT enabled services and to facilitate students to interact with IT professionals, Industry Partners & Academicians from IT and related areas.
- The courses is designed to develop computer professionals versatile is use of computers in almost all field of computer application. The main emphasis of the course is an applied computer use in various fields.

IV. ELIGIBILITY FOR ADMISSION

A candidate who has passed in Higher Secondary Examination with Mathematics or Business Mathematics or Computer Science or Computer Application or Statistics (Academic stream or Vocational stream) as one of the subject under Higher Secondary Board of Examination, Tamil Nadu as per norms set by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the syndicate, subject to such conditions as may be prescribed there to are permitted to appear and qualify for the Bachelor of Computer Application degree examination after 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 March.
- 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, Salem.
- Each subject will have four to six hours of lecture per week apart from practical training at the end of each semester.

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	CIA Test I & II (2.5 from each Test)	-	05
2	Model Exam	-	10
3	Assignment	-	05
4	Attendance	-	05
	Total	-	25

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

1	Model Exam	-	20
2	Observation Note	-	10
3	Attendance	-	10
	Total	-	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 the above 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 examination in 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 2023-24 (i.e.,) for the students who are to be admitted to the First year of the course during the Academic year 2023-24 and thereafter.

XII. TRANSITORY PROVISIONS

Candidates who were admitted to the UG course of study before 2021-2022 shall be permitted to appear for the examinations under those regulations for the period of Three yearsie., upto and inclusive of the Examinations of 2023-2024. 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: **(5 x 7 = 35)**	Answer all the questions One Question from each Unit (Either or Type)
PART- C: **(3 x 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)**	

BCA (COMPUTER APPLICATIONS) 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

SEMESTER: I & II

SEM	PART	COURS ECODE	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		Allied Mathematics– I:	4	3	25	75	100
	III	24U1CAC01	**Core I:** Computer Fundamentals And Python Programming	5	4	25	75	100
	III	24U1CACP01	**Core practical I:** Python programming Lab	5	3	40	60	100
	III	23U1ENAC01	Soft Skills For Effective Communication	2	2	25	75	100
	IV	24U1CSAC01	Ability Enhancement Compulsory Course (AECC 1): Introduction to HTML	2	2	25	75	100
	IV	23U1VE01	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		Allied Mathematics– II	4	3	25	75	100
	III	24U2CAC02	**Core II :** Data Structures Using Java	5	4	25	75	100
	III	24U2CACP02	**Core practical II:** Data Structures Using Java Lab	5	3	40	60	100
	III	23U2CSAC02	Ability Enhancement Compulsory Course (AECC 2): Office Automation	2	2	25	75	100
	IV	24U2CAS01	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	English – III	5	3	25	75	100
	III		Allied -III	4	3	25	75	100
	III	24U3CAC03	**Core III :** Database Management System	4	3	25	75	100
	III	24U3CACP03	**Core practical III:** Snow Flak/SQL Base DBMS Lab	3	2	40	60	100
	IV	DSE – I	Discipline Elective - I	4	3	25	75	100
	III	24U3CAC04	Microsoft Power BI	3	3	25	75	100
	IV	NMEC	Non Major Elective – 01	2	2	25	75	100
			Total	**30**	**22**	**215**	**585**	**800**
IV	I	23U4LT04	Foundation Tamil – IV	5	3	25	75	100
	II	23U4LE04	English – IV	5	3	25	75	100
	III		Allied - IV	4	3	25	75	100
	III	24U4CAC05	**Core IV:** Data Analytics using Tableau	4	3	25	75	100
	III	24U4CACP04	Data Analytics using Tableau Lab	3	3	40	60	100
	III	DSE – II	Discipline Elective – II	4	3	25	75	100
	III	24U4CACP05	Data Science Using R Programming Lab	3	2	40	60	100
	IV	NMEC	Non Major Elective – 02	2	2	25	75	100
			Total	**30**	**22**	**230**	**570**	**800**

SEMESTER: V & VI

SEM	PART	COURSECODE	COURSE TITLE	Hrs	CREDIT	MARKS		
						CIA	EE	TOT
V	III	24U5CAC06	Artificial Intelligence Using Python	5	4	25	75	100
		24U5CACP06	Artificial Intelligence Using Python Lab	4	3	40	60	100
	III	24U5CACP07	Microsoft Azure AI Fundamental AI 900 Lab	5	4	40	60	100
	III	DSE – III	Discipline Elective – III	5	4	25	75	100
	III	DSE – IV	Discipline Elective – IV	5	4	25	75	100
	III	24U5CAPR01	Mini Project	4	4	40	60	100
	IV	24U5CAS_	SBEC-II	2	2	25	75	100
	V	24U5CAIN01	Internship	-	1	-	-	-
			Total	**30**	**26**	**220**	**480**	**700**
VI	III	24U6CAC07	Ui path - Automation Robotics	5	4	25	75	100
	III	24U6CACP08	Robotic Process Automation Lab	4	3	40	60	100
	III	24U6CAC08	Mongo DB	5	4	25	75	100
	III	DSE – V	Discipline Elective – V	5	4	25	75	100
	III	DSE – VI	Discipline Elective – VI	5	4	25	75	100
	III	24U6CAPR02	Project Work	4	4	40	60	100
	IV	24U6CAS_	SBEC-III	2	2	25	75	100
	V		Extension Activities	-	1	-	-	-
			Total	**30**	**26**	**205**	**495**	**700**
Grand Total				**180**	**140**	**1300**	**3300**	**4600**

DECIPLINE SPECIFIC ELECTIVES

Course Code	DSE	Course Name	Semester
24U3CADE01	DSE – I	Operating System	Semester: III
24U3CADE02	DSE – I	Fundamentals of Artificial Intelligence	Semester: III
24U3CADE03	DSE – I	Software Engineering	Semester: III
24U4CADE04	DSE – II	Data Science Using R Programming	Semester: IV
24U4CADE05	DSE – II	Internet Of Things	Semester: IV
24U4CADE06	DSE – II	Pervasive Computing	Semester: IV
24U5CADE07	DSE – III	Microsoft Azure AI Fundamental AI 900	Semester: V
24U5CADE08	DSE – III	Quantum Computing	Semester: V
24U5CADE09	DSE – III	Block Chain Technology	Semester: V
24U5CADE10	DSE – IV	Web Application Development	Semester: V
24U5CADE11	DSE – IV	Computer Graphics with multimedia	Semester: V
24U5CADE12	DSE – IV	Compiler Design	Semester: V
24U6CADE13	DSE – V	Big Data Analytics	Semester: VI
24U6CADE14	DSE – V	Computational thinking	Semester: VI
24U6CADE15	DSE – V	Neural Networks and Fuzzy Logic	Semester: VI
24U6CADE16	DSE – VI	Cryptography & Network Security	Semester: VI
24U6CADE17	DSE – VI	Cyber Security	Semester: VI
24U6CADE18	DSE – VI	Ethical Hacking	Semester: VI

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

Course Code	Course Name	Semester
24U2CAS01	Human Computer Interaction	Semester: II
24U2CAS02	Social Media & Security	Semester: II
24U5CAS03	Advanced Excel	Semester: V
24U5CAS04	Professional Ethics	Semester: V
24U6CAS05	Academic Writing and Academic portfolio	Semester: VI
24U6CAS06	Sentiment Analysis	Semester: VI
24U6CAS07	Analytical Skills	Semester: VI

DEPARTMENT OF COMPUTER APPLICATIONS
(BCA)

VISION OF THE DEPARTMENT

To provide high academic goals to the students and make them the world leaders bothin educational and research through effective teaching.

MISSION OF THE DEPARTMENT

- To create, share and apply knowledge in Computer Science including inter disciplinary areas that extends the scope of Computer Science and benefit humanity.
- To educate students to be successful, ethical and effective problem solvers.
- To prepare the students to contribute positively to the economic well being of our region and nation.

PROGRAMME OUTCOMES

K1 : REMEMBER K2 : UNDERSTAND **K3 : APPLY K4 : ANALYZE** **K5 : EVALUATE K6 : CREAT**

PROGRAMME OUTCOMES The graduate will		
POs	**Descriptions**	**Knowledge level**
PO 01	Computer Applications graduates to work effectively both as an individual and a team leader on multi disciplinary projects.	K1
PO 02	Computer Applications Graduates follow ethical principles and norm in developing applications.	K1
PO 03	Inculcates the ability to analyze, identify, formulate and develop computer applications using modern computing tools and techniques.	K2
PO 04	Computer Applications Graduates apply the knowledge of mathematical fundamentals in the field of Computer Application developments.	K2
PO 05	Improves communication skills so that they can effectively present technical information in oral and written reports	K3
PO 06	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practices.	K3
PO 07	Apply ethical principles and commit to professional ethics and responsibilities.	K3

PROGRAMME SPECIFIC OUTCOMES

BCA (COMPUTER APPLICATIONS)

AFTER COMPLETION OF THE PROGRAMME THE GRADUATES WILLBE ABLE TO

PROGRAM SPECIFIC OUTCOME (PSO)

The graduate will

PSOs	DESCRIPTIONS	Knowledge Level
PSO 01	Students have a clear understanding of the concepts of key areas in Computer Applications.	K1
PSO 02	Students are capable to analyze and apply latest technologies to solve problems in the areas of Computer Applications.	K3
PSO 03	It makes them to analyze and synthesis computing systems through quantitative and qualitative techniques.	K4

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

The graduate will

PEOs	DESCRIPTIONS	Knowledge level
PEO 01	Befall an entrepreneur who can afford resolutions & extend software harvest for activity needs.	K3
PEO 02	Engross in life-long learning to acclimatize the technical encroachments in the budding vicinities of Computer Applications.	K4
PEO 03	To provide students with an academic situation that fosters Excellence, intelligibility, and headship and Promote restiveness of life-long learning.	K5
PEO 04	Evolve as globally skilled Computer professionals possessing control dexterity for developing novel solutions in multidisciplinary domains.	K5

Subject Title	COMPUTER FUNDAMENTALS AND PYTHON PROGRAMMING	Semester	I
Subject Code	24U1CAC01	Specialization	CA
Type	Core: Theory	L:T:P:C	5:0:0:5

Course objective:

- Students get basic knowledge of computer fundamentals.
- Students learn about number systems and logic gates.
- Students learn about Circuits and Operating System
- Build basic programs using fundamental programming constructs like variables, conditional logic, looping, and functions
- 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	• Bartee, Thomas C, "Digital Computer Fundamentals", 6th Edition, TMH, 1995. • Mark Lutz, "Learning Python Powerful Object Oriented Programming", O'reilly Media 2018, 5th Edition. • Timothy A. Budd, "Exploring Python", Tata MCGraw Hill Education Private Limited 2011, 1 st Edition. • John Zelle, "Python Programming: An Introduction to Computer Science", Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1590282410
Website/Link	http://bedford-computing.co.uk/learning/wp-content/uploads/2015/10/Introduction-to-Computer-Science-Using-Python.pdf www.tutorialspoint.com/cprogramming/ www.programiz.com/c – programming

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	PYTHON PROGRAMMING LAB	Semester	I
Subject Code	24U1CACP01	Specialization	CA
Type	Core: Practical	L:T:P:C	0:0:5:4

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 Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
24U1CSAC01	INTRODUCTION TO HTML	Skill Enha. Course (SEC)	2	-	-		2	25	75	100

Learning Objectives	
LO1	Insert a graphic within a web page.
LO2	Create a link within a web page.
LO3	Create a table within a web page.
LO4	Insert heading levels within a web page.
LO5	Insert ordered and unordered lists within a web page. Create a web page.

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

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the page formatting. Concept of list	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Creating Links. Know the concept of creating link to email address	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Concept of adding images Understand the table creation.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	"Mastering HTML5 and CSS3 Made Easy", Teach U Comp Inc., 2014.
2	Thomas Michaud, "Foundations of Web Design: Introduction to HTML & CSS"
Web Resources	
1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

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

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

Subject Title	DATA STRUCTURES USING JAVA	Semester	II
Subject Code	24U2CAC02	Specialization	CA
Type	Core: Theory	L:T:P:C	5:0:0:5

Course objective:

- To learn why Java is useful for the design of desktop and web applications.
- To learn how to implement object-oriented designs with Java.
- To impart the basic concepts of data structures and algorithms.
- To acquaint the student with the basics of the various data structures and make the students knowledgeable in the area of data structures.
- 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	12

	Circular linked list: implementation, Double linked list implementation, insertion, deletion and searching operations.	
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 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. 6. G. Brassard and P. Bratley, "Fundamentals of Algorithms", PHI, New Delhi, 1997. 7. A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, "The design and analysis of Computer
Website/Link	https://www.tutorialspoint.com/data_structures_algorithms/tree_traversal.htm https://www.geeksforgeeks.org/introduction-to-recursion-data-structure-and-algorithm-tutorials/ https://www.geeksforgeeks.org/job-sequencing-problem/ 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 – Lo

Subject Title	**DATA STRUCTURES USING JAVA LAB**	**Semester**	**II**
Subject Code	**24U2CACP02**	**Specialization**	**CA**
Type	**Core: Practical**	**L:T:P:C**	**5:0:0:4**

List of Experiments
1. Create a Simple Program Using Array in Java.
2. Create a Simple Program Using Java String.
3. Write a Java Program to Create Multi threading.
4. Write a Java Program to handle Exception Handling.
5. Create Event Handling using Mouse.
6. Create Event Handling using Keyboard.
7. Write a Java program for sorting a given list of names in ascending order.
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	Ability Enhancement Compulsory Course (AECC 2) Soft Skill-2 – Theory	L:T:P:C	2:0:0:2

COURSE OBJECTIVE

- To introduce students with basic concepts of MS- Office application Word, Excel, PowerPoint.

COURSE OUTCOMES

CO Number	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	6
II	**Working with Tables:** Designing and Reviewing a Word Document: Setting Paragraph Indent and Spacing- Inserting Header and footer – Changing Page Setup Option.	K3	6
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	6
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	6
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	6

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	DATABASE MANAGEMENT SYSTEM	Semester	III
Subject Code	24U3CAC03	Specialization	CA
Type	Core: Theory	L:T:P:C	4:0:0:3

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. Understand the basic concepts of Snowflake Database.

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.	K2,K4
CO3	Analyze a given database application scenario to use ER model for conceptual design of the database.	K3
CO4	Apply normalization techniques to improve database design.	K4
CO5	Understand the basic concepts of Snowflake Database.	K4

Unit	Contents	No. of Sessions
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	**Relational Database Design:**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	**Introduction to Snowflake:** Snowflake Schema in Data warehouse Model- Difference between Snowflake Schema And Star Schema -Key Concepts& Architecture-Benefits of snow flake-important functions of Snowflake concepts in Dbms.	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. Snowflake : The Definitive Guide, Joyce Kay Avila,Publisher(s):O'Reilly Media, Inc.ISBN: 9781098103828(Unit V)
Reference Books	1.Elmasri Ramez, Navathe Shamkant B, "Fundamentals of Database Systems", 7th Edition, Pearson, 2016. 2.Ramakrishnan Raghu, Gehrke Johannes, "Database Management Systems", 3rd Edition, McGraw Hill Education, 2014.
Website/Link	1. https://db-book.com 2. https://docs.snowflake.com/en/user-guide/intro-key-concepts 3. https://www.simplilearn.com/what-is-a-snowflake-database-article 4. https://www.geeksforgeeks.org/snowflake-schema-in-data-warehouse model/ 5. https://www.oreilly.com/library/view/snowflake-the-definitive/9781098103811/

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	Snow Flak/SQL Base DBMS Lab	Semester	III
Subject Code	24U3CACP03	Specialization	CA
Type	Core: Practical	L:T:P:C	0:0:3:2

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	Execute Basic SnowFlakeSQL statements for creating and managing tables using DDL.
9	Execute Basic SnowFlakeSQL statements for creating and managing tables using DML.
10	To create a simple Database and Alter the Database using Snowflake.

Subject Title	MICROSOFT POWER BI	Semester	III
Subject Code	24U3CAC04	Specialization	NA
Type	Core: Theory	L:T:P:C	3:0:0:3

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.“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.“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.”Power BI for Beginners”: A Step-by-Step Training Guide Using Best Practice Methodologies 2020 Theta Systems Limited. 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	Power BI for Beginners - 2020.pdf (windows.net) Learn Power BI INTRODUCTION TO MICROSOFT POWER BI: BRING YOUR DATA TO LIFE! (projanco.com) powerbi-intro.pdf Microsoft_Press_ebook_Introducing_Power_BI_PDF_mobile (2).pdf 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

Subject Title	DATA ANALYTICS USING TABLEAU	Semester	IV
Subject Code	24U4CAC05	Specialization	CA
Type	Core: Theory	L:T:P:C	4:0:0:3

Course objective:

1. Understand the foundational concepts of analytics and its application in data visualization using Tableau.
2. Gain proficiency in connecting to and managing various data sources within Tableau.
3. Develop skills in creating basic visualizations such as bar charts, line charts, and geographic visualizations.
4. Learn advanced techniques for data visualization including working with extracts, joins, blends, and filtering data effectively.
5. Acquire knowledge in designing and building interactive dashboards in Tableau for effective data communication and analysis.

CO No.	CO Statement	Knowledge Level
CO1	Ability to articulate the analytics cycle and its relevance in decision-making processes.	K1
CO2	Competence in navigating Tableau's interface and utilizing its features to connect, extract, and manage data sources efficiently.	K2
CO3	Proficiency in creating a variety of visualizations including bar charts, line charts, and geographic representations to effectively communicate insights from data.	K3
CO4	Skill in advanced data manipulation techniques such as joins, blends, and filtering to refine and analyze datasets accurately.	K4
CO5	Capability to design and deploy interactive dashboards in Tableau for sharing insights and facilitating data-driven decision-making within organizations.	K4

Unit	Contents	No. of Sessions
I	Introduction: The cycle of analytics-Connecting to data-Foundations for building visualizations: Measures and dimensions-Discrete and continuous fields-Visualizing data :Bar charts-line charts-Geographic visualizations-Using Show Me-Putting everything together in a Dashboard	12
II	Working with Data in Tableau : Architecture of Tableau- Installation of TableauDesktop-The interface of Tableau – How to start with Tableau?-the Tableau Paradigm – A simple example – Connecting to Data - Managing data source metadata-working with extracts instead of live connections-Creating extracts-Using extracts-Performance-Portability and security-When to use an extract-Tableau file types-Joins and blends-Filtering data	12

III	Basic data visualizations: Comparing values-Bar charts-Bar charts variations-Visualizing dates and time-Relating parts of the Data to the whole-Visualizing distributions-Visualizing multiple axes to compare different measures-Introduction to calculations-Row level calculations-Aggregate level calculations-Level of details calculations	12
IV	Dashboards: Key concepts for Dashboards-Designing Dashboards in Tableau-Dashboard example- Sharing your Dashboards-Publishing to PDF-Export to Pivot Tables and images-Exporting packaged workbooks-Publishing to Tableau server	12
V	Data Analytics: Trends : Customizing trendlines – Trend models-Analyzing trend models- Clustering-Distributions-Forecasting--Introducing Tableau Prep	12

Learning Resources	
Text Books	Joshua N Milligan, "Learning Tableau 2019" Third Edition,Packt Publishing LTD
Reference Books	Jack Hyman, "Tableau for Dummies" Second Edition,John Wiley and Sons, Inc. Daniel G Murray,"Tableau your Data",Second Edition,Wiley
Website/Link	https://help.tableau.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	DATA ANALYTICS USING TABLEAU LAB	Semester	IV
Subject Code	24U4CACP04	Specialization	CA
Type	Core: Practical	L:T:P:C	0:0:3:3

List of Experiments

1	Connect Tableau to a CSV file containing sample sales data.Import the data into Tableau and explore its structure.
2	Explore the imported sales data using various Tableau visualizations.Create bar charts, line charts, and scatter plots to analyze sales trends.
3	Identify and clean any missing or erroneous data in the sales dataset using Tablea
4	Perform data aggregation and create calculated fields for analysis
5	Design a dashboard that includes the bar chart created earlier.Add interactivity features such as filters and actions to the dashboard.
6	Publish the dashboard created earlier to Tableau Public or Tableau Server
7	Import a dataset into Tableau Prep and perform basic cleaning and transformation tasks.
8	Use time series data to forecast future sales using Tableau's forecasting capabilities
9	Create histograms or box plots to analyze the distribution of sales or other variables.
10	Use clustering techniques to segment customers based on purchasing behavior

Subject Title	DATA SCIENCE USING R PROGRAMMING LAB	Semester	IV
Subject Code	24U4CACP05	Specialization	CA
Type	Core: Practical	L:T:P:C	0:0:3:2

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	ARTIFICIAL INTELLIGENCE USING PYTHON	Semester	V
Subject Code	24U5CAC06	Specialization	CA
Type	Core: Theory	L:T:P:C	5:0:0:4

Course objective:

1. To introduce the artificial intelligence (AI) techniques to solve problems and search strategies to find optimal solution paths from start to goal state.
2. To introduces Python programing for solving AI problems.
3. To introduce the AI Agents their design, planning and learning techniques.
4. To introduce the basic data mining and visualization techniques.

CO No.	CO Statement	Knowledge Level
CO1	Understand fundamental AI concepts and identify a range of symbolic and non-symbolic AI techniques.	K1
CO2	Demonstrate an understanding of various AI algorithms	K2,K4
CO3	Use different ML techniques used in AI Applications.	K3
CO4	Demonstrate an understanding of Statistical function used in AI	K4
CO5	Identify problems where artificial intelligence techniques are applicable	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	**Introduction to Artificial Intelligence**: Introduction – Need of AI – Branches of AI - Making machines think like humans - General Problem Solver - Building an intelligent agent - Types of models - Installing Python 3 - Installing on Ubuntu - Installing on Windows.**Fundamental Use Cases for Artificial Intelligence**: Representative AI use cases - Digital personal assistants and chatbots - Personal chauffeur - Uber ATG - Shipping and warehouse management - Human health.	12

IV	**Chatbots**The future of chatbots - Chatbots - Chatbot concepts - A well-architected chatbot - Chatbot platforms - Creating a chatbot using DialogFlow - DialogFlow setup - Integrating a chatbot into a website using Python - How to set up a webhook in DialogFlow - Enabling webhooks for intents - Setting up training phrases for an intent - Setting up parameters and actions for an intent - Building fulfillment responses from a webhook - Checking responses from a webhook.	12
V	**Building Recommender Systems:** Extracting the nearest neighbors-Building a K-nearest neighbors classifier-Computing similarity scores-Finding similar users using collaborative filtering-Building a movie recommendation system. **Heuristic Search Techniques: Introduction**-Uninformed versus informed search-Constraint satisfaction problems-Local search techniques-Simulated annealing-Constructing a string using greedy search-Solving a problem with constraints-Solving the region-coloring problem-Building an 8-puzzle solver.	12

Learning Resources	
Text Books	1. Kenneth A. Lambert, Martin Osborne, "Fundamentals of Python: First Programs, Cengage Learning", second edition, 2018 2. Artificial Intelligence with Python - Second Edition - Alberto ArtasanchezPrateek Joshi. 3. Artificial Intelligence Programming with Python: From Zero to Hero,Perry Xiao published by Wiley
Reference Books	1. Artificial Intelligence with Python - Second Edition - Alberto Artasanchez (Author), Prateek Joshi (Author). 2. AI and Machine Learning for Coders: A Programmer's Guide to Artificial Intelligence 1st Edition by Laurence Moroney (Author).
Website/Link	1. AI-with-Python.pdf 2. AI with Python (tutorialspoint.com) 3. AI With Python Tutorial - GeeksforGeeks 4. Lecture 0 - CS50's Introduction to Artificial Intelligence with Python (harvard.edu)

Mapping with Programme Outcomes

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

S-Strong , M- Medium , L – Lo

Subject Title	ARTIFICIAL INTELLIGENCE USING PYTHON LAB	Semester	V
Subject Code	24U5CACP06	Specialization	NA
Type	Core: Practical	L:T:P:C	0:0:4:3

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 for loading and reading dataset from different types of files(Ex: .csv,.xlsx,.txt)
4. Write a Program to Implement Breadth First Search using Python.
5. Write a Program to Implement Depth First Search using Python.
6. Write a program to implement 8 puzzle problem.
7. Write a program to implement Tic-Tac-Toe game using python.
8. Write a python program to implement simple Chatbot?
9. Write a python program to implement K-nearest neighbors.
10. Write a program to implement Hill Climbing Algorithm

Subject Title	Microsoft Azure Fundamental AI 900 Lab	Semester	V
Subject Code	24U5CACP07	Specialization	NA
Type	Core: Practical	L:T:P:C	0:0:5:4

List of Experiments	
1	Deploy and test various Azure Cognitive Services such as Computer Vision, Speech, and Language Understanding.
2	Utilize Azure Text Analytics to perform sentiment analysis on a given dataset of text documents.
3	Train a custom image classification model using Azure Custom Vision and evaluate its performance.
4	Build a simple speech recognition application using Azure Speech Services.
5	Develop a language translation application using Azure Translator Text API to translate text between multiple languages.
6	Create a basic chatbot using Azure Bot Service and integrate it with various channels like Teams or Web Chat.
7	Implement an anomaly detection system using Azure Anomaly Detector API on a time-series dataset.
8	Build a recommendation system using Azure Personalizer to provide personalized recommendations to users.
9	Use Azure Text Analytics Named Entity Recognition to identify and classify entities in a given text.
10	Develop a face recognition system using Azure Face API to detect and identify faces in images or video streams.

Subject Title	Ui path - Automation Robotics	Semester	VI
Subject Code	24U6CAC07	Specialization	NA
Type	Core: Theory	L:T:P:C	5:0:0:4

Course objective:

- To understand basic concepts of RPA.
- To Describe IIPA, where it can be applied and how it implemented .
- To Describe the different types of variables,Control Flow and data manipulation techniques.
- To Understand Image, Text and Data Tables Automation.
- To describe various types of Exceptions and strategies to handle.

CO No.	CO Statement	Knowledge Level
CO1	Understand the basic concepts of RPA	K1
CO2	Describe various components and platforms of RPA	K2
CO3	To Describe the different types of variables, control flow and data manipulation techniques.	K3
CO4	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 down sides 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 – CognitiveAutomation – Agile ,Scrum , Kanbanand Waterfall 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	12

	(with a step-by-step example).	
IV	Taking Control of the Controls- Finding and attaching windows- Finding the control- Techniques forwaiting for a control- Act on controls - mouse and keyboard activities- Working with Ui Explorer-Handling events – Revisit recorder – Screen Scraping -WhentouseOCR-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 Automationl land book : A Guide to Implementing RPA Systems ,2020 ,lSBN-13 (electronic) : 978-7-4842-5729-6, Publisher : Apress. 2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher : Packt Publishing Release Date : March 2018 ISBN:9787788470940.
Reference Books	1. Frank Casale, Rebecca Dilla, IieidiJaynes, LaurenLivingston, "lntroduction to Robotic Process Automation : a Primer", Institute of Robotic Process Automation. 2. Richard Murdoch, I {obotic Process Automation : Guide' Io Building Software Robots, 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	1. https:/fivrvw.rripatl:.r:onr/r'pa/;'ol;otic-pl'occss-ailtt:r'r:irtiou

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	ROBOTIC PROCESS AUTOMATION LAB	Semester	VI
Subject Code	24U6CACP08	Specialization	CA
Type	Core : Practical	L:T:P:C	0:0:4:3

LIST OF EXPERIMENTS
PART-A
1. Download, Install and Activate Ui- Path Studio .Learn all the basics of RPA (Variables, arguments and Control flow etc.)
2. Write a program to perform if-activity ,switch-activity.
(Suggested Hint: Find the smallest and biggest numbers in an array.)
3. Write a program to perform while activity, do-while activity, for-each activity. (Suggested Hint : how an integer variable will increase from 5 to 50 in increments of 5.)
4. Write a program to perform Flowchart and Sequence activity on Scalar variables.
5. Write a program to perform Flowchart and Sequence activity on Collection variables.
6. Write a program to
i)build a data table(static)
ii) build a data table using data scraping(Dynamically)
7. Write a program to implement Arithmetic operations in 2Excelfiles.
8. Write a program to read an Excel file and creating a data table by using data from the Excel file
9. Write a program for acting on controls using mouse and keyboard activities.
10. Write a program for screen scraping using OCR
11. Write a program to extract Email Address
PART-B
Develop a bot of the following 4 applications
12. Implement Amazon Data Scraping.
13. Email Automation.
14. Transferring Data from one system to another.
15. Forms Processing

Subject Title	MONGODB	Semester	VI
Subject Code	24U6CAC08	Specialization	CA
Type	Core: Theory	L:T:P:C	5:0:0:4

Course objective:

1. Understand Mongo DB's fundamentals, including its architecture and basic CRUD operations.
2. Master advanced querying techniques such as aggregation pipelines & geospatial queries.
3. Learn scalability strategies like indexing, shading, & replication for optimal performance.
4. Develop proficiency in data modeling and schema design to build robust MongoDB databases.
5. Gain practical skills to integrate MongoDB into real-world applications and deploy them effectively.

CO No.	CO Statement	Knowledge Level
CO1	To provide students the right skills and knowledge needed to develop Applications MongoDB	K1
CO2	To provide students the right skills and knowledge needed to run on Applications	K1, K2
CO3	Explain the detailed architecture, define objects, load data, query data and performance	K2, K3
CO4	Understand replication and sharding in MongoDB	K4
CO5	To learn about deployment and administration	K5

Unit	Contents	No. of Hours
I	A database for the modern web: Born in the cloud - MongoDB's Key Features - MongoDB's core server and Tools - Why MongoDB – MongoDB through the JavaScript shell: - Diving into the MongoDB shell - Creating and querying with indexes - Basic administration - Writing programs using MongoDB: - MongoDB through the Ruby lens - How the drivers work - Building a simple application.	14
II	Document-oriented data: Principles of schema design - Designing an E-Commerce data model - Nuts and bolts on databases, collections, and documents - Queries and aggregation: E-commerce queries - MongoDBs query language - Aggregating orders - Aggregation in detail.	12
III	A brief tour of document updates - E-commerce updates - Atomic document processing - Nuts and bolts: MongoDB updates and deletes. - Indexing and	12

	query optimization: Indexing theory - Indexing in practice - Query optimization.	
IV	Replication: Replication overview - Replica sets - Master-slave replication - Drivers and replication - Sharding: Sharding overview - A sample shard cluster- Querying and indexing a shard cluster - Choosing a shard key - Sharding in production.	12
V	Deployment - Monitoring and diagnostics – Maintenance - Performance troubleshooting - Design patterns - MongoDB in PHP, Java, and C++ - Spatial indexing.	10

Learning Resources	
Text Books	Kyle Banker "MongoDB in Action" Manning Publications Co, 2012. Rick Copeland "MongoDB Applied Design Patterns", 1st Ed, O-Reilly Media Inc, 2013.
Reference Books	Gautam Rege (2012). Ruby and MongoDB Web Development Beginners Guide. Packt Publishing Ltd. David Hows (2009) The definitive guide to MongoDB, 2nd edition, Apress Publication
Website/Link	https://www.mongodb.com https://www.geeksforgeeks.org/mongodb/ https://www.w3schools.com/mongodb/ 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 – Lo

Subject Title	OPERATING SYSTEMS	Semester	III
Subject Code	24U3CADE01	Specialization	CA
Type	Elective : Theory	L:T:P:C	4:0:0:3

Course objective:

1. To introduce students with basic concepts of Operating System, its functions and services.
2. To familiarizethe students with various views and management policies adopted by O.S.
3. Pertaining with processes, Deadlock, Memory, File and I/O operations

CO No.	CO Statement	Knowledge Level
CO1	Analyze the structure of OS and basic architectural components involved in OS design	K1
CO2	Analyze and design the applications to run in parallel either using process or thread models of different OS	K2,K4
CO3	Organize the various device and resource management techniques for time sharing and distributed systems	K3
CO4	Explain the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system	K4
CO5	Interpret the mechanisms adopted for file sharing in distributed Applications	K4

Unit	Contents	No. of Sessions
I	Operating System Objectives and Functions. History of Operating System: First, Second, Third & Fourth Generation Operating System. Types of Operating System: Main Frame - Server - Multiprocessor -Personal Computer - Embedded - Real-Time Operating System. The Evolution of Operating System	12
II	Threads: Process and Threads - Multithreading - Thread Functionality - Mutual Exclusion and Synchronization: Principles of Concurrency - Mutual Exclusion - Semaphores. Deadlock and Starvation:Resources - Principles of Deadlock - Deadlock Detection and Recovery - Deadlock Avoidance and Prevention.	12
III	Memory Management Requirements - Memory Partitioning - Paging - Segmentation. Virtual Memory: Hardware and Control Structures. Operating System Software: Fetch Policy - Placement Policy -Replacement Policy - Basic Algorithms - Page Buffering.	12
IV	Types of Scheduling: Long Term Scheduling - Medium Term Scheduling - Short-Term Scheduling. Scheduling Algorithm: Short Term Scheduling Criteria - The Use of Priorities - Alternative Scheduling Policies. File Management: Overview - File Organization and Access - File Sharing - Record Blocking - Secondary Storage Management.	12

V	The Evolution of the I/O function-Direct Memory Access. I/O Buffering: Single Buffer-Double Buffer-Circular Buffer-The Utilities of Buffering. Disk Scheduling: Disk Performance Parameters-Disk Scheduling Polices-RAID. Case Study: Windows OS, Linux OS, and MAC OS	12

Learning Resources	
Text Books	Operating Systems Internals and Design Principles" by William Stallings, Second Edition, PHI Learning Private Limited, New Delhi, 2012.
Reference Books	Modern Operating Systems" by Andrew S. Tanenbaum, Third Edition, PHI Learning Private Limited, NewDelhi, 2011.
Website/Link	http://faculty.salina.k-state.edu/tim/ossg/Introduction/OSrole.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	FUNDAMENTALS OF ARTIFICIAL INTELIGENCE	Semester	III
Subject Code	24U3CADE02	Specialization	CA
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 or outcomes by using decision making techniques.	K4
CO5	Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area.	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 Back wand Reasoning-Matching,	12
IV	Symbolic and Statistical Reasoning: Introduction to Non monotonic Reasoning - Logics for Non monotonic Reasoning-Implementation Issues -Probability and Bayes Theorem-Certainty Factors and Rule-based Systems-Bayesian Networks-Dumpster-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	Artificial Intelligence: A Guide to Intelligent Systems" by Michael Negnevitsky "Artificial Intelligence: Structures and Strategies for Complex Problem Solving" by George F. Luger 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	SOFTWARE ENGINEERING	Semester	III
Subject Code	24U3CADE03	Specialization	CA
Type	Elective : Theory	L:T:P:C	4:0:0:3

Course objective:.

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 ofSoftware, 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.	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 andanalysis, Requirements validation, Requirements management.	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, Design evolution.	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 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	12

	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.	**12**

Learning Resources	
Text Books	1. Software Engineering: A Practitioner's Approach Roger S. Pressman 20th Anniversary Edition FIFTH EDITION. 2. Rajib Mall Fundamentals of Software Engineering Prentice Hall of India Pvt Ltd, 3 rd Edition 2010. 3. Srinivasan Desikan, Gopalaswamy Ramesh- Software Testing Principles and Practices, Pearson Education,2012.
Reference Books	1. Software Engineering, 10/e May 2017 by Ian Sommerville (Author) "Think Like A Programmer" by V. Anton Spraul 2. Rajib Mall Fundamentals of Software Engineering Prentice Hall of India Pvt Ltd, 3 rd Edition 2010. 3. Sandeep Desai, Abhishek Srivastava Software Testing: A Practical Approach PHI Learning Pvt. Ltd, 2012. 4. David Burns Selenium 2 Testing Tools: Beginners Guide Tata MCGraw Hill Edition, 2012.
Website/Link	**https://spoken-tutorial.org/tutorial** **www.w3schools.com** **https://www.coursera.orgN** **www.softwareengineerinsider.com/articles/what-is-software-engineering.html.** **https://www.udemy.com/courses/development/software-engineering.** **https://www.tutorialspoint.com/software_testing/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	DATA SCIENCE USING R PROGRAMMING	Semester	IV
Subject Code	24U4CADE04	Specialization	CA
Type	Elective : Theory	L:T:P:C	4:0:0:3

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,intergrating 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	12

	R Program - The R Script File - operators in R - Variables in R - R Data Structures.	
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 and mohamed 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

	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	24U4CADE05	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	**Introduction** Introduction to IoT: Definition & characteristics of IoT– Physical Design of IoT: Things in IoT, IoT protocols. Logical Design of IoT: IoT functional blocks – IoT Communication Models.	12
II	**IoT enabled Technologies** Wireless Sensor Networks, Cloud computing, Big data Analytics,Communication protocols, Embedded Systems. IoT Levels & Deployment Templates.	12
III	**Domain Specific IoTs:** Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.	12
IV	**IOT Platforms design methodology** IOT Platforms design methodology - Introduction, IOT Design methodology – Case study on IoT system for weather monitoring.	12
V	**IoT Systems logical design using Python:** Introduction- Installing python - Python data types and data structures - Control Flow – Functions – Modules – Packages – File Input / Output – Date / Time Operations – Classes.	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

S-Strong , M- Medium , L – Low

Subject Title	PERVASIVE COMPUTING	Semester	IV
Subject Code	24U4CADE06	Specialization	CA
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.
5. To Understand Interaction Design – HCI and Wearable Computing Environment.
6. To identify Security Challenges & Ethics in Pervasive Computing

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, 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, Modelling Context-Aware Systems, Mobility awareness, spatial	12

	awareness, temporal awareness: Coordinating and scheduling, ICT system awareness, Middleware Support	
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: Autonomy and Self1determination, Responsibility: legal, moral & social, distributive justice, digital divide and sustainable development	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 Perspective‖", 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%5CFundamentalsOfMobilePe r 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	MICROSOFT AZURE AI FUNDAMENTAL AI 900	Semester	V
Subject code	24U5CADE07	Specialization	CA
Type	Elective: Theory	L:T:P:C	5:0:0:4

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 to Artificial Intelligence Workloads and Responsible AI** **Features of Common AI Workloads -** Anomaly Detection Workloads - Computer Vision Workloads - Natural Language Processing Workloads - Knowledge Mining Workloads. **Guiding Principles for Responsible AI -** Fairness in AI Solutions - Reliability and Safety in AI Solutions - Privacy and Security in AI Solutions - Inclusiveness in AI Solutions - Transparency in AI Solutions - Accountability in AI Solutions.	12
II	**Fundamentals of Machine Learning on Azure** **Common Machine Learning Types -** Regression Scenarios - Classification Scenarios - Clustering Scenarios. **Core Machine Learning Concepts -** Features and Labels in a Dataset - Training and Validation Datasets. **Capabilities of Visual Tools in Azure Machine Learning Studio -** Automated Machine Learning - Azure Machine Learning Designer.	12
III	**Computer Vision Workloads on Azure** **Common Types of Computer Vision Solutions -** Image Classification - Object Detection - Optical Character Recognition (OCR) - Facial Detection and Analysis.	12

	Azure Tools and Services for Computer Vision - Computer Vision Service - Custom Vision Service - Face Service - Form Recognizer Service.	
IV	**Natural Language Processing (NLP) Workloads on Azure Common NLP Workload Scenarios -** Key Phrase Extraction - Entity Recognition - Sentiment Analysis - Language Modeling - Speech Recognition and Synthesis –Translation. **Azure Tools and Services for NLP Workloads -** Language Service - Speech Service - Translator Service.	12
V	**Conversational AI Solutions on Azure** - Features and Uses for Bots- Capabilities of Power Virtual Agents and Azure Bot Service.	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	QUANTUM COMPUTING	Semester	V
Subject code	24U5CADE08	Specialization	CA
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.
- Goal of understanding basic quantum algorithms and analyzing them.
- Also addresses limitations of quantum algorithms and introduces the necessary tools.

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 PROGRAM 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
	S	S	M	L

S-Strong , M- Medium , L – Low

Subject Title	BLOCK CHAIN TECHNOLOGY	Semester	III
Subject Code	24U5CADE09	Specialization	NA
Type	Elective : Theory	L:T:P:C	5:0:0:4

Course objective:

- Impart strong technical understanding of Block chain technologies
- Develop familiarity of current technologies, tools, and implementation strategies
- Introduce application areas, current practices, and research activity.

CO No.	CO Statement	Knowledge Level
CO1	Understand the types, benefits and limitation of block chain.	K1
CO2	Explore the block chain decentralization and cryptography concepts.	K2,K4
CO3	Enumerate the Bitcoin features and its alternative options.	K3
CO4	Describe and deploy the smart contracts.	K4
CO5	Summarize the block chain features outside of currencies.	K4

Unit	Contents	No. of Sessions
I	**Introduction to Blockchain&Crypto currencies:** Blockchain- Public Ledgers, Blockchainas Public Ledgers- Bitcoin,Blockchain2.0, Smart Contracts, Blockin a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain-Cryptographic Hash Functions–Hash Pointers and Data Structures – Digital Signatures – Public Keys as Identities – A Simple Cryptocurrency.	12
II	**How Bitcoin Achieves Decentralization:** Centralization vs. Decentralization-Distributed consensus–Consensus without identity using a blockchain-Incentives and proof of work.	12
III	**Mechanics of Bitcoin:** Bit coin transactions – Bit coin Scripts – Applications ofBitcoinscripts–Bitcoinblocks–TheBitcoinnetwork-Limitationsandimprovements.	12
IV	**How to Store and Use Bitcoins:** Simple Local Storage – Hot and Cold Storage –Splitting and Sharing Keys–Online Wallets and Exchanges–Payment Services–Transaction Fees– Currency Exchange Markets.	12

V	**Community, Politics, and Regulation:** Consensus in Bit coin – Bitcoin Core Software – Stakeholders: Who's in Charge? – Roots of Bitcoin – Governments Notice Bitcoin – Anti Money-Laundering – Regulation – New York's Bit License Proposal**.**	

Learning Resources	
Text Books	1.ArvindNarayanan, JosephBonneau, EdwardFelten, Andrew Miller, and Steven Goldfeder.“Bitcoinand cryptocurrency technologies: a comprehensive introduction”. Princeton University Press, 2016.
Reference Books	1.Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies", John Wiley & Sons, Inc., 2013. 2. Tom White, "Hadoop: The Definitive Guide", Reilly Publications, 2011. 3. Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012. 4. Russell Bradberry, Eric Blow, "Practical Cassandra A developers Approach", Pearson Education, 2014.
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	WEB APPLICATION DEVELOPMENT	Semester	V
Subject code	24U5CADE10	Specialization	CA
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	NO. OF SESSIONS
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	12
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.	12
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.	12
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.	12

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.	**12**

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, aScript,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	24U5CADE11	Specialization	CA
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 – GUI- Video Display Devices – CRT – Raster and Random scan displays – Input Devices – Hard copy Devices – Line Drawing Algorithm – DDA Algorithm – Line Function – Circle Generating Algorithm.	12
II	Line Attributes – Curve Attributes – Color and Gray Scale Levels – Area Fill Attributes – Character Attributes – Bundled Attributes. Basic Transformations – Matrix Representatives – Composite 2D Transformations- Translation – Rotation – Scaling – Reflection and Shearing. Graphics:	12
III	3D Transformations – Viewing Pipeline – Viewing Functions – point Clipping and Line Clipping – Cohen Sutherland Line Clipping – Polygon Clipping – Sutherland Hodgeman Clipping – Curve and Text Clipping – Exterior Clipping.	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. Donald Hearn M. Pauline Baker, Computer Graphics C Version, 2nd edition, Pearson Education, 2014. 2. 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 3. "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. • "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	24U5CADE12	Specialization	CA
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 symboltable - 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	nciples of Complier Design by Alfred V.Aho, Jeffrey D.Ullman , Narosa Publications House.
REFERENCE BOOKS	dern 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	24U5CADE13	Specialization	CA
Type	Elective: Theory	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work, â€¢ .
- To securely interact with them,â€¢ Design, build, and deploy smart contracts and distributed applications,

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understanding the basic concepts of data science and its functions	K1
CO2	Exploring cluster analysis methods	K2,K4
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 Isnâ€™t? 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-comparison 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	Introduction to Hadoop : 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- Managing resources and Applications with Hadoop YARN-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. Economy.	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 & Sons, Inc., 2013. 2. Tom White, "Hadoop: The Definitive Guide", Oâ€™Reilly Publications, 2011. 3. Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012. 4. Russell Bradberry, Eric Blow, "Practical Cassandra A developers Approach", Pearson Education, 2014.
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

	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	COMPUTATIONAL THINKING	Semester	VI
Subject code	24U5CADE14	Specialization	CA
Type	Elective: Theory	L:T:P:C	5:0:0:4

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	24U5CADE15	Specialization	CA
Type	Elective: Theory	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

6. The main objective of this course is to provide the student with the basic understanding of neural networks and fuzzy logic fundamentals,
7. Program the related algorithms and Design the required and related systems.
8. Biological motivation to design intelligent systems and control
9. Study the learning strategies of Artificial Neural networks and theirϖ 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	Neural Networks and Fuzzy System-dynamical System approach to machine intelligent, Bart Kosko University of Southern California LauranceFausett, Englewood cliffs, N.J., "Fundamentals of Neural Networks", PearsonEducation, New Delhi, 2008
WEBSITE/LINK	ieeexplore.ieee.org 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	CRYPTOGRAPHY AND NETWORK SECURITY	Semester	VI
Subject Code	24U6CADE16	Specialization	CA
Type	Elective: Theory	L:T:P:C	5:0:0:4

Course objective:

1. To understand basics of Cryptography and Network Security.
2. To be able to secure a message over insecure channel by various means.
3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. To understand various protocols for network security to protect against the threats in the networks.

CO No.	CO Statement	Knowledge Level
CO1	Explain the various security aspects and its importance	K1
CO2	Outline the several types of security attacks and various cryptographic algorithms	K1,k2
CO3	Summarize about message authentication and security practices.	K2,k3
CO4	Apply symmetric key and public key cryptographic algorithms to perform the process of cryptography.	K4
CO5	Analyze the various cryptographic algorithms and apply them accordingly	K4,k5

Unit	Contents	No. of Hours
I	Computer security concepts-The OSI Security Architecture- Security attacks-security services-Security Mechanisms – A model for Network Security. Classical Encryption Techniques: Symmetric Cipher model.	12
II	Block Ciphers and the Data Encryption Standard: Block cipher Principles-The Data Encryption Standard-A Des Example- Strength of DES – Block cipher design principles.	12
III	ASYMMETRIC KEY CIPHERS: Primes – Primality Testing-Fermat's and Euler's Theorem - Public key Cryptography and RSA: Principles of public key crypto systems. RSA Algorithm.	12
IV	Data Integrity Algorithms: Simple Hash function – Security of hash function – SHA. Authentication requirement – Authentication function – MAC. Digital signature and authentication protocols – DSS- user Authentication.	12

V	SECURITY PRACTICE AND SYSTEM SECURITY: Electronic Mail security – PGP, S/MIME – IP security .SYSTEM SECURITY: Intruders – Malicious software – Firewalls.	**12**

Learning Resources	
Text Books	1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI3rd Edition, 2006.
Reference Books	2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007. 3. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and NetworkSecurity, Wiley India Pvt.Ltd
Website/Link	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview https://onlinecourses.swayam2.ac.in/arp19_ap79/preview

Mapping with Programme Outcomes

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
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	CYBER SECURITY	Semester	VI
Subject code	24U6CADE17	Specialization	NA
Type	Elective : 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	ETHICAL HACKING	Semester	VI
Subject code	24U6CADE18	Specialization	CA
Type	Elective: Theory	L:T:P:C	5:0:0:4

COURSE OBJECTIVE:

1. To understand the fundamental concepts of computer system, including hardware and software.
2. To Design, and analyze precise specifications of algorithms, procedures, and interaction behavior.
3. To apply the appropriate technologies, skills and tools in various fields of Computer Science.
4. 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	ieeexplore.ieee.org 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	HUMAN COMPUTER INTERACTION	Semester	II
Subject Code	24U2CAS01	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

Subject title	Social Media & Security	Semester	V
Subject code	24U2CAS02	Specialization	CA
Type	SBEC : Theory	L:T:P:C	2:0:0:2

COURSE OBJECTIVE:

To equip students with the knowledge and skills to analyze, manage, and mitigate security risks associated with social media platforms, ensuring safe and ethical use in both personal and professional contexts.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	**Understanding Risks**: Identify and assess the security threats and vulnerabilities associated with social media platforms.	K1
CO2	**Privacy Protection**: Learn techniques to safeguard personal and organizational information on social media.	K2
CO3	**Incident Response**: Develop skills to detect and respond to social media-based cyberattacks	K3
CO4	**Policy Development**: Create and implement security policies for safe social media use.	K4
CO5	**Tool Utilization**: Use specialized tools to monitor and secure social media activities effectively.	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	Introduction to Social Media, Understanding Social Media, Different Types and Classifications, The Value of Social Media, Cutting Edge Versus Bleeding Edge, The Problems That Come With Social Media, Is Security Really an Issue? Taking the Good With the Bad.	6
II	Dark side Cybercrime, Social Engineering, Hacked accounts, cyberstalking, cyberbullying, predators, phishing, hackers.	6
III	Being bold versus being overlooked Good social media campaigns, Bad social media campaigns, sometimes it's better to be overlooked, Social media hoaxes, The human factor, Content management, Promotion of social media.	8
IV	Risks of Social media Introduction Public embarrassment, Once it's out there, it's out there False information, Information leakage, Retention and archiving, Loss of data and equipment.	4
V	Policies and Privacy Blocking users controlling app privacy, Location awareness, Security Fake accounts passwords, privacy and information sharing..	6

LEARNING RESOURCES	
Text books	1. Interdisciplinary Impact Analysis of Privacy in Social Networks, Recognizing Your DigitalFriends, Encryption for Peer-to-Peer Social Networks Crowd sourcing and Ethics, Authors:Altshuler Y, EloviciY, Cremers A.B, Aharony N, Pentland A. (Eds.). 2.SocialMediasecurity

	Https://www.sciencedirect.com/science/article/pii/B97815974998660000
Reference books	1. Michael Cross, Social Media Security Leveraging Social Networking While Mitigating Risk. 2. Online Social Networks Security, Brij B. Gupta, Somya Ranjan Sahoo, Principles, Algorithm, Applications, and Perspectives, CRC press.
Website/link	Website/ Link https://www.trendmicro.com/en_in/research/21/f/best-practices-for-social-media security.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	Advanced Excel	Semester	V
Subject code	24U5CAS03	Specialization	CA
Type	SBEC : Theory	L:T:P:C	2:0:0:2

COURSE OBJECTIVE:

The objective of this course is to help the students learn the advanced features of Excel, to summarise, analyse, explore, and present visualisations of data in the form of charts, graphs.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Handle large amounts of data	K1
CO2	Aggregate numeric data and summarise into categories and subcategories	K2
CO3	Filtering, sorting, and grouping data or subsets of data	K3
CO4	Create pivot tables to consolidate data from multiple files	K4
CO5	Presenting data in the form of charts and graphs	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	Basics of Excel – Customizing common options – Absolute and relative cells – Protecting and un-protecting worksheets and cells – Working with Functions – Writing conditional expressions – logical functions – lookup and reference functions: VlookUP with Exact Match, Approximate Match, – Using VLookUP to consolidate Data from Multiple Sheets.	6
II	Data Validations - Specifying a valid range of values - Specifying a list of valid values – Specifying custom validations based on formula – Working with Templates – Designing the structure of a template - Sorting and Filtering Data - Sorting tables – multiple-level sorting - custom sorting - Filtering data for selected view - advanced filter options.	6
III	Creating Pivot tables Formatting and customizing Pivot tables – advanced options of Pivot tables – Pivot charts – External data sources – data consolidation feature to consolidate data – Show Value As % of Row, % of Column, Running Total, Compare with Specific Field – Viewing Subtotal under Pivot.	8
IV	More Functions: Date and time functions – Text functions – Database functions – Power Functions – Formatting Using auto formatting option for worksheets – Using conditional formatting option for rows, columns and cells – WhatIf Analysis – Data Tables.	4
V	Charts: Formatting Charts – 3D Graphs – Bar and Line Chart together – Secondary Axis in Graphs – Sharing Charts with PowerPoint / MS Word, Dynamically – Inline Charts, data Charts – Overview of all the new features.	6

LEARNING RESOURCES	
Text books	1. Excel 2019 All-in-One For Dummies – 2018- Greg Harvey
Reference books	1.Microsoft Excel 2019 Pivot Table Data Crunching-2019,Bill Jelen and Michael Alexander 2. **"Excel 2019 Bible"Author**: Michael Alexander, Richard Kusleika, and John Walkenbach,**Publisher**: Wiley,**Publication Year**: 2018 **3."Excel Power Pivot & Power Query For Dummies" Author**: Michael Alexander **Publisher**: WileyN **Publication Year**: 2016
Website/link	1) https://www.tutorialspoint.com/advanced_excel/advanced_excel_tutorial.pdf 2) https://www.coursera.org/learn/excel-advanced 3) https://www.upgrad.com/blog/advanced-excel-formulas-a-must-know-for-all-professionals/

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	Sentiment Analysis	Semester	VI
Subject Code	24U6CAS06	Specialization	CA
Type	SBEC : Theory	L:T:P:C	2:0:0:2

Course objective:

To introduce to computational study of people's opinions, sentiments, emotions, moods, andattitudes

CO No.	CO Statement	Knowledge Level
CO1	To understand the underlying structure of the problem commonly used to express opinions, sentiments, and emotions	K1
CO2	To understand the underlying structure of the language constructs commonly used to express opinions, sentiments, and emotions	K2,K4
CO3	To understand core areas of sentiment analysis	K3
CO4	To understand rules and extraction of entity in sentiment analysis	K4
CO5	To understand sentiment lexicon generation	K4

Unit	Contents	No. of Sessions
I	Introduction, Sentiment analysis applications, Sentiment analysis research, Sentiment analysis as mini-NLP,The Problem of Sentiment Analysis, Definition of opinion, Definition of opinionsummary.	6
II	Different types of opinions, Document Sentiment Classification, Supervised sentiment classification, Unsupervised sentiment classification, Sentiment rating prediction, Cross-Domain Sentiment Classification, Cross-Language Sentiment Classification.	6
III	Sentence Subjectivity and Sentiment Classification, Subjectivity, Sentence Subjectivity Classification, Sentence Sentiment Classification, Aspect Sentiment Classification	6
IV	Rules ofSentiment composition, Negation and Sentiment, Aspect and Entity Extraction, Frequency based aspect extraction, Exploring syntactic relations, Using supervised learning	6
V	Sentiment Lexicon Generation, Dictionary based approach, Corpus based approach, Sentiment word embedding, Analysis of Comparative Opinions, Problem definition, Identifying comparative sentences, Identifying the preferred entity set, Special types of comparison	6

Learning Resources	
Text Books	Sentiment Analysis: Mining Opinions, Sentiments, and Emotions, by Bing Liu
Reference Books	1. Sentiment Analysis in Social Networks By Federico Pozzi, Elisabetta Fersini, EnzaMessina, Bing Liu · 2016 2. Sentiment Analysis for Social Media, Antonio Moreno, Carlos A. Iglesias, MDPI 2020 3. New Opportunities for Sentiment Analysis and Information Processing, AakanshaSharaff, G. R. Sinha, Surbhi Bhatia, IGI Global, 2021 4. Sentiment Analysis and Knowledge Discovery in Contemporary Business, Dharmendra Singh Rajput, Ramjeevan Singh Thakur, S. Muzamil Basha, IGI Global, 2018
Website/Link	https://www.analyticsvidhya.com/blog/2021/06/nlp-sentiment-analysis/ https://www.geeksforgeeks.org/what-is-sentiment-analysis/

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	ANALYTICAL SKILLS	Semester	VI
Subject code	24U6CAS07	Specialization	CA
Type	SBEC : Theory	L:T:P:C	2:0:0:2

COURSE OBJECTIVE:

Intended to inculcate quantitative analytical skills and reasoning as an inherent ability in students.

CO NO.	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand the basic concepts of arithmetic ability, quantitative ability, logical reasoning, business computations and data interpretation and obtain the associated skills.	K1
CO2	Apply the skills and competencies acquired in the related areas	K2
CO3	Analyze the problem and use logic to interpret and handle different situations	K3
CO4	Solve problems pertaining to quantitative ability, logical reasoning and verbal ability inside and outsidethe campus.	K4
CO5	Acquire competency in the use of verbal reasoning	K4

UNIT	CONTENTS	NO. OF SESSIONS
I	Number system: Types of numbers, rules of divisibility, multiplicity and squaring of numbers, HCF and LCM of numbers. Average: Average of numbers, Arithmetic Mean, Real-life examples of average, Application1based questions	6
II	Number series: Series Completion, Analogy, Classification. Coding-Decoding: Letter Coding, Direct Letter Coding, Number / Symbol Coding, deciphering message word codes, number and symbol codes for messages	6
III	Percentage: Concept of Percentage, Comparison based questions, Application-based questions. Profit and Loss: Profit or Loss, Cost price, Selling price, Calculation of profit and loss percent, Application-based questions, conceptual formulae.	6
IV	Simple interest: the concept of simple interest, general formulas, application-based questions. Compound interest: basic concepts and formula-based questions, the difference between simple interest and compound interest	6
V	Alphabet Test: Alphabetical order of words, Letter-word problems, Word formation by unscrambling letters. Number Test: Number Test, Position switching of numbers. Blood Relation: Coded Relations, relation-based puzzle.	6

LEARNING RESOURCES	
Text books	1. A MODERN APPROACH TO NON-VERBAL REASONING by R S AGGARWAL, S Chand Publishing 2. QUANTITATIVE APTITUDE FOR COMPETITIVE EXAMINATIONS by R S AGGARWAL, S Chand Publishing 3. QUANTITATIVE APTITUDE by ABHIJIT GUHA, Tata McGraw Hill, India
Reference books	1. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Ramnagar,New Delhi-110055 2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers. 3. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw HillPublications
Website/link	1) What Are Analytical Skills? Definition and Examples - Forage (theforage.com) 2) What Are Analytical Skills? 9 Examples & Tips to Improve (betterup.com) 3) 7 Steps To Improve Your Analytical Thinking Skills (talentbridge.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