SEMESTER: I									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22CAB01	Advanced Data Structures and Algorithms	PC	NIL	3	3	0	0	3
2	22CAB02	Operating Systems	PC	NIL	3	3	0	0	3
3	22CAB03	Computer Networks	PC	NIL	3	3	0	0	3
4	22CAB04	Cloud Computing	PC	NIL	3	3	0	0	3
5	22CAB05	Python Programming	PC	NIL	3	3	0	0	3
6	22CAB06	Database Management System	PC	NIL	3	3	0	0	3
PRACTICAL									
7	22CAP01	Advanced Data Structures and Algorithms Laboratory	PC	NIL	4	0	0	4	2
8	22CAP02	Database Management System Laboratory	PC	NIL	4	0	0	4	2
9	22CAE01	English for Pragmatic Usage	EEC	NIL	2	0	0	2	1
				TOTAL	28	18	0	10	23

SEMESTER: II									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22CAA01	Probability and Statistics for Computer Science	FC	NIL	3	3	0	0	3
2	22CAB07	Data Mining and Data Warehousing	PC	22CAB06	3	3	0	0	3
3	22CAB08	Programming in Java	PC	NIL	3	3	0	0	3

4	22CAB09	Big Data Analytics	PC	NIL	3	3	0	0	3
5	E1	Elective – I	PE	Ref. PE	3	3	0	0	3
6	E2	Elective – II	PE/OE	Ref. PE/OE	3	3	0	0	3
PRACTICAL									
7	22CAP03	Programming in Java Laboratory	PC	NIL	4	0	0	4	2
8	22CAP04	Big Data Analytics Laboratory	PC	NIL	4	0	0	4	2
				TOTAL	**26**	**18**	**0**	**8**	**22**

SEMESTER: III									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	22CAB10	Machine Learning	PC	NIL	3	3	0	0	3
2	22CAB11	Web Technology	PC	NIL	3	3	0	0	3
3	22CAB12	Cyber Security	PC	22CAB03	3	3	0	0	3
4	E3	Elective – III	PE	Ref. PE	3	3	0	0	3
5	E4	Elective – IV	PE	Ref. PE	3	3	0	0	3
6	E5	Elective – V	PE	Ref. PE	3	3	0	0	3
PRACTICAL									
7	22CAP05	Machine Learning Laboratory	PC	NIL	4	0	0	4	2
8	22CAP06	Web Technology Laboratory	PC	NIL	4	0	0	4	2
9	22CAE02	Mini Project	EEC	NIL	4	0	0	4	2
				TOTAL	**30**	**18**	**0**	**12**	**24**

A p p r o v e d   b y   T e n t h   A c a d e m i c   C o u n c i l

SEMESTER: IV									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
PRACTICAL									
1	22CAE03	Project Work	EEC	22CAE02	24	0	0	24	12
				TOTAL	**24**	**0**	**0**	**24**	**12**

(A) FC, PC, PE, OE, and EEC Courses

(a)   Foundation Courses (FC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
I	22CAA01	Probability and Statistics for Computer Science	**FC**	NIL	3	3	0	0	3

(b)   Professional Core (PC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
I	22CAB01	Advanced Data Structures and Algorithms	**PC**	NIL	3	3	0	0	3
2	22CAB02	Operating Systems	**PC**	NIL	3	3	0	0	3
3	22CAB03	Computer Networks	**PC**	NIL	3	3	0	0	3
4	22CAB04	Cloud Computing	**PC**	NIL	3	3	0	0	3
5	22CAB05	Python Programming	**PC**	NIL	3	3	0	0	3
6	22CAB06	Database Management System	**PC**	NIL	3	3	0	0	3
7	22CAB07	Data Mining and Data Warehousing	**PC**	22CAB06	3	3	0	0	3
8	22CAB08	Programming in Java	**PC**	NIL	3	3	0	0	3
9	22CAB09	Big Data Analytics	**PC**	NIL	3	3	0	0	3
10	22CAB10	Machine Learning	**PC**	NIL	3	3	0	0	3
11	22CAB11	Web Technology	**PC**	NIL	3	3	0	0	3
12	22CAB12	Cyber Security	**PC**	22CAB03	3	3	0	0	3
13	22CAP01	Advanced Data Structures and Algorithms Laboratory	**PC**	NIL	4	0	0	4	2
14	22CAP02	Database Management System Laboratory	**PC**	NIL	4	0	0	4	2
15	22CAP03	Programming in Java Laboratory	**PC**	NIL	4	0	0	4	2

16	22CAP04	Big Data Analytics Laboratory	**PC**	NIL	4	0	0	4	2
17	22CAP05	Machine Learning Laboratory	**PC**	NIL	4	0	0	4	2
18	22CAP06	Web Technology Laboratory	**PC**	NIL	4	0	0	4	2

(c) Professional Electives									
Artificial Intelligence and Data Science									
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22CAX01	Internet of Things	**PE**	NIL	3	3	0	0	3
2	22CAX02	Artificial Intelligence	**PE**	NIL	3	3	0	0	3
3	22CAX03	Robotic Process Automation	**PE**	NIL	3	3	0	0	3
4	22CAX04	Natural Language Processing	**PE**	NIL	3	3	0	0	3
5	22CAX05	Data Center Virtualization	**PE**	NIL	3	3	0	0	3
6	22CAX06	Social Network Analysis	**PE**	NIL	3	3	0	0	3
Software Engineering and Entrepreneurship									
7	22CAX07	Microservices and Devops	**PE**	NIL	3	3	0	0	3
8	22CAX08	Agile Methodology	**PE**	NIL	3	3	0	0	3
9	22CAX09	Organizational Behaviour	**PE**	NIL	3	3	0	0	3
10	22CAX10	User Interface Design	**PE**	NIL	3	3	0	0	3
11	22CAX11	Design Thinking	**PE**	NIL	3	3	0	0	3
12	22CAX12	Entrepreneurship	**PE**	NIL	3	3	0	0	3
13	22CAX13	Intellectual Property Rights	**PE**	NIL	3	3	0	0	3
14	22CAX14	Human Resource Management	**PE**	NIL	3	3	0	0	3

Digital Security

						L	T	P	C
15	22CAX15	Ethical Hacking	**PE**	NIL	3	3	0	0	3
16	22CAX16	Digital Forensics	**PE**	22CAB12	3	3	0	0	3
17	22CAX17	Virtualization and Cloud Security	**PE**	22CAB04	3	3	0	0	3
18	22CAX18	Blockchain Technology	**PE**	NIL	3	3	0	0	3
19	22CAX19	Software Quality Assurance	**PE**	NIL	3	3	0	0	3
20	22CAX20	Information Security	**PE**	NIL	3	3	0	0	3

(d)	Open Elective Courses (OE)								
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22CAO01	Employability Enhancement and Analytical Skills	**OE**	NIL	3	3	0	0	3

(e)	Employability Enhancement Courses (EEC)								
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22CAE01	English for Pragmatic Usage	**EEC**	NIL	2	0	0	2	1
2	22CAE02	Mini Project	**EEC**	NIL	4	0	0	4	2
3	22CAE03	Project Work	**EEC**	22CAE02	24	0	0	24	12

Bridge Courses

For the MCA Students admitted under Non-Computer Science background category

Bridge Courses (BC)										
S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
Semester – I										
1	22CAW01	Fundamentals of Computers	**BC**	NIL	3	3	0	0	3
2	22CAW02	Mathematical Foundation of Computer Science	**BC**	NIL	3	3	0	0	3
Semester – II										
3	22CAW03	Object Oriented Programming using C++	**BC**	NIL	3	3	0	0	3
4	22CAW04	Computer Organization	**BC**	NIL	3	3	0	0	3

Total =12 Credits

SUMMARY						
SL. No.	SUBJECT AREA	CREDITS AS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1	FC	0	3	0	0	03
2	PC	22	13	13	0	48
3	PE/OE	0	6	9	0	15
4	EEC	1	0	2	12	15
TOTAL CREDITS		23	22	24	12	81

Total =81 Credits

22CAB01 ADVANCED DATA STRUCTURES AND ALGORITHMS

		L	T	P	C
		3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	Understand and apply Linear Data Structures- List, Stack and Queue.	1.1	The students will be able to describe, explain and use abstract data types including Stacks, Queues and Linked Lists.
2.0	Understand and apply non linear data structures- Trees	2.1	The students will be able to design and implement Tree data structures and Heaps.
3.0	Understand the graph algorithms	3.1	The students will be able to design and implement non linear data structures - graphs.
4.0	Learn different algorithms analysis techniques	4.1	The students will be able to able to develop various algorithm design and implementation.
5.0	Apply data structures and algorithms in real time applications	5.1	The students will be able to able to analyze the efficiency of algorithm.

UNIT I - LINEAR DATA STRUCTURES	(9)

Introduction - Abstract Data Types (ADT) – Stack – Queue – Circular Queue - Double Ended Queue - Applications of Stack: Evaluating Arithmetic Expressions - Applications of Queue - Linked Lists - Singly Linked List - Doubly Linked lists – Applications of Linked List: Polynomial Manipulation.

UNIT II - NON-LINEAR TREE STRUCTURES	(9)

Tree : Basic Terminologies, implementation of tree- Binary Tree – Types of Binary tree- Properties of Binary tree - Expression trees – Binary tree traversals – Applications of trees – Binary search tree - Balanced Trees - AVL Tree - B-Tree - Red black Tree.

UNIT III - GRAPHS	(9)

Representation of graph - Graph Traversals - Depth-first and breadth-first traversal - Applications of graphs - Topological sort – Shortest-path algorithms – Dijkstra's algorithm – Bellman-Ford algorithm – Floyd's Algorithm - Minimum spanning tree – Prim's and Kruskal's algorithms.

UNIT IV - ALGORITHM DESIGN AND ANALYSIS	(9)

Algorithm Analysis – Asymptotic Notations - Divide and Conquer – Merge Sort – Quick Sort - Binary Search - Greedy Algorithms – Knapsack Problem – Dynamic Programming: Characteristics, Components, and Comparison - Applications.

UNIT V - ADVANCED ALGORITHM DESIGN AND ANALYSIS	(9)

Backtracking – N-Queen's Problem – Sum of Subset Problems –Graph Coloring Problem - Branch and Bound: Introduction, Travelling Salesman Problem, 0/1 Knapsack Problem - P & NP Problems – NP-Complete Problems – Approximation Algorithms for NP-Hard Problems.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Anany Levitin "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2017.
2. M. A. Weiss, "Data Structures and Algorithm Analysis in Java", Pearson Education Asia, 2013.
3. Rajesh K Shukla, "Analysis and Design of Algorithms: A Beginner's Approach", Wiley Publication, 2015.
4. Gilles Brassard, "Fundamentals of Algorithms", Pearson Education, 2015.
5. Harsh Bhasin, "Algorithms Design and Analysis", Oxford University Press, 2015.

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1	2	1	2	1	-	-	-	1	1	1	1	2	2
2	2	2	1	1	1	-	-	-	1	1	1	1	2	1
3	2	2	1	2	1	-	-	-	1	1	1	1	2	1
4	2	2	2	2	1	-	1	-	1	2	1	1	2	2
5	2	2	2	2	1	-	1	-	1	2	1	1	2	2
CO	1.8	2	1.4	1.8	1	-	1	-	1	1.4	1	1	2	1.6

Mapping of COs with POs / PSOs

22CAB05 PYTHON PROGRAMMING				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE REQUISITE : NIL

	Course Objectives			**Course Outcomes**
1.0	To use Python data structures –- lists, tuples, dictionaries.	**1.1**		The students will be able to represent compound data using Python lists, tuples, and dictionaries.
2.0	To develop Python programs with conditionals and loops.	**2.1**		The students will be able to structure simple Python programs for solving problems.
3.0	To define Python functions and call them.	**3.1**		The students will be able to decompose a Python program into functions.
4.0	To do input/output with files in Python.	**4.1**		The students will be able to read and write data from/to files in Python Programs
5.0	To learn and use object oriented paradigm in python programs	**5.1**		The students will be able to develop the python program using class and objects.

UNIT I - INTRODUCTION DATA, EXPRESSIONS, STATEMENTS	**(9)**

Introduction to Python and installation, variables, expressions, statements, Numeric data types: int, float, Boolean, string. Basic data types: List - List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters. Tuple - Create and Access, Operations, Functions, Inserting, Deleting and Modifying elements in Tuple. Sets: Operations and Methods. Dictionaries: Operations and Methods.

UNIT II - CONTROL FLOW, LOOPS, FUNCTIONS	**(9)**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if- elif-else); Iteration: statements break, continue. Functions - function and its use, pass keyword, flow of execution, parameters and arguments.

UNIT III - ADVANCED FUNCTIONS, ARRAYS	**(9)**

Fruitful functions: return values, parameters, local and global scope, function composition, Recursion; Advanced Functions: lambda, map, filter, reduce, basic data type comprehensions. Python arrays: create an array, Access the Elements of an Array, array methods.

UNIT IV - FILES, EXCEPTIONS	**(9)**

Files: Types of file, file I/O, Seek() and tell() methods, Zipping and Unzipping files Exception: Errors in python programs, Exceptions, Exception Handling, Types of Exceptions, Introduction to basic standard libraries.

UNIT V - OBJECT ORIENTED PROGRAMMING, FRAMEWORK	**(9)**

Object, Class, Method, Inheritance, Polymorphism, Data Abstraction, Encapsulation, Python Frameworks: Explore Django Framework.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O_Reilly Publishers, 2017.

2. Dr. R. Nageswara Rao, "Core Python Programming", 3rd edition revised and updated, Dreamtech Press, 2022.

3. Vamsi Kurama, "Python Programming: A Modern Approach", Kindle Edition, Pearson Publication, 2018.

4. Kenneth A. Lambert, Martin Osborne, "Fundamentals of Python: First program, Introduction to Python", Course Technology Cengage, Edition: import, 2011.

5. John V.Guttg, "Introduction to Computation and Programming using Python", MIT press, 2013.

							Mapping of COs with POs / PSOs							
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2	2	-	-	-	-	1	2	2	2	1	2	2
2	3	2	2	-	-	-	-	1	2	2	2	1	2	2
3	3	2	2	-	-	-	-	1	2	2	2	1	2	2
4	3	3	3	-	-	-	-	1	2	2	2	1	2	2
5	3	2	2	-	-	-	-	2	3	3	2	1	2	2
CO	3	2.2	2.2	-	-	-	-	1.2	2.2	2.2	2	1	2	2

22CAB06 DATABASE MANAGEMENT SYSTEMS

	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To learn the different issues involved in the design and implementation of a database system.	1.1	The students will be able to understand database architecture, data models and utilize a wide range of features available in a DBMS package.
2.0	Understand database structure, relational algebra, integrity constraints	2.1	The students will be able to use SQL- the standard language of relational databases.
3.0	Formulate SQL queries and PL/SQL on data and its syntax.	3.1	The students will be able to use PL/SQL-procedural language extension to Structured Query Language.
4.0	Apply normalization techniques to Normalize the database.	4.1	The students will be able to understand the functional dependencies and their relationship to keys.
5.0	Understand the techniques for Controlling the consequences of concurrent data access.	5.1	The students will be able to understand the concept of Transaction processing and next generation databases.

UNIT I - INTRODUCTION TO DATABASE SYSTEMS	(9)

Introduction to database systems – Definition of DBMS- Advantages of DBMS – Views of data – Levels of data Abstraction – Data Models and types – Database architecture – Entity Relationship Model – ER diagram – EER MODEL.

UNIT II - RELATIONAL DATA MODEL	(9)

Relational database structure – Procedural and Non procedural languages – Relational algebra : operations - Integrity Constraints – SQL Commands : DDL – DML – TCL –DCL Set operations – Join Operations - Aggregation in SQL - Using the group by clause.

UNIT III - SQL AND PL/SQL	(9)

PL/SQL Block – Introduction to PL/SQL – The Advantages of PL/SQL - PL/SQL Architecture - PL/SQL Data types - Variable and Constants – Using Built-in Functions – Conditional and Unconditional Statements – Stored procedures – Procedure with Parameters (IN,OUT and IN OUT) – Procedure with Cursors – Dropping a Procedure.

Functions in PL/SQL : Difference between Procedures and Functions – User Defined Functions – Nested Functions –Using stored function in SQL statements – Trigger – Types of Triggers – Row Level Triggers – Statement Level Triggers –DDL Triggers.

UNIT IV - DEPENDENCY PRESERVATION AND DB DESIGN	(9)

Functional Dependency: Full Functional Dependency - Partial dependency – Transitive dependency - Multi Valued Dependency – Decomposition – Normalization – Normal Forms: 1 NF- 2 NF – 3 NF – BCNF - 4 NF- 5 NF.

UNIT V - TRANSACTIONAL PROCESSING	(9)

Transaction – Properties of transaction – Transaction state – Serialization : types – Need for Serialization – Two Phase Commit – Save Point – Concurrency – Locking protocols – Time stamp protocol – Next Generation Databases : No SQL , New SQL and Big Data – Document Databases – Data Models and Storage – No SQL APIs.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Abraham Silber Schatz, Henry F. Korthand S.Sudarshan,"Database System Concepts", 7th Edition, McGraw Hill, 2020.

2. Elmasri R, S. V. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson, New Delhi, 2017.

3. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, New Delhi, 2003.

4. C. J. Date, "An Introduction to Database Systems", 8th Edition, Addison Wesley, 2006.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	1	-	1	2	-	1	-	3	-	1	1	-	1
2	1	2	2	2	2	-	2	-	2	2	2	2	2	1
3	2	1	-	-	1	-	1	-	2	2	2	2	-	2
4	2	2	2	-	2	-	2	-	3	2	1	2	1	2
5	1	2	2	2	3	-	2	-	2	2	1	2	-	2
CO	1.5	1.6	2	1.6	2	-	1.6	-	2.4	2	1.4	1.8	1.5	1.6

		L	T	P	C
22CAP01 ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY					
		0	0	4	2

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	Understand and apply Linear Data Structures.	**1.1**	The students will be able to demonstrate concepts of Stack, Queue, Linked List.
2.0	Understand and apply Non-Linear Data Structures.	**2.1**	The students will be able to demonstrate concepts of Tree and Graph.
3.0	Understand the various Sorting Algorithms.	**3.1**	The students will be able to demonstrate the Sorting Algorithms.
4.0	Understand the compound data using Python Lists, Class and Methods.	**4.1**	The students will be able to demonstrate Searching and Sorting Techniques.
5.0	Understand the concepts of Inheritance, Polymorphism and Overriding.	**5.1**	The students will be able to code to implement object oriented paradigm

List of Experiments (Implementation using Python)

1. Array implementation of Stack and Queue ADTs.

2. Linked list implementation of Stack and Queue ADTs.

3. Applications of Stack ADT.

4. Implementation of Binary Search Trees.

5. Implementation of AVL Trees.

6. Graph representation and Traversal Algorithms.

7. Given a graph with appropriate weights for each node, find the single source shortest path using Dijkstra's algorithm.

8. To implement Merge Sort and Quick Sort.

9. Given a program to implement 0/1 Knapsack using Dynamic Programming.

10. Given the Eight Queens Puzzle Problem of placing Eight Chess Queens on an 8×8 Chessboard so that no two queens attack each other.

TOTAL (P:60) :60 PERIODS

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	2	1	-	-	-	1	1	1	1	2	2
2	2	2	2	1	1	-	-	-	1	1	1	1	2	1
3	2	2	2	2	1	-	-	-	1	1	1	1	2	1
4	2	2	2	2	1	-	1	-	1	2	1	1	2	2
5	2	2	2	2	1	-	1	-	1	2	1	1	2	2
CO	2	2	2	1.8	1	-	1	-	1	1.4	1	1	2	1.6

Mapping of COs with POs / PSOs

		L	T	P	C
22CAP02 DATABASE MANAGEMENT SYSTEM LABORATORY					
		0	0	4	2

PRE REQUISITE : NIL

	Course Objectives			Course Outcomes
1.0	Learn to create and use a database	**1.1**		The students will be able to design and implement a database schema for a given problem domain.
2.0	Be familiarized with a query language	**2.1**		The students will be able to query and populate using database.
3.0	Have a good understanding of DDL, DML commands and DCL commands.	**3.1**		The students will be able to create and maintain tables using PL/SQL.
4.0	Familiarize advanced SQL queries and PL/SQL	**4.1**		The students will be able to create triggers and functions
5.0	Be exposed to different applications	**5.1**		The students will be able to develop simple project and prepare reports.

List of Experiments

1. Creation of a database and writing SQL queries to retrieve information from the database.

2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.

3. Creation of Views, Synonyms, Sequence, Indexes, Save point.

4. Creating an Employee database to set various constraints.

5. Creating relationship between the databases.

6. Write a PL/SQL block to satisfy some conditions by accepting input from the user.

7. Write a PL/SQL block that handles all types of exceptions.

8. Creation of database Triggers and Functions.

TOTAL (P:60) :60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	-	-	2	2	2	-	2	-	1	1	1	1	-	-
2	-	-	1	1	2	-	1	-	3	2	2	1	1	2
3	-	-	1	1	1	-	2	-	2	1	1	2	-	-
4	-	2	2	2	2	-	2	-	2	2	2	1	2	2
5	-	2	2	2	1	-	1	-	2	2	2	1	2	2
CO	-	2	1.6	1.6	1.6	-	1.6	-	2	1.6	1.6	1.2	1	2

		L	T	P	C
22CAE01 ENGLISH FOR PRAGMATIC USAGE		0	0	2	1

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To enable the students to incorporate the correct usage of grammar in communication.	**1.1**	The students will be able to employ appropriate grammar in spoken and written communication.
2.0	To improve the communicative competence through various discourse.	**2.1**	The students will be able to gain adequate speaking skills to convey information effectively.
3.0	To enable the students to write intricate texts, summaries, mails and reports.	**3.1**	The students will be able to compose contents for texts, summaries, mails and reports.

UNIT I - GRAMMAR	**(10)**
Verb – Tenses – Subject Verb Agreement - Error Spotting – Sentence Completion – Conditional Clauses.	

UNIT II - JOB REQUISITES	**(10)**
Self Introduction - Mini Presentation – Team Building Practices – Facing Interview Panel - Answering Familiar Questions - Company Profile - Stress Interviews - Group Discussion.	

UNIT III - WRITING NUANCE	**(10)**
Email Writing and Netiquettes - Job Application and Resume - Passage Writing (Topic & Picture Description) – Technical Report (Project Report)	

	TOTAL (P:30) :30 PERIODS

REFERENCES:

1. Rizvi, Ashraf M. "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

2. Sudharshana, N.P and Saveetha.C, "English for Technical Communication", Cambridge University Press, New Delhi, 2017.

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	2	1	3	1	3	-	-	-	-	-	1
2	-	-	-	3	1	3	1	3	-	-	-	-	-	1
3	-	-	-	2	1	3	1	2	-	-	-	-	-	1
CO	-	-	-	2.3	1	3	1	2.6	-	-	-	-	-	1

22CAA01 PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE

	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To describe the features of discrete and continuous random variable.	1.1	The students will be able to find expectation, variance, standard deviation moments and moment generating function for discrete and continuous random variables.
2.0	To define the discrete and continuous distributions and solve the problems about the distributions.	2.1	The students will be able to apply the concept of expectation and moment generating functions to discrete and Continuous distributions and find the probability values for the defined distributions.
3.0	To gain the knowledge about marginal and conditional distributions.	3.1	The students will be able to explain the skills in handling situations involving more than one random variable and functions of random variables.
4.0	To identify the population parameter and test statistic of given scenario.	4.1	The students will be able to find a hypothesis, testing method for the given numerical set of data to analyze the significance.
5.0	To plan, design and conduct experiments to analyze the resulting data in order to obtain valid objective conclusion.	5.1	The students will be able to apply analysis of variance for the data set in order to analyze the significance.

UNIT I - PROBABILITY AND RANDOM VARIABLES	(9)

Probability – Axioms of probability – Conditional probability – Baye's theorem - Random variables - Probability function – Moments – Moment generating functions and their properties.

UNIT II - STANDARD DISTRIBUTIONS	(9)

Discrete Distributions: Binomial, Poisson and Geometric. Continuous Distribution: Uniform and Normal Distributions.

UNIT III - TWO DIMENSIONAL RANDOM VARIABLES	(9)

Joint Distributions - Marginal and Conditional Distributions – Covariance - Correlation and Regression.

UNIT IV - TESTING OF HYPOTHESIS	(9)

Sampling Distributions -Testing of Hypothesis for Mean, Variance. t - Distribution, F – Distribution - Chi-Square Test for Independence of Attributes and Goodness of fit.

UNIT V - DESIGN OF EXPERIMENTS	(9)

Analysis of Variance- Completely Randomized Design - Randomized Block Design - Latin Square Design.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Veerarajan T, "Probability and Statistics, Random Processes and Queuing Theory and Queuing Networks", 4th Edition, Tata McGraw-Hill, New Delhi 2018.

2. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 2020.

3. Allen, O. Arnold, "Probability, Statistics and Queuing Theory with Computer Applications", 2nd ed., Elsevier, New Delhi, 1990.

4. Taha, H.A., "Operations Research - An Introduction", Pearson Education, New Delhi, 2017.

5. Trivedi, S. K, "Probability and Statistics with Reliability, Queuing and Computer Science Applications", John Wiley & Sons, New Delhi, 2008.

	Mapping of COs with POs / PSOs													
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	2	1	1	-	1	-	-	-	2	1	1	1	-
2	3	2	1	1	-	1	-	-	-	2	1	1	1	1
3	3	2	2	1	1	-	-	-	-	1	2	1	1	-
4	2	3	2	1	3	-	-	-	2	3	-	-	1	2
5	2	3	2	1	2	1	-	1	2	2	1	1	2	2
CO	2	2	2	1	2	1	-	1	2	2	1	1	1	2

22CAB07 DATA MINING AND DATA WAREHOUSING

		L	T	P	C
		3	0	0	3

PRE REQUISITE : Database Management System

	Course Objectives		Course Outcomes
1.0	To impart knowledge in Data Mining.	1.1	The students will be able to understand various types of data that can be mined.
2.0	To understand the various Data Preprocessing in Data Mining.	2.1	The students will be able to gain awareness about the importance of data cleaning.
3.0	To provide knowledge in classification methods and clustering.	3.1	The students will be able to know about various classification methods and the evaluation of clustering.
4.0	To understand about various pattern mining.	4.1	The students will be able to apply a various patterns in data mining.
5.0	To provide knowledge Data Warehousing.	5.1	The students will be able to acquire knowledge about various data warehousing design and its usage.

UNIT I - INTRODUCTION TO DATA MINING	(9)

Data Mining Definition - Why Data Mining - Types of Data can be Mined – Patterns – Technologies - Applications-Issues in Data Mining - Data Objects and Attribute Types - Basic Statistical Descriptions of Data - Data Visualization - Measuring Data Similarity and Dissimilarity - Case Study.

UNIT II - DATA PREPROCESSING	(9)

Data Preprocessing: An Overview - Data Cleaning - Data Integration - Data Reduction - Data Transformation and Data Discretization.

UNIT III - CLASSIFICATION AND CLUSTERING	(9)

Classification: Basic Concepts – Decision Tree Induction – Bayes Classification Methods – Rule Based Classification– Model Evaluation and Selection. Clustering: Analysis – Partitioning, Hierarchical, Density Based Methods and Grid Based Methods – Evaluation of Clustering.

UNIT IV - PATTERN MINING	(9)

Pattern Mining in Multilevel, Multidimensional Space - Constraint: Based Frequent Pattern Mining - Mining High Dimensional Data and Colossal Patterns - Mining Compressed Patterns - Pattern Exploration and Application.

UNIT V - DATA WAREHOUSING	(9)

Data Warehouse: Basic Concepts - Data Warehouse Modeling Data Cube and OLAP - Data Warehouse Design and Usage – Implementation - Data Generalization- Case Study.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers, 2012.

2. George M. Marakas, "Modern Data Warehousing, Mining and Visualization: Core Concepts", Spring, 2012.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	-	2	2	-	-	-	2	3	-	-	3	-
2	2	2	-	2	2	-	-	-	2	3	-	-	3	-
3	2	3	3	3	2	-	-	2	3	3	2	2	3	2
4	2	2	3	3	2	-	-	2	3	3	2	1	3	1
5	2	2	2	2	2	-	-	2	2	2	2	1	2	2
CO	2	2.2	2.7	2.4	2	-	-	2	2.4	2.8	2	1.3	2.8	1.7

Mapping of COs with POs / PSOs

		L	T	P	C
22CAB08 PROGRAMMING IN JAVA					
		3	0	0	3

PRE REQUISITE : NIL

	Course Objectives			Course Outcomes
1.0	To learn about Basic Concepts in Java.	1.1		The students will be able to understand about Basics of Java.
2.0	To learn about Class Fundamentals, Objects and Overloading.	2.1		The students will be able to understand about Class, Objects and Overloading Concepts.
3.0	To provide knowledge of Inheritance and Packages and Interfaces.	3.1		The students will be able to Inheritance, Package creation and Interface Concepts.
4.0	To learn about Exception handling, Multithreading and I/O.	4.1		The students will be able to understand about Exception handling, Multithreading and I/O.
5.0	To learn about Generics, String Handling and Collection Framework.	5.1		The students will be able to understand about Generics, String handling and Collection Framework.

UNIT I - BASICS IN JAVA	(9)

History and Evolution of Java – An Overview of Java – Data Types, Variables, Type Conversions and Casting, Arrays – Operators – Control Statements - Command Line Arguments – Lambda Expressions.

UNIT II - CLASSES AND OBJECTS, OVERLOADING	(9)

Introducing Classes : Class Fundamentals - Declaring Objects - Methods - Constructors - this Keyword - Garbage Collection – Overloading Methods and Constructors – Object as Argument and Returning Objects – Array of Objects –Recursion - Understanding Static – Final – Nested and Inner Class.

UNIT III - INHERITANCE, PACKAGES AND INTERFACES	(9)

Inheritance Basics – Using Super – Method Overriding – Dynamic Method Dispatch – Abstract Classes –Using Final with Inheritance – Packages Member Access – Importing Packages – Interfaces – Using Static Methods in an Interface.

UNIT IV - EXCEPTION HANDLING, MULTITHREADING AND I/O	(9)

Exception Handling Fundamentals – Exception Types – Using Try and Catch – Multiple Catch Clauses – Nested Try – Throw –Throws – Finally - Built-in Exceptions – User Defined Exceptions – Multithreaded Programming : Main Thread – Creating Threads - Thread Priorities – Synchronization – Inter Thread Communication – Enumeration - Type Wrappers – Auto boxing - I/O Basics : Buffered Input Stream – Buffered Output Stream – Print Stream – Print Writer- Reading and Writing a File.

UNIT V - GENERICS, STRING HANDLING AND COLLECTION FRAMEWORK	(9)

Generic Class – Bounded Types – Generic Methods - String Handling : String Class –String Buffer and String Builder Class - Collection Frame works : Collection Interfaces – Collection Classes : Array List – Linked List – Hash Set – Tree Set – Priority Queue – Iterator – Map : Map Interfaces – Map Classes : Hash Map – Tree Map - Comparators.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Herbert Schildt, "Java: The Complete Reference", Eleventh Edition, Oracle Press, McGraw – Hill Education, 2019.

2. Cay S. Horstmann, "Core Java Volume I - Fundamentals", Tenth Edition, Prentice Hall, 2016.

3. Herbert Schildt, "Java : A Beginner's Guide", Seventh Edition, Oracle Press, McGraw – Hill Education, 2017.

Mapping of COs with POs / PSOs														
COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1	-	1	2	2	-	1	-	3	-	2	1	-	1
2	2	2	2	2	2	-	2	-	2	2	2	2	2	1
3	2	2	-	-	2	-	2	-	2	2	2	2	2	2
4	2	2	2	-	2	-	2	-	3	2	2	2	1	2
5	1	1	1	1	2	-	1	-	1	1	1	-	-	2
CO	1.6	1.75	1.5	1.6	2	-	1.6	-	2.2	1.75	1.8	1.75	1.6	1.6

22CAB09 BIG DATA ANALYTICS

		L	T	P	C
		3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To learn tips and tricks for Big Data use cases and solutions.	**1.1**	The students will be able to get knowledge about the basic terminology of Big Data Analytics.
2.0	To understand data analysis Lifecycle and Analytical methods.	**2.1**	The students will be able to get knowledge of Data mining tool and practical experience of applying data mining algorithms.
3.0	Learn to build and maintain reliable, scalable, distributed systems with Hadoop.	**3.1**	The students will be able to design applications using NoSQL and HADOOP
4.0	Understand the basics of R programming including vectors, list, etc.	**4.1**	The students will be able to recognize and make appropriate use of different types of data structures.
5.0	Become proficient in writing a fundamental program and perform analytics with R.	**5.1**	The students will be able to design and write functions in R and to create sophisticated figures and graphs.

UNIT I - INTRODUCTION	(9)

Introduction – Characteristics and Considerations – Data Structures – Business drivers – Business intelligence Vs Data science – Analytical Architecture –Key Roles of the New Big Data Ecosystem – Data Scientist - Big Data Applications.

UNIT II - DATA ANALYTICS LIFECYCLE & ADVANCED ANALYTICS THEORY AND METHODS	(9)

Data Analytics Lifecycle: Discovery – Data preparation – Model Planning – Model Building – Communicate results – Operationalize – Key Roles for a Successful Analytic Project – Case Studies. Association Rules: Apriori Algorithm – Applications of Association Rules - Regression: Linear Regression – Logistic Regression.

UNIT III - NoSQL, HADOOP AND MAP REDUCE	(9)

Base Concept. NoSQL: Types of Databases – Advantages – NewSQL – SQL vs. NoSQL vs NewSQL. Introduction to Hadoop: Features – Advantages – Versions – Overview of Hadoop Eco systems – Hadoop distributions – Hadoop vs. SQL – RDBMS vs. Hadoop – Hadoop Components – Architecture – HDFS – Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression. Hadoop 2 (YARN): Architecture – Interacting with Hadoop Eco systems.

UNIT IV - R PROGRAMMING	(9)

Overview – Environment Setup – Data Types – Variables – Operators – Decision Making – Loops Statements – Function – Strings – Vectors: Scalars, Recycling, Operations – Function: All and Any, Vectorized operations, NA and NULL values, Filtering , Vectorized if-then else, Vector Equality, Vector Element names. Lists: Creation, Operations – Accessing List Components and Values, Applying functions to lists, Recursive List. Matrices: Creation, Operations – Applying functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction- Avoiding Dimension Reduction, Higher Dimensional arrays.

UNIT V - ARRAYS, DATAFRAMES, INTERFACING AND GRAPHICS	(9)

Arrays: Creating, Accessing, Manipulating Array Elements – Factors: Factors and Tables, Factors and Levels, Functions, Working with tables. Data Frames: Creation, Matrix-like Operations, and Merging Data frames – Applying functions to Data Frames. R Data Interfaces: CSV Files – Excel files – Databases. Graphics: Creating Graphs, Customizing Graphs, Saving graphs to files, Creating three-dimensional plots. Charts: Pie chart – Bar Chart – Box plots – Histograms – Line Graphs – Scatter plots.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley & Sons Publications.

2. Tom White, "Hadoop: The Definitive Guide", Third Edition, Oreilly Media, 2011.

3. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", NoStarch Press, 2011.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	1	-	-	-	1	1	2	1	1	1
2	3	3	3	2	1	-	-	-	2	2	3	1	3	2
3	3	2	2	1	-	-	-	-	1	1	2	1	1	1
4	3	2	2	1	1	-	-	-	2	2	2	1	1	1
5	3	2	2	1	1	-	-	-	2	2	2	1	1	1
CO	3	2.2	2.2	1.4	1	-	-	-	1.6	1.6	2.2	1	1.4	1.2

		L	**T**	**P**	**C**
22CAP03 PROGRAMMING IN JAVA LABORATORY					
		0	0	4	2

PRE REQUISITE : NIL

	Course Objectives		**Course Outcomes**
1.0	Learn Array Concepts, Operators and Control Structures.	**1.1**	The students will be able to program Array Concepts, Operators and Control Structures
2.0	Familiar with Classes, Objects and Overloading.	**2.1**	The students will be able to create Classes, Objects and Overloading
3.0	Have a good understanding of Inheritance, Polymorphism and Interfaces.	**3.1**	The students will be able to develop Programs for Inheritance, Polymorphism and Interfaces
4.0	Familiarize on Packages and Threads.	**4.1**	The students will be able to create Packages and Threads
5.0	Learn about handling the Exception and AWT Controls.	**5.1**	The students will be able to handle Exception and AWT.

List of Experiments

1. Write a java Program with Multi- dimensional Array.

2. Write a java program to work with Operators and Control Structures.

3. Design a Java Program with Class and Objects and Constructors.

4. Write a Java Program to implement Overloading in Java.

5. Write a Java Program on Inheritance.

6. Write a Java Program to implement Runtime Polymorphism and Interfaces.

7. Design a java Program to implement the User-Defined Package.

8. Create a Java Program with Threads.

9. Write a Java Program to handle the Exception.

10. Create a web page using AWT.

TOTAL (P:60) :60 PERIODS

	Mapping of COs with POs / PSOs													
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1	-	-	1	1	-	2	-	1	1	1	1	-	-
2	1	-	1	1	2	-	1	-	3	2	2	1	1	2
3	1	2	1	1	1	-	2	-	2	1	1	2	-	-
4	1	2	2	2	2	-	2	-	2	2	2	1	2	2
5	1	2	2	2	1	-	1	-	2	2	2	1	2	2
CO	1	2	1.5	1.4	1.4	-	1.6	-	2	1.6	1.6	1.6	1.6	2

	22CAP04 BIG DATA ANALYTICS LABORATORY				
		L	**T**	**P**	**C**
		0	**0**	**4**	**2**

PRE REQUISITE : NIL

	Course Objectives		**Course Outcomes**
1.0	Understand the basics of R programming including list, vectors etc.	**1.1**	The students will be able to recognize and make appropriate use of different types of data structures
2.0	Write functions including generic functions using various methods and loops	**2.1**	The students will be able to identify and implement appropriate control structures to solve a particular programming problem
3.0	To understand and appreciate how to summarize large volumes of data effectively by appropriate use of charts.	**3.1**	The students will be able to use R to create sophisticated figures and graphs.
4.0	Understanding of the statistical procedures most often used by practicing engineers.	**4.1**	The students will be able to design efficient algorithms for mining the data from large volumes
5.0	To understand various search methods and visualization techniques.	**5.1**	The students will be able to apply data modeling techniques to large data sets.

List of Experiments

1.   Use of Array and List

2.   Use of Strings

3.   Use of Matrices

4.   Use of Vectors

5.   Use of Function

6.   Implement Discrete Distributions

7.   Implement Continuous Distribution

8.   Perform the Testing of Hypothesis

9.   Visualize data using different Plots

10. Implement Association Rules

11. Implement Linear and Logistic Regression

TOTAL (P:60) :60 PERIODS

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	2	-	-	-	-	-	1	2	1	1	1
2	3	3	3	2	-	-	-	-	2	2	3	1	3	2
3	3	2	2	1	-	-	-	-	-	1	2	1	1	1
4	3	2	2	1	1	-	-	-	2	2	2	1	1	1
5	3	2	2	1	1	-	-	-	2	2	2	1	1	1
CO	3	2.2	2.2	1.4	1	-	-	-	2	1.6	2.2	1	1.4	1.2

		L	T	P	C
22CAB10 MACHINE LEARNING					
		3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To introduce the basic concepts and techniques of machine learning and learn about dimensionality reduction.	1.1	The students will be able to illustrate the foundations of machine learning and apply suitable dimensionality reduction techniques for an application.
2.0	To provide understanding of various model and features.	2.1	The students will be able to select the appropriate model and use feature engineering techniques.
3.0	To learn Probability and Bayesian Concept Learning.	3.1	The students will be able to make use of Probability and Bayesian Concept Learning to solve the given problem.
4.0	To learn Classification and regression algorithms.	4.1	The students will be able to implement various Classification and regression algorithms and its performance.
5.0	To understand clustering and neural networks concepts.	5.1	The students will be able to apply clustering and neural networks concepts to solve real world problems.

UNIT I – INTRODUCTION	**(9)**

Human Learning - Types – Machine Learning - Types - Problems not to be solved - Applications - Languages/Tools– Issues. Preparing to Model: Introduction - Machine Learning Activities - Types of data - Exploring structure of data - Data quality and remediation - Data Preprocessing.

UNIT II - MODEL EVALUATION AND FEATURE ENGINEERING	**(9)**

Model Evaluation: Model Selection - Training Model - Model Representation and Interpretability - Evaluating Performance of a Model - Improving Performance of a Model - Feature Engineering: Introduction - Feature Transformation – Feature Subset Selection.

UNIT III – PROBABILITY AND BAYESIAN LEARNING	**(9)**

Importance of Statistic Tools – Concept of Probability-Random Variables - Discrete distributions-Continuous distributions- Multiple Random Variables. Bayesian Concept Learning: Bayes Theorem-Concept Learning- Bayesian Belief Network.

UNIT IV - SUPERVISED LEARNING	**(9)**

Classification: Introduction-Example-Classification model-Learning steps- Common classification algorithms- K-Nearest Neighbor-Decision Tree-Random Forest Model - Support Vector Machines. Regression: Introduction-Example-Simple linear regression-Multiple linear regression-Assumptions and problems in Regression Analysis- Improving the accuracy.

UNIT V - UNSUPERVISED LEARNING AND ARTIFICIAL NEURAL NETWORKS	**(9)**

Unsupervised Learning Vs Supervised Learning – Applications – Clustering - Biological Neuron - Artificial Neuron-Types of Activation Function-Architectures of NN – Learning process in ANN – Back Propagation. Reinforcement Learning.

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, "Machine Learning", 1st Edition, Pearson Education, 2019.

2. AurelienGeron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O'Reilly, 2019.

3. Willi Richert, Luis Pedro Coelho, "Building Machine Learning Systems with Python", 2ndEdition, Packt Publishing Ltd., 2015.

4. T. Hastie, R. Tibshirani, J. H. Friedman, "Introduction to Statistical Machine Learning", First Edition, Springer, 2017.

	Mapping of COs with POs / PSOs														
COs	**POs**													**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	
1	2	1	1	1	2	2	2	1	1	2	2	1	2	2
2	2	1	1	1	2	2	2	1	1	2	2	1	2	2
3	3	3	2	1	2	2	2	2	2	3	3	2	2	3
4	3	2	1	1	2	2	2	2	2	3	3	2	2	3
5	3	2	1	1	2	2	2	2	2	3	3	2	2	3
CO	2.6	1.8	1.2	1	2	2	2	1.6	1.6	2.6	2.6	1.6	2	2.6

22CAB11 WEB TECHNOLOGY						

	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE REQUISITE : NIL

	Course Objectives		**Course Outcomes**
1.0	To learn about the html tags.	**1.1**	The students will be able to apply the necessary HTML elements to the Document's design.
2.0	To learn about scripting language and CSS.	**2.1**	The students will be able create the Programs Using Scripting Language and CSS Presentation
3.0	To understand about DOM concepts.	**3.1**	The students will be able to DOM concepts.
4.0	To learn about create a web application using XML and JSP Technology.	**4.1**	The students will be able develop XML and JSP Programs.
5.0	To understand the React JS concepts.	**5.1**	The students will be able to implement React JS.

UNIT I - WEB ESSENTIALS	**(9)**
Clients, Servers and Communication : The Internet - Basic Internet Protocols - The World Wide Web - HTTP Request Message - Response Message - Web Clients - Web Servers - Markup Languages : HTML – History and Versions - Basic XHTML Syntax and Semantics – HTML Elements - Relative URLs – Lists – Tables – Frames –Forms - XML – Creating HTML Documents.	

UNIT II - STYLE SHEETS AND JAVASCRIPT	**(9)**
CSS – Features - Core Syntax - Style Sheets and HTML - Style Rule Cascading and Inheritance - Text Properties - Box Model – Normal Flow Box Layout - Client-Side Programming: The JavaScript Language- JavaScript in Perspective – Syntax - Variables and Data Types-Statements-Operators– Literals– Functions– Objects– Arrays -Built-in Objects-JavaScript Debuggers.	

UNIT III - DOM	**(9)**
DOM - DOM History and Levels - Intrinsic Event Handling - Modifying Element Style -The Document Tree - DOM Event Handling - Accommodating Noncompliant Browsers - Properties of Window.	

UNIT IV - XML AND JSP	**(9)**
XML - Documents and Vocabularies - Versions and Declaration - Namespaces - JavaScript and XML: Ajax - DOM based XML Processing- JSP Technology - JSP and Servlets - Running JSP Applications -Basic JSP-Tag Libraries and Files-Model-View- Controller Paradigm.	

UNIT V - REACT JS	**(9)**
Fundamentals of React JS – JSX – Components – Events – Lists – Forms – Styling React using CSS –Building a React Web Application.	

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Jeffrey C.Jackson, "Web Technologies - A Computer Science Perspective", 1st Edition, Pearson Education, 2015.
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", 5th Edition, Pearson Education, 2012.
3. Cory Gackenheimer, Introduction to React, Apress, 2015.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	-	-	2	2	-	2	-	2	-	2	2	2
2	3	2	2	2	-	2	-	-	-	3	-	1	-	-
3	3	-	3	2	2	2	-	2	-	-	-	2	3	-
4	-	3	1	2	-	-	-	2	-	2	-	-	2	2
5	2	-	2	2	-	-	-	-	-	2	-	-	2	-
CO	2.5	2.33	2	2	2	2	-	2	-	2.25	-	1.67	2.25	2

Mapping of COs with POs / PSOs

		L	T	P	C
22CAB12 CYBER SECURITY		3	0	0	3

PRE REQUISITE : Computer Networks

	Course Objectives			Course Outcomes
1.0	To learn the principles of cyber security and to identify threats and risks.	1.1		The students will be able to identify a set of risk and security requirements to ensure that there are no gaps in an organization's security practices.
2.0	To learn how to secure physical assets and develop system security controls.	2.1		The students will be able to achieve management, operational and technical means for effective cyber security.
3.0	To understand how to apply security for Business applications and Network Communications.	3.1		The students will be able to audit and monitor the performance of cyber security controls.
4.0	To learn the technical means to achieve security.	4.1		The students will be able to spot gaps in the system and device improvements.
5.0	To learn to monitor and audit security measures.	5.1		The students will be able to report vulnerabilities in the system.

UNIT I – PLANNING FOR CYBER SECURITY	**(9)**

Introduction - Standards and a Plan of Action - Security Governance Principles, Components and Approach - Information Risk Management - Asset Identification - Threat Identification - Vulnerability Identification - Risk Assessment Approaches - Likelihood and Impact Assessment - Risk Determination, Evaluation and Treatment - Security Management Function - Security Policy - Acceptable Use Policy - Security Management.

UNIT II – SECURITY CONTROLS	**(9)**

People Management - Human Resource Security - Security Awareness and Education - Information Management - Information Classification and handling – Privacy - Documents and Record Management - Physical Asset Management - Office Equipment - Industrial Control Systems - Mobile Device Security - System Development - Incorporating Security into SDLCCase study on information security policies.

UNIT III - CYBER SECURITY FOR BUSINESS APPLICATIONS AND NETWORKS	**(9)**

Business Application Management - Corporate Business Application Security - End user Developed Applications - System Access - Authentication Mechanisms - Access Control - System Management - Virtual Servers - Network Storage Systems - Network Management Concepts - Firewall-IP Security - Electronic Communications – Case study on OWASP vulnerabilities using OWASP ZAP tool.

UNIT IV - TECHNICAL SECURITY	**(9)**

Supply Chain Management - Cloud Security - Security Architecture - Malware Protection - Intrusion Detection - Digital Rights Management - Cryptographic Techniques - Threat and Incident Management - Vulnerability Management - Security Event Management - Forensic Investigations -Local Environment Management - Business Continuity – Case study on cloud and cryptographic vulnerabilities.

UNIT V - SECURITY ASSESSMENT	**(9)**

Security Monitoring and Improvement - Security Audit - Security Performance - Information Risk Reporting - Information Security Compliance Monitoring - Security Monitoring and Improvement Best Practices – Case study on vulnerability assessment using ACUNETIX.

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. William Stallings, "Effective Cyber Security-A guide to using Best Practices and Standards", Addison-Wesley Professional, First Edition, 2018.
2. Adam Shostack, "Threat Modelling- Designing for Security", Wiley Publications, First Edition, 2014.
3. Gregory J. Touhill and C. Joseph Touhill, "Cyber Security for Executives- A Practical Guide", Wiley Publications, First Edition, 2014.
4. RaefMeeuwisse, "Cyber Security for Beginners", Second Edition, Cyber Simplicity Ltd, 2017.
5. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Second Edition, Syngress, 2013.
6. OWASP ZAP : https://owasp.org/www-project-zap/ACUNETIX: https://www.acunetix.com/

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	2	-	2	1	1	2	1	1	1	1	1	1	1
2	2	2	1	2	2	2	2	2	2	2	2	2	2	2
3	1	2	2	1	2	2	2	1	2	2	-	1	2	-
4	2	2	1	2	2	1	1	-	2	2	1	2	1	1
5	2	2	1	1	1	-	1	1	1	1	1	1	2	1
CO	1.6	2	1.25	1.6	1.6	1.5	1.6	1. 25	1.6	1.6	1.25	1.4	1.6	1.25

Mapping of COs with POs / PSOs

22CAP05 MACHINE LEARNING LABORATORY

	L	T	P	C
	0	0	4	2

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To understand about the basic concepts and techniques of Machine Learning.	**1.1**	The students will be able to handle different types of dataset and use different libraries.
2.0	To become familiar data preprocessing techniques.	**2.1**	The students will be able to demonstrate data preprocessing.
3.0	To understand about the Naïve Bayes Classifier and decision tree.	**3.1**	The students will be able to demonstrate Naïve Bayes Classifier and decision tree.
4.0	To become familiar with Random Forest Algorithm, KNN and SVM algorithms.	**4.1**	The students will be able to implement Random Forest Algorithm, KNN and SVM algorithms.
5.0	To understand about regression, clustering methods and ANN.	**5.1**	The students will be able to demonstrate Various regression, K-means Clustering and Multi-layer ANN.

LIST OF EXPERIMENTS

1. Exploration of a Data Set in the IDE and create dataset and perform pandas and numpy operations.

2. Python program to calculate mean, median, variance, standard deviation and exploring relationship between variables of the given numerical data.

3. Implementation of various data preprocessing techniques on real time dataset.

4. Program to implement Naïve Bayes Classifier Algorithm using Python.

5. Program to find the attribute with maximum information gain and gain ratio and construct the decision tree for the given data using Python.

6. Program to implement Random Forest Algorithm and K-NN algorithm using Python.

7. Program to implement Support Vector Machines learning algorithm using Python.

8. Python program to implement Simple Linear regression, Multi Linear regression and Logistic Regression algorithms.

9. Program to implement K-Means Clustering algorithm using Python.

10. Program to implement multi-layer Artificial Neural Network using Python.

TOTAL (P:60) : 60 PERIODS

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	1	2	2	1	1	1	2	2	1	1	1
2	2	3	3	1	2	2	1	1	1	3	3	3	2	2
3	2	3	3	1	2	2	1	2	1	3	3	3	3	3
4	2	3	3	1	2	2	1	2	1	3	3	3	3	3
5	2	3	3	1	2	2	1	2	1	3	3	3	3	3
CO	2	2.8	2.8	1	2	2	1	1.6	1	2.8	2.8	2.6	2.4	2.4

Mapping of COs with POs / PSOs

22CAP06 WEB TECHNOLOGY LABORATORY				
	L	**T**	**P**	**C**
	0	0	4	2

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To understand the basic html tags.	**1.1**	The students will be able to display the webpage using html tags.
2.0	To understand image map concepts.	**2.1**	The students will be able to know image map.
3.0	To understand about script concepts	**3.1**	The students will be able to validate the fields using scripting languages.
4.0	To understand the concept of XML.	**4.1**	The students will be able to store the data using XML program.
5.0	To learn React JS development.	**5.1**	The students will be able to programs using React JS.

LIST OF EXPERIMENTS

1. Create a HTML page, which has properly aligned paragraphs with image along with it.
2. Write a program to display list of items in different styles.
3. Create both client side and server side image maps.
4. Create your own style sheets and use them in your web page.
5. Create a form with various fields and appropriate front and validations using any one of the scripting languages.
6. Create a web page using XML.
7. Create React JS program to validate user input.
8. Develop a program for User Registration Form using React JS.
9. Develop a web application project using React JS.

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	2	2	2	1	-	-	-	1	1	1	1	2	2
2	2	2	2	1	1	-	-	-	1	1	1	1	2	1
3	2	2	2	2	1	-	-	-	1	1	1	1	2	1
4	2	2	2	2	1	-	1	-	1	2	1	1	2	2
5	2	2	2	2	1	-	1	-	1	2	1	1	2	2
CO	**2**	**2**	**2**	**1.8**	**1**	**-**	**1**	**-**	**1**	**1.4**	**1**	**1**	**2**	**1.6**

22CAE02 MINI PROJECT

	L	T	P	C
	0	0	4	2

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To provide the opportunity to the students to demonstrate independence and originality, to plan and organize a large project over a long period.	1.1	Students will be able to identify the problem and analyze the project requirements.
2.0	To carry out the opportunity to specialize in specific areas of Computer Applications.	2.1	Students will be able to apply current techniques and software tools necessary for solving complex modules.
3.0	To provide opportunity to demonstrate a wide range of skills and knowledge learned.	3.1	Students will be able to show their individuality and inspiration in the mini project by designing a specific to real time applications.
4.0	To work effectively in a team environment to accomplish a common goal.	4.1	Students will be able to improve their individuality and work as team player.
5.0	To encourage integration of knowledge gained in the previous course.	5.1	Students will be able to interpret the data and synthesis the information to derive conclusion for implementation of project.

DESCRIPTION

The Mini Project may be allotted to a single student or to a group of students not exceeding four per group. The Head of the department shall constitute a project review committee for the mini project. The title of the project is approved by head of the department under the guidance of the project review committee. Student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. There shall be three reviews during the semester and the progress will be reviewed by the committee. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per regulations.

TOTAL (P:60) = 60 PERIODS

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	1	2	2	1	1	1	-	2	2	1	1	1
2	2	2	1	2	1	1	2	3	-	2	2	1	2	2
3	2	2	3	2	2	2	2	3	2	3	3	3	2	2
4	2	2	3	2	2	2	2	3	2	3	3	3	2	2
5	2	2	3	2	2	2	2	3	2	3	3	3	2	2
CO	2	2	1.6	2	1.8	1.6	1.8	2.6	2	2.6	2.6	2.2	1.8	1.8

Mapping of COs with POs / PSOs

			L	T	P	C
22CAE03 PROJECT WORK			0	0	24	12

PREREQUISITE: Mini Project

	Course Objectives		**Course Outcomes**
1.0	To learn to plan, analyze, design and implement software project.	1.1	Students will be able to acquire knowledge by applying various techniques in plan, analyze, design and implement software project.
2.0	To understand software engineering principles and develop an ability to apply them to software design of real life problems in an industry/commercial environment.	2.1	Students will be able to apply engineering principles such cost estimation and time estimation for project.
3.0	To learn to work as a team and to focus on getting a working project done on time with each student being held accountable for their part of the project.	3.1	Students will be able to get motivated to work as a team and to focus on getting a working project done on time with each student being held accountable for their part of the project.
4.0	To learn about communication.	4.1	Students will be able to demonstrate the ability to communicate effectively in speech.
5.0	To learn about professional ethics.	5.1	Students will be able to demonstrate professional ethics while working within team.
6.0	To understand programming language concepts.	6.1	Students will be able to apply programming language concepts for the project development.
7.0	To learn about different software development process models and how to choose an appropriate one for a project.	7.1	Students will be able to choose from various software development process models appropriate for project.
8.0	To learn about methods of documenting a project.	8.1	Students will be able to demonstrate the ability in writing the project details in document.

DESCRIPTION

The Project Work may be allotted to a single student. The Head of the department shall constitute a project review committee for the project work. The title of the project is approved by head of the department under the guidance of the project review committee. Student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. There shall be three reviews during the semester and the progress will be reviewed by the committee. Student(s) shall make presentation on the progress made by him / her before the committee and evaluation is done as per regulations.

TOTAL (P:24x15)= 360 PERIODS

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	2	2	2	2	1	2	3	3	3	2	2
2	3	3	3	2	3	2	2	1	2	3	3	3	2	2
3	2	2	2	1	3	3	3	3	2	2	2	2	2	2
4	2	2	2	1	3	3	3	3	2	2	2	2	2	2
5	1	1	2	2	3	3	3	3	3	3	3	3	3	3
6	1	1	2	2	3	3	3	3	3	3	3	3	3	3
7	1	1	2	2	3	3	3	3	3	3	3	3	3	3
8	1	1	2	2	3	3	3	3	3	3	3	3	3	3
CO	1.75	1.75	2.25	1.75	2.88	2.75	2.75	2.5	2.5	2.75	2.75	2.75	2.5	2.5

Mapping of COs with POs / PSOs

Professional Electives - Artificial Intelligence and Data Science

22CAX01 INTERNET OF THINGS				
	L	**T**	**P**	**C**
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives			Course Outcomes
1.0	To make the students to know about basics of Electrical and Electronic devices.		1.1	The students will be able to examine basics of Electrical circuits and Electronic devices.
2.0	To make the students to know about basics and block diagram of IoT.		2.1	The students will be able to describe IOT characteristics and its essential components.
3.0	To make the students to know about Arduino processor and working of Analog and Digital I/O pins.		3.1	The students will be able to explain Arduino processor, working of Analog and Digital I/O pins and illustrate small projects.
4.0	To make the students to know about Raspberry pi and its interface with other devices.		4.1	The students will be able to explain Raspberry pi, its interface with other devices and illustrate small projects.
5.0	To motivate the students to implement the IoT using Arduino/ Raspberry Pi.		5.1	The students will be able to implement IoT system using Arduino/Raspberry Pi.

UNIT I - BASIC ELECTRONICS	**(9)**

Introduction - Current, Voltage and Resistance - Analog and Digital Signal - Conductors Vs Insulators – KCL- KVL - Basic Electronics components - calculating equivalent resistance for series and parallel circuits- Ohm's law- Color coding for a resistor – LED – LCD – LDR - Case Studies.

UNIT II - FUNDAMENTALS OF IOT	**(9)**

Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT Communication Models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry - Case Studies.

UNIT III - PROGRAMMING USING ARDUINO	**(9)**

Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial (UART), I2C Communications and SPI communication - Arduino Boards: Mega, Due, Zero and 101 - Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming - Case Studies.

UNIT IV - PROGRAMMING USING RASPBERRY PI	**(9)**

Technical Description of Raspberry Pi - comparison of Raspberry Pi Vs Arduino - Operating Systems for RPi - Preparing SD Card for Pi - Connecting Raspberry Pi as PC - Exploring Raspberry Pi Environment- Logical design using Python - Case Studies.

UNIT V - APPLICATIONS OF IOT	**(9)**

Various Real time applications of IoT- Home Automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications - Case Studies.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A Hands-on Approach", Universities Press, 2015.
2. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Wiley Publications, Second Edition, 2013.
4. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
5. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2012.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	2	1	2	2	1	2	2	2	2	2	1	3	-
2	2	2	2	2	2	1	2	2	3	3	3	1	3	-
3	2	3	3	3	3	2	2	2	3	3	3	3	3	2
4	2	3	3	3	3	2	2	2	3	3	3	3	3	2
5	2	3	3	3	3	2	2	2	3	3	3	3	3	2
CO	**2**	**2.6**	**2.4**	**2.6**	**2.6**	**1.6**	**2**	**2**	**2.8**	**2.8**	**2.8**	**2.2**	**3**	**2**

22CAX02 ARTIFICIAL INTELLIGENCE				
	L	**T**	**P**	**C**
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		**Course Outcomes**
1.0	To understand the various characteristics of Intelligent agents	**1.1**	The students will be able to understand the fundamental Intelligent agents.
2.0	To learn the different search strategies in AI	**2.1**	The students will be able to use appropriate search algorithms for any AI problem
3.0	To learn to represent knowledge in solving AI problems	**3.1**	The students will be able to represent a problem using first order predicate logic.
4.0	To understand the different ways of designing software agents	**4.1**	The students will be able to provide the apt agent strategy to solve a given problem.
5.0	To know about the various applications of AI.	**5.1**	The students will be able to design applications for NLP that use Artificial Intelligence.

UNIT I - INTRODUCTION	**(9)**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II - PROBLEM SOLVING METHODS	**(9)**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games.

UNIT III - KNOWLEDGE REPRESENTATION	**(9)**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories -Reasoning with Default Information.

UNIT IV - SOFTWARE AGENTS	**(9)**

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V - APPLICATIONS	**(9)**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. S. Russeland, P. Norvig, "Artificial Intelligence – A Modern Approach", Third Edition, Pearson Education, 2009.

2. David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: A Logical Approach", Oxford University Press, 2004.

3. G. Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Fourth Edition, Pearson Education, 2002.

4. J. Nilsson, "Artificial Intelligence: A New Synthesis", Elsevier Publishers, 1998.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	1	-	2	2	-	-	1	2	2	2	-	2	-
2	2	2	2	2	2	-	-	1	2	3	2	2	2	1
3	2	3	3	2	2	-	-	2	3	3	2	2	2	2
4	3	3	3	2	2	-	-	2	3	3	2	2	2	2
5	3	3	3	2	2	-	-	2	3	3	2	2	2	2
CO	2.4	2.4	2.8	2	2	-	-	1.6	2.6	2.8	2	2	2	1.8

A p p r o v e d   b y   T e n t h   A c a d e m i c   C o u n c i l

22CAX04 NATURAL LANGUAGE PROCESSING				
	L	**T**	**P**	**C**
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives			**Course Outcomes**
1.0	To introduce the basic concepts Regular expressions and Finite State Automata.	1.1	The students will be able to explain about the application of Finite state automata and regular expression in NLP.
2.0	To provide understand of various Morphological Processing.	2.1	The students will be able to apply Human Morphological Processing.
3.0	To understand and learn N-grams and part of speech tagging.	3.1	The students will be able to implement N-grams and part of speech tagging in NLP.
4.0	To understand and learn Phonetics and Speech Synthesis.	4.1	The students will be able to apply phonetics & speech synthesis in real world problems.
5.0	To understand basics of automatic speech recognition and syntactic parsing.	5.1	The students will be able to explain about automatic speech recognition & syntactic parsing.

UNIT I – INTRODUCTION	**(9)**

Knowledge in Speech and Language Processing – Ambiguity- Models and Algorithms - Regular Expressions & Finite State Automata: Regular Expressions – Automata - Disjunction, Grouping, and Precedence- Advanced Operators - Formal Languages – Non-Deterministic FSAs – sing an NFSA to Accept Strings – Recognition as Search – Relating Deterministic and Non-Deterministic Automata – Regular Languages and FSAs.

UNIT II - WORDS AND TRANSDUCERS	**(9)**

Survey of English Morphology - Inflectional Morphology - Derivational Morphology – Cliticization - Non-Concatenative Morphology – Agreement - Finite-State Morphological Parsing - Construction of a Finite-State Lexicon - Finite-State Transducers - Sequential Transducers and Determinism - FSTs for Morphological Parsing - Transducers and Orthographic Rules – Lexicon-Free FSTs: Word and Sentence Tokenization - Segmentation in Chinese -Detection and Correction of Spelling Errors - Minimum Edit Distance – Human Morphological Processing.

UNIT III - N-GRAMS AND PART OF SPEECH TAGGING	**(9)**

Word Counting in Corpora - Simple (Unsmoothed) N-grams - Training and Test Sets - N-gram Sensitivity to the Training Corpus - Unknown Words: Open Versus Closed Vocabulary Tasks - Evaluating N-grams - Perplexity - Smoothing - Laplace Smoothing. Part-of-Speech Tagging: Rule-Based Part-of-Speech Tagging - HMM Part-of-Speech Tagging - Transformation-Based Tagging - Evaluation and Error Analysis - Advanced Issues in Part-of-Speech Tagging.

UNIT IV - PHONETICS AND SPEECH SYNTHESIS	**(9)**

Speech Sounds and Phonetic Transcription - Articulatory Phonetics - Phonological Categories and Pronunciation Variation - Acoustic Phonetics and Signals - Phonetic Resources - Advanced: Articulatory and Gestural Phonology. Speech Synthesis: Text Normalization - Phonetic Analysis - Prosodic Analysis - Diphone Waveform synthesis - Unit Selection (Waveform) Synthesis.

UNIT V - AUTOMATIC SPEECH RECOGNITION AND SYNTACTIC PARSING	**(9)**

Speech Recognition Architecture - Feature Extraction: MFCC vectors - Acoustic Likelihood Computation - The Lexicon and Language Model - Search and Decoding - Context-Dependent Acoustic Models: Triphones - Modeling Variation. Computational Phonology: Finite State Phonology - Learning Phonology and Morphology. Syntactic Parsing: Parsing as Search - Search in the Face of Ambiguity - Dynamic Programming Parsing Methods - Partial Parsing.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Pearson Publication, India, 2014.

2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", 1st Edition, OReilly Media, 2009.

3. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", 2nd Edition, Chapman and Hall/CRC Press, 2010.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	1	2	1	2	2	1	2	2	2	2	2	2
2	3	3	2	2	1	2	2	1	2	2	2	2	2	2
3	3	3	2	2	1	2	2	2	2	2	2	2	2	2
4	3	3	2	2	1	2	2	2	2	2	2	2	2	2
5	3	3	2	2	1	2	2	2	2	2	2	2	2	2
CO	2.8	2.8	1.8	2	1	2	2	1.6	2	2	2	2	2	2

Mapping of COs with POs / PSOs

<table>
<tr><td colspan="5" align="center">**22CAX05 DATA CENTER VIRTUALIZATION**</td></tr>
<tr><td></td><td>**L**</td><td>**T**</td><td>**P**</td><td>**C**</td></tr>
<tr><td></td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
</table>

PRE REQUISITE : NIL

<table>
<tr><td colspan="2" align="center">**Course Objectives**</td><td colspan="2" align="center">**Course Outcomes**</td></tr>
<tr><td>1.0</td><td>To understand the basic of virtualization.</td><td>1.1</td><td>The students will be able to describe virtualization and server virtualization platform.</td></tr>
<tr><td>2.0</td><td>To understand vCenter Server Management.</td><td>2.1</td><td>The students will be able to deploy vCenter Server.</td></tr>
<tr><td>3.0</td><td>To understand resource virtualization.</td><td>3.1</td><td>The students will be able to explain communication between devices across different office and data center locations.</td></tr>
<tr><td>4.0</td><td>To understand functions of virtual machines.</td><td>4.1</td><td>The students will be able to explain the working of virtual machines.</td></tr>
<tr><td>5.0</td><td>To understand various functionalities of VMware.</td><td>5.1</td><td>The students will be able to describe about securing, monitoring and automating of VMware.</td></tr>
</table>

UNIT I - INTRODUCTION TO VIRTUALIZATION	**(9)**

Understanding Virtualization: Describing Virtualization, Understanding the Importance of virtualization, Understanding virtualization software operation. Understanding Hypervisors: Describing a Hypervisors, Understanding the Role of a Hypervisor, Comparing today's Hypervisors. Introducing VMware vSphere 6: Exploring VMware vSphere 6.0, Planning a VMware vSphere Deployment, Deploying VMware ESXi, Performing post installation configuration.

UNIT II - VMWARE VCENTER SERVER	**(9)**

Installing and Configuring vCenter Server: Introducing vCenter Server, Choosing the version of vCenter server, planning and designing a vCenter server deployment, Installing vCenter server and its components, Installing vCenter server in a linked mode group, Deploying the vCenter server virtual appliance, exploring vCenter Server, creating and managing a vCenter Server Inventory, Exploring vCenter servers management features, Managing vCenter Server settings, vSphere web client administration.

UNIT III - CREATING AND CONFIGURING VIRTUAL NETWORKS	**(9)**

Introduction to Virtual Network, Working with vSphere Standard Switches, Working with vSphere Distributed switches, Examining Third-Party distributed virtual switches, Configuring virtual switch security. Implementing vSphere Storage Fundamentals: vSphere storage concepts, understanding virtual volumes, SCs vs. LUNs, storage policies, Virtual volumes, Working with VMFS Datastores, Raw device mappings, NFS Datastores, VM-level storage configuration.

UNIT IV - WORKING WITH VIRTUAL MACHINES	**(9)**

Creating and Managing Virtual Machines: Understanding Virtual Machines, Creating a Virtual Machine, Installing a guest Operating System, Installing VMware tools, Managing Virtual Machines, Modifying Virtual Machines, Cloning VMs, Creating templates and deploying Virtual Machines, Using OVF templates, Using content libraries, Working with vApps, Importing machines from other environments. Configure and maintain a vCloud Air Connection: Create a VPN connection between vCloud Air and On-premise site, Deploy a Virtual Machine using vCloud Air, Migrate a virtual machine to vCloud Air, Verify VPN connection configuration to vCloud Air, Configure vCenter Server Connection to vCloud Air.

UNIT V - SECURING AND MONITORING	(9)

Securing VMware vSphere: Overview of vSphere security, Securing ESXi Hosts, Securing vCenter Server, Securing virtual machines.

Monitoring VMware vSphere Performance: Overview of performance monitoring, Alarms, Working with performance charts, Monitoring CPU, Memory, Network and Disk usage.

Automating VMware vSphere: Advantages of Automation, vSphere automation options, Automation with Power CLI, Using vCLI from vSphere management assistant, Using vSphere management assistant for automation with vCenter , ESXCLI and PowerCLI.

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Nick Marshall, "Mastering VMware vSphere 6 (SYBEX) (Paperback)", Grant Orchard. ISBN: 978-1-118-92515-7.

2. John A. Davis, Steve Baca, "VCP6-DCV Official Cert Guide (Exam #2V0-621) (Paperback)", ISBN-13: 978-9332581265

3. G. B. Abhilash, "VMware vSphere 6.5 Cookbook: Over 140 task-oriented recipes to install, configure, manage, and orchestrate various VMware vSphere 6.5 components", 3rd Edition.

4. Matthew Portnoy, "Virtualization Essentials (Paperback)".

5. Andrea Mauro, Paolo Valsecchi, Karel Novak, "Mastering VMware vSphere 6.5".

6. Martin Hoskenr, "VMware Software-Defined Storage Paperback".

7. Tony Sangha and Bayu Wibowo, "VMware NSX Cookbook".

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1	1	2	1	1	1	1	1	2	2	2	2	2	2
2	2	3	3	2	2	2	2	2	3	3	3	3	3	3
3	2	3	3	2	2	2	2	2	3	3	3	3	3	3
4	1	3	3	2	2	2	2	2	2	3	3	3	3	3
5	1	3	3	2	2	2	2	2	3	3	3	3	3	3
CO	1.4	2.6	2.8	1.8	1.8	1.8	1.8	1.8	2.6	2.8	2.8	2.8	2.8	2.8

	22CAX08 AGILE METHODOLOGY	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

PRE REQUISITE : NIL

	Course Objectives		**Course Outcomes**
1.0	To provide students about agile software development practices and how small teams can apply them to create high-quality software.	**1.1**	The students will be able to realize the importance of interacting with business stakeholders in determining the requirements for a software system.
2.0	To provide a understanding of software design and a set of software technologies and APIs.	**2.1**	The students will be able to perform iterative software development processes: how to plan them, how to execute them.
3.0	To provide a detailed examination and demonstration of Agile development.	**3.1**	The students will be able to analyze trade-off in selecting software engineering method for knowledge management.
4.0	To understand about Requirement Engineering.	**4.1**	The students will be able to manage agile requirement environment and modeling.
5.0	To understand about quality assurance.	**5.1**	The students will be able to analyze agile metrics quality assurance.

UNIT I - AGILE METHODOLOGY	**(9)**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values.

UNIT II - AGILE PROCESSES	**(9)**

Lean Production – SCRUM – Crystal - Feature Driven Development - Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT III - AGILITY AND KNOWLEDGE MANAGEMENT	**(9)**

Agile Information Systems – Agile Decision Making – Earl's Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

UNIT IV - AGILITY AND REQUIREMENTS ENGINEERING	**(9)**

Impact of Agile Processes in RE – Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment - Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V - AGILITY AND QUALITY ASSURANCE	**(9)**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Glob.

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. David J. Anderson and Eli Schragenheim, Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.

2. Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

3. Kevin C. Desouza, Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

4. Robert C. Martin, Agile Software Development, Principles, Patterns and Practices, International Edition, Pearson Education Limited, 2013.

COs	\multicolumn{12}{c}{POs}	\multicolumn{2}{c}{PSOs}
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	-	-	1	-	1	-	2	-	-	-	1	-
2	2	1	1	-	1	-	1	2	3	-	-	-	2	-
3	2	1	2	1	2	1	1	2	3	-	1	2	2	3
4	2	2	3	1	2	1	1	2	3	2	1	2	2	3
5	2	2	3	1	2	1	1	2	3	2	1	2	2	3
CO	2	1.4	2.25	1	1.6	1	1	2	2.8	2	1	2	1.8	3

Mapping of COs with POs / PSOs

22CAX09 ORGANISATIONAL BEHAVIOUR				
	L	**T**	**P**	**C**
	3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To learn the basic concepts of organizational behaviour and management.	**1.1**	The students will be able to know the organization behaviour and management concepts.
2.0	To understand the knowledge of personality and motivation concepts.	**2.1**	The students will be able to understand the personality and various motivation theories.
3.0	To acquaint the concepts of work stress and team dynamics in the organisation.	**3.1**	The students will be able to realize the work stress and team work in organisation.
4.0	To know the power and leadership quality in the organisation.	**4.1**	The students will be able to apply the power and leadership quality in the organisation.
5.0	To impart the knowledge of communication and decision making.	**5.1**	The students will be able to improve the communication and decision making if the problem raised.

UNIT I – INTRODUCTION	**(9)**
Nature of organisations – Nature of OB – Foundations for OB – Reasons for studying OB – Shortcomings – Behavioural sciences contributed to OB – Scope – Approaches – Evolution. Management and Managers: Functions of management – Different roles played by a manager – Manager hierarchy – Evolution – Contemporary trends in management thinking.	

UNIT II – PERSONALITY AND MOTIVATION	**(9)**
Personality: Nature – Personality passes through different stages – Seven factors determine personality – Personality structure – Personality and OB. Motivation: Nature – Importance – Challenges – Theories of motivation – Motivation across cultures.	

UNIT III - WORK STRESS AND TEAM DYNAMICS	**(9)**
Work Stress: Stress experience – Work stress model – Burnout – Stress Management – Stress and performance. Team Dynamics: Nature – Benefits – Types of teams – Implementing teams in organisations – Team issues – Effective teamwork – Typical teams.	

UNIT IV - POWER AND LEADERSHIP	**(9)**
Power and Political Behaviour: Power – Power dynamics – Sources of Power – Effective use of power – Power tactics – Politics – Types – Ethics of power and politics. Leadership: Nature – Leadership and Management – Importance – Formal and informal – Leadership styles – Theories of Leadership – Issues – Development.	

UNIT V - COMMUNICATION AND DECISION MAKING	**(9)**
Communication: Significance – Interpersonal communication – Organisational communication – Networks – Roles – Policies and Audit -Informal communication – Communication media – Information technology. Decision Making: Nature – Types – Conditions – Models – Process – Styles – Individual and Group decision making.	

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Aswathappa K, "Organisational Behaviour", Fourteenth Edition, Himalaya Publishing House, 2022.
2. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, "Organizational Behaviour", 18 th Edition, Pearson, 2018.
3. Uma Sekaran, "Organizational Behaviour", New Delhi: Tata McGraw Hill, 2016.
4. Charles W.L Hill and Steven L McShane, "Principles of Management", McGraw Hill Education, Special Indian Edition, 2017.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2	1	2	3	2	1	2	2	1	1	1	1	2
2	1	1	2	2	2	3	1	3	3	1	2	1	2	1
3	1	2	2	2	2	3	2	3	3	1	1	1	1	1
4	2	3	2	3	3	2	3	2	1	1	1	1	2	2
5	1	2	2	2	3	3	2	3	3	1	2	3	2	2
CO	1.6	2	1.8	2.2	2.6	2.6	1.8	2.6	2.4	1	1.4	1.4	1.6	1.6

22CAX10 USER INTERFACE DESIGN				
	L	**T**	**P**	**C**
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		**Course Outcomes**
1.0	Gaining factual knowledge about various types of user interfaces	1.1	Students will be able to understanding importance of user interface and benefits of good design
2.0	To learn about design process and business functions	2.1	Students will be able to understand user interface design process and business functions
3.0	To learn the characteristics and components of windows and various controls	3.1	Students will be able to understanding characteristics of windows, device based and screen based controls
4.0	To study about various problems in windows design with icons and colors	4.1	Students will be able to design page layout that supports find ability of hierarchical content and task completion
5.0	To explore different Test methods and tools	5.1	Students will be able to conduct effective forms with focused input controls

UNIT I - INTRODUCTION	**(9)**
Human–Computer Interface – Graphical User Interface: Direct Manipulation Graphical System, advantages and disadvantages, Characteristics of Graphics Interface — Web User Interface: Popularity –Characteristic & Principles.	

UNIT II HUMAN COMPUTER INTERACTION	**(9)**
User Interface Design Process: Obstacles –Usability –Human Characteristics In Design – Human Interaction Speed – Business Functions: Requirement Analysis – Direct – Indirect Methods – Basic Business Functions: Design Standards – System Training and documentation needs– Human Consideration In Screen Design – Structures Of Menus – Functions Of Menus– Contents Of Menus– Formatting the Menus – Phrasing the Menu – Selecting Menu Choice – Navigating Menus– Graphical Menus.	

UNIT III WINDOWS	**(9)**
Characteristics – Components – Presentation Styles – Types– Managements– Organizations – Operations– Web Systems– Device – Based Controls: Characteristics–Screen – Based Controls: Operate Control – Text Boxes– Selection Control– Combination Control– Custom Control– Presentation Control.	

UNIT IV MULTIMEDIA	**(9)**
Text for Web Pages – Effective Feedback and Guidance and Assistance–Internationalization and Accessibility – Icons and Image: Icons – Multimedia – Colors: color uses – possible problems with colors – colors and human vision – choosing colors.	

UNIT V WINDOWS LAYOUT AND TEST	**(9)**
Organizing and laying out screens, Test, test and retest: Prototypes – Kinds of Tests – Developing and conducting the test – Analyze, Modify and Retest, Information Search – Visualization – Hypermedia – WWW– Software Tools.	

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Wilbent. O. Galitz ,"The Essential Guide To User Interface Design", John Wiley& Sons, 2001.

2. Ben Sheiderman, "Design The User Interface", Pearson Education, 1998.

3. Alan Cooper, "The Essential Of User Interface Design", Wiley – Dream Tech Ltd., 2002.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	1	2	2	1	2	2	1	1	2	2	2	-	-
2	2	1	2	2	1	2	2	1	1	2	2	2	2	2
3	2	1	2	2	1	2	2	1	1	2	2	2	2	2
4	2	1	2	2	1	2	2	1	1	2	2	2	2	2
5	2	1	2	2	1	2	2	1	1	2	2	2	2	2
CO	**2**	**1**	**2**	**2**	**1**	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**1.6**	**1.6**

22CAX12 ENTREPRENEURSHIP				
	L	**T**	**P**	**C**
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		**Course Outcomes**
1.0	To understand the skills and characteristics of successful Entrepreneurs.	**1.1**	The students will be able to gain entrepreneurial competence to run the business efficiently.
2.0	To understand creativity of Idea to Opportunity.	**2.1**	The students will be able to understand the opportunity and creative ideas for entrepreneurship.
3.0	To impart knowledge of Legal and Intellectual Property Rights.	**3.1**	The students will be able to capable of preparing IPR and legal aspects.
4.0	To plan the business and marketing.	**4.1**	The students will be able to plan and marketing the business effectively.
5.0	To impart knowledge of ventures	**5.1**	The students will be able to efficient in launching and develop their business ventures successfully.

UNIT I - FUNDAMENTALS OF ENTREPRENEURSHIP	**(9)**

Introduction – Key to Development - Evolving concepts – Resource Organization – Entrepreneurial Traits – Difference Between Inventors and Entrepreneurs – Role Models – Social Support – Business Model – Entrepreneurship Mindset – Big Companies and Start-ups – Misconceptions and Myths. Entrepreneurship Developments: Types of start-ups – Intrapreneurship – Careers – Female Entrepreneurship – Small and Medium Business Enterprises – International Entrepreneurship – Role of Educational Institutions -Mistakes Startup Make – Emerging Trends.

UNIT II - CREATIVITY AND IDEA TO OPPORTUNITY	**(9)**

Creativity: Introduction – Creativity and Entrepreneurship – Characteristics – Blocks to creativity – Creativity at work – Sources of New Ideas – Techniques for Generating Ideas – Idea to Opportunity: Definition – Recognition – Process – Sources of Opportunity – Steps for Assessing Business Potential – Steps for Tapping Opportunity.

UNIT III - LEGAL ASPECTS AND IPR	**(9)**

Legal Aspects for Business: Introduction – Formation of Business Entity – Taxation – Deemed Public Limited Company – Requirements of Private/Public Company – Board of Directors – Roles and Responsibilities – Procedure – Legal Acts Governing Business in India – Winding up a Registered Company – Need of Lawyer – Intellectual Property Rights: University Research – IPR Importance – IP Importance for Startups – IP Rights – Patents – Trademarks – Copyrights.

UNIT IV - BUSINESS AND MARKETING PLAN	**(9)**

Business Plan: Entrepreneurial Opportunities and Business Plan – Necessity – Drivers – Business Failures – Preparation – Prepare a Plan – Basics of Business Plan – Importance – Reasons for Failures – Marketing Plan: Marketing Research – Benefits – Scope – Types – Marketing Research on Internet – Industry Analysis – Competitor Analysis – Target Market – Market Segmentation – Market Positioning – Building a Market Plan – Marketing Mix.

UNIT V – VENTURES	**(9)**

Venture Team and Organisational Plan – Venture success – Importance – Team Building – Effective Venture Team – Venture Team Development – People Management – Organisational Structure and Systems – Effective Organisational Structure – Financing Venture: Need Money – Different Stages – Sources of Finance - Seed Funding – Venture Capital Funding – Funding from Banks – Lease Financing – Launching a Venture: Steps – Incorporation and Issuance of Stocks –

Stockholders Agreement – Raise Different Resources – Leverage of Intellectual Property – Build a Winning Team – Motivation and Inspiring the Team – Pilot Testing – Record Keeping of Expenses – Todo Checklist – Managing Cash – Due Diligence – Scheduling.

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. S.S.Khanka, "Entrepreneurial Development", S. Chand and Company Limited, New Delhi, 2016.

2. Arya Kumar, "Entrepreneurship", Pearson Publication, 2012.

3. Dr. Robert D Hisrichis, Dr Michael P Peters, Dr Dean Shepherd, Dr Sabyasachi Sinha, "Entrepreneurship", Eleventh Edition, McGraw Hill, 2022.

4. Charantimath Poornima M, "Entrepreneurship Development and Small Business Enterprises", Pearson Education, 3rd Edition (2018).

	Mapping of COs with POs / PSOs													
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	1	1	2	3	2	2	2	2	1	1	2	1	1
2	2	3	1	2	2	2	2	3	2	2	1	2	1	1
3	1	2	1	1	2	2	3	1	2	1	1	1	1	1
4	2	3	2	2	3	3	2	3	3	1	2	2	2	1
5	1	1	1	1	2	1	1	1	1	1	2	1	1	1
CO	1.8	2	1.2	1.6	2.4	2	2	2	2	1.2	1.4	1.6	1.2	1

22CAX13 INTELLECTUAL PROPERTY RIGHTS

	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To understand about IPR regime.	**1.1**	The students will be able to explain about Intellectual Property Rights.
2.0	To learn about Patent.	**2.1**	The students will be able to explore about Patent and its legal requirements.
3.0	To learn about Trademarks.	**3.1**	The students will be able to examine about trademark types and its functions.
4.0	To learn about Copyrights.	**4.1**	The students will be able to examine about Rights and Protection covered by Copyright.
5.0	To understand about Geographical indication of goods and Industrial Design.	**5.1**	The students will be able to explain the need of GI Protection and kind of protection provided by Industrial Designs.

UNIT I – OVERVIEW OF THE IPR REGIME	(9)

Introduction – Types of Intellectual Property: Industrial Property, Artistic and Literary Property, Sui Generis Systems. Need for Intellectual Property Rights – Rationale for protection of IPR – Impact of IPR on development, health, agriculture and genetic resources – IPR in India – Genesis and Development – IPR in abroad – Examples of IPR – International Organizations, agencies and treaties.

UNIT II – PATENTS TRIPS	(9)

Definition – Kind of inventions protected by patent – Patentable and Non Patentable inventions, Process and product patent, double patent – patent of addition. Legal requirements for patents – Granting of patent – Rights of a patent-exclusive right. Patent application Process: Searching a Patent – Drafting of a Patent – Filing of a patent – Types of Patent Applications – Patent Document: Specification and Claims – Management of IP Assets and IP Portfolio – Commercial exploitation of IP – Assignment, Licensing, Infringement. Different Layers of International Patent System: National, Regional and International Options.

UNIT III – TRADEMARKS	(9)

Rights of Trademark – Kind of Signs used as trademarks – Types, Purpose and Functions of a Trademark - Trademark Protection – Trademark Registration – Acquisition of Trademark Rights – Protectable matter – Selecting and Evaluating Trademark – Trademark Registration Processes.

UNIT IV – COPYRIGHTS	(9)

Rights and Protection covered by Copyright – Law of Copyrights: Fundamental of Copyright Law – Originality of Material - Rights of reproduction – Rights to perform the work publicly, Copyright Ownership issues – Obtaining Copyright Registration – Notice of Copyright – International Copyright Law – Infringement of Copyright under Copyright Act. Related Rights: Distinction between related Rights and Copyright – Celebrity Rights, Academic Integrity or Plagiarism: An Intellectual Theft.

UNIT V – GEOGRAPHICAL INDICATION OF GOODS AND INDUSTRIAL DESIGN	(9)

Geographical indication of goods: Types - Need of GI Protection and GI Laws – Indian GI Act. Traditional Knowledge: Indigenous – Medicinal – Bio-Prospecting Knowledge examples – Need for Protection – Positive Protection – Defensive Protection – Legal Aspects. Industrial Designs: Protection – Kind of Protection provided by Industrial Designs – Integrated Circuits. Role and Liabilities of IPRs in India: Cyberlaw issues – Criminal Law, Data Safety, Online Privacy, Health Privacy – Freedom of Expression and Human Rights, Net Neutrality – National Security.

TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. K. Bansal & P. Bansal, "Fundamentals of IP for Engineers".
2. Deborah, E. Bouchoux, "Intellectual Property Right", Cengage Learning.
3. Prabuddha Ganguli, "Intellectual Property Right – Unleashing the Knowledge Economy", Tata McGraw Hill Publishing Company Ltd.
4. Electronic Resource Guide ERG Published online by the American Society of International Law.
5. "Intellectual Property Rights and Development Policy: Report of the Commission on Intellectual Property Rights", London September 2002 (Web Resource).
6. WIPO Intellectual Property Handbook: Policy, Law and Use (Web Resource)

Mapping of COs with POs / PSOs														
Cos	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1	-	-	-	2	2	3	-	3	3	-	-	1	1
2	1	-	-	-	2	2	3	-	3	3	-	-	2	2
3	1	-	-	-	2	2	3	-	3	3	-	-	2	2
4	1	-	-	-	2	2	3	-	3	3	-	-	2	2
5	1	-	-	-	2	2	3	-	3	3	-	-	2	2
CO	1	-	-	-	2	2	3	-	3	3	-	-	1.8	1.8

		L	T	P	C
22CAX14 HUMAN RESOURCE MANAGEMENT					
		3	0	0	3

PRE REQUISITE : NIL

	Course Objectives			Course Outcomes
1.0	To understand the basic concepts, functions and processes of human resource management	1.1		Students would have gained knowledge on the various aspects of HRM
2.0	To enable students to learn the skills of talent acquisition practices	2.1		Students will gain knowledge needed for success as a human resources professional.
3.0	To describe corporate training & development methods	3.1		Students will develop the skills needed for a successful HR manager
4.0	To develop conceptual understanding of compensation management system and career concepts.	4.1		Students would be prepared to implement the concepts learned in the workplace.
5.0	To develop practical insights and problem solving capabilities for effectively managing the organizational appraisal and control practices	5.1		Students would be aware of the emerging concepts in the field of HRM

UNIT I PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT	**(9)**

Evolution of human resource management – The importance of the human capital – Role of human resource manager – Challenges for human resource managers - trends in Human resource policies – Computer applications in human resource management – Human resource accounting and audit.

UNIT II HUMAN RESOURCE PLANNING AND RECRUITMENT	**(9)**

Importance of Human Resource Planning – Forecasting human resource requirement –matching supply and demand - Internal and External sources- Organizational Attraction-. Recruitment, Selection, Induction and Socialization- Theories, Methods and Process.

UNIT III TRAINING AND DEVELOPMENT	**(9)**

Types of training methods –purpose- benefits- resistance. Executive development program – Common practices - Benefits – Self development – Knowledge management.

UNIT IV EMPLOYEE ENGAGEMENT	**(9)**

Compensation plan – Reward – Motivation – Application of theories of motivation – Career management – Mentoring - Development of mentor – Protégé relationships- Job Satisfaction, Employee Engagement, Organizational Citizenship Behavior: Theories, Models.

UNIT V PERFORMANCE EVALUATION AND CONTROL	**(9)**

Method of performance evaluation – Feedback – Industry practices. Promotion, Demotion, Transfer and Separation – Implication of job change. The control process – Importance – Methods – Requirement of effective control systems grievances – Causes – Implications – Redressal methods.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Gary Dessler and Biju Varkkey, Human Resource Management, 14th Edition, Pearson Education Limited, 2015.
2. David A. Decenzo, Stephen.P.Robbins, and Susan L. Verhulst, Human Resource Management, Wiley International Student Edition, 11th Edition, 2014.
3. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012.
4. Bernadin, Human Resource Management ,Tata Mcgraw Hill ,8th edition 2012.
5. Wayne Cascio, Managing Human Resource, McGraw Hill, 2015.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1	1	1	-	2	2	2	1	2	-	-	1	-	-
2	2	1	1	1	2	2	2	2	2	-	-	1	-	-
3	2	1	1	1	2	2	2	2	2	-	-	1	1	1
4	2	1	1	1	2	2	2	2	2	-	-	1	1	1
5	2	1	1	1	2	2	2	2	2	-	-	1	2	2
CO	**1.8**	**1**	**1**	**1**	**2**	**2**	**2**	**1.8**	**2**	**-**	**-**	**1**	**1.33**	**1.33**

Professional Electives: Digital Security

22CAX15 ETHICAL HACKING				
	L	**T**	**P**	**C**
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To identify and learn the basics, tools and skills for ethical hacking.	1.1	Students will able to realize the basics of Hacking.
2.0	To identify the process and techniques in order to compromise a target system.	2.1	Students will able to explain the basic vulnerabilities in any computing system.
3.0	To learn security techniques used to protect system and user data.	3.1	Students will able to categorize the types of hacking attacks.
4.0	To demonstrate systematic understanding of the threats to Wireless and Firewall systems.	4.1	Students will able to interpret the vulnerabilities in Wireless and Firewall systems.
5.0	To learn the possible attacks in Application hacking and their countermeasures to take.	5.1	Students will able to determine the possible attacks in complex real time systems and their counter measures.

UNIT I - INTRODUCTION	(9)

Introduction: Hacking – types of hacking - purpose – types of hackers – Ethical hacking process - Hacking terminologies – tools – skills.

UNIT II – CASING THE ESTABLISHMENT	(9)

Foot Printing: Definition - Internet foot printing – Scanning – Determine System is Alive – Determine Services Running or Listening – Detecting the Operating System – Processing and storing scan data – Enumeration – basic banner grabbing – Enumerating common Network services.

UNIT III – PASSWORD HACKING	(9)

Introduction – Password Cracking – Cracking the Windows – Glide Code – Windows Screen Saver Password – XOR – Internet Connection Password – HTTP authentication – BIOS Passwords – Cracking other passwords – Remote Access Sharing Password Decoding – Breaking DES algorithm – Brute Force Password Cracking – Default Passwords.

UNIT IV - WIRELESS AND FIREWALL HACKING	(9)

Wireless Equipment – Discovery and monitoring – Denial of Service Attacks – Common DoS Attack Techniques – DoS Countermeasures – Encryption Attacks – Authentication attacks – Firewalls – Firewalls landscape – Firewall identification – Scanning through firewalls – Packet filtering – Case Studies.

UNIT V - APPLICATION HACKING AND COUNTER MEASURES	(9)

Web and Database Hacking – Web Server Hacking – Web application Hacking – Common Web application Vulnerabilities – Database Hacking – Mobile Hacking – Hacking android iOS.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Ankit Fadia, "An Unofficial Guide to Ethical Hacking", Macmillan India Ltd, 2006.

2. EC – Council Press, "Ethical Hacking and Countermeasures: Attack Phases", 1st Edition, Cengage Learning, 2009.

3. Bob Bittex, "Hacking for Beginners: Ultimate Guide to become a Hacker", Paperback Edition, 2017.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	1	2	2	1	2	-	-	1	1	-		-	-
2	1	2	1	2	2	1	-	-	1	1	1	1	-	-
3	2	2	1	2	2	1	-	-	1	1	2	1	-	-
4	2	1	3	2	2	1	-	-	2	1	3	2	2	2
5	2	2	3	2	3	-	-	-	2	1	3	2	2	2
CO	1.8	1.6	2	2	2	1.25	-	-	1.4	1	2.25	1.5	2	2

		L	T	P	C
22CAX18 BLOCKCHAIN TECHNOLOGY					
		3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To understand the basics of block chain technology.	**1.1**	The students will be able to Identify the basics of block chain technology concepts and its applications.
2.0	To understand the design and implementation of crypto currency.	**2.1**	The students will be able to discover the implementation of crypto currency.
3.0	To learn the Ethereum model, its consensus model and code execution.	**3.1**	The students will be able to relate deep understanding of the Ethereum model, its consensus model and code execution.
4.0	To illustrate the architectural components of a hyperledger and its development framework.	**4.1**	The students will be able to illustrate the architectural components of a hyperledger and its development framework.
5.0	To learn about the alternative blockchain and emerging trends.	**5.1**	The students will be able to infer the alternative blockchain and emerging trends in blockchain.

UNIT I - BLOCKCHAIN ESSENTIALS	**(9)**

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization.

UNIT II - CRYPTOCURRENCY	**(9)**

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Bitcoin limitations – Name coin – Prime coin – Zcash – Smart Contracts – Ricardian Contracts.

UNIT III - ETHEREUM	**(9)**

Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

UNIT IV - WEB3 AND HYPERLEDGER	**(9)**

Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.

UNIT V - ALTERNATIVE BLOCKCHAIN AND EMERGING TRENDS	**(9)**

Kadena – Ripple – Rootstock – Quorum – MaidSafe – BigchainDB - Tendermint – Scalability – Privacy – Blockchain Research – Notable Projects – Miscellaneous Tools.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Imran Bashir, "Mastering Blockchain", 2ndEdition, Packt Publication, Mumbai, 2018.
2. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", VPT Publisher, 2017.
3. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 1stEdition, O"Reilly Media Inc, USA,2015.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2	1	1	-	1	-	-	-	1	-	-	1	1
2	3	2	1	1	-	-	-	-	-	-	-	-	1	1
3	3	1	2	1	-	-	-	-	1	-	-	-	1	1
4	3	1	2	2	1	-	-	-	2	-	-	-	1	1
5	3	2	1	2	1	-	-	-	2	-	-	1	1	1
CO	3	1.6	1.4	1.4	1	1	-	-	1.67	1	-	1	1	1

22CAX19 SOFTWARE QUALITY ASSURANCE

		L	T	P	C
		3	0	0	3

PRE REQUISITE : NIL

Course Objectives		Course Outcomes	
1.0	To outline the fundamental concepts of Software Quality.	1.1	The students will be able to apply the concepts in software testing.
2.0	To illustrate knowledge about software testing process flow and testing documents.	2.1	The students will be able to implement the concepts of manual testing.
3.0	To study the management concepts and testing techniques.	3.1	The students will be able to design the test cases and to getting familiarity over major testing team process.
4.0	To provide a complete coverage of functionality tools.	4.1	The students will be able to apply the testing tools exposure in real time applications.
5.0	To develop test cases using test management tool.	5.1	The students will be able to use the testing tools to check the behavior of the real time application using management tools.

UNIT I – INTRODUCTION TO QUALITY AND SOFTWARE QUALITY	(9)

Introduction – Software Development Life Cycle (SDLC) – Historical Perspective of Quality – Total Quality Management – Continuous Improvement Cycle – Constraints of Software Quality Assessment – Customer is a King – Software Quality Management – Software Defects – Important Aspects of Quality Management – Types of Products – Quality Management System Structure – Pillars of Quality Management System

UNIT II – FUNDAMENTALS OF SOFTWARE TESTING	(9)

Definition of Testing – Approaches to Testing – Popular Definitions of Testing – Testing during Development Life Cycle – Requirements Traceability Matrix - Essentials of Software Testing – Workbench – Important Features of Testing Process – Test Planning – Test Team Approach – Testing Process – Black Box Testing – White Box Testing

UNIT III - MANAGEMENT CONCEPTS AND TESTING TECHNIQUES	(9)

Configuration Management – Configurable Items – Base Lining –Configuration Management Planning – Types of Software Risks – Handling of Risks in Testing – Unit Testing – Integration Testing – System Testing –User Acceptance Testing – SRS – Use Case Design – Test Case Design – Bug Report Preparation – Case Studies.

UNIT IV - FUNCTIONALITY TOOL	(9)

Silk Test : Introduction – Architecture – Automated Testing Process – Quick start with Silk Test – Configuring the settings - Exposure to Silk Test IDE – Plug and Play test case.

UNIT V - TEST MANAGEMENT	(9)

Testing Process – Specifying Testing Requirements – Planning Tests – Calling Tests with Parameters – Creating and Viewing Requirements Coverage – Generating Automated Test Scripts – Running Tests – Writing Test Sets – Case Studies.

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. M.G. Limaye, Software Testing, Tata McGraw – Hill, 2009.
2. Dr.K.V.V.Prasad, Software Testing Tools, Dreamtech, 2004.
3. URL : www.onestoptesting.com/SilkTest
4. URL : www.onestoptesting.com/testdirector

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	2	1	1	-	-	-	1	1	1	1	1	2	2
2	2	2	1	-	-	-	-	-	1	1	1	1	2	1
3	2	2	1	-	-	-	-	-	1	1	1	1	2	1
4	2	2	2	-	-	-	1	-	1	2	1	1	2	1
5	2	2	2	1	2	-	1	1	1	2	1	1	2	1
CO	1.8	2	1.4	1	2	-	1	1	1	1.4	1	1	2	1.2

Mapping of COs with POs / PSOs

Open Elective Courses

22CAO01 EMPLOYABILITY ENHANCEMENT AND ANALYTICAL SKILLS				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

	Course Objectives		Course Outcomes
1.0	To enable learners to achieve linguistic competence in oral and written discourse efficiently.	1.1	The students will be able to write in an effective manner that demonstrates an understanding of the basic concepts of grammar.
2.0	To acquire necessary listening and speaking skills in order to comprehend discourse and to express effectively and exchange ideas.	2.1	The students will be able to listen and comprehend lectures and communicate effectively in their area of Specialization and speak fluently.
3.0	To learn various active reading and writing strategies in order to comprehend, analyze and communicate ideas.	3.1	The students will be able to read different genres of texts, infer implied meanings and write effectively for a variety of professional and social settings.
4.0	To develop students to workout solution for problems that involves mathematical aptitude.	4.1	The students will be able to solve aptitude problems with ease.
5.0	To develop students to workout solutions for problems that involves general reasoning.	5.1	The students will be able to solve reasoning problems with ease.

UNIT I – GRAMMAR	(9)
Parts of Speech – Synonyms & Antonyms - Primary Auxiliary Verbs – Modal Auxiliary Verbs - Tenses – Articles– Preposition – Conjunction–Common Errors - Subject Verb Agreement – Error Spotting – One word Substitution – Jumbled Sentences – Confusable word – Idioms and Phrases – Degrees of Comparison – Sentence Completion.	

UNIT II - LISTENING AND SPEAKING	(9)
LISTENING - Listening Strategies - Listening for Specific Information- Listening to TED & INK Talks - Listening for Signpost Language - Listening to Telephonic Conversations. SPEAKING - Group/Pair Presentations - Visume - Interview Skills – GD.	

UNIT III - READING AND WRITING	(9)
READING - Strategies for Effective Reading - Reading for Specific Information - Speed Reading Techniques - Critical Reading. WRITING - Job Application Letter with Resume - E-mail Writing - Paragraph Writing.	

UNIT IV - APTITUDE	(9)
Number System- Ratio & Proportion-Percentages-Averages-Profit & Loss.	

UNIT V - REASONING	(9)
Figure Series-Blood Relation-Analogy-Coding and Decoding-Odd one out.	

	TOTAL (L:45) : 45 PERIODS

REFERENCES:

1. Tickoo, M. L., A. E. & Subramaniam, P. R., "Intermediate Grammar Usage & Composition", Orient Blackswan, 1976.
2. Davis, Jason and Liss, Rhonda, "Effective Academic Writing (Level 3)", Oxford University Press, 2006.
3. Koneru, Aruna, "English Language Skills" Tata McGraw-Hill Education, 2011.
4. Raman, Meenakshi and Sharma, Sangeeta, "Technical Communication English Skills for Engineers", Oxford University Press, 2008.
5. Khattar, Dinesh, "Quantitative Aptitude", Third Edition New Delhi: Pearson, 2014.
6. Aggarwal R.S., "A Modern Approach to Verbal & Non Verbal Reasoning", Revised Edition, S. Chand Publishers, New Delhi, 2017.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	-	-	2	-	3	1	3	-	1	-	-	-	1
2	-	-	-	3	1	3	1	3	1	1	-	-	-	1
3	-	-	-	2	1	3	1	2	1	1	-	-	-	1
4	3	3	3	2	2	-	-	-	-	2	-	-	-	2
5	3	3	3	2	2	-	-	-	-	2	-	-	-	2
CO	3	3	3	2.2	1.5	3	3	2.7	1	1.4	-	-	-	1.4