Pimpri Chinchwad Education Trust's

Pimpri Chinchwad University

Sate, Pune – 412106

PCET's
Pimpri
Chinchwad
University

Learn | Grow | Achieve

Curriculum Structure

B. TECH
COMPUTER SCIENCE & ENGINEERING
(Batch-2024-2028)

School of Engineering and Technology

Effective from

Academic Year 2024-25 Program Structure

December Version 1.3

Preamble:

We, at Pimpri Chinchwad University, offer the Bachelor of Technology in Computer science and Engineering program to provide students with a comprehensive education in the science and practice of recent trends in computer engineering. Our mission is to prepare graduates who are competent, compassionate, and committed to promote technology through cutting edge practical assignments.

The B.Tech. in Computer Science and Engineering program integrates knowledge from various disciplines such as mathematics, science, engineering, statistics and programming languages to provide a holistic understanding of the core of computer science in engineering. The curriculum includes courses in databases, computer network, data structures, operating systems, web technologies; cloud computing, compiler construction and artificial intelligence. Students will also have opportunities to gain practical experience through internships, mini and major projects, webinars and various technical competitions like hackathon.

Our program aims to develop student's critical thinking, communication, and leadership skills to enable them to work effectively and to provide sustainable solutions for the real-world technical challenges in the recent industry trends by maintaining professional standards, ethical values and integrity. Graduates of our program will be able to apply their knowledge and skills to work on the cutting-edge technologies of the industry and also to appear for post graduate educations in respective fields.

We are committed to providing a supportive and inclusive learning environment that values diversity, equity, and inclusion. Our faculty members are dedicated to excellence in teaching, research, and technology and are actively engaged in advancing the field of computer and engineering through scholarly activities and professional organizations. We invite students who share our passion to use and create technology for computer engineering to join our program and embark on a journey of learning and growth that will prepare them for rewarding careers and lifelong learning.

Vision and Mission of Program:

Vision:

To develop engineers well versed with Critical Theory and Practical's (problem solving ability); and sensitive to National and Global challenges from Inter-disciplinary perspective. To create Industry ready; socially and ethically strong professionals.

Mission:

Our mission is

- To develop the Computer Professionals by imparting computer engineering knowledge with professional ethics
- To provide the service to the communities to which we belong at local and national levels, combined with a deep awareness of our ethical responsibilities to our profession and to society

Program Outcome

At the end of program, students should be able to

PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives

Program Educational Objectives (PEOs) for a BTECH in Artificial Intelligence & Machine Learning program are as follows:

- **PEO 1:** To provide students with knowledge and skills to become leading experts in the field of computer science engineering.
- **PEO 2:** To provide an innovative and comprehensive curriculum that integrates theoretical knowledge with practical experience, research opportunities, and professional development
- **PEO 3:** To groom the student's overall personality for professional growth.
- **PEO 4:** To inculcate values and ethics among the students and making them aware about their social commitments.

Program Specific Outcomes

At the end of program, students should be able to

PSO 1	Use knowledge to write programs and integrate them with the hardware/software products in the domains of artificial Intelligent systems, data Science, networking and web technology.
PSO 2	Participate in planning and implement solutions to cater to business specific requirements, displaying team dynamics and professional ethics.

INDEX

Sr. No.	Type of course	Abbreviations
1	Basic Science Course	**BSC**
2	Engineering Science Course	**ESC**
3	Programme Core Course	**PCC**
4	Programme Elective Course	**PEC**
5	Multidisciplinary Minor	**MIN**
6	Open Elective Other than a particular program	**OE**
7	Vocational and Skill Enhancement Course	**VSEC**
8	Ability Enhancement Course	**AEC**
9	Entrepreneurship / Economics / Management Courses	**MGMT**
10	Indian Knowledge System	**IKS**
11	Value Education Course	**VEC**
12	Research Methodology	**RM**
13	Comm. Engg. Project / Field Project	**CEP/FP**
14	Project	**PROJ**
15	Internship/ OJT	**OJT**
16	Co-curricular Courses	**CC**
17	Massive Open Online Courses	**MOOC**

Sr. No.	Type of course	No. of Courses	Total Credits	
			No.	%
1	Basic Science Course	**4**	**16**	**9.52**
2	Engineering Science Course	**5**	**14**	**8.33**
3	Programme Core Course	**29**	**76**	**45.24**
4	Programme Elective Course	**10**	**19**	**11.31**
5	Multidisciplinary Minor	**5**	**10**	**5.95**
6	Open Elective Other than a particular program	**4**	**8**	**4.76**
7	Vocational and Skill Enhancement Course	**2**	**-**	**-**
8	Ability Enhancement Course / Co-curricular Courses	**4**	**6**	**3.57**
9	Indian Knowledge System	**2**	**-**	**-**
10	Value Education Course	**2**	**-**	**-**
11	Research Methodology	**1**	**2**	**1.19**
12	Comm. Engg. Project / Field Project	**2**	**2**	**1.19**
13	Project	**3**	**9**	**5.36**
14	Internship/ OJT	**1**	**6**	**3.57**
15	Massive Open Online Courses	**0**	**0**	**-**
	Total	**72**	**168**	

Credit Distribution Per Semester by Course Type

Sr. No.	Course Type	No. of Credits / Semester								Total
		1	2	3	4	5	6	7	8	
1	Basic Science Course (BSC)	8	8							16
2	Engineering Science Course (ESC)	7	7							14
3	Programme Core Course (PCC)	3	3	16	14	14	12	7	7	76
4	Programme Elective Course (PEC)					4	7	4	4	19
5	Multidisciplinary Minor (MD M)				2	2	2	2	2	10
6	Open Elective (OE)			4	4					8
7	Vocational and Skill Enhancement Course (VSEC)									0
8	Ability Enhancement Course (AEC)	1	1							2
9	Entrepreneurship/Economics/ Management Courses	2	2							4
10	Indian Knowledge System (IKS)									0
11	Value Education Course (VEC)									0
12	Research Methodology								2	2
13	Comm. Engg. Project (CEP)/Field Project (FP)			1	1					2
14	Project					1		2	6	9
15	Internship/ OJT							6		6
16	Co-curricular Courses (CC)									0
17	Massive Open Online Courses (MOOC)									0
	Total	**21**	**21**	**21**	**21**	**21**	**21**	**21**	**21**	**168**

PCET's Pimpri Chinchwad University
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Pimpri Chinchwad University
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PCET'S

PIMPRI CHINCHWAD UNIVERSITY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

Computer Science and Engineering Structure

As per Guidelines of NEP-2020 to be implemented

w.e.f. from Academic Year 2024-25

Choice Based Credit System (CBCS)

(2024 Pattern)

SEMESTER - III

Course Code	Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	Credits	Hrs	CIA	ESA	PR/ OR	Total
UBTCE201	PCC	Data Structures and Algorithms	3	-	-	3	3	40	60	-	100
UBTCE202	PCC	Data Structures and Algorithms Laboratory	-	1	-	1	2	25	-	25	50
UBTCE203	PCC	Python Programming	3	-	-	3	3	40	60	-	100
UBTCE204	PCC	Python Programming Laboratory	-	1	-	1	2	25	-	25	50
UBTCE205A & UBTCE205B	OE	Open Elective-I	3	-	-	3	3	40	60	-	100
UBTCE206A & UBTCE206B	OE	Open Elective-I Lab	-	1	-	1	2	25	-	25	50
UBTCE207	PCC	Discrete Mathematics	3	-	-	3	3	40	60	-	100
UBTCE208	PCC	Operating System	3	-	-	3	3	40	60	-	100
UBTCE209	CEP	Community Engineering Project	-	2	-	2	2	25	-	25	50
UFL201	AEC	Foreign Language I	2	-	-	-	2	-	-	-	-
ACUHV201 / ACCOI 201	AC	UHV II: Understanding Harmony / Constitution of India	2	-	-	-	2	-	-	-	-
Total			17	4	4	20	29	300	300	150	700

List of Open Elective I: Semester-III

Course Code	Elective-A	Course Code	Elective-B
UBTCE205 OE-Open Elective-I			
UBTCE205A	Digital Logic and Microprocessor	UBTCE205B	Signal System
UBTCE206 OE-Open Elective-I Lab			
UBTCE206A	Digital Logic and Microprocessor Lab	UBTCE206B	Signal System Lab

Foreign Language –I for Semester-III

Course Code	Foreign Language I
UFL201 FL-I	
UFL201 A	Foreign Language: German-I
UFL201 B	Foreign Language: Japanese-I

SEMESTER - IV

Course Code	Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	Credits	Hrs	CIA	ESA	PR/ OR	Total
UBTCE210	PCC	Database Management System	2	-	-	2	2	20	30	-	50
UBTCE211	PCC	Database Management System Laboratory	-	1	-	1	2	25	-	25	50
UBTCE212	PCC	Java Programming	2	-	-	2	2	20	30	-	50
UBTCE217A	PCC	Java Programming Laboratory	-	1	-	1	2	25	-	25	50
UBTCE218	CEP	Project Based on Digital and Technological Solutions	-	1	-	1	2	25	-	25	50
UBTCE219	PCC	Computer Organization and Architecture	2	-	-	2	2	20	30	-	50
UBTCE220	PCC	Applied Statistical Techniques	2	-	-	2	2	20	30	-	50
UBTCE221A / UBTCE221B	OE	Open Elective-II	3	-	-	3	3	40	60	-	100
UBTCE222A / UBTCE222B	OE	Open Elective-II Lab	-	1	-	1	2	25	-	25	50
MOOCCE401	MOOC	Web Development Using Django	-	-	2	2	2	25	-	25	50
MOOCCE402	MOOC	Foundations of Cybersecurity in Linux	-	-	2	2	2	25	-	25	50
UFL202	AEC	Foreign Language II	2	-	-	-	2	-	-	-	-
MIN	MIN	Multidisciplinary Minor - I	2	-	-	2	2	20	30	-	50
ACUHV201 / ACCOI 201	AC	UHV: Understanding Harmony / Constitution of India	2	-	-	-	2	-	-	-	-
Total			17	4	4	21	29	290	210	150	650

List of Open Elective II: Semester-IV

Course Code	Elective-A	Course Code	Elective-B
UBTCE221 OE-OPEN ELECTIVE-II			
UBTCE221A	Internet of Things	UBTCE221B	Digital Image Processing
UBTCE222 OE-OPEN ELECTIVE-II LAB			
UBTCE222A	Internet of Things Lab	UBTCE222B	Digital Image Processing Lab

Foreign Language –II for Semester-IV

Course Code	Foreign Language II
UFL201 FL-II	
UFL202 A	Foreign Language: German-II
UFL202 B	Foreign Language: Japanese-II

SEMESTER - V

Course Code	Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	Credits	Hrs	CIA	ESA	PR/ OR	Total
UBTCE301	PCC	Theory of Computation	2	-	1	3	3	40	60	-	100
UBTCE302	PCC	Computer Network	3	-	-	3	3	40	60	-	100
UBTCE303	PCC	Computer Network Lab	-	1	-	1	2	25	-	25	50
UBTCEPE301/ UBTCEPE303	PEC	Program Elective I	3	-	-	3	3	40	60	-	100
UBTCEPE302/ UBTCEPE304	PEC	Program Elective I Lab	-	1	-	1	2	25	-	25	50
UBTCE304	PCC	Advanced Web Programming	2	-	-	2	2	20	30	-	50
UBTCE305	PCC	Advanced Web Programming Lab	-	1	-	1	2	25	2	25	50
–	MIN	Multidisciplinary Minor - 2	2	-	-	2	2	20	30	-	50
MOOCCE503	MOOC	Software Engineering and Project Management(Agile Project Management with Jira	-	-	2	2	2	25	-	25	50
MOOCCE504	MOOC	Foundations of Blockchain & Java EE	-	-	2	2	2	25	-	25	50
UBTCE309	PROJ	Technical Seminar–CSE	-	-	1	1	1	25	-	25	50
UFL301	VSEC	Foreign Language III	2	-	-	-	2	-	-	-	-
ACALR301/ ACCEVS301	AEC	Aptitude and Logical Reasoning / Environmental Studies	2	-	-	-	2	-	-	-	-
Total			16	3	6	21	28	310	240	150	700

List of Program Elective I: Semester-V

Course Code	Elective-A	Course Code	Elective-B
UBTCEPE301 & UBTCEPE303 – Program Elective-I			
UBTCEPE301	Intelligent Systems	UBTCEPE303	Cloud Computing and Architecture
UBTCEPE302 & UBTCEPE304 - Program Elective-I Laboratory			
UBTCEPE302	Intelligent Systems Lab	UBTCEPE304	Cloud Computing and Architecture Lab

Foreign Language –III for Semester-V

Course Code	Foreign Language III
UFL301 FL-III	
UFL301 A	Foreign Language: German-III
UFL301 B	Foreign Language: Japanese-III

Note: #Refer separate booklet for Multidisciplinary Minor (MDM Courses)

SEMESTER - VI

Course Code	Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	Credits	Hrs	CIA	ESA	PR/ OR	Total
UBTCE309	PCC	Software Testing and Quality Assurance	3	-	-	3	3	40	60	-	100
UBTCE310	PCC	Software Testing and Quality Assurance Lab	-	1	-	1	2	25	-	25	50
UBTCE311	PCC	Design and Analysis of Algorithms	3	-	-	3	3	40	60	-	100
UBTCE312	PCC	Design and Analysis of Algorithms Lab	-	1	-	1	2	25	-	25	50
UBTCEPE305/ UBTCEPE307	PEC	Program Elective II	3	-	-	3	3	40	60	-	100
UBTCEPE306/ UBTCEPE308	PEC	Program Elective II Lab	-	1	-	1	2	25	-	25	50
UBTCEPE309/ UBTCEPE310	PEC	Program Elective III	3	-	-	3	3	40	60	-	100
MOOCCE601	MOOC	Data Science and Pattern Recognition using Python	-	-	2	2	2	25	-	25	50
MOOCCE602	MOOC	Redhat Openstack Administration	-	-	2	2	2	25	-	25	50
–	MIN	Multidisciplinary Minor -3	2	-	-	2	2	20	30	-	50
UFL302	VSEC	Foreign Language IV	2	-	-	-	2	-	-	-	-
ACALR301/ ACCEVS301	AC	Aptitude Test / Professional Ethics	2	-	-	-	2	-	-	-	-
Total			18	3	4	21	28	305	270	125	700

List of Program Elective II & III: Semester-VI

Course Code	Elective-A	Course Code	Elective-B
UBTCEPE305 & UBTCEPE307 – Program Elective-II			
UBTCEPE305	Machine Learning with Python	UBTCEPE307	Adaptive Visualization Techniques
UBTCEPE306 & UBTCEPE308 - Program Elective-II Laboratory			
UBTCEPE306	Machine Learning with Python Lab	UBTCEPE308	Adaptive Visualization Techniques Lab
UBTCEPE309 & UBTCEPE310 – Program Elective-III			
UBTCEPE309	Optimization Techniques and Applications	UBTCEPE310	Applied Data Science

Foreign Language –IV for Semester-VI

Course Code	Foreign Language IV
UFL302 FL-IV	
UFL302 A	Foreign Language: German-IV
UFL302 B	Foreign Language: Japanese-IV

Note: #Refer separate booklet for Multidisciplinary Minor (MDM Courses)

SEMESTER - VII

Course Code	Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	Credits	Hrs	CIA	ESA	PR/ OR	Total
UBTCE401	PCC	Mobile Application Development	3	-	-	3	3	40	60	-	100
UBTCE402	PCC	Mobile Application Development Lab	-	1	-	1	2	25	-	25	50
UBTCEPE401/ UBTCEPE402	PEC	Program Elective IV	3	-	-	3	3	40	60	-	100
UBTCEPE403/ UBTCEPE404	PEC	Program Elective IV Lab	-	1	-	1	2	25	-	25	50
–	MIN	Multidisciplinary Minor - 4	2	-	-	2	2	20	30	-	50
MOOCCE701	MOOC	Microsoft Power BI Data Analyst	-	-	2	2	2	25	-	25	50
MOOCCE702	MOOC	Software Testing and AI Automation	-	-	1	1	2	25	-	25	50
UBTCE404	INT/ OJT	Industry/ International/ Research INTERNSHIP	-	6	-	6	12	100	-	100	200
UBTCE405	PROJ	Major Project - ICSE	-	1	-	2	2	20	-	30	50
Total			8	9	3	21	30	320	150	230	700

List of Program Elective IV: Semester-VII

Course Code	Elective-A	Course Code	Elective-B
UBTCEPE401 & UBTCEPE402: Program Elective-IV			
UBTCEPE401	Fundamentals of Deep Learning	UBTCEPE402	Big Data and Business Analytics
UBTCEPE403 & UBTCEPE404 - Program Elective-IV Laboratory			
UBTCEPE403	Fundamentals of Deep Learning Lab	UBTCEPE404	Big Data and Business Analytics Lab

Note: #Refer separate booklet for Multidisciplinary Minor (MDM Courses)

SEMESTER - VIII

Course Code	Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	Credits	Hrs	CIA	ESA	PR/ OR	Total
UBTCE406	PCC	Dev-Ops	3	-	-	3	3	40	60	-	100
UBTCE407	PCC	Dev-Ops Lab	-	1	-	1	2	25	-	25	50
UBTCE408	RM	Research Methodology & IPR	2	-	-	2	2	20	30	-	50
UBTCE409	PROJ	Major Project–II	-	6	-	6	12	100	-	100	200
UBTCEPE405/ UBTCEPE406	PEC	Program Elective V	3	-	-	3	3	40	60	-	100
UBTCEPE407/ UBTCEPE408	PEC	Program Elective V Lab	-	1	-	1	2	25	-	25	50
MOOCCE801	MOOC	Virtual Reality (MOOC 11)	-	-	2	2	2	25	-	25	50
UBTCEPE409/ UBTCEPE410	MOOC	Program Elective VI (MOOC 12)	-	-	1	1	2	25	-	25	50
–	MIN	Multidisciplinary Minor - 5	2	-	-	2	2	20	30	-	50
Total			10	8	3	21	30	320	180	200	700

List of Program Elective V & VI: Semester-VIII

Course Code	Elective-A	Course Code	Elective-B
UBTCEPE405 & UBTCEPE406 : Program Elective V			
UBTCEPE405	Generative Models and Applications	UBTCEPE406	Natural Language Processing and LLM
UBTCEPE407 & UBTCEPE408 : Program Elective V Laboratory			
UBTCEPE407	Generative Models and Applications Lab	UBTCEPE408	Natural Language Processing and LLM Lab
UBTCEPE409 & UBTCEPE410 : Program Elective VI			
UBTCEPE409	Cloud Security	UBTCEPE410	Ethical Hacking

INTERNSHIP SCHEMES

	Scheme A	Scheme B
Semester	7 and 8th Semester	7 and 8th Semester
Mode	Offline	Online and MOOC Courses
Duration	3–4 Months	3–4 Months

Note: #Refer separate booklet for Multidisciplinary Minor (MDM Courses)

COURSE SYLLABUS

COMPUTER SCIENCE & ENGINEERING

SEMESTER-III

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Data Structures and Algorithms	Course Code/ Course Type	UBTCE201/PCC
Course Pattern:	2024	Version	1.0

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:
1. Knowledge of C Programming

Course Objectives (CO):	**The objectives of Data Structures and Algorithms are:** 1. To gain the knowledge about the concept of stack, queue and linked list. 2. To categorize the use of searching and sorting techniques. 3. Learn programming methodology for capability building. 4. Apply programming concepts to solve real life problem. 5. Implement Non-Linear Data Structures like Trees and graphs using programming language.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Apply and analyze use of stacks, queues and linked lists with their applications. 2. Apply and analyze use of searching and sorting techniques with their applications 3. Perform operations like searching, insertion, deletion, traversing mechanism etc. on various data structures. 4. Apply advanced data structure strategies to solve real world problems. 5. Apply concepts learned in various domains like DBMS, compiler

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to data structures, representing stacks and queues in C using arrays, linked lists: operations Stack and Queue implementation using Linked list, infix to post fix conversion, postfix expression evaluation, doubly linked lists, circular lists, polynomial representation & operations.	**CLO 1**	**9**
UNIT II		
Linear and binary search methods, sorting – Bubble sort, Selection sort, Insertion sort, Quick sort and Merge Sort. Input and output – concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations.	**CLO 2**	**9**
UNIT III		
Linear Data Structure Array: Representation of arrays, Applications of arrays, sparse matrix and its representation., Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi, Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue, Linked List: Singly Linked List, Doubly Linked list, Circular linked list ,Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.	**CLO 3**	**9**

UNIT IV		
Nonlinear Data Structure: Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees to Binary Trees, Applications of Trees- Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance, Graph-Matrix Representation of Graphs, Elementary Graph operations, (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree).	**CLO 4**	**9**
UNIT V		
Hashing And File Structures: Hashing: The symbol table, Hashing Functions, Collision-Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, indexing structure for index files, hashing for direct files, multi-key file organization and access methods.	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Herbert Schildt, "C++: The Complete Reference", McGraw Hill Education, 2003.
2. John R. Hubbard, "Data Structures with C++", Schaum's Outlines, Tata McGraw Hill Education, 2000.

Reference Books:

1. Michael T. Goodrich, Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", Wiley India Pvt. Ltd., 2004.
2. Seymour Lipschutz, "Data Structures", Schaum's Outlines, Tata McGraw Hill Education, 2006

Online Resources/E-learning Resources:

1. https://nptel.ac.in/courses/106102064 Data Structures and Algorithms, IIT Delhi Prof. Naveen Garg Date of Reference 18-4-2024
2. https://nptel.ac.in/courses/106103069 Date of Reference 18-4-2024

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Data Structures and Algorithms Laboratory	Course Code/ Course Type	UBTCE202/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Basic knowledge of Programming in C

Course Objectives (CO):	**The objectives ofPython Programming Laboratory are:** 1. To learn the fundamentals of the Python programming language. 2. To create Python list tuple to represent compound data. solving, and learning methods in solving engineering problems. 3. To write and execute simple as well as complex Python programs. 4. To analyze the concepts of procedural as well as object-oriented Python programs. 5. To perform files handling operations and handle exceptions using Python.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Develop static, interactive, and adaptive visualizations using various libraries and tools. 2. Design personalized and context-aware data visualization systems. 3. Visualize real-time and multimodal data effectively for various applications. 4. Integrate machine learning insights into visual formats to enhance interpretability. 5. Design and deploy a complete adaptive visualization project using real-world datasets.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical1 :	1	WAP to demonstrate push, pop, traverse operations performed on stack.	CLO1	2
2	Practical 2:	2	WAP to implement linear / circular queue using array.	CLO1	2
3	Practical 3:	3	WAP to perform insertion and deletion in a single and double linked list	CLO2	2
4	Practical 4:	4,5	WAP to sort an array of N elements using Selection sort.	CLO 2	4
5	Practical 5:	6	WAP to sort an array of N elements using Insertion sort	CLO3	2
6	Practical 6:	7	WAP to sort an array of N elements using Quick sort	CLO3	2

7	Practical 7:	8	WAP to sort an array of N elements using Merge sort.	CLO4	2
8	Practical 8:	9	Write a program that uses both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers: i. Linear search ii. Binary search	CLO4	2
9	Practical 9:	10	Write a program to perform the following operations: 1.Insert an element into a binary search tree. 2.Delete an element from a binary search tree. 3.Search for a key element in a binary search tree.	CLO5	2
10	Practical 10:	11,12	i.To write a python program to handle Exceptions using Python Built-in Exceptions. ii. To implement Depth First Search / Breadth First Search Algorithm	CLO5	4
11	Mini Project:	13,14,15	Mini Project /Task	CLO1-5	6

Learning Resources:

Text Books:

1. Herbert Schildt, "C++: The Complete Reference", McGraw Hill Education, 2003.
2. John R. Hubbard, "Data Structures with C++", Schaum's Outlines, Tata McGraw Hill Education, 2000.

Reference Books:

1. Michael T. Goodrich, Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", Wiley India Pvt. Ltd., 2004.
2. Seymour Lipschutz, "Data Structures", Schaum's Outlines, Tata McGraw Hill Education, 2006

Online Resources/E-learning Resources:

1. https://nptel.ac.in/courses/106102064 Data Structures and Algorithms, IIT Delhi Prof. Naveen Garg Date of Reference 18-4-2024
2. https://nptel.ac.in/courses/106103069 Date of Reference 18-4-2024

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Python Programming	Course Code/ Course Type	UBTCE203/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Pre-Requisite:

1. Basic knowledge of Programming in C

Course Objectives (CO):	**The objectives of Python Programming are:** 1. To learn the fundamentals of the Python programming language. 2. To create Python list tuple to represent compound data. solving, and learning methods in solving engineering problems. 3. To write and execute simple as well as complex Python programs. 4. To analyze the concepts of procedural as well as object-oriented Python programs. 5. To perform files handling operations and handle exceptions using Python.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Elaborate the features of Python programming language. 2. Apply the conditional and looping constructs using python. 3. Use the multidimensional array and string operations using python. 4. Analyze and apply the object-oriented concepts using python programming. 5. Apply the file handling and exception handling using python programming.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Python: Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, and Set - Type Conversion- Operators. Execution of a Python, Program, Writing Our First Python Program, Statements Precedence of Operators.	**CLO 1**	**6**
UNIT II		
Decision Making and looping: Conditional (if), Alternative (if-else), Chained Conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Math and Random number functions.	**CLO 2**	**6**
UNIT III		
Array and String: Arrays in Python, Strings and Characters. Strings: String Slices, Immutability, String Functions and Methods, String Module; Lists as Arrays, Sum an Array of Numbers, Linear Search, Binary Search	**CLO 3**	**6**

UNIT IV		
Function and OOPs concept: User defined functions - function arguments & its types, lambda functions and list comprehension, OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.	**CLO 4**	**6**
UNIT V		
Text Files, Reading and Writing Files, Format Operator; Command Line Arguments, Errors and Exceptions, Handling Exceptions, Modules, Packages; Illustrative Programs: Word Count, Copy File.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson, 2012.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python", O'Reilly,2nd Edition, 2018.

Reference Books:

1. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2006
2. Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009

Online Resources/E-learning Resources:

1. https://www.w3schools.com/python/
2. https://www.learnpython.org/

Name of the Program:	BTECH CSE	Semester: 5	Level: UG
Course Name:	Python Programming Laboratory	Course Code/ Course Type	UBTCE204/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Basic knowledge of Programming in C

Course Objectives (CO):	**The objectives ofPython Programming Laboratory are:** 1. To learn the fundamentals of the Python programming language. 2. To create Python list tuple to represent compound data. solving, and learning methods in solving engineering problems. 3. To write and execute simple as well as complex Python programs. 4. To analyze the concepts of procedural as well as object-oriented Python programs. 5. To perform files handling operations and handle exceptions using Python.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Develop static, interactive, and adaptive visualizations using various libraries and tools. 2. Design personalized and context-aware data visualization systems. 3. Visualize real-time and multimodal data effectively for various applications. 4. Integrate machine learning insights into visual formats to enhance interpretability. 5. Design and deploy a complete adaptive visualization project using real-world datasets.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Command Line Argument	1	To write a python program that accept command line arguments as input and perform some operations.	CLO 1	2
2	Data structure	2	To write a python program to perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in data types: Strings, List, Tuples, Dictionary, and Set.	CLO 1	2
3	Control Statements	3	To write a python program to Solve problems using decision and looping statements.	CLO 2	2
4	Linear Search	4	To write a python program to handle numerical operations using math and random number functions.	CLO 3	2

5	Binary Search	4	To write a python program to perform linear search & Binary search using strings.	CLO 3	2
6	Numerical Operations	6	To write a python program to perform lambda functions and list comprehension.	CLO 4	2
7	User Defined Functions	7	To write a python program to Create user-defined functions with different types of function arguments with example.	CLO 4	2
8	Packages and Modules	8, 9	To write a python program to Create packages and import modules from packages to solve real problems.	CLO 4	4
9	File Handling Operations	10, 11	CTo write a python program to perform File manipulations- open, close, read, write, append and copy from one file to another.	CLO 5	4
10	Exception Handling Operations	12	To write a python program to handle Exceptions using Python Built-in Exceptions.	CLO5	2
10	Mini Project	13, 14, 15	Implement mini project in a group of 3 to 4 students	1, 2, 3, 4, 5	6

Learning Resources:

Text Books:

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson, 2012.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python", O'Reilly,2nd Edition, 2018.

Reference Books:

1. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2006
2. Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009

Online Resources/E-learning Resources:

1. https://www.w3schools.com/python/
2. https://www.learnpython.org/

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Digital Logic & Microprocessor	Course Code/ Course Type	UBTCEOE201/OE
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Basic knowledge of Programming in C

Course Objectives (CO):	**The the objective of Digital Electronics & Logic Design are:** 1. To understand the basics of Digital fundamentals, Boolean algebra, its applications and combinational logic circuits in digital systems. 2. To Study various combinational digital circuits using logic gates. 3. To Study, analysis and design of clocked sequential circuits. 4. To get acquaint students with the asynchronous Sequential Circuits and Design of Hazard free circuits. 5. To learn the architecture and pin configuration of 8086 Microprocessor.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Use digital electronics in the present contemporary world. 2. Design various combinational digital circuits using logic gates. 3. Do the analysis and design procedures for synchronous and asynchronous sequential circuits. 4. Use the semiconductor memories and related technology. 5. To identify the architecture and pin configuration of 8086 Microprocessor

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Digital Fundamentals : Number Systems –Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes –Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine.	**CLO 1**	**9**
UNIT II		
Combinational Circuit Design: Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder –Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.	**CLO 2**	**9**
UNIT III		
Synchronous Sequential Circuits: Flip flops –SR, JK, T, D, Master/Slave FF –operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits –Design –Moore/Mealy models, state minimization, design of Counters-Ripple Counters,, Shift registers, Universal Shift Register.	**CLO 3**	**9**

UNIT IV		
Memory Devices and Digital Integrated Circuits: Digital integrated circuits: logic families and their Characteristics -RTL, TTL, ECL, CMOS. Basic memory structure –ROM -PROM –EPROM –EEPROM Programmable Logic Devices –Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA).	**CLO 4**	**9**
UNIT V		
8086 Microprocessor: Introduction to 8086 architecture , pin description, External memory interfacing, Maximum mode bus cycle, memory interfacing, Minimum mode System configuration, Maximum mode system configuration, Interrupts processing, instruction set.	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Digital Logic And Computer Design By M. Morris Mano (2nd Edition), PHI
2. Modern Digital Electronics By R.P. Jain, Mc Graw Hill
3. Digital Electronics By Malvino Leach, McGraw Hill

Reference Books:

1. Thomas. L. Floyd ,"Digital Fundamentals" , Pearson ,11th Edition.
2. Digital Systems: Principles and Applications, Book by Ronald J Tocci
3. DoughlasV.Hall, —Microprocessors and Interfacing, Programming and Hardware, TMH,2012.

Online Resources/E-learning Resources:

1. https://www.udemy.com/topic/digital-electronic/ dated 16/04/24
2. https://www.classcentral.com/course/youtube-digital-electronics-48205 dated 16/04/24

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Digital Logic & Microprocessor Lab	Course Code/ Course Type	UBTCEOE202/OE
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	1	25	-	25

Pre-Requisite:

1. Basic knowledge of Programming in C

Course Objectives (CO):	**The the objective of Digital Electronics & Logic Design are:** 1. To understand the basics of Digital fundamentals, Boolean algebra, its applications and combinational logic circuits in digital systems. 2. To Study various combinational digital circuits using logic gates. 3. To Study, analysis and design of clocked sequential circuits. 4. To get acquaint students with the asynchronous Sequential Circuits and Design of Hazard free circuits. 5. To learn the architecture and pin configuration of 8086 Microprocessor.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Use digital electronics in the present contemporary world. 2. Design various combinational digital circuits using logic gates. 3. Do the analysis and design procedures for synchronous and asynchronous sequential circuits. 4. Use the semiconductor memories and related technology. 5. To identify the architecture and pin configuration of 8086 Microprocessor

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical 1	1	Introduction: Study of logic gates.	CLO1	2
2	Practical 2	2	Simplification, Realization of Boolean expressions using Logic gates / Universal gates. 1. Realization of half/full adder using logic gates	CLO1	2
3	Practical 3	3	TSimplification, Realization of Boolean expressions using Logic gates / Universal gates. 1. Realization of half/full Subtractor using logic gates	CLO1	2
4	Practical 4	4	1. Realization of parallel adder /Subtractor using 7483 chip	CLO2	2
5	Practical 5	5	1. BCD to Ex-3 code conversion and vice versa .Realization of parallel adder /Subtractor using 7483 chipb.BCD to Ex-3 code conversion and vice versa	CLO2	2
6	Practical 6	6	Realization of Binary to Gray code converter & vice versa	CLO2	2
7	Practical 7	7	1. MUX using 74153 for Arithmetic circuits	CLO3	2

8	Practical 8	8	DEMUX using 74139 for code converter	CLO3	2
9	Practical 9	9	Realization of one/two bit comparator & study of 7485 magnitude Comparator.	CLO3	2
10	Practical 10	10	Use of decoder chip to drive LED/LCD display	CLO3	2
11	Practical 11	11	Priority Encoder	CLO3	2
12	Practical 12	12	Truth table verification of flip-flops 1. JK master slave	CLO4	2
13	Practical 13	13	Truth table verification of flip-flops T-type	CLO4	2
14	Practical 14	14	To study 8086 microprocessor system.	CLO5	2
15	Practical 15	15	Assembly language program using 8086 MASM software and 8086 microprocessor kit-Addition,subtraction,multiplication,division	CLO5	2

Learning Resources:

Text Books:

1. Digital Logic And Computer Design By M. Morris Mano (2nd Edition), PHI
2. Modern Digital Electronics By R.P. Jain, Mc Graw Hill
3. Digital Electronics By Malvino Leach, McGraw Hill

Reference Books:

1. Thomas. L. Floyd ,"Digital Fundamentals" , Pearson ,11th Edition.
2. Digital Systems: Principles and Applications, Book by Ronald J Tocci
3. DoughlasV.Hall, —Microprocessors and Interfacing, Programming and Hardware, TMH,2012.

Online Resources/E-learning Resources:

1. https://www.udemy.com/topic/digital-electronic/ dated 16/04/24
2. https://www.classcentral.com/course/youtube-digital-electronics-48205 dated 16/04/24

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Signal System	Course Code/ Course Type	UBTCEOE203/OE
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Signal theory, Math

Course Objectives (CO):	**The objectives of Signal System are:** 1. To recall the basic knowledge about the different type of signals 2. To recognize the system analysis in frequency domain. 3. To apply the knowledge of Fourier and Laplace transform. 4. TTo analyze correlation and spectral density. 5. To evaluate probability, random variables &signals.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. To identify different type of signals. 2. Explain the system analysis in frequency domain. 3. Apply knowledge of Fourier and Laplace transform. 4. Analyze correlation and spectral density 5. Evaluate the probability, random variables & signals.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Signals and Systems: Definition of signals and systems, communication and control systems as examples, Classification of signals: Continuous time and discrete time, even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power. Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (accumulator for DT), time scaling, time shifting and folding, precedence rule. Elementary signals: exponential, sine, step, impulse and its properties, ramp, rectangular, triangular, signum, sinc. Systems: Definition, Classification: linear and non linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.	**CLO 1**	**9**
UNIT II		
System Analysis: System modeling: Input output relation, impulse response, block diagram, integro-differential equation and state-space representation. Definition of impulse response, convolution integral, convolution sum, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential, exponential to exponential and unit step to rectangular, rectangular to rectangular only. Computation of convolution sum by all methods.	**CLO 2**	**9**

UNIT III		
System Analysis in Frequency Domain using Fourier Transform & Laplace Transform: Definition and necessity of CT and DT Fourier series and Fourier transforms. Analogy between CTFS, DTFS and CTFT, DTFT. CT Fourier series, CT Fourier transform and its properties, problem solving using properties, amplitude spectrum, phase spectrum of the signal and system. Interplay between time and frequency domain using sinc and rectangular signals. Limitations of FT and need of LT and ZT, , ROC and pole zero concept.	**CLO 3**	**9**
UNIT IV		
Correlation and Spectral Density: Definition of Correlation and Spectral Density, correlogrm, analogy between correlation, covariance and convolution, conceptual basis, autocorrelation, cross correlation, energy/power spectral density, properties of correlation and spectral density, inter relation between correlation and spectral density..	**CLO 4**	**9**
UNIT V		
Probability, Random Variables and Random Signals: Experiment, sample space, event, probability, conditional probability and statistical independence. Random variables: Continuous and Discrete random variables, cumulative distributive function, Probability density function, properties of CDF and PDF. Statistical averages, mean, moments and expectations, standard deviation and variance. Probability models: Uniform, Gaussian, Binomial.	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley India.
2. Simon Haykins, "Introduction to Analog and Digital Communications", Wiley India.

Reference Books:

1. Simon Haykins, "Introduction to Analog and Digital Communications", Wiley India.
2. Charles Phillips, "Signals , Systems and Transforms" , 3rd Edition, Pearson Education.
3. Peyton Peebles, "Probability, Random Variable, Random Processes", 4th Edition, Tata Mc GrawHill.

Online Resources/E-learning Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ee28/preview

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Signal System Laboratory	Course Code/ Course Type	UBTCEOE204/OE
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	1	25	-	25

Pre-Requisite:

1. Signal theory, Math

Course Objectives (CO):	**The objectives of Signal System are:** 1. To recall the basic knowledge about the different type of signals 2. To recognize the system analysis in frequency domain. 3. To apply the knowledge of Fourier and Laplace transform. 4. TTo analyze correlation and spectral density. 5. To evaluate probability, random variables &signals.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. To identify different type of signals. 2. Explain the system analysis in frequency domain. 3. Apply knowledge of Fourier and Laplace transform. 4. Analyze correlation and spectral density 5. Evaluate the probability, random variables & signals.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical 1	1	Sketch and write Defining mathematical expression for the following signals in CTand DT using MATLAB- Unit step, rectangular, exponential, signum, sine, sinC, triangular, unit impulse, unit ramp.	CLO1	2
2	Practical 2	2	Take any two CT and DT signals and perform the following operation Amplitude scaling, addition,multiplication,differentiation,integration (accumulator for DT), time scaling, time shifting and folding	CLO2	2
3	Practical 3	3	Express any two system mathematical expressions in input output relation form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time in variant, Invertible	CLO3	2
4	Practical 4	4	Express any two system mathematical expressions in input output relation form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time in variant, Invertible	CLO3	2

5	Practical 5	5	Express any two system mathematical expressions in impulse response form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time in variant, Invertible	CLO3	2
6	Practical 6	6	State and prove the properties of Fourier Transform. Take rectangular and sinc signal as examples and demonstrate the applications of CTFT properties. And also demonstrate the interplay between the time and frequency domain.	CLO4	2
7	Practical 7	7	State and prove the properties of Fourier Transform. Take rectangular and sinc signal as examples and demonstrate the applications of CTFT properties. And also demonstrate the interplay between the time and frequency domain.	CLO4	2
8	Practical 8	8	State and prove the properties of Laplace Transform. Take any example of a system in time domain and demonstrate the application of LT in system analysis	CLO4	2
9	Practical 9	9	State and prove the properties of Laplace Transform. Take any example of a system in time domain and demonstrate the application of LT in system analysis	CLO4	2
10	Practical 10	10	Design and implement a complete adaptive visualization solution for a dataset (e.g., health data, IoT, education analytics)	CLO4	2
11	Practical 11	11	State and prove the properties of Laplace Transform. Take any example of a system in time domain and demonstrate the application of LT in system analysis	CLO4	2
12	Practical 12	12	Find the following for the given energy signal- Autocorrelation, Energy from Autocorrelation, Energy from definition, Energy Spectral Density directly	CLO5	2
13	Practical 13	13	Find the following for the given energy signal- Autocorrelation, Energy from Autocorrelation, Energy from definition, Energy Spectral Density directly	CLO5	2
14	Practical 14	14	Find the following for the given energy signal- Autocorrelation, Energy from Autocorrelation, Energy from definition, Energy Spectral Density directly	CLO5	2

Text Books:

1. Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley India.
2. Simon Haykins, "Introduction to Analog and Digital Communications", Wiley India.

Reference Books:

1. Simon Haykins, "Introduction to Analog and Digital Communications", Wiley India.
2. Charles Phillips, "Signals , Systems and Transforms" , 3rd Edition, Pearson Education.
3. Peyton Peebles, "Probability, Random Variable, Random Processes", 4th Edition, Tata Mc GrawHill.

Online Resources/E-learning Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ee28/preview

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Discrete Mathematics	Course Code/ Course Type	UBTCE207/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Pre-Requisite:

1. Determinants, Matrices, Limits, continuity, Differentiation

Course Objectives (CO):	**The objectives of Discrete Mathematics are:** 1. To familiarize the students with the concepts and techniques of logics & sets. 2. To recognize relations and its real-life application. 3. To comprehend Algebraic structure and its application. 4. To acquire the knowledge of graph theory 5. To acquire the knowledge of trees to understand the concepts of different types of algorithms and its applications that would enhance analytical thinking power.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Explain the logic, normal forms and its application. 2. Comprehend the relations & functions. 3. Comprehend the algebraic structures. 4. Comprehend & apply the knowledge of graph theory in data structure and other core subjects. 5. Solve traversing problems, searching by using the concept of Trees.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Logic : Propositions and Connectives, Truth table, laws of Propositions, Logical Equivalence, Normal Forms: DNF, CNF, PCNF & PDNF Logical implication, Quantifiers, Application of Propositional logic.	**CLO 1**	**6**
UNIT II		
Relation and Functions: Relation, representation of relation, types, Equivalence relation, Equivalence class, Partitions, Partial ordering relation, Hasse diagram, Lattice, Function and types of Functions.	**CLO 2**	**6**
UNIT III		
Algebraic structures: Algebraic structures, Semi group, Monoid, Group, abelian group, cyclic group, Coding Theory.	**CLO 3**	**6**

UNIT IV		
Graph and Applications: Introduction, Graph models, Hand shaking lemma, Types of graphs, Matrix representation of Graphs, adjacency and incidence Matrix, Isomorphism, Connectivity, Eulerian and Hamiltonian Graphs, Shortest path, Travelling Salesman Problem, Dijkstra's algorithm, Planar graph and Euler formula.	**CLO 4**	**6**
UNIT V		
Trees: Introduction, properties, Rooted tree, Tree Traversal, path length, weighted tree, prefix code, Huffman coding, spanning tree, Minimal spanning tree, Kruskal algorithm, Prim's algorithm, cut set, The Max flow- Min cut Theorem (Transport Network) Application of tree.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. C. L. Liu, "Elements of Discrete Mathematics", Tata McGraw-Hill, 4th Edition, 2017, ISBN 978- 1259006395.

Reference Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGrawHill, 8th Edition, 2018, ISBN 978- 1259676512.
2. Dr. K. D. Joshi, "Foundations of Discrete Mathematics", New Age International Limited Publishers, 2nd Edition, January 2014, ISBN-13: 978-8122435986

Online Resources/E-learning Resources:

1. https://www.classcentral.com/subject/discrete-mathematics
2. https://www.coursera.org/courses?query=discrete%20mathematics

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Operating system	Course Code/ Course Type	UBTCE208/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Pre-Requisite:

1. Knowledge of Computer Architecture and Digital Logic
2. Proficiency in C/C++ or Python

Course Objectives (CO):	**The the objective of Operating system are:** 1. Understand the fundamental concepts and responsibilities of an operating system 2. Explore how operating systems manage hardware resources such as CPU, memory, storage, and I/O devices 3. Gain insights into process scheduling, synchronization, and deadlock prevention techniques 4. Learn how file systems and memory management strategies are implemented in real-world OSs. 5. Develop hands-on skills by analyzing and building small components of an operating system using labs and simulations
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Explain the architecture and functions of modern operating systems 2. Implement and simulate key OS concepts such as process scheduling and memory allocation 3. Analyze and apply synchronization techniques for process and thread management. 4. Understand and evaluate file systems, I/O management, and protection mechanisms. 5. Demonstrate the ability to solve real-world OS problems using practical tools and test environments

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Operating Systems & Processes Evolution of OS and types (batch, multitasking, real-time), OS as a resource manager, Processes and threads, Context switching and states	**CLO 1**	**6**
UNIT II		
CPU Scheduling and Concurrency Process scheduling: FCFS, SJF, Round Robin, Multilevel. Multithreading and CPU burst prediction. Process synchronization: critical section, semaphores, mutexes. Deadlocks: detection, prevention, avoidance	**CLO 2**	**6**

UNIT III		
Memory Management Contiguous and non-contiguous memory allocation, Paging and segmentation, Virtual memory and page replacement algorithms (FIFO, LRU), Swapping and memory fragmentation	**CLO 3**	**6**
UNIT IV		
File Systems and Storage Management File concepts, file access methods, and directory structure, Disk scheduling algorithms (FCFS, SSTF, SCAN), File system implementation: FAT, i-nodes, Mounting, allocation methods, and protection. .	**CLO 4**	**6**
UNIT V		
Security, I/O and VirtualizationI/O structure, polling vs. interrupt-driven I/O, DMA and device drivers, OS-level security: authentication, access control, Basics of virtualization and containers.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Mastering Microsoft Power BI" by Brett Powel

Reference Books:

1. "Modern Operating Systems" by Andrew S. Tanenbaum and Herbert Bos
2. "Operating Systems: Three Easy Pieces" by Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau (free online)
3. "Linux Kernel Development" by Robert Love

Online Resources/E-learning Resources:

1. • Introduction to Operating Systems Specialization (Duke University)

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Community Engineering Project	Course Code/ Course Type	UBTCE209/ CEP
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

Course Objectives (CO):	**The objectives of Python Programming are:** 1. Develop an understanding of the role of engineering in addressing community needs and promoting sustainable development. 2. Apply engineering design processes and methodologies to identify, analyze, and prioritize community challenges. 3. Collaborate with community stakeholders to co-create solutions that are culturally sensitive, socially equitable, and environmentally sustainable. 4. Gain practical experience in project management, budgeting, and resource allocation for community engineering projects. 5. Communicate effectively with diverse audiences through written reports, oral presentations, and multimedia platforms.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Develop an understanding of the role of engineering in addressing community needs and promoting sustainable development. 2. Apply engineering design processes and methodologies to identify, analyze, and prioritize community challenges. 3. Collaborate with community stakeholders to co-create solutions that are culturally sensitive, socially equitable, and environmentally sustainable. 4. Gain practical experience in project management, budgeting, and resource allocation for community engineering projects. 5. Communicate effectively with diverse audiences through written reports, oral presentations, and multimedia platforms.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Community Engineering: Overview of course objectives, expectations, and project guidelines Introduction to community-based participatory research and design principles Case studies of successful community engineering projects	**CLO 1**	**6**
UNIT II		
Needs Assessment and Stakeholder Engagement: Methods for conducting community needs assessments and asset mapping, ,Techniques for engaging diverse stakeholders in the design process, Ethical considerations in working with communities.	**CLO 2**	**6**
UNIT III		
Project Planning and Design: Project scoping, goal setting, and defining success criteria, Engineering design processes and methodologies, Incorporating sustainability principles into project design	**CLO 3**	**6**

UNIT IV		
Implementation and Collaboration: Project management techniques, including scheduling, budgeting, and resource allocation, Interdisciplinary collaboration and team dynamics, Effective communication with community partners and project stakeholders .	**CLO 4**	**6**
UNIT V		
Project Execution and Monitoring: Prototyping and testing of project solutions, Monitoring project progress and making adjustments as needed, Documentation and record-keeping for project evaluation **Impact Evaluation and Reflection:**Methods for assessing the social, economic, and environmental impact of community engineering projects, Reflective practices and peer feedbackn	**CLO 5**	**6**
Total Hours		**30**

Assesment:

1. Project Proposal: Written proposal outlining the project scope, objectives, and methodology (20
2. Project Implementation: Development and implementation of the digital solution, including documentation and code repository (30
3. Final Report: Written report summarizing the project process, outcomes, and impact assessment (30
4. Presentation: Oral presentation of project findings and demonstration of the digital

Name of the Program:	B.TECH CSE	Semester: 3	Level: UG/PG
Course Name:	German A1.1	Course Code/ Course Type	UFL201A/AEC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

Course Objectives (CO):	**The the objective of German A1.2 are:** 1. To remember new words and their spellings. 2. To analyze the new concepts. 3. To apply the basic vocab and grammar concepts. 4. To comprehend the German text. 5. To create basic sentences in German.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Spell simple words in German 2. Can understand everyday expressions. 3. Able to frame simple sentences in German language. 4. Can introduce themselves and others. 5. Can answer questions about themselves.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Guten Tag: Speak about yourself and others, Speak about Countries and Languages Grammar – Sentence formation and verbs usage	**CLO 1**	**6**
UNIT II		
Freunde, Kollegen und Ich: Speak about your Hobbys, To fix a meeting, Speak about work and Profession, To creat a profile on Internet Grammar – How to use 'The' in german, Singular and plural forms of Nouns	**CLO 2**	**6**
UNIT III		
In der Stadt: To get to know about Cities and Places, how to find way and understand directions, learn international words Grammar – Negations (how to use NO in german), Definite articles, indefinite articles	**CLO 3**	**6**
UNIT IV		
Kleidung und Mode Speak about cloths and shopping, lead a discussion during cloths shopping, discussion in departmental store, understand and research information about Berlin, Grammar – Separable and non-separable verbs	**CLO 4**	**6**

UNIT V		
Tag für Tag & Zeit mitFreunden: Clock timings, To speak about family and friends, Daily routine To speak about free time activity, to understand the specific information from the text, to order and to pay in a restaurant Grammar – Possessivarticle, Modalverbs, use of on,at,from. . . till, Seprable verbs and past tense	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Netzwerk A1, Ernst klett Verlag & Goyal Publishers & Distributors Pvt. Ltd.
2. Studio d A1, Cornelesen Verlag & Goyal Publishers & Distributors Pvt. Ltd.
3. Netzwerk Neu A1, Ernst klett Verlag & Goyal Publishers& Distributors Pvt. Ltd

Reference Books:

1. Hallo Deutsch A1,ErnstKlettVerlag, Goyal Publishers & Distributors Pvt. Ltd
2. ThemenAktuell 1, Hueberverlag
3. Maximal Ernst klettVerlag&Goyal Publishers & Distributors Pvt. Ltd

Online Resources/E-learning Resources:

1. Youtube :https://youtube.com/@LearnGermanwithAnja?si=BkJYDPi7TS0fT4lr
2. https://youtube.com/@deutschlernenmitheidi?si=TkICIabzioaU0roZ
3. Instagram :instagram.com/learngermanwithanja

Name of the Program:	B.TECH CSE	Semester: 3	Level: UG/PG
Course Name:	Basic Japanese language skill	Course Code/ Course Type	UFL201B/AEC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. Desire to get acquainted with the Japanese language.

Course Objectives (CO):	**The the objective of Basic Japanese language skill are:** 1. To meet the needs of ever-growing industry, with respect to language support. 2. To get introduced to Japanese society and culture through language. 3. To acquire competitive edge in career choices. 4. To participate effectively & responsibly in a multi-cultural world. 5. To enable learners to communicate effectively in Japanese language.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Read and Write Hiragana script. 2. Write and Speak basic sentences. 3. Comprehend and speak about time, hobbies, likes and dislikes. 4. Write basic kanji.dialogues indicating how they are used in actual conversation 5. Use the Hiragana script in discussion.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Japanese Language – Introduction of script, culture, History of script ,Speaking : Self introduction, listening : short video skit on self-introduction	**CLO 1**	**6**
UNIT II		
Introduction of Hiragana Script - Writing : Hiragana script, Speak : Basic sentences, General vocabulary : Months , Days of the week ,Basic numbers, colours	**CLO 2**	**6**
UNIT III		
Basic Sentence formation -Basic sentence structure : Affirmative and Negative , General vocabulary: about family	**CLO 3**	**6**
UNIT IV		
Time and verbs –Speaking : Talking about routine, Writing: routine using verbs and time, reading : A clock	**CLO 4**	**6**
UNIT V		
Introduction of Katakana and basic kanji – Affirmative present ,past & future Reading : English words, country names Writing : Basic Kanji	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Minna no Nihongo , " Japanese for everyone", Elementary Main Textbook , Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. Shyoho Volume 1
2. Genki Japan
3. Haru Vol. 1 & 2

Online Resources/E-learning Resources:

1. https://youtu.be/1JephUxTHxg?si=ouCwTXZc-fYgY9Kh
2. https://youtu.be/9EfbkBkF2ag?si=rLNzc55-REacMoGu
3. https://youtu.be/DpEolYasgyg?si=dya9ue-YMSHO3VOG

Name of the Program:	B.Tech/B.B.A/ B.C.A/B.Sc/ B.Pham	Semester: 3	Level: UG
Course Name:	UHV-II: Understanding Harmony	Course Code/ Course Type	ACUHV201/AC
Course Pattern:	2024	Version	1.0

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. NIL

Course Objectives (CO):	**The objectives of Understanding Harmony are:** 1. To train the student for Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence 2. To comprehend (or develop clarity) the harmony in the human being, family, society and nature/existence 3. To strengthen self-reflection. 4. To infuse a sense of commitment and courage to act 5. 5. To understand Holistic Understanding of Harmony on Professional Ethics.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Analyze the most important requirement for any human being. 2. Apply correct appraisal of Physical needs, meaning of Prosperity in detail 3. Analyze salient values in relationship, Friends and Foes, Empathy, False Prestige. 4. Develop holistic perception of harmony at all levels of existence 5. Apply the Holistic Understanding of Harmony on Professional Ethics

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 1. Purpose and motivation for the course, recapitulation from Universal Human Values-I 2. Self-Exploration–what is it? - Its content and process; Personality Traits-Self Excellence, Natural Acceptance and Experiential Validation- as the process for self-exploration, Adaptability, Belief and Understanding- Self discipline 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.	**CLO 1**	**8**
UNIT II		

Understanding Harmony in the Human Being - Harmony in Myself:1. Understanding human being as a co-existence of the sentient I and the material Body 2. Understanding the needs of Self (I) and Body - happiness and physical facility 3. Understanding the Body as an instrument of I (I being the doer, seer and enjoyer)- Habits and Hobbies, SWOT Analysis (Activity) 4. Understanding the characteristics and activities of I and harmony in I – Dalai Lamas Tibetan Personality Test – Dr. Menningers Psychometric Test. 5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail	**CLO 2**	**5**
UNIT III		
Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship 2. Understanding the meaning of Trust; Difference between intention and competence 3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Friends and Foes, Empathy, False Prestige.	**CLO 3**	**5**
UNIT IV		
Understanding Harmony in the Nature and Existence - Whole existence as Coexistence:1. Understanding the harmony in the Nature and its Equanimity, Respect for all, Nature as Teacher 2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature 3. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space 4. Holistic perception of harmony at all levels of existence.	**CLO 4**	**5**
UNIT V		
Implications of the above Holistic Understanding of Harmony on Professional Ethics1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Vision for the Holistic alternatives, UHVs for entrepreneurship	**CLO 5**	**7**
Total Hours		**30**

Learning Resources:

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

Reference Books:

1. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
2. Small is Beautiful - E. F Schumacher
3. Slow is Beautiful - Cecile Andrews
4. The Story of Stuff (Book).

Online Resources/E-learning Resources:

1. https://www.studocu.com/in/document/jss-science-and-technology-university/human-values/uhv-handout-2-harmony-in-the-human-being/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf
3. https://vemu.org/uploads/lecture-notes/22-12-2022-1850871704.pdf

Name of the Program:	B.TECH CSE	Semester: 3	Level: UG
Course Name:	Constitution of India	Course Code/ Course Type	ACCOI201/AC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. NIL

Course Objectives (CO):	**The objectives of Constitution of India are:** 1. To familiarize the students with the key elements of the Indian constitution 2. To enable students to grasp the constitutional provisions and values 3. To acquaint the students with the powers and functions of various constitutional offices and institutions. 4. To make students understand the basic premises of Indian politics 5. To make students understand the role of constitution and citizen-oriented measures in a democracy
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Analyze the basic structure of Indian Constitution 2. Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution 3. know about our Union Government, political structure & codes, procedures 4. Elaborate our State Executive & Elections system of India 5. Access the Amendments and Emergency Provisions, other important provisions given by the constitution

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Indian Constitution The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly. The Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of India Constitution	**CLO 1**	**8**
UNIT II		
FR's, FD's and DPSP's Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building	**CLO 2**	**5**
UNIT III		
Governance and Constitution1. Federalism in India - Features, Local Government -Panchayats –Powers and functions; 73rd and 74th amendments, Election Commission – Composition, Powers and Functions; Electoral Reforms, Citizen oriented measures – RTI and PIL – Provisions and significance	**CLO 3**	**5**

UNIT IV		
Union Executive Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.	**CLO 4**	**5**
UNIT V		
IState Executive & Elections, Amendments and Emergency Provisions State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (How and Why) and Important Constitutional Amendments till today. Emergency Provisions	**CLO 5**	**7**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Constitution of India" (for Competitive Exams) - Published by Naidhruva Edutech Learning Solutions, Bengaluru. – 2022
2. "Engineering Ethics", M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Prentice –Hall, 2004

Reference Books:

1. "SamvidhanaOdu" - for Students & Youths by Justice HN NagamohanDhas, Sahayana, kerekon
2. "Constitution of India, Professional Ethics and Human Rights" by Shubham Singles, Charles E. Haries, published by Cengage Learning India, Latest Edition – 2019.
3. "Introduction to the Constitution of India", (Students Edition.) by Durga Das Basu (DD Basu) Prentice –Hall, 2008
4. "The Constitution of India" by Merunandan K B: published by Merugu Publication.

Online Resources/E-learning Resources:

1. https//opportunitycell.com/online-course-on-the-indian-constitution-by-ministry-of-law-justice/#google-vignette dated 19/4/2024
2. https://onlinecourses.nptel.ac.in/noc20-lw03/preview dated 19/4/2024

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Database Management System	Course Code/ Course Type	UBTCE210/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Pre-Requisite:

1. Knowledge of C Programming and DSA

Course Objectives (CO):	**The the objective of Database Management System are:** 1. Ability to design entity relationship and convert entity relationship diagrams into RDBMS and ability to identify the data models for relevant problems. 2. Apply normalization for the development of application software's 3. Develop understanding concepts of Relational Database design and query languages. 4. Demonstrate effective Query processing and Transaction Processing. 5. Summarize concurrency control protocols and recovery algorithms.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. An ability to design ER Model for any application 2. To Decompose any Schema by applying normal forms 3. To construct SQL queries for any requirement 4. To Understand the Query Evaluation and Execution processes 5. To write Trigger, Cursor, PL/SQL Programs and to design object oriented, extended relational schemas

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction Database System Applications, Database Systems versus File Systems, View of Data, Data Models, Database Languages, Database Users and Administrators, Transaction Management, Database System Structure, Application architectures, History of Database Systems. Entity-Relationship Model, Basic Concepts, Constraints, Keys, Design Issues, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R Features, Design of an E-R Database Schema, Reduction of an E-R Schema to Tables.	**CLO 1**	**6**
UNIT II		
Relational Model Structure of Relational Databases, The Relational Algebra, Extended Relational-Algebra Operations, Modification of the Database, Views, The Tuple Relational Calculus, The Domain Relational Calculus. Relational-Database Design:, First Normal Form, Pitfalls in Relational-Database, Design, Functional Dependencies, Decomposition, BCNF, Third, Fourth and more Normal Forms, Overall Database Design Process.	**CLO 2**	**6**

UNIT III		
Structured Query Language Basic Structure, Set Operations, Aggregate Functions, Null Values, Nested Sub queries, Views, Integrity and Security, Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authentication.	**CLO 3**	**6**
UNIT IV		
Transaction Management Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Execution, Serializability, Recoverability, Implementation of Isolation, Transaction Definition in SQL, Testing for Serializability.	**CLO 4**	**6**
UNIT V		
Concurrency Control Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularities, Multiversion Schemes, Deadlock Handling, Insert and Delete Operations Weak Levels of Consistency, Concurrency in Index Structures. Recovery System, issues & solutions.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, "Database Systems: The complete Book" Pearson Education, 2002.

Reference Books:

1. Silberschatz, H. Korth and S. Sudarshan, "Database System Concepts", 4rth Edition, McGraw-Hill International, 2002.
2. R. Elmasri and Shamakant B. Navathe, "Fundamentals of Database Systems", 3rd Edition, AddisionWesley , 2000

Online Resources/E-learning Resources:

1. http://www.cs.helsinki.fi/u/laine/tikape/k03/material03.html dated 19/4/2024
2. http://infolab.stanford.edu/ ullman/dscb.html dated 19/4/2024
3. 3. http://cs.nyu.edu/courses/spring06/G22.2433-001/dated 19/4/2024

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Database Management System Laboratory	Course Code/ Course Type	UBTCE211/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	1	25	-	25

Pre-Requisite:

1. Basic knowledge of Programming in C

Course Objectives (CO):	**The the objective of Database Management System Laboratory are:** 1. Develop understanding concepts of Relational Database design and query languages 2. Demonstrate effective Query processing and Transaction Processing. 3. Apply normalization for the development of application software's 4. Ability to design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data 5. Ability to identify the data models for relevant problems
Course Learning Outcomes (CLO):	**Students would be able to:** 1. An ability to design ER Model for any application 2. To Decompose any Schema by applying normal forms 3. To construct SQL queries for any requirement 4. To Understand the Query Evaluation and Execution processes 5. To write Trigger, Cursor, PL/SQL Programs and to design object oriented, extended relational schemas.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical 1	1	Analyze the problem and come with the entities in it. Identify what Data has to be persisted in the databases.	CLO1	2
2	Practical 2	2	Installation of MySQL and practicing DDL	CLO1	2
3	Practical 3	3	Practice queries using ANY, ALL, IN, EXISTS, UNION, INTERSECT Union: The union operator returns all distinct rows selected by two or more queries.	CLO2	2
4	Practical 4	4	Practice Queries using Aggregate functions, Group By, Having Clause and Order Clause.	CLO2	2
5	Practical 5	5	1. Practice Queries using Aggregate functions, Group By, Having Clause and Order Clause.	CLO2	2
6	Practical 6	6	Implement Indexes: An index is an ordered list of the contents of a column, (or a group of columns) of a table.	CLO3	2
7	Practical 7	7	Implement Exception handling	CLO3	2

8	Practical 8	8	Implement Triggers	CLO4	2
9	Practical 9	9	Implement Cursors	CLO4	2
10	Practical 10	10	Implementing Operations on relations using PL / SQL.	CLO5	2
11	Practical 11	11	Implementing Operations on relations using PL / SQL.	CLO5	2
12	Practical 12	12	Implementing Operations on relations using PL / SQL.	CLO5	2
13	Practical 13	13	Mini Project /Task	CLO 1,2,3,4,5	6

Learning Resources:

Text Books:

1. Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, "Database Systems: The Complete Book" - Pearson Education, 2002.

Reference Books:

1. Silberschatz, H. Korth and S. Sudarshan, "Database System Concepts", 4rth Edition,McGraw-Hill International, 2002.
2. R. Elmasri and Shamakant B. Navathe, "Fundamentals of Database Systems", 3rd Edition, AddisionWesley , 2000.
3. DoughlasV.Hall, —Microprocessors and Interfacing, Programming and Hardware, TMH,2012.

Online Resources/E-learning Resources:

1. http://www.cs.helsinki.fi/u/laine/tikape/k03/material03.html
2. http://infolab.stanford.edu/ ullman/dscb.html
3. http://cs.nyu.edu/courses/spring06/G22.2433-001/

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Java Programming	Course Code/ Course Type	UBTCE212/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Pre-Requisite:

1. Basic knowledge of Programming in C and C++

Course Objectives (CO):	**The the objective of Java Programming are:** 1. To learn the fundamentals of the Java programming language 2. To learn object-oriented principles like abstraction, encapsulation, inheritance, and polymorphism and apply them in solving problems using java 3. To apply the concepts of exception handling, multithreading and collection classes using java 4. To develop software applications using JDBC connectivity. 5. To design the Graphical User Interface using applets and swing controls.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. To grasp the fundamentals programming concepts of Java programming language 2. To apply object-oriented principles like abstraction, encapsulation, inheritance, polymorphism in solving problems using java 3. To perform exception handling, multithreading code using java 4. To develop software applications using JDBC connectivity 5. To design the Graphical User Interface using event handling

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Java Programming Java Programming- History of Java, comments, Java Buzz words, Data types, Variables, Constants, Scope and Lifetime of variables, Operators, Type conversion and casting, Enumerated types, Control flow- block scope, conditional statements, loops, break and continue statements, arrays, simple java standalone programs, class, object, and its methods constructors, methods, static fields and methods, access control, this reference, overloading constructors, recursion, exploring string class, garbage collection.	**CLO 1**	**6**
UNIT II		
InheritancelInheritance – Inheritance types, super keyword, preventing inheritance: final classes and methods. Polymorphism – method overloading and method overriding, abstract classes and methods. Interfaces- Interfaces Vs Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface, inner class. Packages- Defining, creating and accessing a package, importing packages.	**CLO 2**	**6**

UNIT III		
Exception Handling and Multithreading Exception handling-Benefits of exception handling, the classification of exceptions - exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception subclasses. Multithreading – Differences between multiple processes and multiple threads, thread life cycle, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication, producer consumer problem	**CLO 3**	**6**
UNIT IV		
Database Management Collection Framework in Java – Introduction to java collections, Overview of java collection framework, commonly used collection classes- Array List, Vector, Hash table, Stack, Lambda Expressions. Files- Streams- Byte streams, Character streams, Text input/output, Binary input/output, File management using File class. Connecting to Database – JDBC Type 1 to 4 drivers, connecting to a database, querying a database and processing the results, updating data with JDBC, Data Access Object (DAO)..	**CLO 4**	**6**
UNIT V		
Event HandlingGUI Programming with Swing - The AWT class hierarchy, Introduction to Swing, Swing Vs AWT, Hierarchy for Swing components, Overview of some Swing components – Jbutton, JLabel, JTextField, JTextArea, simple Swing applications, Layout management – Layout manager types – border, grid and flow Event Handling- Events, Event sources, Event classes, Event	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Java Fundamentals a Comprehensive Introduction" HerbertSchildt and DaleSkrien,TMH
2. "Head First Java: Your Brain on Java - A Learner's Guide", 1st Edition, by Bert Bates, Kathy Sierra

Reference Books:

1. "Java: the complete reference" by Herbert Schildt and DaleSkrien, TMH
2. "Java For Dummies (For Dummies" (Computer/Tech)) 8th Edition by Barry Burd

Online Resources/E-learning Resources:

1. https://onlinecourses.nptel.ac.in/noc20-cs58/preview Programming in Java by Prof. Debasis Samanta
2. https://onlinecourses.nptel.ac.in/noc2

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Java Programming Laboratory	Course Code/ Course Type	UBTCE217/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Basic knowledge of Programming in C and C++

Course Objectives (CO):	**The objectives of Java Programming Laboratory are:** 1. To learn the fundamentals of the Java programming language 2. To learn object-oriented principles like abstraction, encapsulation, inheritance, and polymorphism and apply them in solving problems using java 3. To apply the concepts of exception handling, multithreading and collection classes using java 4. To develop software applications using JDBC connectivity. 5. To design the Graphical User Interface using applets and swing controls
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Grasp the fundamentals of the Java programming language 2. Apply object-oriented principles like abstraction, encapsulation, inheritance, polymorphism in solving problems using java 3. Create exception handling, multithreading code using java. 4. Develop software applications using JDBC connectivity. 5. Design the Graphical User Interface using event handling.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical1 :	1	Write a java program to define the data types, variable, operators, arrays and control structures.	CLO1	2
2	Practical 2:	2	Develop a Program to define class and constructors. Demonstrate constructors with method overloading.	CLO1	2
3	Practical 3:	3, 4	ADevelop a Program to define inheritance and show method overriding.	CLO2	4
4	Practical 4:	5	Develop a Program to demonstrate Exception Handling	CLO3	2
5	Practical 5:	6, 7	Develop a Program to demonstrate Multithreading	CLO3	4
6	Practical 6:	8	Develop a Program to demonstrate I/O operations	CLO4	2

7	Practical 7:	9	Develop a Program to demonstrate Database handling.	CLO4	2
8	Practical 8:	10	Develop a Program to demonstrate Network Programming.	CLO5	2
9	Practical 9:	11	Develop a Program to demonstrate Applet structure and event handling.	CLO5	2
10	Practical 10:	12	Develop a Program to demonstrate Layout managers.	CLO5	2
11	Mini Project	13, 14, 15	Develop a Project using java.	CLO5	6

Learning Resources:

Text Books:

1. "Java Fundamentals a Comprehensive Introduction" Herbert Schildt and Dale Skrien,TMH
2. "Head First Java: Your Brain on Java - A Learner's Guide", 1st Edition, by Bert Bates, Kathy Sierra

Reference Books:

1. "Java: the complete reference" by Herbert Schildt and DaleSkrien,TMH
2. "Java For Dummies (For Dummies" (Computer/Tech)) 8th Edition by Barry Burd

Online Resources/E-learning Resources:

1. https://onlinecourses.nptel.ac.in/noc20-cs58/preview Programming in Java By Prof. Debasis Samanta
2. 2. https://onlinecourses.nptel.ac.in/noc22-cs47/preview

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Community Engineering Project	Course Code/ Course Type	UBTCE218/ CEP
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

Course Objectives (CO):	**The objectives of Python Programming are:** 1. Develop an understanding of the role of engineering in addressing community needs and promoting sustainable development. 2. Apply engineering design processes and methodologies to identify, analyze, and prioritize community challenges. 3. Collaborate with community stakeholders to co-create solutions that are culturally sensitive, socially equitable, and environmentally sustainable. 4. Gain practical experience in project management, budgeting, and resource allocation for community engineering projects. 5. Communicate effectively with diverse audiences through written reports, oral presentations, and multimedia platforms.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Develop an understanding of the role of engineering in addressing community needs and promoting sustainable development. 2. Apply engineering design processes and methodologies to identify, analyze, and prioritize community challenges. 3. Collaborate with community stakeholders to co-create solutions that are culturally sensitive, socially equitable, and environmentally sustainable. 4. Gain practical experience in project management, budgeting, and resource allocation for community engineering projects. 5. Communicate effectively with diverse audiences through written reports, oral presentations, and multimedia platforms.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Community Engineering: Overview of course objectives, expectations, and project guidelines Introduction to community-based participatory research and design principles Case studies of successful community engineering projects	**CLO 1**	**6**
UNIT II		
Needs Assessment and Stakeholder Engagement: Methods for conducting community needs assessments and asset mapping, ,Techniques for engaging diverse stakeholders in the design process, Ethical considerations in working with communities.	**CLO 2**	**6**
UNIT III		
Project Planning and Design: Project scoping, goal setting, and defining success criteria, Engineering design processes and methodologies, Incorporating sustainability principles into project design	**CLO 3**	**6**

UNIT IV		
Implementation and Collaboration: Project management techniques, including scheduling, budgeting, and resource allocation, Interdisciplinary collaboration and team dynamics, Effective communication with community partners and project stakeholders .	**CLO 4**	**6**
UNIT V		
Project Execution and Monitoring: Prototyping and testing of project solutions, Monitoring project progress and making adjustments as needed, Documentation and record-keeping for project evaluation **Impact Evaluation and Reflection:**Methods for assessing the social, economic, and environmental impact of community engineering projects, Reflective practices and peer feedbackn	**CLO 5**	**6**
Total Hours		**30**

Assesment:

1. Project Proposal: Written proposal outlining the project scope, objectives, and methodology (20
2. Project Implementation: Development and implementation of the digital solution, including documentation and code repository (30
3. Final Report: Written report summarizing the project process, outcomes, and impact assessment (30
4. Presentation: Oral presentation of project findings and demonstration of the digital

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Computer Organization and Architecture	Course Code/ Course Type	UBTCE219/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Pre-Requisite:

1. NIL

Course Objectives (CO):	**The the objective of Computer Organization are:** 1. To recognize the components of Computer 2. To articulate the principles of computer organization and the basic architectural concepts 3. To learn simple register transfer language to specify various computer operations 4. To interpret and summarize the pipelining concept and multiprocessor systems 5. To design, and program a simple digital computer ALU operation
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Student will learn the concepts of computer organization for several engineering applications 2. Student will develop the ability and confidence to use the fundamentals of computer organization as a tool in the engineering of digital systems. 3. An ability to identify, formulate, and solve hardware and software computer engineering problems using sound computer engineering principle 4. To impart the knowledge on micro programming 5. Comprehend the concepts of advanced pipelining techniques

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Fundamentals Of Computers Basic Functional units of Computers: Types and generation of computers, Functional units, basic Operational concepts, Bus structures. Software, Performance, Architecture: Von Neumann and Harvard architecture. Data Representation: Signed number representation, fixed and floating-point representations. Booth's Algorithm, Restoring Algorithm, Non-Restoring algorithm	**CLO 1**	**6**
UNIT II		
THE MEMORY SYSTEM Basic concepts of semiconductor RAM memories Memory Hierarchy, Primary memory, Secondary Memory and its types, Magnetic Tape, Magnetic Disk, Optical disk, magnetic-optical, and other modern disks etc, Cache memories and its types, Cache coherence and Virtual Memory, Paging Replacement algorithm, DMA, DMA Transfer modes, sequential access, and direct access storage device.	**CLO 2**	**6**
UNIT III		

REGISTER TRANSFER LANGUAGE AND MICRO-OPERATIONS Register Transfer Language and Micro Operations: Introduction to RTL- Registers, Bus and memory transfers, Micro operations: Arithmetic, Logic, and Shift micro-operation, Arithmetic logic shift unit	**CLO 3**	**6**
UNIT IV		
Central Processing Unit Organization Basic Computer Organization: Computer Registers and types, Instructions, Instruction cycle, Types of Instructions: Memory Reference Instructions, Input & output, Timing and control, Interrupts, Central Processing Unit organization: General Register Organization, stack organization, Addressing modes and its types, Data Transfer and Manipulation, Program Control, CISC and RISC processors Control unit design: Design approaches,Control memory, Address sequencing Parallelism, Throughput and Speedup .	**CLO 4**	**6**
UNIT V		
MULTI-PROCESSOR ORGANIZATION Pipelining and Vector Processing: Basic concepts, Instruction level Parallelism, Pipeline hazards, Hazards, Time Space Diagram, instruction Pipelining, Arithmetic Pipelining, Multiprocessor and Multicore operation, Loosely-coupled (distributed memory) multiprocessor system, Tightly-coupled (shared memory) multiprocessor system,SISD,SIMD, MISD,MIMD.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Computer Organization – Carl Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill
2. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI

Reference Books:

1. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI
2. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI/Pearson
3. Fundamentals or Computer Organization and Design, - SivaraamaDandamudi Springer Int. Edition.
4. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Fourth Edition Elsevier

Online Resources/E-learning Resources:

1. https://www.classcentral.com/course/swayam-principles-of-communication-systems-i-7963 dated 16/04/2024
2. https://onlinecourses.nptel.ac.in/noc22-ee05/preview dated 16/04/2024

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Applied Statistical Techniques	Course Code/ Course Type	UBTCE220/PCC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Pre-Requisite:

1. Basic statistical concepts

Course Objectives (CO):	**The the objective of Applied Statistical Techniques are:** 1. To familiarize the students with advanced techniques in Statistics 2. To acquire knowledge of techniques of advanced level of sampling & estimation 3. To apply tests of hypothetical techniques and its applications that would enhance analytical thinking power 4. To learn the where and how to apply parametric & non-parametric tests with applications 5. Compare parametric and non-parametric inference
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Identify the advanced terms in statistics 2. Explain the estimation & its techniques 3. Apply knowledge of hypothesis techniques to test large and small samples 4. Apply non-parametric tests on practical situations 5. Analyze parametric and non-parametric inference

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Sampling Techniques Random sampling, Sampling from finite and infinite populations, with and without replacement, central limit theorem, Standard error of sampling, Sampling distribution of sample mean and proportion	**CLO 1**	**6**
UNIT II		
EstimationIntroduction, Types of estimation, Interval estimation, Point estimation: Maximum likelihood function, Method of moments, Criteria for good estimates: Unbiasedness, Consistency, Sufficiency by Neyman factorization theorem	**CLO 2**	**6**
UNIT III		
Test of Hypothesis-I Introduction, Hypothesis, Simple and composite hypothesis, Type I and Type II errors, Level of significance, Critical region, Student's-t test, Z-test	**CLO 3**	**6**
UNIT IV		
Test of Hypothesis-II Test of hypothesis for small & large sample by Chi-Square distribution, Student's-t distributions, F-distributions. Degree of freedom, Analysis of variance (ANOVA): one-way, two-way (without interactions), P-Value.	**CLO 4**	**6**
UNIT V		

Nonparametric Inference Non-parametric Inference, order statistics, Tolerance region, Sign test, Mann-Whitney test, Wilcoxon signed rank test, Spearman's rank correlation test, Chi-square test	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2014.
2. Hugh Neill, Trigonometry: A complete Introduction, John Murray Learning, 2018.
3. George B. Thomas, Jr and Ross L. Finney, Calculus and Analytical Geometry, 9th Edition, 1998

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2010
2. Ron Larson, Trigonometry, Brooks/Cole, 9th Edition, 2013.
3. Robert E, Moyer, Trigonometry, Mc. Graw Hill, Addision-Wesely, 4th Edition, 2009.

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Internet of Things	Course Code/ Course Type	UBTCEOE205/OE
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Computer Networks and Security

Course Objectives (CO):	**The the objective of Internet of Things are:** 1. To comprehend fundamentals of Internet of Things (IoT) 2. To learn advances in IOT 3. To learn methodologies for IoT application development 4. To learn the IoT protocols, cloud platforms and security issues in IoT 5. To learn real world application scenarios of IoT along with its societal and economic impact using case studies and real time examples
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Comprehend the fundamentals and need of IOT. 2. Apply IoT enabling technologies for developing IoT systems 3. Apply design methodology for designing and implementing IoT applications 4. Analyze IoT protocols for making IoT devices communication 5. Design cloud based IoT systems

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Internet of Things: Concepts Introduction to Internet of Things (IoT): Definition, Characteristics of IoT, Vision, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Societal Benefits of IoT, Technical Building Blocks. Physical Design of IoT: Sensors and Actuators, Need of Analog / Digital Conversion. Logical Design of IoT: IoT functional blocks, Applications in IoT.	**CLO 1**	**10**
UNIT II		
IoT: Design Methodology IoT Design Methodology: Steps, Basics of IoT Networking, Internet Structure, Connectivity Technologies, IoT Communication Models, Four pillars of IoT: M2M, SCADA, WSN, RFID.	**CLO 2**	**9**
UNIT III		
IoT Protocols: Sensor Networks, Protocol Standardization for IoT, M2M and WSN Protocols, RFID Protocol, Modbus Protocol, Zigbee Architecture. IP based Protocols: MQTT (Secure), 6LoWPAN, LoRa	**CLO 3**	**9**

UNIT IV		
Cloud Platforms for IoT: Software Defined Networking, Introduction to Cloud Storage Models, Communication API. WAMP: AutoBahn for IoT, Xively Cloud for IoT. Python Web Application, Amazon Web Services for IoT, SkyNet IoT Messaging Platform, RESTful Web Service, GRPC,SOAP.	**CLO 4**	**9**
UNIT V		
Security in IoT: Introduction, Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling. Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for IoT, Challenges in designing IOT applications	**CLO 5**	**8**
Total Hours		**45**

Learning Resources:

Text Books:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 2nd Edition,Wiley Publication, ISBN: 978-1-119-99435-0

Reference Books:

1. DawoudShenoudaDawoud, Peter Dawoud, "Microcontroller and Smart Home Networks", ISBN: 9788770221566, e-ISBN: 9788770221559
2. Charles Crowell, "IoT-Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT", ISBN-13 : 979-8613100194
3. David Hanes, Gonzalo Salgueiro, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press, ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5, TMH,2012.

Online Resources/E-learning Resources:

1. https://nptel.ac.in/courses/106/105/106105166/
2. https://nptel.ac.in/courses/108/108/108108098/

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Internet of Things Laboratory	Course Code/ Course Type	UBTCEOE206/OE
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Computer Networks and Security lab

Course Objectives (CO):	**The objectives of Internet of Things Laboratory are:** 1. To understand fundamentals of Internet of Things (IoT) 2. To learn advances in IoT. 3. To learn methodologies for IoT application development 4. To learn the IoT protocols, cloud platforms and security issues in IoT 5. To learn real world application scenarios of IoT along with its societal and economic impact using case studies and real time examples
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand the fundamentals and need of IOT. 2. Apply IoT enabling technologies for developing IoT systems 3. Apply design methodology for designing and implementing IoT applications 4. Analyze IoT protocols for making IoT devices communication 5. Design cloud based IoT systems

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical1	1	Connection of an Arduino board with ESP8266 wifi module.	CLO1	2
2	Practical 2	2	IoT based control of an LED using Arduino.	CLO2	2
3	Practical 3	3	IoT based control of an LED using Arduino.	CLO2	2
4	Practical 4	4	IoT and cloud based data logger using LM35 and Arduino.	CLO3	2
5	Practical 5	4	IoT and cloud based data logger using LM35 and Arduino.	CLO3	2
6	Practical 6	6	IoT and cloud based data logger using LM35 and Arduino.	CLO3	2
7	Practical 7	7	IoT based home automation using Arduino.	CLO4	2
8	Practical 8	8	IoT based home automation using Arduino	CLO4	2
9	Practical 9	9	IoT based home automation using Arduino.	CLO4	2
10	Practical 10	10	IoT based street light control using Arduino.	CLO5	2

11	Practical 11	11	IoT based street light control using Arduino.	CLO5	2
12	Practical 12	12	IoT based street light control using Arduino	CLO5	2
13	Practical 13	13	IoT based DC motor speed control using Arduino.	CLO5	2
14	Practical 14	14	IoT based DC motor speed control using Arduino.	CLO5	2
15	Practical 15	15	IoT based DC motor speed control using Arduino.	CLO5	2

Learning Resources:

Text Books:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 2nd Edition,Wiley Publication, ISBN: 978-1-119-99435-0

Reference Books:

1. DawoudShenoudaDawoud, Peter Dawoud, "Microcontroller and Smart Home Networks", ISBN: 9788770221566, e-ISBN: 9788770221559
2. Charles Crowell, "IoT-Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT", ISBN-13 : 979-8613100194
3. David Hanes, Gonzalo Salgueiro, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press, ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5

Online Resources/E-learning Resources:

1. 1. https://nptel.ac.in/courses/106/105/106105166/
2. https://nptel.ac.in/courses/108/108/108108098/

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Digital Image Processing	Course Code/ Course Type	UBTCEOE207/OE
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Digital Signal Processing

Course Objectives (CO):	**The the objective of Digital Image Processing are:** 1. To become familiar with digital image fundamentals 2. To get exposed to simple image enhancement techniques in Spatial and Frequency domain 3. To learn concepts of degradation function and restoration techniques 4. To study the image segmentation and representation techniques 5. To become familiar with image compression and recognition methods
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Learn the basics and fundamentals of digital image processing, such as Digitization, sampling, quantization, and 2D-transforms 2. Operate on images using the techniques of smoothing, sharpening and enhancement in spatial Domain 3. Learn the basics of compression digital image and their different types 4. Analyze the restoration concepts and filtering techniques 5. Explore the basics of segmentation & features extraction techniques

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Digital Image Processing Introduction Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relations, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram. Color fundamentals & models – RGB, HSI YIQ.	**CLO 1**	**9**
UNIT II		
Image Enhancement in Spatial Domain IoT Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations. Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening. Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain. Homomorphic filtering. Restoration: Noise models, Restoration using inverse filtering and Wiener filtering. Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering	**CLO 2**	**9**

UNIT III		
Image Compression Types of redundancy, Fidelity criteria, Lossless compression – Run length coding, Huffman coding, Bitplane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG	**CLO 3**	**9**
UNIT IV		
Image Segmentation and Morphological Operations Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative - Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding - Global, Adaptive. Otsu's Method. Region Growing, Region Splitting and Merging. Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.	**CLO 4**	**9**
UNIT V		
Image Restoration and Description Image Restoration, degradation model, Properties, Noise models ,Mean Filters , Order Statistics , Adaptive filters , Band reject Filters, Band pass Filters ,Notch Filters , Optimum Notch Filtering, Inverse Filtering, Wiener filtering. Representation, Chain codes, Polygonal approximation, Signatures. Boundary Descriptors, Shape numbers, Fourier Descriptors, Statistical moments. Regional Descriptors, Topological, Texture. Principal Components for Description	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Third Edition, 2010.
2. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2002

Reference Books:

1. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006
2. 2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson Education, Inc., 2011

Online Resources/E-learning Resources:

1. Digital Image Processing, IIT Kharagpur ,Prof. P.K. BiswasLink: https://nptel.ac.in/courses/117105079
2. NPTEL Video Course :NOC:Digital Image ProcessingLink:
3. https://www.digimat.in/nptel/courses/video/117105135/L02.html

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Digital Image processing Laboratory	Course Code/ Course Type	UBTCEOE208/OE
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Digital signal Processing

Course Objectives (CO):	**The objectives of Digital Image processing Laboratory are:** 1. To become familiar with digital image fundamental operations 2. To get exposed to simple image enhancement techniques in Spatial and Frequency domain 3. To learn concepts of degradation function and restoration techniques 4. To study the image segmentation and representation techniques. 5. To become familiar with image compression and recognition methods
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Learn the basics and fundamentals of digital image processing operations, such as Digitization, sampling, quantization, and 2D-transforms 2. Operate on images using the techniques of smoothing, sharpening and enhancement in spatial Domain. 3. Learn the basics of compression digital image and their different types. 4. Analyze the restoration concepts and filtering techniques. 5. Explore the basics of segmentation & features extraction techniques.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical1 :	1	Conversion of 24 bit color image to 8 bit, 4 bit image.	CLO1	2
2	Practical 2:	2	Perform Morphological operations –Erosion, Dilation, Opening, Closing	CLO1	2
3	Practical 3:	3	Apply image negation and power-law correction operations on image.t	CLO1	2
4	Practical 4:	4, 5	Study of statistical properties- Mean, Standard deviation, Variance & histogram plotting.	CLO1	4
5	Practical 5:	6	Enhance image using histogram equalization and stretching.	CLO2	2
6	Practical 6:	7	To perform image filtering in spatial domain.	CLO2	2
7	Practical 7:	8	To perform image filtering in frequency domain	CLO4	2

8	Practical 8:	9	Perform image smoothing and sharpening operations	CLO2	2
9	Practical 9:	10	Detect image edges using Sobel, Prewitt and Roberts operator.	CLO4	2
10	Practical 10:	11	Compress image using DCT / Wavelet transform.	CLO3	2
11	Practical 11:	12, 13	Apply Global and adaptive thresholding to an image.	CLO4	4
12	Practical 12:	14, 15	Compress image using DCT / Wavelet transform.	CLO5	4

Learning Resources:

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Third Edition, 2010.
2. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2002

Reference Books:

1. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson Education, Inc., 2011

Online Resources/E-learning Resources:

1. Digital Image Processing, IIT Kharagpur, Prof. P.K. BiswasLink: https://nptel.ac.in/courses/117105079
2. NPTEL Video Course :NOC:Digital Image ProcessingLink

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Web Development Using Django	Course Code/ Course Type	MOOCCE401/MOOC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	25	-	25

Pre-Requisite:

1. Basic knowledge of Python programming and HTML

Course Objectives (CO):	**The the objective of Web Development Using Django are:** 1. To introduce the fundamentals of web development using the Django framework 2. To provide hands-on experience in building and managing web applications with Django 3. To equip students with knowledge of database migrations and data modeling in Django 4. To develop skills in creating dynamic, interactive, and responsive web applications 5. To integrate front-end and back-end development within the Django framework
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Build and deploy web applications using the Django framework 2. Design and manage databases with Django's ORM and migrations 3. Implement user authentication and authorization in Django applications 4. Integrate static files, templates, and front-end components into Django projects. 5. Use Django to develop scalable and maintainable full-stack web applications

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Django Framework Overview of Web Development and Django –(Introduction to the MVC (Model-View-Controller) Pattern,Installing Django and Setting Up the Environment),Creating a Django Project –(Django Project and App Structure,Django Settings and Configuration),URL Mapping and Views –(Defining URLs and Views,Dynamic URLs and Path Converters),Handling HTTP Requests and Responses-(Hands-on Exercise: Create a basic Django project with URL routing and simple views).	**CLO 1**	**6**
UNIT II		
Working with Models and Databases Django ORM (Object-Relational Mapping) –(Defining Models and Fields,Querying and Managing Data with ORM),Database Migrations –(Creating and Applying Migrations,Handling Schema Changes),Relationships in Django Models –(One-to-Many and Many-to-Many Relationships,Using Foreign Keys), Integrating Databases –(Setting Up SQLite/PostgreSQL with Django Hands-on Exercise: Build and manage a database schema using Django ORM and migrations.).	**CLO 2**	**6**
UNIT III		

Django Templates and Static Files Introduction to Django Templates –(Using Template Tags and Filters,Template Inheritance), Working with Static Files –(Managing CSS, JavaScript, and Images in Django,Using the Static Files App),Dynamic Data in Templates –(Passing Context to Templates,Displaying Query Results in HTML),Form Handling in Django-(Creating and Processing Forms,Form Validation and Customization,Hands-on Exercise: Design a Django app with dynamic templates and static assets integration.).	**CLO 3**	**6**
UNIT IV		
Advanced Django Features User Authentication and Authorization-(User Model and Authentication Flow,Managing Permissions and Groups),Working with Django Admin-(Customizing the Django Admin Interface,Adding Custom Admin Actions),Middleware in Django –(Overview of Middleware and Its Role,Writing Custom Middleware),Building APIs with Django-(Introduction to Django REST Framework,Creating Basic RESTful APIs,Hands-on Exercise: Implement user authentication and build a REST API for a Django app.). .	**CLO 4**	**6**
UNIT V		
Deployment and Capstone Project Deploying Django Applications –(Preparing the Project for Deployment,Deploying on Platforms like Heroku or AWS),Scaling and Maintaining Django Projects –(Caching, Load Balancing, and Debugging,Logging and Monitoring Django Applications),Capstone Project-(Design and Develop a Full-Stack Web Application,Integrate Authentication, Database, and RESTful API,Deploy and Demonstrate the Completed Application).	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Django for Beginners" by William S. Vincent
2. "Lightweight Django" by Julia Elman and Mark Lavin

Reference Books:

1. "Two Scoops of Django" by Daniel Roy Greenfeld and Audrey Roy Greenfeld
2. "Python Web Development with Django" by Jeff Forcier, Paul Bissex, and Wesley Chun
3. "Pro Django" by Marty Alchin

Online Resources/E-learning Resources:

1. https://www.coursera.org/learn/django-web-framework
2. https://www.coursera.org/projects/django-database-migrations

Name of the Program:	BTECH CSE	Semester: 4	Level: UG
Course Name:	Foundations of Cyber security in Linux	Course Code/ Course Type	MOOCCE402/MOOC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	25	-	25

Pre-Requisite:

1. Basic understanding of Linux and networking concepts

Course Objectives (CO):	**The the objective of Foundations of Cyber security in Linux are:** 1. To introduce core concepts of cybersecurity and their application in Linux environments 2. To provide hands-on experience in configuring and securing Linux systems 3. To equip students with knowledge of system hardening, network security, and threat detection in Linux 4. To integrate theoretical cybersecurity principles with practical Linux system administration 5. To prepare students for entry-level roles in cybersecurity and Linux administration
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand key principles of cybersecurity, including confidentiality, integrity, and availability 2. Implement user and file system security measures in Linux 3. Configure and manage secure network connections in Linux environments 4. Detect and respond to security incidents using Linux tools and logging mechanisms. 5. Apply advanced system administration techniques to secure Linux servers

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Foundations of Cybersecurity Introduction to Cybersecurity (Core Concepts: CIA Triad (Confidentiality, Integrity, Availability, Common Threats and Attacks (Phishing, Malware, Ransomware) , Understanding Security Policies (Risk Management and Compliance, Importance of Security Awareness), Fundamentals of Linux Security (Linux Permissions and File Ownership, Best Practices for Linux Security), Case Studies in Cybersecurity(Hands-on Exercise: Implement file permissions and security configurations in a Linux environment).	**CLO 1**	**6**

UNIT II		
Linux System Administration and Security Basics(Based on Red Hat RH134 - Red Hat System Administration II) Managing Users and Groups (User Authentication and Password Policies, Configuring Sudo for Privileged Access), File System Security (Access Control Lists (ACLs), Encrypting File Systems with LUKS. Process Management and Security (Understanding Process Priorities, Managing Process Permissions. Service Hardening (Disabling Unnecessary Services, Configuring System Logs for Security Audits) Hands-on Exercise: Harden a Linux system by securing user accounts and encrypting data.	**CLO 2**	**6**
UNIT III		
Securing Network Connections in Linux Introduction to Network Security (Understanding Firewalls and iptables/nftables, Basics of SELinux and AppArmor). Configuring Secure Network Services (SSH Security: Keys, Configurations, and Best Practices, Configuring Secure Web and FTP Services), Secure Remote Access (VPN Configuration Basics, Managing Certificates and OpenSSL), Troubleshooting Network Issues (Analyzing Network Traffic with Wireshark, Using tcpdump for Incident Analysis). Hands-on Exercise: Set up a secure SSH server and configure firewall rules.	**CLO 3**	**6**
UNIT IV		
Advanced Linux Security and Incident Response User Monitoring and Logging in Linux (Configuring rsyslog and journalctl, Setting Up Intrusion Detection Systems (IDS)), Security Automation (Using Bash Scripts for Security Monitoring , Introduction to Ansible for Security Automation. Incident Response in Linux (Analyzing Logs for Security Incidents, Isolating and Mitigating Threats), Forensics in Linux (Basics of Memory and Disk Forensics, Tools for Data Recovery and Analysis). Hands-on Exercise: Detect and analyze a simulated security incident in a Linux environment. .	**CLO 4**	**6**
UNIT V		
Capstone Project and Integration Comprehensive System Hardening (Applying Learned Security Measures to a Linux System, Securing Web Servers, Databases, and Applications), Configuring Linux for Secure Networking (Implementing Best Practices for Network Security, Advanced Firewall Configurations). Capstone Project (Design and Implement Secure Linux Environment, Document and Present Security Strategies and Configurations), Future Directions (Preparing for Advanced Certifications (RHCE, CompTIA Security+), Emerging Trends in Linux Security and Cybersecurity. Capstone Project Presentation: Deploy a secure Linux server with end-to-end security measures.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Red Hat RH124: Red Hat System Administration I"
2. "Red Hat DO101: Introduction to OpenShift Applications".

Reference Books:

1. "Practical Guide to Linux Commands, Editors, and Shell Programming" by Mark G. Sobell
2. "Linux Bible" by Christopher Negus
3. "Cybersecurity for Beginners" by Raef Meeuwisse

Name of the Program:	B.TECH CSE	Semester: 4	Level: UG/PG
Course Name:	German A1.2	Course Code/ Course Type	UFL 202 A/AEC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. Can understand and use familiar, everyday expressions and very simple sentences aimed at satisfying specific needs

Course Objectives (CO):	**The the objective of German A1.2 are:** 1. To get along with a basic vocab 2. To understand German day to day culture 3. Can communicate in routine situations 4. To be able to have a direct exchange of information about familiar matters 5. To describe own surroundings
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Communicate in the areas of immediate importance 2. Able to frame simple sentences in formal conversation 3. Translate simple sentences from English to the German language and vice-versa 4. Construct a dialogue, in the German language, for basic human interactions in a social context 5. Take part in an interaction relating to basic conversation

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Kontakte planning of letter writing, ramification of Letter, writing and understanding, discussion about language learning, find information from texts, understand conversations on various topics, texts related to office life Grammar – Usage of Articles and Prepositions	**CLO 1**	**6**
UNIT II		
MeineWohnungUnderstand home advertisements, describe house, how to reply invitations, how to express 'likes and dislikes', speak about different forms of living, how to write a text on house Grammar – Adjectives	**CLO 2**	**6**
UNIT III		
AllesArbeit? Talk about daily routine, talk about past, understand job advertisements, understand blogs on jobs, express opinions about jobs, prepare telephonic dialogues, speak about jobs ,Grammar – Past tense, Sentence connectors	**CLO 3**	**6**

UNIT IV		
Kleidung und Mode Speak about cloths and shopping, lead a discussion during cloths shopping, discussion in departmental store, understand and research information about Berlin, Grammar – Separable and non-separable verbs	**CLO 4**	**6**
UNIT V		
Gerund und munter & Ab in den Urlaub Learn body parts, Health related dialogue, City orientation, Travel reports, discussion regarding different travel destinations and weather Grammar – Imperative, Time adverbs	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Netzwerk A1, Ernst klettVerlag & Goyal Publishers & Distributors Pvt. Ltd.
2. Studio d A1, CornelesenVerlag & Goyal Publishers & Distributors Pvt. Ltd.
3. NetzwerkNeu A1, Ernst klettVerlag & Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. Hallo Deutsch A1,ErnstKlettVerlag, Goyal Publishers & Distributors Pvt. Ltd
2. ThemenAktuell 1, Hueberverlag
3. Maximal Ernst klettVerlag & Goyal Publishers & Distributors Pvt. Ltd

Online Resources/E-learning Resources:

1. Youtube :https://youtube.com/@LearnGermanwithAnja?si=BkJYDPi7TS0fT4lr
2. https://youtube.com/@deutschlernenmitheidi?si=TkICIabzioaU0roZ
3. Instagram :instagram.com/learngermanwithanja

Name of the Program:	B.Tech	Semester: 4	Level: UG/PG
Course Name:	Japanese language skill - L2	Course Code/ Course Type	UFL202B/AEC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assesment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. Desire to get acquainted with the Japanese language. Basic knowledge of Hiragana and Katakana.

Course Objectives (CO):	**The the objective of Japanese language skill - L2 are:** 1. To meet the needs of ever-growing industry, with respect to language support 2. To get introduced to Japanese society and culture through language 3. To promote multilingualism in exposing students to different cultures 4. Fostering respect for linguistic diversity 5. Learning additional language to develop a better memory, talent for problem solving, ability to concentrate
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Read & write words that have been borrowed from other language 2. Comprehend and speak basic conversation with basic particles 3. Speak and write about Routine 4. Basic sentence patterns incorporated into short dialogues indicating how they are used in actual conversation 5. Comprehend grammatical structure, and improve communication abilities

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Katakana Script Katakana Script / Writing Kanji	**CLO 1**	**6**
UNIT II		
System of demonstrative words Minna no Nihongo lesson no. 1,2 & 3	**CLO 2**	**6**
UNIT III		
Minna no Nihongo lesson no. 4T(Write and Speak basic sentences in correct tenses)	**CLO 3**	**6**
UNIT IV		
Reading : Basic conversation using particles Listening : conversation related to particles Speaking : Sentences about give, lend, teach, receive	**CLO 4**	**6**
UNIT V		
Tenses Writing : Affirmative present ,past & future Negative present ,past,& future sentences Writing : About Routine	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Minna no Nihongo , " Japanese for everyone" ,Elementary Main Textbook , Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. Shyoho Volume 1
2. Genki Japan
3. Haru Vol. 1 & 2

Online Resources/E-learning Resources:

1. https://youtu.be/1JephUxTHxg?si=ouCwTXZc-fYgY9Kh
2. https://youtu.be/9EfbkBkF2ag?si=rLNzc55-REacMoGu
3. https://youtu.be/DpEolYasgyg?si=dya9ue-YMSHO3VOG

Name of the Program:	B.Tech/B.B.A/ B.C.A/B.Sc/ B.Pham	Semester: 4	Level: UG
Course Name:	UHV-II: Understanding Harmony	Course Code/ Course Type	ACUHV201/AC
Course Pattern:	2024	Version	1.0

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. NIL

Course Objectives (CO):	**The objectives of Understanding Harmony are:** 1. To train the student for Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence 2. To comprehend (or develop clarity) the harmony in the human being, family, society and nature/existence 3. To strengthen self-reflection. 4. To infuse a sense of commitment and courage to act 5. 5. To understand Holistic Understanding of Harmony on Professional Ethics.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Analyze the most important requirement for any human being. 2. Apply correct appraisal of Physical needs, meaning of Prosperity in detail 3. Analyze salient values in relationship, Friends and Foes, Empathy, False Prestige. 4. Develop holistic perception of harmony at all levels of existence 5. Apply the Holistic Understanding of Harmony on Professional Ethics

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 1. Purpose and motivation for the course, recapitulation from Universal Human Values-I 2. Self-Exploration–what is it? - Its content and process; Personality Traits-Self Excellence, Natural Acceptance and Experiential Validation- as the process for self-exploration, Adaptability, Belief and Understanding- Self discipline 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.	**CLO 1**	**8**
UNIT II		

Understanding Harmony in the Human Being - Harmony in Myself:1. Understanding human being as a co-existence of the sentient I and the material Body 2. Understanding the needs of Self (I) and Body - happiness and physical facility 3. Understanding the Body as an instrument of I (I being the doer, seer and enjoyer)- Habits and Hobbies, SWOT Analysis (Activity) 4. Understanding the characteristics and activities of I and harmony in I – Dalai Lamas Tibetan Personality Test – Dr. Menningers Psychometric Test. 5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail	**CLO 2**	**5**
UNIT III		
Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship 2. Understanding the meaning of Trust; Difference between intention and competence 3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Friends and Foes, Empathy, False Prestige.	**CLO 3**	**5**
UNIT IV		
Understanding Harmony in the Nature and Existence - Whole existence as Coexistence:1. Understanding the harmony in the Nature and its Equanimity, Respect for all, Nature as Teacher 2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature 3. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space 4. Holistic perception of harmony at all levels of existence.	**CLO 4**	**5**
UNIT V		
Implications of the above Holistic Understanding of Harmony on Professional Ethics1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Vision for the Holistic alternatives, UHVs for entrepreneurship	**CLO 5**	**7**
Total Hours		**30**

Learning Resources:

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

Reference Books:

1. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
2. Small is Beautiful - E. F Schumacher
3. Slow is Beautiful - Cecile Andrews
4. The Story of Stuff (Book).

Online Resources/E-learning Resources:

1. https://www.studocu.com/in/document/jss-science-and-technology-university/human-values/uhv-handout-2-harmony-in-the-human-being/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf
3. https://vemu.org/uploads/lecture-notes/22-12-2022-1850871704.pdf

Name of the Program:	B.TECH CSE	Semester: 4	Level: UG
Course Name:	Constitution of India	Course Code/ Course Type	ACCOI201/AC
Course Pattern:	2024	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. NIL

Course Objectives (CO):	**The objectives of Constitution of India are:** 1. To familiarize the students with the key elements of the Indian constitution 2. To enable students to grasp the constitutional provisions and values 3. To acquaint the students with the powers and functions of various constitutional offices and institutions. 4. To make students understand the basic premises of Indian politics 5. To make students understand the role of constitution and citizen-oriented measures in a democracy
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Analyze the basic structure of Indian Constitution 2. Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution 3. know about our Union Government, political structure & codes, procedures 4. Elaborate our State Executive & Elections system of India 5. Access the Amendments and Emergency Provisions, other important provisions given by the constitution

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Indian Constitution The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly. The Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of India Constitution	**CLO 1**	**8**
UNIT II		
FR's, FD's and DPSP's Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building	**CLO 2**	**5**
UNIT III		
Governance and Constitution1. Federalism in India - Features, Local Government -Panchayats –Powers and functions; 73rd and 74th amendments, Election Commission – Composition, Powers and Functions; Electoral Reforms, Citizen oriented measures – RTI and PIL – Provisions and significance	**CLO 3**	**5**

UNIT IV		
Union Executive Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.	**CLO 4**	**5**
UNIT V		
IState Executive & Elections, Amendments and Emergency Provisions State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (How and Why) and Important Constitutional Amendments till today. Emergency Provisions	**CLO 5**	**7**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Constitution of India" (for Competitive Exams) - Published by Naidhruva Edutech Learning Solutions, Bengaluru. – 2022
2. "Engineering Ethics", M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Prentice –Hall, 2004

Reference Books:

1. "SamvidhanaOdu" - for Students & Youths by Justice HN NagamohanDhas, Sahayana, kerekon
2. "Constitution of India, Professional Ethics and Human Rights" by Shubham Singles, Charles E. Haries, published by Cengage Learning India, Latest Edition – 2019.
3. "Introduction to the Constitution of India", (Students Edition.) by Durga Das Basu (DD Basu) Prentice –Hall, 2008
4. "The Constitution of India" by Merunandan K B: published by Merugu Publication.

Online Resources/E-learning Resources:

1. https//opportunitycell.com/online-course-on-the-indian-constitution-by-ministry-of-law-justice/#google-vignette dated 19/4/2024
2. https://onlinecourses.nptel.ac.in/noc20-lw03/preview dated 19/4/2024

Name of the Program:	BTECH CSE	Semester: 5	Level: UG
Course Name:	Theory of Computation	Course Code/ Course Type	UBTCE301/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	1	3	3	40	60	-

Pre-Requisite:

1. Discrete Mathematics
2. Digital Electronics & Logic Design

Course Objectives (CO):	**The objectives of Theory of Computation are:** 1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages 2. To illustrate finite state machines to solve problems in computing 3. To familiarize Regular grammars, context frees grammar 4. To propose computation solutions using Turing machines 5. To analyze the problem types
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Elaborate basic concepts of formal languages of finite automata techniques 2. Develop formal mathematical methods to prove properties of languages, grammars and automata 3. Able to construct context free grammar for various languages 4. Applying normal form techniques push down automata and Turing Machines for any language 5. Illustrate the decidability or undecidability of various problems

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
FORMAL LANGUAGE THEORY AND FINITE AUTOMATA: Introduction, Basic concepts, Languages, Finite State Machine, Deterministic Finite Automata, Non-Deterministic Finite Automata, Equivalence of Deterministic and Nondeterministic Finite Automata, Minimization of Deterministic Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Introduction to Mealy and Moore Machine.	**CLO 1**	**6**
UNIT II		
REGULAR EXPRESSIONS: Introduction, Identities of Regular Expressions, Conversion of Regular Expressions to Finite Automata, Arden's Theorem, Closure properties of regular languages, Regular Grammar with Finite Automata., Pumping Lemma for Regular Languages.	**CLO 2**	**6**
UNIT III		
CONTEXT FREE LANGUAGE AND GRAMMAR: Context Free Language, Context Free Grammar - Derivation Trees, Sentential Forms, Leftmost and Rightmost derivations of Strings., Ambiguity in CFG's, Simplification of CFG, Chomsky Normal Form, Griebach Normal Form, Chomsky Hierarchy.	**CLO 3**	**6**

UNIT IV		
PUSHDOWN AUTOMATA: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA. **TURING MACHINES (TM):** Formal definition and behavior, Languages of a TM, TM as accepters, and TM as a computer of integer functions, Types of TMs.	**CLO 4**	**6**
UNIT V		
COMPUTABILITY AND COMPLEXITY THEORY: Decidable and Un-decidable Problems, Undecidable Problems that are Recursively Enumerable, P Class and NP Class with examples, P vs NP Problems, NP-Complete NP-Hard Problems.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages and Computation, 3rdedition, Pearson Education, India
2. J.Martin, —Introduction to Languages and the Theory of Computation, Third Edition, TMH, 2007

Reference Books:

1. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India
2. Micheal Sipser, —Introduction of the Theory and Computation, Thomson Brokecole, 3rd Edition, 2013

Online Resources/E-learning Resources:

1. https://www.udemy.com/course/the-complete-theory-of-computation/?couponCode=ST8MT40924
2. https://onlinecourses.nptel.ac.in/noc19_cs79/preview

Name of the Program:	BTECH CSE	Semester: 5	Level: UG
Course Name:	Computer Network	Course Code/ Course Type	UBTCE302/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Fundamental of Computers

Course Objectives (CO):	**The objectives of Computer Network are:** 1. To gain the knowledge of communication systems 2. To learn and understand the history of Computer Network and its evolution with the help of service models 3. To learn the various principles of Network layer, its management and Routing algorithms at Network layer 4. To learn the services offered by Transport layer 5. To learn the Applications layer and session layer protocols; and its services
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Identify various data communication techniques along with types of networks 2. Interpret OSI and TCP/IP Protocol suites 3. Design routing algorithms to find shortest path in network 4. Compare TCP and UDP services 5. Demonstrate application layer protocols

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Data Communication: Fundamentals of Data Communication, Type of Connections, Network Topologies, Types of Networks-LAN, WAN And MAN; Data and Signals, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance; Introduction to Digital to Digital, Analog to Digital, Digital to Analog, Analog to Analog Conversions; Transmission Modes.	**CLO 1**	**9**
UNIT II		
Introduction to Computer Networks: Introduction to OSI and TCP/IP Protocol Suite, Classification of Addressing Mechanisms, Guided Media: Twisted Pair Cable, Coaxial Cable and Fiber-Optic Cable, Unguided Media: Wireless, Radio Waves, Microwaves and Infrared; Introduction to Data Link Layer.	**CLO 2**	**9**
UNIT III		
Network Layer and Routing Principles: Network Layer Services, Packet Switching: Datagram and Virtual Circuit Approach, Network Layer Performance: Delay, Throughput, Packet Loss, Congestion Control; IPv4: Datagram Format; Routing Algorithms: Distance Vector, Link-state, Path Vector Routing.	**CLO 3**	**9**

UNIT IV		
Transport Layer and its Services: Overview of Transport Layer, Transport Layer services, User Datagram Protocol (UDP): User Datagram, UDP Services, UDP Applications; Transmission Control Protocol (TCP): TCP Services, Features, TCP Segment, TCP Connection, TCP Congestion Control.	**CLO 4**	**9**
UNIT V		
Application Layer Protocols: Introduction to Application Layer, Client-Server Paradigm, Socket Interface, DHCP, FTP, TFTP, WWW & HTTP, Electronic Mail: SMTP, POP3, IMAP and MIME.	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Behrouz A Forouzan , "Data Communications and Networking", 5th Ed, McGraw – Hill Education India Edition 2013, ISBN-13: 9781259064753.
2. Behrouz A. Forouzan,"TCP-IP protocol suite ", Tata McGraw Hill Edition, 4th Edition 2010, ISBN-13: 9780070706521.

Reference Books:

1. James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2. S. Tanenbaum , "Computer, Networks", PHI Publication, 4th edition, ISBN: 8178087855.
3. William Stallings, "Data and Computer Communications", Person Education, 8th Edition, ISBN:- 9788131715369.

Online Resources/E-learning Resources:

1. Computer Networks and Internet Protocol By Prof. Soumya Kanti Ghosh,

   Prof. Sandip Chakraborty – IIT Kharagpur
2. https://onlinecourses.nptel.ac.in/noc22_cs19/preview

Name of the Program:	BTECH CSE	Semester: 5	Level: UG
Course Name:	Computer Network Laboratory	Course Code/ Course Type	UBTCE303/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Fundamental of Computers

Course Objectives (CO):	**The objectives of Computer Network Laboratory are:** 1. To establish communication among the computing nodes in various networking architectures. 2. Configure the computing nodes with understanding of protocols and technologies. 3. Use different communicating modes and standards for communication. 4. Use modern tools for network traffic analysis. 5. To learn network programming.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Comprehend working and architecture of college/ organization network. 2. Design network application by using various concepts of layered architecture. 3. Write program to analyze working of various protocols and packets. 4. Demonstrate LAN and WAN protocol behavior using Modern Tools. 5. Justify the working of error control and error detection mechanism using a program.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Network Topologies Setup	1	Set up and test different network topologies (star, bus, ring, mesh) using simulation tools like Cisco Packet Tracer or NS2/NS3	CLO1	2
2	Exploring OSI and TCP/IP Layers	2	Use Wireshark to capture network traffic and analyze headers for different layers.	CLO2	2
3	IP Addressing and Subnetting	3	Design an IPv4 addressing scheme and implement subnetting in a small network using Cisco Packet Tracer	CLO2	2
4	Routing Algorithm Implementation	4	Configure static and dynamic routing (RIP, OSPF) in Cisco Packet Tracer	CLO3	2
5	IPv4 Packet Analysis	5	Use Wireshark to capture and analyze IPv4 packets, identifying different fields in the packet structure	CLO3	2
6	UDP and TCP Communication	6	Implement a TCP client-server program to demonstrate connection establishment and data transfer	CLO4	2

7	TCP Congestion Control Analysis	7, 8	Simulate TCP congestion control mechanisms (slow start, congestion avoidance) using NS2/NS3.	CLO4	4
8	Web Communication using HTTP	9, 10	Set up a simple web server and client using Python Flask and analyze HTTP requests/responses	CLO5	4
9	File Transfer using FTP and TFTP	11, 12	Set up an FTP server and client, transfer files, and analyze the protocol behavior.	CLO5	4
10	Mini Project	13,14,15	Mini Project in a group of 3 to 4 students	1, 2, 3, 4, 5	6

Learning Resources:

Text Books:

1. J1. Behrouz A Forouzan, "Data Communications and Networking", 5th Ed, McGraw – Hill Education India Edition 2013, ISBN-13: 9781259064753
2. Behrouz A. Forouzan, "TCP-IP protocol suite ", Tata McGraw Hill Edition, 4th Edition 2010, ISBN-13: 9780070706521

Reference Books:

1. James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009
2. S. Tanenbaum, "Computer, Networks", PHI Publication, 4th edition, ISBN: 8178087855
3. William Stallings, "Data and Computer Communications", Person Education, 8th Edition, ISBN: 9788131715369

Online Resources/E-learning Resources:

1. Computer Networks and Internet Protocol By Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty by IIT Kharagpur
2. https://onlinecourses.nptel.ac.in/noc22_cs19/preview

Name of the Program:	BTECH CSE	Semester: 5	Level: UG
Course Name:	Intelligent Systems	Course Code/ Course Type	UBTCEPE301/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Basic Programming, Discrete Mathematics, Data Structures

Course Objectives (CO):	**The objectives of Intelligent Systems are:** 1. Explain fundamentals, approaches, and applications of Artificial Intelligence. 2. Apply search methods and problem-solving strategies in AI systems. 3. Use knowledge representation and reasoning techniques for intelligent decision-making. 4. Implement fuzzy logic concepts to handle uncertainty in intelligent systems. 5. Apply genetic algorithms and evolutionary methods for solving optimization problems.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Describe the key concepts, approaches, and applications of Artificial Intelligence. 2. Apply search algorithms and game strategies to solve AI-based problems. 3. Represent knowledge using logical techniques and perform reasoning for inference. 4. Design fuzzy logic-based systems to handle imprecision and uncertainty. 5. Implement genetic algorithms for solving optimization and search problems in intelligent systems.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Basics of Artificial Intelligence : Introduction to Artificial Intelligence (Definition and Scope), History and Evolution of AI, **Intelligent Agents :** Types, Properties, and Environments **Approaches to AI :** Symbolic Reasoning, Machine Learning, Evolutionary Computing Rationality, Autonomy, and Perception in AI, **Applications of AI :** NLP, Robotics, Game Playing, Expert Systems	**CLO 1**	**8**
UNIT II		
Problem Solving in Artificial Intelligence : Problem Formulation and State Space Representation, **Uninformed Search Strategies :** Breadth-First, Depth-First, Uniform-Cost, Depth-Limited Search, **Informed Search Strategies :** Greedy Best-First Search, A* Algorithm, **Local Search Algorithms :** Hill Climbing, Simulated Annealing, **Constraint Satisfaction Problems (CSP):** Representation, Backtracking Search, **Game Playing :** Minimax Algorithm, Alpha-Beta Pruning	**CLO 2**	**10**

UNIT III		
Knowledge Representation and Reasoning : Introduction to Knowledge Representation, Propositional Logic and First-Order Predicate Logic, **Knowledge Representation Techniques :** Semantic Networks, Frames, Production Rules, Ontologies, **Inference Mechanisms :** Forward Chaining, Backward Chaining, Resolution, **Reasoning under Uncertainty :** Probabilistic Reasoning, Bayesian Networks, Knowledge Engineering and Expert Systems	**CLO 3**	**9**
UNIT IV		
Fuzzy Logic and Uncertainty Handling : Introduction to Fuzzy Logic and Fuzzy Sets, Membership Functions and Linguistic Variables, Fuzzy Set Operations (Union, Intersection, Complement), Fuzzy Rules and Fuzzy Inference Systems, Defuzzification Techniques **Applications of Fuzzy Logic :** Control Systems, Decision Support Systems	**CLO 4**	**9**
UNIT V		
Genetic Algorithms and Evolutionary Computing : Introduction to Genetic Algorithms and Evolutionary Computing, **Biological Inspiration :** Natural Selection, Crossover, Mutation, Fitness Evaluation, **Structure of Genetic Algorithms :** Representation of Solutions, Selection Methods, Genetic Operators, **Applications of Genetic Algorithms :** Optimization, Scheduling	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Artificial Intelligence: A Modern Approach, Stuart Jonathan Russell, Peter Norvig, 2014, ISBN: 9781292024202
2. Introduction to Evolutionary Computing, Agoston E. Eiben, J.E. Smith, 2013, ISBN: 9783662050941

Reference Books:

1. Introduction to Artificial Intelligence, Wolfgang Ertel, 2018, ISBN: 9783319584867
2. Soft Computing And Its Applications, Rafik Aziz Aliev, Rashad Rafig Aliyev, 2001, ISBN: 9789813105874

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/learn/evolutionary-computation-and-its-engineering-applications
2. Coursera: https://www.coursera.org/learn/introduction-to-ai

Name of the Program:	BTECH CSE	Semester: 5	Level: UG
Course Name:	Intelligent Systems Laboratory	Course Code/ Course Type	UBTCEPE302/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Python Programming, Data Structures

Course Objectives (CO):	**The objectives of Intelligent Systems Laboratory are:** 1. Design and implement intelligent agents that interact with environments and make decisions based on multiple input conditions. 2. Apply various search algorithms to solve structured problem-solving tasks using Python. 3. To Develop reasoning systems using logical operators and rule-based knowledge representation techniques. 4. Construct fuzzy logic-based systems to handle imprecise inputs and perform decision-making under uncertainty. 5. Implement genetic algorithms for solving optimization problems with fitness evaluation and constraint handling.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Develop intelligent agents capable of selecting actions based on multiple environmental conditions. 2. Implement and compare search algorithms like BFS and DFS to solve pathfinding and puzzle-solving problems. 3. Create rule-based reasoning systems using logical expressions for decision-making scenarios. 4. Design and simulate fuzzy logic systems to handle uncertainty and perform decision-making using fuzzy inference. 5. Apply genetic algorithms to optimize functions with constraint handling and evaluate solutions based on fitness criteria.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Smart Home Agent	1	Write a Python program for a smart home agent that controls multiple devices (fan, light, heater) based on inputs like temperature, light intensity, and time of day. The agent should: Turn ON/OFF the fan based on temperature, Switch lights ON at night if light intensity is low, Turn heater ON if temperature drops below a certain level during winter hours (Include at least three sensor inputs and define action rules for combinations of these inputs)	CLO 1	2
2	Goal-Based Vacuum	2, 3	Implement A*, Greedy Best-First Search for pathfinding or game scenarios.	CLO 1	4

3	BFS Pathfinding	4	Design a backtracking-based solution to problems like Sudoku, Map Coloring, or N-Queens.	CLO 2	2
4	DFS Puzzle Solver	5	Create a knowledge base and inference engine for medical or diagnostic applications.	CLO 2	2
5	Eligibility Reasoning	6	Create a Python program that checks eligibility for a government scheme using compound conditions: Age must be above 18, Income must be below a specified limit, Resident of certain predefined regions (use a list of regions), Education qualification must meet minimum criteria (e.g., high school or above), The system should use logical operators and output whether the person is eligible, not eligible, or conditionally eligible.	CLO 3	2
6	Rule-Based System	7	Build an intelligent agent to play Tic-Tac-Toe, Connect-4, or similar games.	CLO 3	2
7	Fuzzy Set Plotting	8	Implement a basic fuzzy inference system to decide fan speed (low, medium, high) based on temperature input.	CLO 4	2
8	Fan Speed Control	9, 10	Build a rule-based or ML-based chatbot using NLTK or spaCy.	CLO 4	4
9	GA Function Maximization	11	Write a Python program to use a genetic algorithm to maximize the function f(x, y) = sin(x) * cos(y) where: x and y are integers ranging from 0 to 100 Include constraint: x + y must be $\leq$ 120, Implement the following: Binary encoding of solutions, Fitness evaluation with constraint penalty handling, Selection, crossover, and mutation operations, Display the best solution and corresponding fitness value after each generation.	CLO 5	2
10	Mini Project	12, 13, 14, 15	Development of a Rule-Based and Fuzzy Logic Supported Smart Fan Control System	1, 2, 3, 4, 5	8

Learning Resources:

Text Books:

1. Artificial Intelligence with Python: Your Complete Guide to Building Intelligent Apps Using Python 3.x, 2nd Edition, By Alberto Artasanchez, Prateek Joshi, 2020, ISBN: 9781839216077
2. An Introduction to Fuzzy Logic Applications in Intelligent Systems, Switzerland, Kluwer Academic, 2012, ISBN: 9781461536406

Reference Books:

1. Hands-On Genetic Algorithms with Python: Applying Genetic Algorithms to Solve Real-world Deep Learning and Artificial Intelligence Problems, Eyal Wirsansky, 2020, ISBN: 9781838559182
2. Deep Neuro-Fuzzy Systems with Python With Case Studies and Applications from the Industry,
3. Himanshu Singh, Yunis Ahmad Lone, 2019, ISBN: 9781484253618

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/learn/evolutionary-computation-and-its-engineering-applications
2. Coursera: https://www.coursera.org/learn/introduction-to-ai

Name of the Program:	BTECH CSE	Semester: 5	Level: UG
Course Name:	Cloud Computing and architecture	Course Code/ Course Type	UBTCEPE303/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Computer Networks, Operating Systems, Basics of Web Technologies

Course Objectives (CO):	**The objectives of Cloud Computing and Architecture are:** 1. Understand the fundamental concepts, models, and characteristics of cloud computing and its adoption strategies. 2. Explore the enabling technologies and basic security mechanisms essential for cloud environments. 3. Analyze cloud infrastructure, management, and security mechanisms used in building cloud systems. 4. Study cloud architecture patterns and their role in designing scalable, elastic, and reliable cloud solutions. 5. Evaluate cloud service delivery models, pricing strategies, and service quality metrics for effective cloud implementation.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Describe the core concepts, delivery models, deployment types, and benefits of cloud computing. 2. Explain the key enabling technologies and apply basic cloud security concepts in cloud environments. 3. Demonstrate the use of various cloud mechanisms, including infrastructure, management, and security tools. 4. Design cloud architecture solutions using appropriate architectural patterns for scalability and resilience. 5. Assess cloud delivery approaches, pricing models, and service quality metrics to support informed decision-making.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Fundamentals of Cloud Computing : Introduction to Cloud Computing Concepts, Case Study Background and Cloud Adoption Strategies, Understanding Cloud Computing: History, Definitions, Drivers, Benefits, Risks, Fundamental Concepts, Models, Cloud Characteristics, Delivery, and Deployment Models	**CLO 1**	**9**
UNIT II		
Cloud Enabling Technologies and Security Basics : **Cloud-Enabling Technologies :** Virtualization, Networking, Web Technologies, Multitenancy **Fundamental Cloud Security Concepts :** Threats, Vulnerabilities, Security Mechanisms, Risk Management	**CLO 2**	**9**

UNIT III		
Cloud Computing Mechanisms : **Cloud Infrastructure Mechanisms :** Virtual Servers, Storage, Monitoring, Resource Replication **Specialized Mechanisms :** Scaling, Load Balancing, Failover, Hypervisors, Clusters **Cloud Management Mechanisms :** Remote Administration, SLA Management, Billing Systems **Cloud Security Mechanisms :** Encryption, Hashing, Digital Signatures, IAM, SSO	**CLO 3**	**9**
UNIT IV		
Cloud Architecture Design : **Fundamental Cloud Architectures :** Load Balancing, Scalability, Resource Pooling, Cloud Bursting **Advanced Cloud Architectures :** Clustering, Load Balanced Virtual Servers, Zero Downtime, Failure Detection **Specialized Cloud Architectures :** Direct Access, Data Tiering, Virtual Switches, Storage Maintenance	**CLO 4**	**9**
UNIT V		
Working with Clouds – Cost, Quality, and Delivery : Cloud Delivery Model Considerations (Provider and Consumer Perspectives), Cost Metrics and Pricing Models for Cloud Services, Service Quality Metrics, SLAs, and Performance Monitoring	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Cloud Computing Design Patterns, Thomas Erl, Robert Cope, Amin Naserpour, 2015, ISBN: 9780133858631
2. Cloudonomics: The Business Value of Cloud Computing, Joe Weinman, 2015, ISBN: 9781119204732

Reference Books:

1. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif · 2009, ISBN: 9780596802769
2. Virtualization: A Manager's Guide, Dan Kusnetzky, 2011, ISBN: 9781449313180

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/learn/introduction-to-cloud
2. Coursera: https://www.coursera.org/learn/cloud-computing-basics

Name of the Program:	BTECH CSE	Semester: 5	Level: UG
Course Name:	Cloud Computing and Architecture Laboratory	Course Code/ Course Type	UBTCEPE304/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Computer Networks, Operating Systems, Basics of Web Technologies

Course Objectives (CO):	**The objectives of Cloud Computing and Architecture Laboratory are:** 1. Understand the fundamental principles of cloud computing, scaling, and elasticity. 2. Apply enabling technologies like virtualization and security mechanisms in cloud environments. 3. Implement cloud infrastructure mechanisms such as load balancing and monitoring. 4. Design and develop basic cloud architecture solutions for failover, redundancy, and scalability. 5. Evaluate service quality through SLA monitoring and deploy containerized cloud solutions.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Simulate cloud scaling and elasticity concepts using Python-based solutions. 2. Demonstrate virtualization and data security techniques through Python implementations. 3. Apply resource monitoring and load balancing techniques in simulated cloud environments. 4. Design failover and data redundancy mechanisms using Python scripts. 5. Deploy scalable containers and perform SLA-based service quality evaluation.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Scaling Simulation	1	Write a Python script to simulate resource scaling scenarios (horizontal vs. vertical scaling) using simple process/thread creation and control.	CLO 1	2
2	Elasticity Demonstration	2	Develop a Python program to demonstrate the concept of elasticity by simulating workload increase and resource addition.	CLO 1	2
3	VM Management	3	Implement Virtual Machine (VM) creation and management using libvirt and Python bindings, or simulate virtual machine scheduling.	CLO 2	2

4	Data Encryption	4	Create a Python script to encrypt and decrypt text data using symmetric (AES) and asymmetric (RSA) encryption techniques.	CLO 2	2
5	Load Balancing	5	Write a Python program to simulate load balancing using round-robin or least-connection algorithm across multiple service instances.	CLO 3	2
6	Resource Monitoring	6, 7	Develop a resource monitoring script in Python using psutil to monitor CPU, memory, and disk usage, simulating a cloud monitoring mechanism.	CLO 3	4
7	Failover Mechanism	8, 9	Implement a Python-based failover mechanism simulation where service requests are switched between primary and backup instances.	CLO 4	4
8	Data Replication	10, 11	Create a Python-based service that replicates a data file across multiple simulated storage nodes, demonstrating data redundancy.	CLO 4	4
9	Container Deployment	12, 13	Use Python and docker-py or subprocess module to deploy multiple container instances and demonstrate scalability.	CLO 5	4
10	SLA Monitoring	14, 15	Develop a Python script to simulate SLA monitoring by measuring response time of service endpoints and checking against defined thresholds.	CLO 5	4

Learning Resources:

Text Books:

1. Learning Python Networking: A Complete Guide to Build and Deploy Strong Networking Capabilities Using Python 3.7 and Ansible, 2nd Edition, ISBN: 9781789952445
2. Hands-On Docker for Microservices with Python: Design, Deploy, and Operate a Complex System with Multiple Microservices Using Docker and Kubernetes, Jaime Buelta, 2019, ISBN: 9781838822552

Reference Books:

1. Mastering Python for Networking and Security, Leverage the Scripts and Libraries of Python Version 3.7 and Beyond to Overcome Networking and Security Issues, José Ortega, 2021 , ISBN: 9781839216213
2. Docker for Data Science: Building Scalable and Extensible Data Infrastructure Around the Jupyter Notebook Server, Joshua Cook, 2017, ISBN: 9781484230121

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/learn/introduction-to-cloud
2. Coursera: https://www.coursera.org/learn/cloud-computing-basics

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Advanced Web Programming	Course Code/ Course Type	UBTCE304/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Pre-Requisite:

1. Proficiency in a programming language, such as Python or Java

Course Objectives (CO):	**The objectives of Advanced Web Programming are:** 1. To familiarize students with Web Programming basic concepts. 2. To learn and understand Web scripting languages. 3. To explore the Front end and Back-end web programming skills. 4. To understand and learn Mobile web development. 5. To understand and learn Web application deployment.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Develop Static and Dynamic website using technologies like HTML, CSS, Bootstrap. 2. Demonstrate the use of web scripting languages. 3. Develop web application with Front End and Back End Technologies. 4. Develop mobile website using JQuery Mobile.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
INTRODUCTION TO WEB TECHNOLOGIES HTML: Getting started with HTML, Why HTML, Tags and Elements, Attributes, Properties, Headings list, Links, Tables, Images, HTML Form, Media (Audio, Video), Semantic HTML5 Elements. CSS: Why CSS, Types of CSS, How to use CSS, Properties, Classes, Child-Class (Nested CSS), Colors, Text, Background, Border, Margin, Padding, Positioning (flex, grid, inline, block), Animation, Transition. BOOTSTRAP: Why Bootstrap, CSS over Bootstrap, How to Use Bootstrap, Bootstrap Grid System, Bootstrap Responsive, Bootstrap Classes, Bootstrap Components (i.e., Button, Table, List, etc.), Bootstrap as a Cross Platform. W3C: What is W3C, How W3C handles/Supports Web Technologies.	**CLO 1**	**6**
UNIT II		
WEB SCRIPTING LANGUAGES JavaScript: Introduction to Scripting languages, Introduction to JavaScript (JS), JS Variables and Constants, JS Variable Scopes, JS Data Types, JS Functions, JS Array, JS Object, JS Events. Advanced JavaScript: JSON - JSON Create, Key-Value Pair, JSON Access, JSON Array, JS Arrow Functions, JS Callback Functions, JS Promises, JS Async-Await Functions, JS Error Handling. AJAX: Why AJAX, Call HTTP Methods Using AJAX, Data Sending, Data Receiving, AJAX Error Handling. JQUERY: Why JQuery, How to Use, DOM Manipulation with JQuery, Dynamic Content Change with JQuery, UI Design Using JQuery.	**CLO 2**	**6**

UNIT III		
FRONT END TECHNOLOGIES Front-End Frameworks: What is web framework? Why Web Framework? Web Framework Types. MVC: What is MVC, MVC Architecture, MVC in Practical, MVC in Web Frameworks. TypeScript: Introduction to Typescript (TS), Variables and Constants, UNITs in TS. AngularVersion 10+: Angular CLI, Angular Architecture, Angular Project Structure, Angular Lifecycle, Angular UNITs, Angular Components, Angular Data Binding, ReactJS: Introduction to ReactJS, React Components, Inter Components Communication, Components Styling, Routing, Redux- Architecture, Hooks- Basic hooks, useState() hook, useEffect() hook, useContext() hook.	**CLO 3**	**6**
UNIT IV		
BACK-END TECHNOLOGIES Node.JS: Introduction to Node.JS, Environment Setup, Node.JS Events, Node.JS Functions, Node.JS Built-in UNITs, File System, NPM, Install External UNITs, Handling Data I/O in Node.JS, Create HTTP Server, Create Socket Server, Microservices- PM2. ExpressJS: Introduction to ExpressJS, Configure Routes, Template Engines, ExpressJS as Middleware, Serving Static Files, REST HTTP Method APIs, Applying Basic HTTP Authentication, Implement Session Authentication.	**CLO 4**	**6**
UNIT V		
BACK-END WITH DATABASE MongoDB: NoSQL and MongoDB Basics, MongoDB-Node.JS Communication, CURD Operations using Node.JS, Mongoose ODM for Middleware, Advanced MongoDB, Big database Connectivity.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Kogent Learning Solutions Inc, Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Blackbook, Dreamtech Press, Second Edition, ISBN: 9788177228496
2. Raymond Camden, Andy Matthews, JQuery Mobile Web Development Essentials, Packt Publishing, Second Edition, 9781782167891

Reference Books:

1. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, Fourth Edition,978- 81- 265-1635-3 .
2. Dr.HirenJoshi, Web Technology and Application Development, DreamTech, First,ISBN:978-93- 5004-088-1
3. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, Fourth Edition,978- 81-265- 1635-3
4. Ivan Bayross,"Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP,BPB Publications,4th Edition,ISBN:978-8183330084.

Online Resources/E-learning Resources:

1. https://www.udemy.com/course/advanced-web-developer-course-beginner-to advanced
2. https://www.shiksha.com/online-courses/web-development-courses-certification-training-by-nptel-st644

Name of the Program:	BTECH CSE	Semester: 5	Level: UG
Course Name:	Advanced Web Programming Lab	Course Code/ Course Type	UBTCE305/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Proficiency in a programming language, such as Python or Java

Course Objectives (CO):	**The objectives of Advanced Web Programming are:** 1. Apply the concepts of web design using HTML, CSS, Bootstrap, and JavaScript to create responsive web applications. 2. Demonstrate version control, containerization, and frontend development using GitHub, Docker, and Angular framework. 3. Develop server-side applications and RESTful APIs using Node.js, ExpressJS, and MongoDB. 4. Utilize AWS services for deploying and hosting scalable web applications. 5. Implement asynchronous data communication between client and server using AJAX POST method for dynamic web applications.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Design and implement a responsive dashboard with user registration and data handling using AJAX POST. 2. Configure GitHub repository, set up Docker container, and develop user registration and profile management in Angular. 3. Build a static website and implement CRUD APIs for assignment data management using Node.js and MongoDB. 4. Create and host a mobile-friendly web application on AWS VPC or Elastic Beanstalk. 5. Create responsive web interfaces with data collection, storage, and listing using AJAX POST and local storage.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Working with HTML CSS	1, 2, 3	Create a responsive web page which shows the ecommerce/college/exam admin dashboard with sidebar and statistics in cards using HTML, CSS and Bootstrap. b. Write a JavaScript Program to get the user registration data and push to array/local storage with AJAX POST method and data list in new page	CLO1	6

2	Working with GitHub, NVIDEIA Docker	4, 5, 6	Create version control account on GitHub and using Git commands to create repository and push your code to GitHub. b. Create Docker Container Environment (NVIDEIA Docker or any other). c. Create an Angular application which will do following actions: Register User, Login User, Show User Data on Profile Component.	CLO 2	6
3	Working with Node.JS, ExpressJS	7, 8, 9	Create: a. Node.JS Application which serves a static website. b. Create four API using Node.JS, ExpressJS and MongoDB for CURD Operations on assignment	CLO 3	6
4	Working with AWS VPC or AWS Elastic	10, 11, 12	Create a simple Mobile Website using jQuery Mobile. b. Deploy/Host Your web application on AWS VPC or AWS Elastic Beanstalk. Mini Project.	CLO 4	2
5	Working With AJAX POST	13, 14, 15	Create a responsive web page which shows the ecommerce/college/exam admin dashboard with sidebar and statistics in cards using HTML, CSS and Bootstrap. b. Write a JavaScript Program to get the user registration data and push to array/local storage with AJAX POST method and data list in new page.	CLO 5	6

Learning Resources:

Text Books:

1. Kogent Learning Solutions Inc, Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Blackbook, Dreamtech Press, Second Edition, ISBN: 9788177228496
2. Raymond Camden, Andy Matthews, JQuery Mobile Web Development Essentials, Packt Publishing, Second Edition, 9781782167891.

Reference Books:

1. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, Fourth Edition,978- 81- 265-1635-3
2. Dr.HirenJoshi, Web Technology and Application Development, DreamTech, First,ISBN:978-93- 5004-088-1
3. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, Fourth Edition,978- 81-265- 1635-3

Online Resources/E-learning Resources:

1. https://www.udemy.com/course/advanced-web-developer-course-beginner-to advanced
2. https://www.shiksha.com/online-courses/web-development-courses-certification-training-by-nptel-st644
3. https://onlinecourses.swayam2.ac.in/nou20-cs05/preview

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Agile Project Management with Jira	Course Code/ Course Type	MOOCCE501/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	25	25	-

Pre-Requisite:

1. Basic understanding of project management and familiarity with IT systems

Course Objectives (CO):	**The objectives of Agile Project Management with Jira are:** 1. To introduce Agile methodologies and their application in modern project management. 2. To develop expertise in leveraging Atlassian Jira for effective project tracking and management. 3. To integrate Agile principles with technical system administration concepts for streamlined project delivery. 4. To provide hands-on experience in setting up and managing Agile workflows using Jira. 5. To prepare students for roles in Agile project management and IT operations.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand Agile principles, frameworks, and practices. 2. Implement Agile workflows and tools using Atlassian Jira 3. Apply Agile methodologies in system administration and IT projects 4. Analyze and resolve project bottlenecks using Agile techniques 5. Design and manage end-to-end Agile projects in an IT environment

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Fundamentals of Agile Project Management Introduction to Agile –(Principles and Manifesto,Benefits of Agile Over Traditional Methodologies),Agile Frameworks –(Scrum, Kanban, and SAFe,Roles in Agile Teams),Agile Planning and Iterations –(Sprints, User Stories, and Backlogs,Estimation and Velocity),Agile Metrics and Success Indicators-(Hands-on Exercise: Create a sample backlog and sprint plan).	**CLO 1**	**6**
UNIT II		
Working with Models and Databases Introduction to Jira –(Setting Up Jira for Agile Projects,Understanding Boards, Backlogs, and Workflows),Managing Agile Projects in Jira –(Creating Epics, Stories, and Tasks,Configuring and Managing Sprint Boards),Advanced Jira Features-(Automations and Custom Workflows,Generating Agile Reports and Dashboards),Collaboration and Issue Tracking-(Linking Issues and Managing Dependencies,Using Jira for Team Collaboration,Hands-on Exercise: Configure a Jira project with custom workflows and dashboards).	**CLO 2**	**6**

UNIT III		
Agile Practices in System Administration Applying Agile in IT Operations-(Aligning System Administration with Agile Principles,Continuous Integration and Delivery (CI/CD) Practices),Configuring System Automation-(Using Ansible for IT Automation,Managing Configurations in Agile Projects),Monitoring and Logging for Agile Project-(Setting Up Monitoring Systems,Using Logs for Agile Metrics),Managing Dependencies in IT Projects -(Resolving Technical Bottlenecks with Agile Practices, Hands-on Exercise: Automate a system administration task using Ansible within an Agile framework.).	**CLO 3**	**6**
UNIT IV		
Advanced Agile Techniques and Integration Scaling Agile for Large Teams-(Applying SAFe and LeSS Frameworks,Managing Multiple Agile Teams with Jira),Agile Risk and Change Management-(Identifying and Mitigating Risks in Agile Projects,Handling Change Requests in Agile Environments),Agile in DevOps and IT Projects-(Integrating DevOps Practices with Agile,Agile Workflows for System Administration Projects),Jira Integrations and Plugins-(Integrating Jira with Confluence and Bitbucket,Using Plugins to Enhance Jira Functionality,Hands-on Exercise: Manage a large-scale Agile project using Jira with integrated tools.).	**CLO 4**	**6**
UNIT V		
Capstone Project and Future Directions Designing an End-to-End Agile Workflow-(Setting Up a Complete Agile Project in Jira,Incorporating IT Operations and DevOps Practices) ,Agile Project Presentation-(Reporting Progress Using Jira Dashboards,Presenting Agile Metrics and Success Indicators),Challenges in Agile Implementation –(Overcoming Resistance to Agile Practices, Adapting Agile for Non-Traditional Teams),Future Trends in Agile and Jira-(Agile Beyond IT: Marketing, HR, and More,Evolving Features in Jira for Next-Gen Project Management,Capstone Project Presentation: Demonstrate a fully configured Jira project with Agile workflows for IT operations.).	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Agile Project Management with Jira" by David Harned
2. "Red Hat System Administration III"

Reference Books:

1. "Essential Scrum: A Practical Guide to the Most Popular Agile Process" by Kenneth S. Rubin.
2. "Agile Estimating and Planning" by Mike Cohn
3. "Jira 8 Essentials" by Patrick Li
4. "DevOps Handbook: How to Create World-Class Agility, Reliability, and Security" by Gene Kim, Patrick Debois and John Willis.

Online Resources/E-learning Resources:

1. https://www.coursera.org/learn/agile-project-management
2. https://www.coursera.org/learn/agile-atlassian-jira

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Foundations of Blockchain and Java EE	Course Code/ Course Type	MOOCCE502/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	25	-	25

Pre-Requisite:

1. Basic programming knowledge and familiarity with distributed systems concepts

Course Objectives (CO):	**The objectives of Foundations of Blockchain and Java EE are:** 1. To provide foundational knowledge of blockchain technology, its architecture, and applications. 2. To equip students with the skills to develop enterprise-grade applications using Java EE. 3. To understand the interplay between blockchain technologies and Java EE in building robust, secure, and scalable applications. 4. To enhance practical skills in implementing blockchain concepts and Java EE-based solutions. 5. To prepare students for roles in blockchain development and enterprise application programming.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand the principles and architecture of blockchain technology. 2. Analyze blockchain use cases and implement basic blockchain solutions. 3. Develop Java EE applications using enterprise-grade programming techniques. 4. Integrate blockchain functionalities into Java EE-based applications. 5. Design, implement, and deploy secure and scalable enterprise applications leveraging blockchain.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Blockchain Technology Fundamentals of Blockchain (Overview of Blockchain Technology; Distributed Ledgers, Consensus Mechanisms, and Cryptography), Blockchain Architecture (Blocks, Transactions, and Smart Contracts, Public vs. Private Blockchains)Blockchain Use Cases (Cryptocurrency, Supply Chain, and Decentralized Applications) Introduction to Smart Contracts (Basics of Solidity Programming).Hands-on Exercise: Explore a public blockchain and analyze transaction records.	**CLO 1**	**6**
UNIT II		
Developing Blockchain Applications(Based on "Blockchain Basics") Setting Up a Blockchain Environment (Installing and Configuring Development Tools, Creating a Private Blockchain Network). Writing and Deploying Smart Contracts ,(Smart Contract Lifecycle and Deployment, Writing Basic Smart Contracts with Solidity). Integrating Blockchain with Applications (Connecting Web Interfaces with Blockchain; Using APIs to Interact with Blockchain Networks) . Advanced Blockchain Concepts (Sidechains, Oracles, and Layer-2 Solutions). Hands-on Exercise: Write and deploy a smart contract for a simple decentralized application.	**CLO 2**	**6**

UNIT III		
Java EE Fundamentals (Based on Red Hat AD183 - Java EE 7.0) Introduction to Java EE (Overview of Enterprise Java Applications, Java EE Architecture and Components). Developing Web Applications (Servlets, JSP, and WebSocket API; Handling HTTP Requests and Responses) Enterprise JavaBeans (EJB) (Stateless, Stateful, and Singleton Beans; Dependency Injection in Java EE). Security in Java EE Applications (Authentication, Authorization, and Encryption). Hands-on Exercise: Create a basic Java EE web application with servlets and JSP.	**CLO 3**	**6**
UNIT IV		
Advanced Java EE and Blockchain Integration Java EE Persistence API (Introduction to JPA and ORM Concepts; Managing Databases with Java EE). Java EE Messaging and Transactions (JMS and Message-Driven Beans; Distributed Transactions and Two-Phase Commit) Integrating Blockchain into Java EE Applications (Using Blockchain APIs in Java EE; Designing Hybrid Applications with Java EE and Blockchain. Building Scalable Applications (Microservices Architecture with Java EE; Using Kubernetes and Docker for Deployment)Hands-on Exercise: Build a Java EE application that integrates blockchain functionalities.	**CLO 4**	**6**
UNIT V		
Deployment and Capstone Project Deploying Blockchain and Java EE Applications (Deployment Strategies for Blockchain Solutions; Deploying Java EE Applications on Red Hat JBoss)Debugging and Optimizing Applications (Performance Tuning for Java EE; Monitoring Blockchain Transactions) Capstone Project (Design and Develop a Java EE Application with Blockchain Integration; Present the Architecture, Implementation, and Deployment Strategy) . Future Directions in Blockchain and Java EE (Emerging Trends and Career Opportunities; Preparing for Certifications (e.g., Red Hat Certified Application Developer). Capstone Project Presentation: Demonstrate a full-stack blockchain-integrated enterprise application.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher
2. "Enterprise JavaBeans 3.2" by Andrew Lee Rubinger and Aslak Knutsen

Reference Books:

1. "Mastering Blockchain" by Imran Bashir
2. "Java EE 7: The Big Picture" by Dr. Danny Coward
3. "Building Blockchain Projects" by Narayan Prusty
4. "Red Hat Application Development I (AD183)" (Official Course Material)
5. "Beginning EJB in Java EE 8" by Jonathan Wetherbee

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Technical Seminar	Course Code/ Course Type	UBTCE308/PROJ
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	-	1	1	1	25	-	25

Pre-Requisite: NA

Course Objectives (CO):	**The objectives of Technical Seminar are:** 1. Explore current trends in specific area of interest 2. Perform literature survey related to the specific topics of interest 3. Appreciate the results of technical work 4. Write technical reports 5. Summarize and present the technical contents
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Identify and discuss recent advancements and emerging technologies in the chosen area. 2. Conduct an effective literature review by sourcing, analyzing, and comparing research works. 3. Evaluate and interpret technical findings, results, and conclusions from scholarly articles. 4. Prepare well-structured technical reports that clearly present research findings and analysis. 5. Deliver effective technical presentations, summarizing key aspects of the studied topic.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
A Seminar should be given by an individual student based on topics chosen from the emerging areas and technologies of Computer science and Computer Applications. References from journals such as IEEE, ACM etc., shall be used. A report on this seminar with 15-20 pages shall also be prepared and submitted to the guide.	**CLO 1-5**	**15**
Total Hours		**15**

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	German A2.1	Course Code/ Course Type	UFL301A/AEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. Able to have a basic conversation in German

Course Objectives (CO):	**The objectives of German are:** 1. To get familiar with food culture in Germany. 2. To comprehend professional and educational concepts 3. To apply advance grammar topics 4. To Analyze advance text 5. To Design and create texts in German
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Comprehend food related texts 2. Enhance writing skills in German language 3. Enhance professional speaking skills of German language 4. Construct a dialogue, in the German language, for basic human interactions in a social context. 5. Take part in an interaction relating to formal conversation

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Rund ums Essen Kitchen and cooking, Food habits, Emotions and assumptions Grammar – Possessive articles, reflexive verbs	**CLO 1**	**6**
UNIT II		
Nach der Schulzeit Daily activities and experiences during school time, school subjects, school types Grammar – Changing prepositions	**CLO 2**	**6**
UNIT III		
Medien in Alltag Media, activities in media, film Grammar – Degree of comparison	**CLO 3**	**6**
UNIT IV		
Groe und kleineGefühle Festivals and celebrations, invitation cards, thanksgiving cards Grammar – Adjective ending	**CLO 4**	**6**
UNIT V		
Was machen Sie beruflich? and Ganz schonmobil Daily activities in the working world, different professions, public transport and travelling towards working place Grammar – Clauses, Modalverbs in past tense	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Netzwerk A1, Ernst klett Verlag and Goyal Publishers and Distributors Pvt. Ltd.
2. Studio d A1, Cornelesen Verlag and Goyal Publishers and Distributors Pvt. Ltd
3. Netzwerk Neu A1, Ernst klett Verlag and Goyal Publishers and Distributors Pvt. Ltd

Reference Books:

1. Hallo Deutsch A1,Ernst Klett Verlag, Goyal Publishers and Distributors Pvt. Ltd
2. ThemenAktuell 1, Hueber verlag
3. Maximal Ernst klett Verlag and Goyal Publishers and Distributors Pvt. Ltd

Online Resources/E-learning Resources:

1. Youtube :https://youtube.com/@LearnGermanwithAnja?si=BkJYDPi7TS0fT4lr
2. https://youtube.com/@deutschlernenmitheidi?si=TkICIabzioaU0roZ
3. Instagram : instagram.com/learngermanwithanja

Name of the Program:	BTECH CSE	Semester: 6	Level: UG/PG
Course Name:	Basic Japanese language skill	Course Code/ Course Type	UFL301B/AEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	-	-	-

Pre-Requisite:

1. Desire to get acquainted with the Japanese language. Basic knowledge of Hiragana and Katakana. Reading and writing Japanese script with basic kanji

Course Objectives (CO):	**The objectives of Basic Japanese language skill are:** 1. Being fluent in a additional language will increase the opportunities in a competitive job market. 2. To develop students' basic abilities such as listening, speaking, reading and writing. 3. To enhance the listening skills and memory. 4. Unlock career potential with language skills. 5. To interpret a variety of cultural products in the target language from a critical perspective.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Read and write days / dates using Kanji. Write and speak basic sentences with adverb. 2. Identify relations, make sentences using adjectives. 3. Illustrate the location of particle and living things. 4. Conversation in the question answer format. 5. Express ambition appetite aspiration craving.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Minna no Nihongo lesson no.5 and 6 Express Days and dates using kanji. Speaking : days in month with kanji, Particals / Introduction to calenderWriting sentences using Verbs / Adverb Speaking : want to invite someone to do something	**CLO 1**	**6**
UNIT II		
Minna no Nihongo lesson no. 7 and 8 Writing : Verbs / method of an action /family members Speaking : Reference word and Information regarding family Introduction of Adjectives /tenses of adjectives	**CLO 2**	**6**
UNIT III		
Minna no Nihongo lesson no. 9 and 10 Adverbs and Preposition	**CLO 3**	**6**
UNIT IV		
Minna no Nihongo lesson no. 11 and 12 Counters, Adjectives / tenses of adjective	**CLO 4**	**6**
UNIT V		
Minna no Nihongo lesson no. 13 Desire/phrases	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Minna no Nihongo , "Japanese for everyone" ,Elementary Main Textbook , Goyal Publishers and Distributors Pvt. Ltd.

Reference Books:

1. Shyoho Volume 1
2. Genki Japan
3. Haru Vol. 1 and 2

Online Resources/E-learning Resources:

1. https://www.youtube.com/watch?v=p9PEIsOzJ5E
2. https://www.youtube.com/watch?v=RJ1ZdIDJqoY
3. https://www.youtube.com/watch?v=Lo5-5k7EPIM

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Aptitude And Logical Reasoning	Course Code/ Course Type	ACALR301/AEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:NA

Course Objectives (CO):	**The objectives of Aptitude and Logical Reasoning are:** 1. To Familiarize Students with Different Types of Mathematical Problems. 2. To learn and Strengthen Logical Reasoning Skills. 3. To Develop Critical Thinking Skills. 4. To Improve Quantitative and Numerical Skills. 5. To Prepare Students for Standardized Tests and build Confidence in Problem-Solving.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Students will develop enhanced problem-solving abilities through Exposure to various types of aptitude and logical reasoning problems. 2. Sharpen their analytical thinking skills by learning to analyze and interpret different types of data, patterns, and logical structures. 3. Cultivate critical thinking abilities by challenging students to evaluate and assess information, arguments, and scenarios using logical reasoning principles. 4. Apply different forms of logical reasoning, such as deductive reasoning, inductive reasoning, and critical reasoning, to solve problems and make decisions. 5. Students will be able to develop soft skills and communication skills.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Quantitative Aptitude Number System, Problems on Ages, Percentage, Average, Time and Work, Profit and Loss, Permutation and Combination	**CLO 1**	**6**
UNIT II		
Logical Reasoning Number Series, Letter Series, Coding and Decoding, Calendars, Clocks	**CLO 2**	**6**
UNIT III		
Verbal Reasoning Subject-Verb Agreement, Preposition and Verbal Analogy, Closet test	**CLO 3**	**6**
UNIT IV		
Personality Development Resilience, Motivation and Listening skills, Self-confidence, Body language, Leadership, Goal setting, Emotional intelligence, Personal growth and development	**CLO 4**	**6**

UNIT V		
Soft Skills and Communication Skills Introduction to Teamwork, Collaboration and Time Management, Communication Skills, Organization Skills, Introduction to Critical Thinking, Leadership, Negotiation and Presentation Skills, Time Management, Adaptability Skills, actively listening in conversations, Public speaking, Effectively communicating ideas to others, Introduction to Career Development, Goal Setting, Emotional Intelligence Fundamentals, Building Adaptability and Resilience	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Quantitative Aptitude for Competitive Examinations, R.S Agarwal, 2017
2. Quantitative Aptitude for All Competitive Examinations by Abhijit Guha,6th edition,2016
3. Word Power Made Easy by Norman Lewis, 2023

Reference Books:

1. The Pearson Guide to Quantitative Aptitude for Competitive Examinations by Dinesh khattar, 2nd Edition.

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Software Testing and Quality Assurance	Course Code/ Course Type	UBTCE309/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Software Engineering

Course Objectives (CO):	**The objectives of Software Testing and Quality Assurance are:** 1. Grasp the essentials of software testing, quality assurance, and the differences between faults, errors, and failures 2. Learn various testing strategies and techniques, including black box, white box, and grey box testing 3. Develop proficiency in applying different levels of testing, such as unit, integration, system, and acceptance testing 4. Master test planning, management, execution, reporting, and the importance of automated testing tools 5. Understand software quality assurance principles, practices, standards, metrics, and formal approaches
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Identify the history, principles, goals of software testing, and distinguish between testing and debugging 2. Apply various testing techniques to design and execute test cases, understanding their strengths and weaknesses 3. Implement different testing levels and specific methods like boundary value analysis and equivalence partitioning 4. Develop comprehensive test plans, execute manual and automated tests, manage and report test activities effectively 5. Apply quality assurance principles, statistical methods, and standards like ISO 9000 to ensure and enhance software quality

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Software Testing: Introduction, Evolution of Software testing, Basics of Software Testing – faults, errors and failures, Developers vs Test Engineers, testing objectives Principles of testing, Testing and debugging, testing metrics and measurements, Verification and Validation, Testing Life Cycle, SDLC vs STLC	**CLO 1**	**9**

UNIT II		
Software Testing Strategies and Techniques: Types of Testing Techniques- Introduction to Black Box, White Box, Grey Box. Classification of Testing- Functional testing, non-Functional testing, Maintenance testing. White Box Testing- Direct Inspections, Walkthroughs, Technical Reviews, Functional Testing, Basis path testing, Control Structure Testing, Code Coverage Testing, Code Complexity Testing. Black Box Testing- Requirement Based Testing, Boundary Value Analysis, Equivalence Partitioning. Differences between BBT and WBT	**CLO 2**	**9**
UNIT III		
Levels of Testing:A Strategic Approach to Software Testing, Test strategies for conventional Software- Unit Testing, Integration Testing, Incremental Testing: Top-Down, Bottom-Up Integration, Bi-Directional, Non-incremental Integration. Testing on Web Application: Performance Testing, Load/Stress Testing, Security Testing, Client-Server Testing, Scalability, Stability testing. Acceptance Testing: Alpha Testing and Beta Testing, Usability and accessibility testing, Configuration, compatibility testing, Special Tests: Regression Testing, GUI Testing.	**CLO 3**	**9**
UNIT IV		
Test Planning: Preparing a Test Plan, test Approach, criteria for Testing, Test Deliverables, Test Case Specification. Test Reporting- Executing Test Cases, Preparing Test Summary Report. Manual Testing vs Automated Testing Tools. Metrics and Measurement: Types of Metrics, Product Metrics and Process Metrics, Object oriented metrics in testing. Agile Testing: Agile Testing, Difference between Traditional and Agile testing, Agile principles and values, Agile Testing Quadrants, Automated Tests.	**CLO 4**	**9**
UNIT V		
Quality Assurance: Software Quality and Software Quality Assurance. Elements of SQA, SQA Tasks, Goals, and Metrics. Statistical Software Quality Assurance, Six Sigma for Software engineering, ISO 9000 Quality Standards. Quality Metrics: Product and In-Process Metrics, Tools for Quality Management: Ishikawa's 7 Basic Tools, Checklists, Pareto Diagrams	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Naresh Chauhan "Software Testing Principles and Practices", Oxford University Press, 2010
2. Software Engineering – A Practitioners Approach, Roger S. Pressman, 7thEdition, Tata McGraw Hill, 20

Reference Books:

1. Effective Methods of Software Testing, William E Perry, 3rd Edition, Wiley Publishing Inc
2. Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing, Rex Black, Microsoft Press, 1999
3. Agile Testing: A Practical Guide for Testers and Agile Teams, Lisa Crispin and Janet Gregory, 1st Edition, Addison-Wesley Professional, 2008
4. Software Testing Principles and Practices By Srinivasan Desikan, Gopalaswamy Ramesh, Pearson

Online Resources/E-learning Resources:

1. https://www.w3schools.in/software-testing/tutorials/
2. https://www.geeksforgeeks.org/software-testing-tutorial/
3. https://onlinecourses.nptel.ac.in/noc22-cs61/preview

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Software Testing and Quality Assurance Laboratory	Course Code/ Course Type	UBTCE310/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Knowledge of Java Programming

Course Objectives (CO):	**The objectives of Software Testing and Quality Assurance Laboratory are:** 1. Design and execute various test cases manually and using automation tools. 2. Effectively identify, document, track, and manage defects using industry tools 3. Create and maintain automated test scripts, understanding automation's pros and cons 4. Plan, organize, and execute testing activities ensuring coverage and traceability. 5. Evaluate testing tools and select appropriate ones for different scenarios
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand the objectives, scope, and significance of software testing and QA. 2. Gain a comprehensive understanding of different testing techniques and their applications. 3. Become familiar with the defect life cycle and the steps involved in defect management. 4. Learn the principles of test automation, including script development, execution, and maintenance 5. Understand quality assurance processes, including planning, design, execution, and reporting

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Objective and Scope	1	Understand the objectives, scope, and significance of software testing and quality assurance. Familiarize with the lab environment, tools, and resources.	CLO1	2
2	Black Box Testing	2	Write and execute black box functional test cases manually for the given application, focusing on validating its functionality against the specified requirements.	CLO 2	2

3	Unit Test	3	Develop and execute unit tests for a specified module or function using a testing framework such as JUnit or pytest. Emphasize verifying the correctness of individual code units.	CLO 2	2
4	Integration Testing	4	Design and conduct integration testing for a system comprising multiple modules or components. Identify and address interface defects and inconsistencies to ensure seamless interaction between integrated units.	CLO 2	2
5	Bug Report	5	Prepare a comprehensive defect tracking report or bug report using MS-Excel or a defect tracking tool like Jira or BugZilla. Track and manage identified defects systematically.	CLO 3	2
6	Feature of Selenium	6	Study and explore the functionalities and features of Selenium, an open-source automated testing tool for web applications. Understand its capabilities and limitations.	CLO 3	2
7	Bla	7	Perform black box testing on an application using an automated testing tool. Focus on testing points such as data-driven testing, parameterization, and exception handling.	CLO 4	2
8	System Testing	8	Conduct system testing on a complete application based on its functional and non-functional requirements. Report and track defects using a bug tracking tool, ensuring the overall system's quality and performance.	CLO 4	2
9	comprehensive test management tool	9	Investigate the features and usage of QA Complete, a comprehensive test management tool. Learn how to manage test cases, test plans, and test executions effectively.	CLO 5	2
10	Automate the test cases	10, 11	Automate the test cases using the QA Complete tool. Focus on scripting, executing, and maintaining automated tests to enhance testing efficiency	CLO 5	4
11	raising and reporting bugs	12, 13	Learn the process of raising and reporting bugs using bug tracking tools such as Bugzilla or Jira. Use QA Complete for integration and streamline the defect management process	CLO5	4
12	open-source testing tools	14, 15	Explore and analyze open-source testing tools like Web Performance Analyzer or Open-Source Test Automation (OSTA). Evaluate their capabilities and applications in various testing scenarios.	CLO 5	4

Learning Resources:

Text Books:

1. Naresh Chauhan "Software Testing Principles and Practices", Oxford University Press, 2010
2. Software Engineering – A Practitioners Approach, Roger S. Pressman, 7thEdition, Tata McGraw Hill, 20

Reference Books:

1. Effective Methods of Software Testing, William E Perry, 3rd Edition, Wiley Publishing Inc
2. Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing, Rex Black, Microsoft Press, 1999
3. Agile Testing: A Practical Guide for Testers and Agile Teams, Lisa Crispin and Janet Gregory, 1st Edition, Addison-Wesley Professional, 2008
4. Software Testing Principles and Practices By Srinivasan Desikan, Gopalaswamy Ramesh, Pearson

Online Resources/E-learning Resources:

1. https://www.w3schools.in/software-testing/tutorials/
2. https://www.geeksforgeeks.org/software-testing-tutorial/
3. https://onlinecourses.nptel.ac.in/noc22-cs61/preview

Name of the Program:	BTECH CSE	Semester:6	Level: UG
Course Name:	Design and Analysis of Algorithms	Course Code/ Course Type	UBTCE311/ PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Knowledge of C Programming and DSA

Course Objectives (CO):	**The objectives of Design and Analysis of Algorithms are:** 1. Understand the efficiency analysis of algorithms and solve recurrence relations using different methods. 2. Apply divide and conquer and greedy strategies to solve various algorithmic problems effectively. 3. Solve optimization problems using dynamic programming principles and analyze their time complexity. 4. Apply backtracking techniques to solve combinatorial problems and constraint satisfaction problems. 5. Explore the branch and bound technique and understand problem complexity classes (P, NP, NP-Complete, NP-Hard).
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Analyze the time complexity of recursive and non-recursive algorithms using asymptotic notations, Master's theorem, and substitution method. 2. Implement and analyze algorithms like Quick Sort, Binary Search, Max-Min, Kruskal's MST, Dijkstra's algorithm, Fractional Knapsack, Job Sequencing, and Huffman Coding using divide and conquer and greedy approaches. 3. Develop and evaluate algorithms for 0/1 Knapsack, Coin Change, Bellman-Ford, Floyd-Warshall, TSP, and Multistage Graph problems using dynamic programming strategy. 4. Implement backtracking solutions for problems like N-Queens, Hamiltonian Cycle, Sum of Subsets, Graph Coloring, and 0/1 Knapsack using recursive and iterative methods. 5. Apply branch and bound strategies like LC Branch and Bound and FIFO Branch and Bound to solve 0/1 Knapsack and Traveling Salesman Problem, and classify problems into complexity classes.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
INTRODUCTION: Analysis of Algorithm: Efficiency- Analysis framework, asymptotic notations – big O, theta and omega. Analysis of non-recursive and recursive algorithms: Solving Recurrence Equations using Masters theorem and Substitution method.	**CLO 1**	**9**

UNIT II		
DIVIDE AND CONQUER AND GREEDY METHOD: Divide & Conquer: General method, Quick Sort – Worst, Best and average case. Binary search, Finding Max-Min, Large integer Multiplication (for all above algorithms analysis to be done with recurrence). Greedy Method: General method and characteristics, Kruskal's method for MST (using nlogn complexity), Dijkstra's Algorithm, Fractional Knapsack problem, Job Sequencing, Huffman Tree and Huffman Coding Algorithm.	**CLO 2**	**9**
UNIT III		
DYNAMIC PROGRAMMING: General strategy, Principle of optimality, 0/1 knapsack Problem, Coin change-making problem, Bellman- Ford Algorithm, Multistage Graph problem (using Forward computation), Travelling Salesman Problem, Floyd Warshall Algorithms for all pair shortest path problem, example and its complexity analysis.	**CLO 3**	**9**
UNIT IV		
BACKTRACKING: Brute Force method: Introduction to Brute Force method & Exhaustive search, Brute Force solution to 8 queens' problem. General method, Recursive backtracking algorithm, Iterative backtracking method. n-Queen problem, Hamiltonian Cycle, Sum of subsets, Graph coloring, 0/1 Knapsack Problem.	**CLO 4**	**9**
UNIT V		
BRANCH and BOUND: The method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling salesperson problem-LC branch and bound, The classes: P, NP, NP Complete, NP Hard.	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Introduction to Algorithms, Coremen Thomas, Leiserson CE, Rivest RL, PHI.
2. Analysis and Design of Algorithm. Horowitz and Sahani, Computer Science Press, Latest Edition.

Reference Books:

1. The Design and Analysis of Algorithm, Ullmann, Addison-Wesley, Latest Edition.
2. Algorithm Design, Michael T Goodrich, RobartoTamassia, Wiley India.

Online Resources/E-learning Resources:

1. http://www.bu.edu/met/metropolitan-college-people/student/resources/conduct/code.html.
2. https://nptel.ac.in/courses/106106131

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Design And Analysis of Algorithms Lab	Course Code/ Course Type	UBTCE312/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Knowledge of C Programming and DSA

Course Objectives (CO):	**The objectives of Design And Analysis of Algorithms Laboratory are:** 1. Understand and apply fundamental sorting and searching algorithms for problem-solving. 2. Analyze and compare the performance of advanced sorting techniques and their suitability for different problems. 3. Explore optimization problems using Greedy algorithms and Dynamic Programming strategies. 4. Apply backtracking and recursive approaches to solve combinatorial and constraint satisfaction problems. 5. Apply branch-and-bound and related strategies to solve NP-hard optimization problems effectively.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Implement basic iterative sorting algorithms and binary search using the divide and conquer approach. 2. Implement and evaluate advanced sorting algorithms like Merge Sort, Heap Sort, and Quick Sort. 3. Solve optimization problems like the Knapsack problem and analyze the effectiveness of Greedy vs Dynamic Programming approaches. 4. Solve N-Queens problem using backtracking to demonstrate recursive problem-solving techniques. 5. Solve Travelling Salesman Problem using the Least Cost Branch and Bound method and analyze the solution path and cost.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Basic iterative sorting algorithms	1	Basic iterative sorting algorithms: Bubble Sort, selection Sort, Insertion Sort.	CLO 1	2
2	Searching Techinques	2	Binary Search with Divide and conquer approach.	CLO 1	2
3	Sorting Techniques	3	Merge Sort, Heap sort, Quick Sort.	CLO 2	2
4	Selection Problem	4	Fractional Knapsack Problem, Job sequencing with deadline	CLO 2	2

5	Fractional Knapsack Problem	5	Write a program to implement Fractional knapsack using Greedy algorithm and 0/1 knapsack using dynamic programming. Show that Greedy strategy does not necessarily yield an optimal solution over a dynamic programming approach.	CLO 3	2
6	Dynamic Programming	6, 7	Write a program to implement Bellman-Ford Algorithm using Dynamic Programming and verify the time complexity	CLO 3	4
7	N Queens Problem	8, 9	Write a recursive program to find the solution of placing n queens on the chessboard so that no two queens attack each other using Backtracking	CLO 4	4
8	Travelling Salesman Problem	10, 11	Write a program to solve the travelling salesman problem and to print the path and the cost using LC Branch and Bound.	CLO 5	4
9	Mini Project	12, 13, 14, 15	Mini project to solve real word problem using concepts of DAA	1, 2, 3, 4, 5	8

Learning Resources:

Text Books:

1. Introduction to Algorithms, Coremen Thomas, Leiserson CE, Rivest RL, PHI.
2. Analysis and Design of Algorithm. Horowitz and Sahani, Computer Science Press, Latest Edition.

Reference Books:

1. The Design and Analysis of Algorithm, Ullmann, Addison-Wesley, Latest Edition.
2. Algorithm Design, Michael T Goodrich, RobartoTamassia, Wiley India.

Online Resources/E-learning Resources:

1. http://www.bu.edu/met/metropolitan-college-people/student/resources/conduct/code.html.
2. https://nptel.ac.in/courses/106106131

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Machine Learning with Python	Course Code/ Course Type	UBTCEPE305/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Programming (preferably Python), Probability and Statistics, Linear Algebra, Data Structures

Course Objectives (CO):	**The objectives of Machine Learning with Python are:** 1. Understand machine learning concepts, categories, and model development process. 2. Apply unsupervised learning methods and Python libraries to cluster and reduce data dimensions. 3. Explore feature engineering techniques to improve model performance using Python tools. 4. Evaluate supervised and unsupervised machine learning models using appropriate evaluation metrics. 5. Implement and analyze ensemble learning approaches for better predictive accuracy.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Describe the fundamental concepts and categories of machine learning and outline the steps of model building. 2. Implement clustering and dimensionality reduction algorithms using Python for unsupervised learning tasks. 3. Apply feature engineering techniques for effective data preparation and model enhancement. 4. Use model evaluation techniques to assess the performance of supervised and unsupervised models. 5. Develop ensemble learning models and compare their effectiveness with individual learning models.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Machine Learning : Definition and Scope of Machine Learning, Categories of Machine Learning (Supervised, Unsupervised, Semi-supervised, Reinforcement Learning), Real-World Applications of Machine Learning Basic Steps in Building a Machine Learning Model, Introduction to Python Libraries for Machine Learning (numpy, pandas, matplotlib, scikit-learn)	**CLO 1**	**9**
UNIT II		
Introduction to Unsupervised Learning and its Applications, **Clustering Techniques :** K-means, Hierarchical Clustering, DBSCAN **Dimensionality Reduction Techniques :** PCA, t-SNE **Python Libraries for Unsupervised Learning :** scikit-learn, scipy, matplotlib **case Study :** Implement clustering and dimensionality reduction using Python	**CLO 2**	**9**

UNIT III		
Feature Engineering : Importance of Feature Engineering in Machine Learning, **Feature Selection Methods :** Filter, Wrapper, Embedded Techniques **Feature Extraction Techniques :** PCA, LDA, Feature Encoding (Label Encoding, One-Hot Encoding), Feature Scaling and Normalization **Python Libraries for Feature Engineering :** scikit-learn, pandas, feature-engine **Case Study :** Feature selection, extraction, and transformation in Python	**CLO 3**	**9**
UNIT IV		
Model Evaluation Techniques : **Supervised Model Evaluation :** Accuracy, Precision, Recall, F1-Score, Confusion Matrix, ROC-AUC **Unsupervised Model Evaluation :** Silhouette Score, Davies-Bouldin Index, Elbow Method **Cross-Validation Techniques :** K-Fold, Stratified K-Fold, Leave-One-Out **Python Libraries for Model Evaluation :** scikit-learn, matplotlib, seaborn **Case Study :** Evaluate supervised and unsupervised models using Python	**CLO 4**	**9**
UNIT V		
Ensemble Learning Approaches : Introduction to Ensemble Learning and its Advantages, Bagging Techniques (Random Forest, Bootstrap Aggregation), Boosting Techniques (AdaBoost, Gradient Boosting, XGBoost), Voting Classifier and Stacking Models, Python Implementation of Ensemble Learning using scikit-learn, xgboost	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. An Introduction to Machine Learning, Gopinath Rebala, Ajay Ravi, Sanjay Churiwala, 2019, ISBN: 9783030157296
2. Foundations of Machine Learning, Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, 2012, ISBN: 9780262304733
3. Mathur Puneet. Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance, Apress, 2018.

Reference Books:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, 2014, ISBN: 9781139952743
2. Practical Machine Learning with Python: A Problem-solver's Guide to Building Real-world Intelligent Systems, Sarkar Dipanjan, Bali Raghav, Sharma Tushar, Apress, 2018.

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/learn/machine-learning-with-python
2. Coursera: https://www.coursera.org/learn/python-machine-learning

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Machine Learning with Python Laboratory	Course Code/ Course Type	UBTCEPE306/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Basic Python Programming, Probability and Statistics, Linear Algebra

Course Objectives (CO):	**The objectives of Machine Learning with Python Laboratory are:** 1. Understand and demonstrate the basic steps and categories of machine learning using Python. 2. Apply unsupervised learning algorithms and dimensionality reduction techniques using Python libraries. 3. Implement feature selection and scaling techniques to prepare datasets effectively. 4. Evaluate machine learning models using performance metrics for both supervised and unsupervised tasks. 5. Build and compare ensemble learning models for improved predictive performance.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Perform basic machine learning steps and demonstrate different learning categories using Python. 2. Implement clustering and dimensionality reduction using unsupervised learning techniques. 3. Apply feature engineering methods for selection, scaling, and transformation to enhance model performance. 4. Evaluate models using appropriate supervised and unsupervised evaluation metrics. 5. Develop and assess ensemble models like Random Forest and XGBoost for better accuracy and reliability.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	ML Model Steps	1	Implement basic steps of machine learning: data loading, splitting, training, and testing using a simple classifier	CLO 1	2
2	ML Categories Demo	2	Simulate supervised and unsupervised learning with simple Python examples	CLO 1	2
3	K-Means Clustering	3	Implement K-means clustering using Python on a sample dataset and visualize the clusters.	CLO 2	2
4	PCA Dimensionality Reduction	4	Apply Principal Component Analysis (PCA) for reducing the dimensionality of a dataset and visualize the results.	CLO 2	2

5	Feature Selection	5	Perform feature selection using filter (Correlation) and wrapper (RFE) methods using scikit-learn.	CLO 3	2
6	Feature Scaling	6	Implement feature scaling techniques (Standardization, Min-Max Scaling) and observe their effect on model performance.	CLO 3	2
7	Supervised Evaluation	7	Evaluate a supervised classification model using confusion matrix, accuracy, precision, recall, and F1-score.	CLO 4	2
8	Unsupervised Evaluation	8	Evaluate clustering results using silhouette score and Davies-Bouldin Index.	CLO 4	2
9	Ensemble Model Building	9, 10	Implement Random Forest and XGBoost classifiers and compare their performance with basic decision tree classifier.	CLO 5	4
10	Mini Project	11, 12, 13, 14, 15	Choose a dataset (e.g., Iris, Titanic, Housing Prices) Build, tune, evaluate, and document a complete ML solution	1, 2, 3, 4, 5	10

Learning Resources:

Text Books:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly, 2019
2. Andreas C. Müller & Sarah Guido, Introduction to Machine Learning with Python, O'Reilly, 2016

Reference Books:

1. Tom Mitchell, Machine Learning, McGraw-Hill, 1997
2. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 4th Edition
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer

Online Resources/E-learning Resources:

1. Coursera – Machine Learning with Python by IBM
2. Google's Machine Learning Crash Course

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Adaptive Visualization Techniques	Course Code/ Course Type	UBTCEPE307/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Programming, Data Structures, Basics of Data Visualization, Human-Computer Interaction (HCI)

Course Objectives (CO):	**The objectives of Adaptive Visualization Techniques are:** 1. Learn basic concepts of data visualization and use appropriate charts effectively. 2. Perform data analysis and create visualizations using Excel tools. 3. Clean, transform, and prepare data for effective visualization. 4. Build interactive dashboards and tell data stories using Tableau. 5. Design adaptive and responsive visualizations with interactive features.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Identify suitable chart types and apply best practices for effective data visualization. 2. Analyze data and create meaningful visualizations using Excel. 3. Perform data cleaning, transformation, and wrangling for quality data preparation. 4. Develop interactive dashboards and present insights through storytelling using Tableau. 5. Create adaptive visualizations with interactivity and responsive design features.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Basics of Data Visualization and Charts : Introduction to Data Visualization, Importance of Visualization in Data Science **Types of Data:** Categorical, Numerical, Time-series, Geospatial **Basic Chart Types:** Bar chart, Line chart, Pie chart, Scatter plot, Histogram, Choosing the Right Chart, Principles of Effective Data Visualization (Color, Labels, Scales) **Case Study :** Creating basic charts using Python (Matplotlib) or Excel	**CLO 1**	**9**
UNIT II		
Data Analysis and Visualization using Excel : Data Preprocessing and Cleaning in Excel, Using Pivot Tables and Pivot Charts, Conditional Formatting and Data Bars, Excel Functions for Data Analysis (VLOOKUP, HLOOKUP, INDEX-MATCH, IF, SUMIFS, COUNTIFS), Chart Types in Excel: Combination Charts, Sparklines, Using Excel Dashboards for Visualization **Case Study :** Sales/Marketing Data Analysis using Excel	**CLO 2**	**9**

UNIT III		
Data Wrangling Techniques **Understanding Data Quality Issues :** Missing Data, Outliers, Duplicates, Data Cleaning Methods, **Data Transformation :** Scaling, Normalization, Encoding Data Aggregation and Grouping, Merging and Joining Datasets, Hands-on with Pandas (Python) or Power Query (Excel) **Case Study :** Preparing a dataset for visualization	**CLO 3**	**9**
UNIT IV		
Data Storytelling and Visualization using Tableau : Introduction to Tableau Interface, Connecting Tableau to Different Data Sources, Building Interactive Dashboards, Storytelling Concepts: Context, Narrative, and Visual Appeal, Filters, Parameters, and Calculated Fields in Tableau, Best Practices for Storytelling through Dashboards, **Case Study :** Business Insights Presentation using Tableau	**CLO 4**	**9**
UNIT V		
Adaptive Data Visualization : Concept of Adaptive Visualization, Understanding Audience-Centric Visualization Design, Responsive Visualizations across Devices, **Using Interactivity :** Drill-Down, Filtering, Dynamic Views Introduction Plotly for Adaptive Visualization, Automating Visualizations using Python (Plotly Dash/Streamlit), **Case Study :** Adaptive Visualization for Real-Time Data (IoT, Web Analytics)	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Data Visualization with Python: Create an Impact with Meaningful Data Insights Using Interactive and Engaging Visuals, Mario Döbler, Tim Grössmann, Packt Publishing, 2019, ISBN: 9781789956467
2. Learning Tableau 2019: Tools for Business Intelligence, Data Prep, and Visual Analytics, Milligan Joshua N., 3rd Edition, Packt Publishing, 2019, ISBN: 9781788839525
3. Excel 2016 Bible, Walkenbach John, Wiley, ISBN: 9781119067504

Reference Books:

1. Interactive Data Visualization with Python Present Your Data as an Effective and Compelling Story, 2nd Edition, Abha Belorkar, Sharath Chandra Guntuku, Shubhangi Hora, Anshu Kumar, 2020, ISBN: 9781800201064
2. Daniel G. Murray, Tableau Your Data! Fast and Easy Visual Analysis with Tableau Software, Wiley, 2016, ISBN: 9781119001195
3. Data Wrangling with Python Creating Actionable Data from Raw Sources, Dr. Tirthajyoti Sarkar, Shubhadeep Roychowdhury, 2019, ISBN: 9781789804249

Online Resources/E-learning Resources:

1. Coursra: https://www.coursera.org/specializations/data-wrangling-python
2. Coursera: https://www.coursera.org/programs/cu-on-coursera-sqyue/learn/data-understanding-and-visualization

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Adaptive Visualization Techniques Laboratory	Course Code/ Course Type	UBTCEPE308/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Data Visualization, Human-Computer Interaction, Basic Programming (Python/JavaScript)

Course Objectives (CO):	**The objectives of Adaptive Visualization Techniques Laboratory are:** 1. To introduce students to dynamic, interactive, and adaptive data visualizations. 2. To develop skills in using visualization libraries and tools for personalized data representation. 3. To understand the principles of user-centered design in data visualization. 4. To explore real-time, adaptive, and multimodal visualization techniques. 5. To create custom, intelligent, and context-aware visual interfaces.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Develop static, interactive, and adaptive visualizations using various libraries and tools. 2. Design personalized and context-aware data visualization systems. 3. Visualize real-time and multimodal data effectively for various applications. 4. Integrate machine learning insights into visual formats to enhance interpretability. 5. Design and deploy a complete adaptive visualization project using real-world datasets.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Introduction to Visualization Libraries	1	Use libraries like Matplotlib, Seaborn, Plotly, D3.js to Create static and interactive visualizations	CLO1	2
2	Building Responsive Dashboards	2	Create web-based dashboards using Dash, Streamlit, or Tableau Public	CLO1	2
3	User-driven Visualization Adaptation	3	Create Visualizations that change based on user inputs (dropdowns, sliders, filters)	CLO1	2
4	Real-Time Data Visualization	4	Visualize live data (e.g., sensor data, stock prices) using WebSockets or API feeds	CLO2	2

5	Multi-modal Data Visualization	5	Combine visual, auditory (sonification), and textual cues and Create a visualization that supports colorblind users	CLO2	2
6	Context-Aware Visualization	6	Visualizations that adapt based on time, location, or user role (e.g., admin vs. viewer)	CLO2	2
7	Personalized Visualization	7	Use user profiles or preferences to customize data representation	CLO3	2
8	Visualization with Machine Learning Models	8	Visualize ML model predictions, feature importance, decision boundaries	CLO4	2
9	Adaptive Storytelling	9	Create narrative visualizations that change dynamically based on user behavior	CLO4	4
10	Mini Project	10	Design and implement a complete adaptive visualization solution for a dataset (e.g., health data, IoT, education analytics)	1, 2, 3, 4, 5	10

Learning Resources:

Text Books:

1. Tamara Munzner, Visualization Analysis and Design, CRC Press, 2014
2. Ben Fry, Visualizing Data: Exploring and Explaining Data with the Processing Environment, O'Reilly, 2008

Reference Books:

1. Colin Ware, Information Visualization: Perception for Design, 4th Edition, Morgan Kaufmann, 2020
2. Nathan Yau, Data Points: Visualization That Means Something, Wiley, 2013
3. Alberto Cairo, The Functional Art: An Introduction to Information Graphics and Visualization, New Riders, 2012

Online Resources/E-learning Resources:

1. Kaggle Datasets for Visualization
2. D3.js Tutorials

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Optimization Techniques and Applications	Course Code/ Course Type	UBTCEPE309/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Linear Algebra, Calculus, Programming Fundamentals

Course Objectives (CO):	**The objectives of Optimization Techniques and Applications are:** 1. Understand the fundamentals of optimization and its role in machine learning and AI model development. 2. Apply constrained optimization techniques for effective model formulation and regularization in AI systems. 3. Explore various hyperparameter optimization strategies for tuning machine learning models. 4. Implement metaheuristic optimization techniques to enhance model performance in AI applications. 5. Analyze and apply multi-objective and reinforcement-based optimization methods in complex AI problem scenarios.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Describe the role of optimization in ML/AI and apply gradient-based methods for loss minimization. 2. Formulate and solve constrained optimization problems and apply them in AI model design. 3. Implement hyperparameter tuning using grid search, random search, and Bayesian optimization techniques. 4. Apply metaheuristic algorithms like GA, PSO, and DE to optimize AI models and learning systems. 5. Demonstrate the use of multi-objective optimization and reinforcement learning-based methods for AI decision-making tasks.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Fundamentals of Optimization for ML/AI : Role of Optimization in Machine Learning and AI, Convex vs. Non-Convex Optimization, Objective Functions and Loss Functions in ML, Gradient Descent and Its Variants (SGD, Momentum, RMSProp, Adam), Introduction to Hyperparameter Tuning	**CLO 1**	**9**
UNIT II		
Constrained Optimization in AI Models : Optimization under Equality and Inequality Constraints, Lagrange Multipliers and Karush-Kuhn-Tucker (KKT) Conditions, Quadratic Programming for Support Vector Machines (SVMs), Constraint Handling in Deep Learning (e.g., Weight Constraints), Applications in Feature Selection and Regularization (L1, L2, ElasticNet)	**CLO 2**	**9**

UNIT III		
Hyperparameter Optimization Techniques : Grid Search and Random Search, Bayesian Optimization for Hyperparameter Tuning, Hyperband and Successive Halving Algorithms, Use of Optuna, Hyperopt, and Scikit-Optimize Python Libraries, Case Study: Hyperparameter Tuning for Neural Networks and XGBoost	**CLO 3**	**9**
UNIT IV		
Metaheuristic Optimization in AI : Introduction to Metaheuristics in AI Context, Genetic Algorithms for Feature Selection and Neural Architecture Search, Particle Swarm Optimization (PSO) for Neural Network Weight Initialization, Differential Evolution and Evolution Strategies in Model Tuning, Use Cases: Clustering Parameter Optimization, Rule-based System Optimization	**CLO 4**	**9**
UNIT V		
Multi-objective and Reinforcement-based Optimization : Multi-objective Optimization and Pareto Front in AI, Trade-offs Between Accuracy, Time, and Resource Usage, Policy Gradient Methods in Reinforcement Learning (REINFORCE, PPO), Q-learning and Deep Q-Network (DQN) Optimization, Case Study: Multi-objective Optimization in Deep Reinforcement Learning	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Optimization Models, Giuseppe C. Calafiore, Laurent El Ghaoui, 2014, ISBN: 9781107050877
2. MULTI-OBJECTIVE OPTIMIZATION USING EVOLUTIONARY ALGORITHMS, Kalyanmoy Deb, 2010, ISBN: 9788126528042
3. Numerical Optimization, Jorge Nocedal, Stephen Wright, 2006, ISBN: 9780387400655

Reference Books:

1. Automated Machine Learning Hyperparameter Optimization, Neural Architecture Search, and Algorithm Selection with Cloud Platforms, Adnan Masood, 2021, ISBN: 9781800565524
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems, Aurélien Géron, 2019, ISBN: 9781492032618

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/learn/optimization-for-decision-making
2. Coursera: https://www.coursera.org/learn/optimize-machine-learning-model-performance

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Applied Data Science	Course Code/ Course Type	UBTCEPE310/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Python Programming, Probability and Statistics, Basic Linear Algebra

Course Objectives (CO):	**The objectives of Applied Data Science are:** 1. Understand the fundamental concepts of data science and apply data acquisition techniques from various sources. 2. Perform data cleaning, integration, and transformation using appropriate Python tools. 3. Conduct exploratory data analysis (EDA) and understand feature behavior through visualization and profiling. 4. Apply data science methods to solve domain-specific problems across various industries. 5. Learn model deployment techniques and apply automation and monitoring strategies in data science projects.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Acquire and handle data from APIs, web scraping, databases, and other external sources for data science tasks. 2. Clean, integrate, and transform data effectively for analytical modeling and insights generation. 3. Perform exploratory data analysis and interpret feature relationships using visualization tools. 4. Solve domain-specific real-world problems using appropriate data science techniques and analytics. 5. Deploy machine learning models as services and automate workflows for real-time data science solutions.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Data Science and Data Acquisition : What is Data Science? Scope, Process, and Applications, CRISP-DM and OSEMN Frameworks of Data Science, Data Types, Data Sources (APIs, Web Scraping, Open Datasets, Databases), Data Acquisition Techniques: Web Scraping using BeautifulSoup, Scrapy, API Integration, Data Collection from SQL and NoSQL Databases	**CLO 1**	**9**
UNIT II		
Data Cleaning, Integration, and Transformation : Data Cleaning Techniques (Handling Missing Values, Outliers, Duplicate Records), Data Integration from Multiple Sources, Data Transformation: Encoding, Binning, Aggregation, Data Imputation Techniques: Simple, KNN, Iterative, Practical Hands-on with pandas, numpy, and missingno for Data Wrangling	**CLO 2**	**9**

UNIT III		
EDA and Feature Understanding : Understanding Distributions, Correlations, and Patterns in Data, Visualization Techniques for EDA: Histograms, Boxplots, Heatmaps, Pairplots, Data Profiling and Summary Statistics, Understanding Feature Importance and Interaction, Tools and Libraries: pandas-profiling, matplotlib, seaborn, sweetviz	**CLO 3**	**9**
UNIT IV		
Domain-Specific Applications of Data Science : Data Science in Finance: Fraud Detection, Risk Analysis, Healthcare Data Science: Patient Monitoring, Disease Prediction, Social Media Analytics: Sentiment Analysis, Trend Identification, Data Science for IoT: Sensor Data Analysis, Predictive Maintenance, Retail and Marketing: Customer Segmentation, Recommendation Systems	**CLO 4**	**9**
UNIT V		
Model Deployment, Monitoring, and Automation : Basics of Model Deployment: Saving Models using joblib and pickle, Model Deployment using Flask or FastAPI for RESTful Services, Monitoring Model Performance Post-Deployment, CI/CD Concepts for Data Science Projects, Introduction to MLOps: Model Lifecycle Management, Automation of Workflows	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, Wes McKinney, 2017, ISBN: 9781491957615
2. Data Science from Scratch: First Principles with Python, Joel Grus, 2015, ISBN: 9781491904404
3. Building Machine Learning Pipelines, Hannes Hapke, Catherine Nelson, 2020, ISBN: 9781492053149

Reference Books:

1. Hands-On Machine Learning with Scikit-learn and Scientific Python Toolkits: A Practical Guide to Implementing Supervised and Unsupervised Machine Learning Algorithms in Python, Tarek Amr, 2020, ISBN: 9781838823580
2. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, Foster Provost, Tom Fawcett, 2013, ISBN: 9781449374297

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/specializations/data-science-python
2. COursera: https://www.coursera.org/degrees/master-of-applied-data-science-umich

Name of the Program:	BTECH CSE	Semester:6	Level: UG
Course Name:	Data Science and Pattern Recognition using Python	Course Code/ Course Type	MOOCCE601/MOOC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	25	-	25

Pre-Requisite:

1. Proficiency in Python programming
2. Basic understanding of statistics and linear algebra
3. Familiarity with machine learning concepts

Course Objectives (CO):	**The objectives of Data Science and Pattern Recognition using Python are:** 1. Understand the Fundamentals of Data Science and Pattern Recognition 2. Perform Data Preprocessing and Exploratory Data Analysis 3. Build and Evaluate Machine Learning Models for Pattern Recognition 4. Design and Train Deep Learning Models for Image Recognition 5. Apply Reinforcement Learning Techniques to Build Intelligent Agents
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Apply Python for data acquisition, cleaning, transformation, and exploratory data analysis 2. Use pattern recognition techniques such as classification, clustering, and dimensionality reduction 3. Build and train deep neural networks for image and text recognition tasks 4. Understand and implement reinforcement learning strategies using Q-learning and policy gradients 5. Integrate machine learning and deep learning models into data-driven applications

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Data Science and Pattern Recognition What is data science? Overview and process,Introduction to pattern recognition: types, applications,Python for data science: NumPy, Pandas, Matplotlib,Case study: Recognizing handwritten digits (MNIST).	**CLO 1**	**6**
UNIT II		
Data Preprocessing and Exploratory Data Analysis Data collection and cleaning techniques, Feature selection and engineering, Exploratory data analysis: visualization, correlation, outliers, Tools: Seaborn, pandas-profiling, Lab: Data wrangling and EDA on real-world datasets	**CLO 2**	**6**

UNIT III		
Pattern Recognition and Machine Learning Models Supervised learning: SVM, k-NN, Decision Trees, Naive Bayes, Unsupervised learning: K-Means, DBSCAN, Hierarchical Clustering , Dimensionality reduction: PCA, t-SNE, Model evaluation: confusion matrix, ROC, cross-validation, Lab: Implementing classification and clustering models	**CLO 3**	**6**
UNIT IV		
Deep Learning for Pattern Recognition Neural networks and deep learning foundations, Activation functions, forward/backward propagation, Convolutional Neural Networks (CNNs) for image recognition, Using TensorFlow/Keras for DNN implementation, Based on Deep Neural Network by DeepLearning.AI, Lab: Build a CNN to classify images (CIFAR-10 or MNIST)	**CLO 4**	**6**
UNIT V		
Reinforcement Learning and Intelligent Agents Fundamentals of reinforcement learning, Q-learning and policy gradient methods (REINFORCE, PPO), Exploration vs exploitation, rewards, and environment modeling, Applications in robotics, game AI, and recommendation systems, Based on Fundamentals of Reinforcement Learning by University of Alberta, Lab: Use OpenAI Gym to train a basic RL agent	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Pattern Recognition and Machine Learning" by Christopher M. Bishop
2. "Python Data Science Handbook" by Jake VanderPlas

Reference Books:

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
2. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto
3. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

Online Resources/E-learning Resources:

1. https://www.coursera.org/learn/fundamentals-of-reinforcement-learning
2. https://www.coursera.org/learn/deep-neural-network

Name of the Program:	BTECH CSE	Semester: 6	Level: UG
Course Name:	Redhat Openstack Administration	Course Code/ Course Type	MOOCCE602/MOOC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	25	-	25

Pre-Requisite:

1. Red Hat Certified System Administrator (RHCSA) or equivalent Linux administration skills.
2. Familiarity with basic virtualization concepts.
3. Basic understanding of networking fundamentals (IP addressing, routing, etc.).

Course Objectives (CO):	**The objectives of Red Hat OpenStack Administration are:** 1. To introduce the fundamentals of cloud computing and OpenStack architecture 2. To provide practical experience with OpenStack services 3. To equip students with the skills to deploy, configure, and manage core OpenStack services 4. To develop proficiency in using the OpenStack CLI and Horizon dashboard 5. To enable students to troubleshoot and resolve issues
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand the OpenStack architecture and its components 2. Deploy a multi-node OpenStack environment 3. Configure and manage OpenStack services including Keystone, Glance, Nova, Neutron, Cinder, and Horizon 4. Implement networking and storage solutions using Neutron and Cinder 5. Perform administrative tasks such as instance provisioning, image management, and user access control and troubleshoot common OpenStack issues

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction and Architecture Overview of OpenStack and cloud computing concepts OpenStack services and architecture (Keystone, Nova, Neutron, Glance, Cinder, Horizon) OpenStack deployment models and use cases Lab: Navigating the OpenStack CLI and Dashboard (Horizon).	**CLO 1**	**6**
UNIT II		
Installation and Core Services OpenStack deployment using Packstack or Director (OSP Director) Installing and configuring Keystone (identity service) Managing users, tenants, and roles. Lab: Deploy a basic OpenStack environment	**CLO 2**	**6**

UNIT III		
Compute, Image, and Networking Nova (compute) configuration and instance management. Glance (image service) operations and image management. Neutron (networking) concepts: provider networks, tenant networks, routers. Lab: Launch an instance with networking and image configuration	**CLO 3**	**6**
UNIT IV		
Block Storage, Dashboard, and Troubleshooting Cinder (block storage) setup and volume provisioning. Horizon dashboard overview and usage. Common troubleshooting strategies and log file analysis. Lab: Attach volumes to instances, resolve common deployment issues	**CLO 4**	**6**
UNIT V		
Advanced Topics and Security OpenStack high availability concepts OpenStack security best practices Performance tuning and monitoring Review and practice exam Lab: Secure OpenStack services, set up high availability (conceptual)).	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Official Red Hat Courseware for CL110 – Provided by Red Hat Learning Subscription (RHLS)
2. Red Hat OpenStack Platform Documentation (Latest Version)

Reference Books:

1. "Essential Scrum: A Practical Guide to the Most Popular Agile Process" by Kenneth S. Rubin.
2. "OpenStack Administration with Ansible" by Walter Bentley – Packt Publishing
3. "OpenStack in Action" by Cody Bumgardner – Manning Publications
4. "Learning OpenStack Networking (Neutron)" by James Denton – Packt Publishing

Online Resources/E-learning Resources:

1. EX210 – Red Hat Certified Specialist in OpenStack exam. It is recommended (but not mandatory) to take the Red Hat Certified System Administrator (RHCSA) exam prior to EX210
2. Red Hat Learning Subscription (RHLS)

Name of the Program:	Foreign Language	Semester:6	Level: UG/PG
Course Name:	German A2.2	Course Code/ Course Type	UFL302 A/VSEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. Can use simple means to describe the things related to immediate needs

Course Objectives (CO):	**The objectives of German A2.2 are:** 1. To understand the main points when the standard language is used. 2. Describe dreams, goals and hopes. 3. To implement the acquired grammar topics. 4. To deal with most situations typically encountered in the language region. 5. To Design and create texts in the areas of Personal interest.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Learn advance vocabulary terms. 2. Enhance expression skills in German language. 3. Enhance professional speaking skills of German language. 4. Construct short statements justifying own views and plans. 5. Participate in an interaction associated with the topics such as work, school, leisure time, travelling ex.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Gelernt ist gelernt Different learning problems, exams and presentations Grammar – KII, Genetive	**CLO 1**	**6**
UNIT II		
Sportlich sportlich Different sport activities, connection between sport and different emotions, Grammar – deshalb and trotzdem	**CLO 2**	**6**
UNIT III		
Zusammen leben Conflicts in an apartment, living in different types and living with pets Grammar –Connectors (als and wenn)	**CLO 3**	**6**
UNIT IV		
Gute unterhaltung Describe a picture, discussion on different music styles Grammar – Interrogative articles	**CLO 4**	**6**
UNIT V		
Wie die Zeit vergeht! and Typisch, oder?Express different wishes, write a story, speak about proverbs, speak about cliche Grammar – Relative sentences	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Netzwerk A1, Ernst klett Verlag and Goyal Publishers and Distributors Pvt. Ltd.
2. Studio d A1, Cornelesen Verlag and Goyal Publishers andDistributors Pvt. Ltd.
3. Netzwerk Neu A1, Ernst klett Verlag and Goyal Publishers and Distributors Pvt. Ltd

Reference Books:

1. Hallo Deutsch A1,Ernst Klett Verlag, Goyal Publishers Distributors Pvt. Ltd
2. ThemenAktuell 1, Hueber verlag
3. Maximal Ernst klett Verlag and Goyal Publishers and Distributors Pvt. Ltd.

Online Resources/E-learning Resources:

1. YouTube :https://youtube.com/@LearnGermanwithAnja?si=BkJYDPi7TS0fT4lr
2. https://youtube.com/@deutschlernenmitheidi?si=TkICIabzioaU0roZ
3. Instagram : instagram.com/learngermanwithanja

Name of the Program:	Foreign Language	Semester:6	Level: UG/PG
Course Name:	Basic Japanese language skill	Course Code/ Course Type	UFL302B/VSEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. Desire to get acquainted with the Japanese language. Basic knowledge of Hiragana and Katakana. Reading and writing Japanese script with basic kanji. Basic conversation

Course Objectives (CO):	**The objectives of Basic Japanese language skill are:** 1. To meet the needs of ever-growing industry with respect to language support. 2. Access Global Job Opportunities with Language Skills. 3. Expand cognitive abilities and adaptability through language learning. 4. Promote cultural awareness and inclusivity through language acquisition. 5. To engage in cross-cultural dialogue and experiences through participation in curricular, co-curricular, and/or study abroad programs.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Acquire communicative proficiency / confidence . 2. Express your thoughts / desires in writing . 3. Read / Understand the Language script. 4. Develop listening skills . 5. Inter cultural awareness

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Minna no Nihongo lesson no. 14 Te / Ta /Nai forms of verbs	**CLO 1**	**6**
UNIT II		
Minna no Nihongo lesson no. 15 Te forms of verbs /usage of te form	**CLO 2**	**6**
UNIT III		
Minna no Nihongo lesson no. 16 Adjective conjugation	**CLO 3**	**6**
UNIT IV		
Minna no Nihongo lesson no. 17 Verbs Nai forms	**CLO 4**	**6**
UNIT V		
Revision and Conversation practice	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Minna no Nihongo , " Japanese for everyone" ,Elementary Main Textbook , Goyal Publishers and Distributors Pvt. Ltd

Reference Books:

1. Shyoho Volume 1
2. Genki Japan
3. Haru Vol. 1 and 2

Online Resources/E-learning Resources:

1. https://www.youtube.com/watch?v=T3hC03n-qWU
2. https://www.youtube.com/watch?v=T3hC03n-qWU
3. https://www.youtube.com/watch?v=vWUFZ4Z2F4c

Name of the Program:	B.Tech/B.B.A/ B.C.A/B.Sc/ B.Pham	Semester: 6	Level: UG
Course Name:	UHV-I: Professional Ethics	Course Code/ Course Type	ACCEVS301/AC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	-	2	-	-	-

Pre-Requisite:

1. UHV-I

Course Objectives (CO):	**The objectives of UHV-I: Professional Ethics are:** 1. To make the students understand the importance of ethical behavior. 2. To expose the students to the ethical practices to be followed in profession. 3. To sensitize the students to become responsible persons who will uphold ethics in profession when they pursue their career learning. 4. To make students understand Psychological and Philosophical approaches. 5. To make students understand social responsibility and corporate Sustainability .
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Equip themselves with an understanding of moral, professional and personal values. . 2. Learn the need of ethics in shaping their profession The learners will hone their decision-making skills . 3. Refine their business ethics based on psychological and philosophical perspective. 4. Assess the need for a balance between ecology, and economy. 5. Equip themselves with a better understanding of themselves and the society they live in and the responsibilities they shoulder in creating a sustainable world.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Individual and Professional Ethics Introduction to Professional Ethics, Morals, Values and Ethics – Personal and Professional- Sense of Professional Ethics – Code of Ethics by NSPE-Making decisions with ethical dimensions–definition–roadmap to ethical decision making–common standards– internal obstacles – bias – empathy	**CLO 1**	**8**
UNIT II		
Business Ethics Philosophical approaches to Business Ethics – ethical reasoning – ethical issues in business - Social Responsibility of Business- conflict of interest–cultural relativism-Ethical Leadership-Resisting un-ethical authority and domination-Global Business Ethics	**CLO 2**	**5**

UNIT III		
Psychological Approaches Ethical Theories-Psychological and Philosophical Approaches-Myths about Morality-conflict of interest in psychological perspective - Courage-Integrity – ethical dilemma – Emotional Intelligence (Mahabharata- Iskcon Publications)	**CLO 3**	**6**
UNIT IV		
Workplace Ethics Ethics in changing domains of Research–academic integrity–intellectual honesty-Role of Engineers and Managers-Ethical issues in Diverse workplace – competition – free will- Confidentiality – employee rights – Intellectual property rights – discrimination	**CLO 4**	**5**
UNIT V		
Safety, Responsibilities and Rights Ecology, and Economy-Risk benefit analysis and reducing risk SDGs–Corporate social responsibility and Corporate Sustainability - CSR in India - Sustainability Case Studies	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Subramanian. R. Professional Ethics, Oxford Publication,2013
2. Nagarasan. R. S. Professional Ethics and Human Values. New Age International Publications, 2006

Reference Books:

1. Mike W Martin and Roland Schinzinger, "Ethics in Engineering",4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014

Online Resources/E-learning Resources:

1. https://www.nspe.org/resources/ethics/code-ethics
2. https://www.toolshero.com/tag/ethical-decision-making/
3. https://peer.asee.org/case-studies-in-engineering-ethics.pdf

Name of the Program:	BTECH CSE	Semester: 7	Level: UG
Course Name:	Mobile Application Development	Course Code/ Course Type	UBTCE401/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Programming (preferably Python), Probability and Statistics, Linear Algebra, Data Structures

Course Objectives (CO):	**The objectives of Mobile Application Development are:** 1. Understand the fundamental concepts of React Native and apply basic component-based development techniques. 2. Explore user interaction handling and implement navigation between screens in React Native applications. 3. Apply styling, layout principles, and basic animation techniques for responsive mobile app design. 4. Integrate APIs, handle data fetching, and implement local storage for managing application data effectively. 5. Utilize advanced features, perform app testing, and deploy React Native applications on mobile platforms.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Develop React Native applications using components, props, state, and basic UI elements. 2. Implement user input handling, gesture interactions, and navigation between multiple screens. 3. Design visually appealing and responsive mobile interfaces using styling, layout systems, and animations. 4. Perform data fetching from APIs, display data using lists, and manage local storage using AsyncStorage. 5. Integrate device features, debug applications, and deploy React Native apps to Google Play and Apple App Stores.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Basics of React Native : Introduction to React Native: Concept, History, and Benefits, Why Choose React Native? Comparison with Native and Hybrid Approaches, Setting up the Development Environment (Node.js, NPM, Expo CLI, Android Studio, Xcode Basics), Understanding JSX and the Component Model, Functional Components vs. Class Components, Rendering Basic UI Components: View, Text, Image, ScrollView, Introduction to Props and State	**CLO 1**	**9**

UNIT II		
User Interaction and Navigation : , Handling User Inputs: TextInput, Button, Switch, Slider, Event Handling and Method Binding in React Native, Touchable Elements: TouchableOpacity, TouchableHighlight, TouchableWithoutFeedback, Navigation Between Screens using React Navigation Library, Stack Navigator, Tab Navigator, and Drawer Navigation Basics, Passing Data Between Screens	**CLO 2**	**9**
UNIT III		
Styling, Layout, and Animations : Styling Components using StyleSheet, Flexbox Layout System in React Native, Platform-Specific Design: Platform, Dimensions, and Conditional Styling, Introduction to Animations: Animated API Basics, Simple Transitions and Animated Interactions, Responsive Design Principles for Mobile Applications	**CLO 3**	**9**
UNIT IV		
Data Handling, APIs, and Local Storage : Fetching Data from External APIs using fetch and axios, Working with JSON Data and Rendering Lists (FlatList, SectionList), Using AsyncStorage for Local Data Persistence, Introduction to Context API for Application-wide State Management, Error Handling, Network Request Status Handling	**CLO 4**	**9**
UNIT V		
Advanced Features and Deployment of React Native Apps : Introduction to Native Modules and Linking in React Native, Working with Device Features: Camera, Location, and Permissions, Debugging and Testing React Native Applications (Expo Dev Tools, React Native Debugger), Preparing and Building Apps for Deployment (APK, IPA), Steps to Publish React Native Apps on Google Play Store and Apple App Store, Best Practices and App Maintenance Guidelines	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. React Native for Mobile Development, Akshat Paul, Abhishek Nalwaya, ISBN: 978-1-4842-4453-1, apress, 2017 edition
2. React Native in Action Developing IOS and Android Apps with JavaScript, Nader Dabit, Manning, 2019, ISBN: 9781638355892

Reference Books:

1. React Native Cookbook: Recipes for Solving Common React Native Development Problems, Ward Dan, Packt Publishing, 2019, ISBN: 9781788990431
2. React and React Native, Boduch Adam, Packt Publishing, 2017, ISBN: 9781786469571

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/learn/react-native-developing-android-and-ios-apps
2. Coursera: https://www.coursera.org/learn/react-native-course

Name of the Program:	BTECH CSE	Semester: 7	Level: UG
Course Name:	Mobile Application Development Laboratory	Course Code/ Course Type	UBTCE402/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Web Development Basics, Operating System

Course Objectives (CO):	**The objectives of Mobile Application Development Laboratory are:** 1. Understand and implement basic React Native components, props, and state for creating simple mobile applications. 2. Handle user inputs and navigation between screens to develop interactive multi-screen applications. 3. Apply styling, Flexbox layout, and basic animation techniques to design responsive and visually appealing mobile interfaces. 4. Integrate REST APIs and implement local storage for effective data management within mobile applications. 5. Explore device-specific features and prepare mobile applications for real-world deployment.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Develop mobile applications using fundamental React Native components, props, and state management. 2. Implement user interaction handling and navigate across screens using React Navigation. 3. Design responsive layouts and apply simple animations to enhance user experience in mobile applications. 4. Perform data fetching from APIs, handle JSON responses, and manage persistent data using AsyncStorage. 5. Access device features like camera or location and demonstrate deployment-ready mobile app functionality.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	App Layout Basics	1	Create a simple React Native app displaying a welcome message using Text, View, and Image components.	CLO 1	2
2	Props and State Demo	2	Implement an application demonstrating the use of props, state, and event handling.	CLO 1	2
3	Input Handling App	3	Build an app with TextInput, Button, and display the entered text using event handling.	CLO 2	2
4	Multi-Screen Navigation	4	Create a two-screen app using Stack Navigator and pass data between screens.	CLO 2	2

5	Flexbox Layout Design	5	Design a responsive page layout using Flexbox properties for alignment and spacing.	CLO 3	2
6	Simple Animation Effects	6	Apply basic Animated API to create a fade-in effect for a component.	CLO 3	2
7	API Data Fetching	7	Fetch data from a public REST API and display it in a list using FlatList.	CLO 4	2
8	Local Storage Example	8	Store and retrieve user preferences using AsyncStorage.	CLO 4	2
9	Device Feature Access	9, 10	Develop an app that accesses the device's camera or location using appropriate permissions	CLO 5	4
10	Mini Project	11, 12, 13, 14, 15	Develop database driven Mobile Application	1, 2, 3, 4, 5	10

Learning Resources:

Text Books:

1. React Native for Mobile Development, Akshat Paul, Abhishek Nalwaya, ISBN: 978-1-4842-4453-1, apress, 2017 edition
2. React Native in Action Developing IOS and Android Apps with JavaScript, Nader Dabit, Manning, 2019, ISBN: 9781638355892

Reference Books:

1. React Native Cookbook: Recipes for Solving Common React Native Development Problems, Ward Dan, Packt Publishing, 2019, ISBN: 9781788990431
2. React and React Native, Boduch Adam, Packt Publishing, 2017, ISBN: 9781786469571

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/learn/react-native-developing-android-and-ios-apps
2. Coursera: https://www.coursera.org/learn/react-native-course

Name of the Program:	BTECH CSE	Semester: 7	Level: UG
Course Name:	Fundamentals of Deep Learning	Course Code/ Course Type	UBTCEPE401/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Linear Algebra, Probability, Calculus, Python Programming, Machine Learning Basics

Course Objectives (CO):	**The objectives of Fundamentals of Deep LEarning are:** 1. Introduce foundational concepts of deep learning and neural networks. 2. Enable students to understand, design, and train deep learning models. 3. Explore architectures such as CNNs, RNNs, and modern frameworks. 4. Apply deep learning to real-world problems such as image and text classification. 5. Encourage critical thinking about model evaluation, bias, and deployment.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand the principles and building blocks of deep neural networks. 2. Train, evaluate, and tune deep learning models using real datasets. 3. Apply CNNs and RNNs to solve vision and sequence-related tasks. 4. Analyze and compare architectures and optimization techniques for various applications. 5. Demonstrate awareness of deployment techniques and ethical issues in deep learning.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Deep Learning What is Deep Learning?, Deep Learning vs Traditional Machine Learning, Biological Neurons and Artificial Neurons, Perceptron and Multilayer Perceptron (MLP), Activation Functions (ReLU, Sigmoid, Tanh, Softmax), Loss Functions: MSE, Cross-Entropy	**CLO 1**	**9**
UNIT II		
Neural Network Training and Optimization Feedforward and Backpropagation, Gradient Descent and its Variants (SGD, Adam, RMSProp), Weight Initialization, Normalization, Regularization, Overfitting and Underfitting, Hyperparameter Tuning and Model Evaluation	**CLO 2**	**9**
UNIT III		
Convolutional Neural Networks (CNNs) Convolution Operation and Filters, Pooling Layers: Max and Average Pooling, CNN Architectures: LeNet, AlexNet, VGG, ResNet (introductory level), Image Classification and Object Detection Basics, Transfer Learning and Fine-tuning	**CLO 3**	**9**

UNIT IV		
Recurrent Neural Networks (RNNs) and Sequence Models Introduction to Sequential Data, RNNs: Structure and Challenges Vanishing/Exploding Gradient), Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU), Applications: Text Generation, Sentiment Analysis, Time Series Forecasting, Basics of Attention Mechanism	**CLO 4**	**9**
UNIT V		
Advanced Topics and Applications Introduction to Transformers and BERT (conceptual overview), Generative Adversarial Networks (GANs) - Basic Concept, Autoencoders and Dimensionality Reduction, Model Deployment Overview (Flask/Streamlit/TensorFlow Lite), Ethical Considerations in Deep Learning (Bias, Fairness, Explainability)	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
2. Francois Chollet, Deep Learning with Python, 2nd Edition, Manning Publications, 2021.

Reference Books:

1. Michael Nielsen, Neural Networks and Deep Learning, 2015
   (available online: http://neuralnetworksanddeeplearning.com/)
2. Andrew Ng, Deep Learning Specialization Notes (Coursera).
3. Josh Patterson and Adam Gibson, Deep Learning: A Practitioner's Approach, O'Reilly Media, 2017.

Online Resources/E-learning Resources:

1. Deep Learning Specialization – Coursera by Andrew Ng
2. Fast.ai – Practical Deep Learning for Coders

Name of the Program:	BTECH CSE	Semester: 7	Level: UG
Course Name:	Fundamentals of Deep Learning Laboratory	Course Code/ Course Type	UBTCEPE403/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Python Programming, Machine Learning Basics, Linear Algebra, Calculus

Course Objectives (CO):	**The objectives of Fundamentals of Deep Learning Laboratory are:** 1. Enable students to build and train neural network architectures (perceptrons, MLPs, CNNs, RNNs) from scratch and via deep-learning frameworks (TensorFlow/PyTorch). 2. Familiarize students with optimization algorithms (SGD, Adam, etc.) and regularization methods (dropout, batch-norm) to improve convergence and generalization. 3. Guide students through designing and evaluating autoencoders, VAEs, and GANs for unsupervised representation learning and sample generation. 4. Develop skills to visualize training dynamics, loss landscapes, feature maps, and latent spaces to diagnose model behavior. 5. Teach students how to fine-tune pretrained networks for new tasks and package trained models into simple APIs (Flask, TensorFlow Lite) for real-world use.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Implement and train basic neural network architectures from scratch. 2. Apply convolutional and recurrent models to vision and sequence tasks. 3. Use regularization and optimization techniques (batch norm, dropout, advanced optimizers) to improve model performance. 4. Build and evaluate generative models and autoencoders. 5. Deploy and serve trained deep learning models in simple applications.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Perceptron and MLP from Scratch	1	Use Implement a single-layer perceptron and a 2-layer MLP using NumPy and Train on a toy dataset and visualize decision boundaries visualizations	CLO1	2
2	Backpropagation and Optimization	2	Code forward/backward passes for MLP and Experiment with SGD, Momentum, and Adam optimizers on MNIST	CLO1	2
3	Activation Functions and Loss Landscapes	3	Compare Sigmoid, Tanh, ReLU, Leaky ReLU in training speed/convergence and Visualize loss surfaces for different activations	CLO1	2

4	Convolutional Neural Networks (CNNs)	4	Build a small CNN (conv → pool → FC) in PyTorch or TensorFlow Train and evaluate on CIFAR-10; plot training/validation curves	CLO2	2
5	Regularization: Dropout and Batch Normalization	5	Integrate Dropout and BatchNorm layers into your CNN Analyze their effects on overfitting and convergence	CLO2	2
6	Recurrent Neural Networks (RNNs) and LSTM	6	Implement a simple RNN for character-level language modelling Extend to LSTM and compare performance on a text corpus	CLO2	2
7	Autoencoders for Dimensionality Reduction	7	Build a basic under complete autoencoder for MNIST Visualize latent space representations	CLO3	2
8	Variational Autoencoders (VAE)	8	Implement encoder/decoder with reparameterization trick Generate new samples and inspect the learned latent manifold	CLO4	2
9	Generative Adversarial Networks (GANs)	9, 10	Code a DCGAN architecture to generate handwritten digits Track generator/discriminator losses and sample quality over epochs	CLO4	4
10	Transfer Learning and Deployment	11, 12, 13, 14, 15	Fine-tune a pretrained model (e.g., VGG16/ResNet50) on a small custom dataset Export the trained model and deploy via a simple Flask or TensorFlow Lite API	1, 2, 3, 4, 5	10

Learning Resources:

Text Books:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
2. François Chollet, Deep Learning with Python, 2nd Ed., Manning Publications, 2021.

Reference Books:

1. Michael Nielsen, Neural Networks and Deep Learning (online book), 2015.
2. Josh Patterson and Adam Gibson, Deep Learning: A Practitioner's Approach, O'Reilly, 2017.
3. Andrew Ng, Deep Learning Specialization (Coursera lecture notes).

Online Resources/E-learning Resources:

1. TensorFlow Tutorials – https://www.tensorflow.org/tutorials
2. PyTorch Tutorials – https://pytorch.org/tutorials

Name of the Program:	BTECH CSE	Semester: 7	Level: UG
Course Name:	Big Data and Buisness Analytics	Course Code/ Course Type	UBTCEPE402/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Database Management Systems, Programming in Python/Java, Basics of Data Analysis

Course Objectives (CO):	**The objectives of Big Data and Business Analytics are:** 1. Understand the fundamentals of Big Data, its characteristics, ecosystem, and applications in various sectors. 2. Explore Big Data processing technologies, Hadoop architecture, and NoSQL databases for effective data management. 3. Apply MapReduce programming and Big Data tools like Spark, Kafka, and Cassandra for large-scale data processing. 4. Learn data warehousing concepts, including architecture, schema design, and their role in business intelligence. 5. Analyze OLAP operations and implement decision support mechanisms using data cubes and query processing techniques.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Describe Big Data concepts, types, and applications, and explain the need for analytics in business decision making. 2. Demonstrate the use of Hadoop ecosystem components and NoSQL databases for Big Data storage and processing. 3. Write basic MapReduce programs and utilize Spark and other Big Data tools for data analysis tasks. 4. Explain the architecture and schema designs of data warehouses and their significance in decision support systems. 5. Perform OLAP operations and apply data cube querying techniques for business analytics and decision support.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Big Data Analytics : Overview of Big Data: Characteristics (Volume, Velocity, Variety, Veracity, Value), Need for Big Data Analytics in Decision Making, Types of Data: Structured, Semi-structured, Unstructured, Big Data Ecosystem and Architecture Overview, Applications of Big Data in Various Sectors: Finance, Healthcare, E-commerce, IoT	**CLO 1**	**9**
UNIT II		
Big Data Technologies and Hadoop Ecosystem Hadoop Architecture: HDFS, MapReduce, Hadoop Components: NameNode, DataNode, JobTracker, TaskTracker, YARN: Resource Management, Hadoop Ecosystem: Pig, Hive, HBase, Sqoop, Flume, Introduction to NoSQL Databases (MongoDB, Cassandra)	**CLO 2**	**9**

UNIT III		
MapReduce and Big Data Tools : MapReduce Programming Model: Mapper, Reducer, Combiner, Partitioner, Writing Simple MapReduce Programs using Java, Word Count Example and Case Studies in MapReduce, Introduction to Spark: RDDs, DataFrames, Spark vs. Hadoop MapReduce, Basics of Big Data Analytics Tools: Apache Spark, Kafka, Cassandra	**CLO 3**	**9**
UNIT IV		
Data Warehousing Concepts for Business Intelligence : Introduction to Data Warehousing and Business Intelligence, Data Warehouse Architecture: Data Source, Staging Area, ETL, Data Marts, OLAP, Star Schema and Snowflake Schema Design, Role of Data Warehousing in Decision Support Systems (DSS)	**CLO 4**	**9**
UNIT V		
OLAP Operations and Decision Support in Data Warehousing : OLAP Types: MOLAP (Multidimensional OLAP), ROLAP (Relational OLAP), HOLAP (Hybrid OLAP), OLAP Operations: Roll-up, Drill-down, Slice, Dice, Pivot (Rotate), Construction and Querying of Data Cubes, Query Processing and Performance Optimization in OLAP Systems, Role of OLAP in Strategic and Tactical Decision Support, Case Studies: Decision Making using OLAP Queries in Retail, Finance, Healthcare	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Marz, N., & Warren, J. (2015). Big Data: Principles and best practices of scalable real-time data systems, Manning Publications.
2. White, T. (2015). Hadoop: The Definitive Guide (4th ed.). O'Reilly Media.

Reference Books:

1. Guller, M. (2015). Big Data Analytics with Spark: A Practitioner's Guide to Using Spark for Large Scale Data Analysis. Apress.
2. Krishnan, K. (2013). Data Warehousing in the Age of Big Data. Morgan Kaufmann.
3. Sadalage, P. J., & Fowler, M. (2012). NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley.

Online Resources/E-learning Resources:

1. https://www.coursera.org/learn/big-data-introduction
2. https://www.coursera.org/learn/hadoop

Name of the Program:	BTECH CSE	Semester: 7	Level: UG
Course Name:	Big Data and Business Analytics Laboratory	Course Code/ Course Type	UBTCEPE404/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Database Systems, Programming (Python/Java), Basics of Data Analytics

Course Objectives (CO):	**The objectives of Big Data and Business Analytics Laboratory are:** 1. Provide hands-on experience with core Big Data frameworks (Hadoop, Spark).(TensorFlow/PyTorch). 2. Teach students to ingest, process, and store large-scale datasets. 3. Introduce business analytics workflows using BI tools. 4. Develop skills in both batch and real-time data processing. 5. Enable end-to-end analytics: from raw data to interactive dashboards.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Store and manage large datasets using HDFS and HBase. 2. Develop and run MapReduce and Pig jobs for batch analytics. 3. Query and transform data with HiveQL and Spark SQL. 4. Implement real-time streaming pipelines and ML models with Spark. 5. Design and deploy interactive BI dashboards to drive business insights.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	HDFS Fundamentals	1	Install/configure Hadoop locally or via Docker, Perform file operations (put, get, ls, rm) on HDFS	CLO1	2
2	MapReduce Programming	2	Write a WordCount job in Java or Python Run it on a sample text corpus and interpret counters	CLO1	2
3	Pig Latin Scripting	3	Load and preprocess a log-file dataset Use Pig for grouping, filtering, and joining	CLO1	2
4	Hive Data Warehousing	4	Create external/internal tables over CSV/JSON data Run HiveQL queries, partitions, and UDFs	CLO2	2
5	HBase NoSQL Operations	5	Set up HBase shell Perform CRUD on column-family data, design row-key schema	CLO2	2
6	Spark RDD API	6	Develop basic RDD transformations (map, filter, reduceByKey) – Execute a WordCount and persist results	CLO2	2
7	Spark DataFrame and SQL	7	Read Parquet/JSON into DataFrames Run Spark SQL queries and compare performance vs. RDDs	CLO3	2

8	Spark Streaming	8	Ingest live data via socket or Kafka Windowed counts and real-time alerts	CLO4	2
9	Spark MLlib Analytics	9,10	Build a classification/regression model (e.g., logistic regression) Train/test on a large dataset and evaluate with MLlib metrics	CLO4	4
10	Business Intelligence Dashboard	11,12,13,14,15	Connect Power BI or Tableau to processed data (Hive/Spark) Create interactive visualizations and drill-downs	1, 2, 3, 4, 5	10

Learning Resources:

Text Books:

1. Tom White, Hadoop: The Definitive Guide, 4th Ed., O'Reilly, 2015
2. David Loshin, Business Intelligence: The Savvy Manager's Guide, 2nd Ed., Morgan Kaufmann, 2012

Reference Books:

1. Michael Minelli, Michele Chambers and Ambiga Dhiraj, Big Data, Big Analytics, Wiley, 2013
2. Ralph Kimball & Margy Ross, The Data Warehouse Toolkit, 3rd Ed., Wiley, 2013
3. Vignesh Prajapati, Big Data Analytics with Hadoop 3, Packt, 2019

Online Resources/E-learning Resources:

1. Coursera: Big Data Specialization (UC San Diego)
2. edX: Introduction to Big Data (UC San Diego)

Name of the Program:	BTECH CSE	Semester: 7	Level: UG
Course Name:	Microsoft PowerBI Data Analyst	Course Code/ Course Type	MOOCCE701
Course Pattern:	2025	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	-	2	2	2	25	25	-

Pre-Requisite:

1. Basic knowledge of Excel and spreadsheets
2. Familiarity with data visualization concepts
3. Understanding of databases or SQL is helpful but not mandatory

Course Objectives (CO):	**The objectives of Microsoft PowerBI Data Analyst are:** 1. Understand the fundamentals of Business Intelligence (BI) and the role of Power BI in data analytics. 2. Learn how to connect, transform, and model data using Power BI tools. 3. Create interactive visualizations and dashboards to communicate insights effectively. 4. Implement DAX (Data Analysis Expressions) for complex calculations and KPIs effectively. 5. Apply Power BI service features for collaboration, sharing, and automated data refreshes.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Prepare and clean data from various sources for Power BI analysis. 2. Develop and manage robust data models using Power BI Desktop. 3. Create compelling reports, dashboards, and visuals tailored to business needs. 4. Use DAX to write calculated columns, measures, and advanced analytical functions. 5. Publish, share, and automate Power BI reports using Power BI Service and the Power Platform.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Power BI and Business Intelligence What is Business Intelligence (BI)?,Power BI ecosystem: Desktop, Service, Mobile, Importing and connecting data sources (Excel, SQL, web),Data load, Power Query interface	**CLO 1**	**6**
UNIT II		
Data Preparation and Transformation Power Query Editor basics, Cleaning and shaping data (merge, append, pivot, unpivot), Data types and error handling, Data profiling and transformations	**CLO 2**	**6**

UNIT III		
Data Modeling and DAX Star schema and data relationships, Calculated columns and measures, Aggregations, filters, time intelligence,Advanced DAX functions: CALCULATE, RELATED, FILTER	**CLO 3**	**6**
UNIT IV		
Visualization and Reporting Creating interactive visuals: tables, charts, slicers, maps, Report themes and formatting, Drill-through, bookmarks, and custom visuals, KPI indicators and conditional formatting	**CLO 4**	**6**
UNIT V		
Power BI Service, Deployment, and Best Practices Publishing reports to Power BI Service, Workspaces, dashboards, and sharing, Row-level security (RLS) and access control, Refresh scheduling and usage monitoring, Power BI integration with Excel, Teams, and Power Platform	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. " Mastering Microsoft Power BI" by Brett Powel

Reference Books:

1. "The Definitive Guide to DAX" by Alberto Ferrari and Marco Russo
2. "Pro Power BI Desktop" by Adam Aspin
3. "Analyzing Data with Power BI and Power Pivot for Excel" by Alberto Ferrari and Marco Russo

Online Resources/E-learning Resources:

1. Power BI Data Analyst Professional Certificate – Coursera
2. Microsoft Learn – Power BI

Name of the Program:	BTECH CSE	Semester: 7	Level: UG
Course Name:	Software Testing and AI Automation	Course Code/ Course Type	MOOCCE702
Course Pattern:	2025	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	-	2	2	2	25	25	-

Pre-Requisite:

1. Knowledge of Python programming
2. Understanding of Software Development Life Cycle (SDLC)
3. Basic familiarity with machine learning concepts and version control systems (e.g., Git)

Course Objectives (CO):	**The objectives of Software Testing and AI Automation are:** 1. Understand the principles, techniques, and practices of manual and automated software testing. 2. Build and manage automated test suites using tools such as Selenium and PyTest. 3. Integrate test automation into DevOps pipelines using CI/CD tools. 4. Apply AI and machine learning techniques for intelligent test optimization and defect prediction. 5. Explore the use of generative AI to enhance software testing efficiency and create self-healing test frameworks.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Analyze software requirements and design test strategies and cases. 2. Implement Python-based test automation for web and functional testing. 3. Use AI algorithms to prioritize test cases, predict bugs, and generate tests from requirements. 4. Automate testing in a CI/CD pipeline with tools like Jenkins and GitHub Actions 5. Integrate generative AI tools (e.g., Copilot, ChatGPT) for smart test script generation and maintenance

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Software Testing Fundamentals Types of software testing: unit, integration, system, acceptance, Test case development and execution, Defect management and lifecycle, Software quality assurance metrics	**CLO 1**	**6**
UNIT II		
Python-Based Test Automation Introduction to test automation frameworks, Selenium, WebDriver for web automation ,Writing test scripts using Python and PyTest, Assertions, fixtures, and reporting in PyTest	**CLO 2**	**6**

UNIT III		
Continuous Testing in DevOps CI/CD principles and integration with Jenkins/GitHub Actions, Running tests in pipelines and containers, Test orchestration and test data management.	**CLO 3**	**6**
UNIT IV		
AI in Software Testing Overview of AI-driven testing tools, ML for defect prediction and code coverage, AI-based test case generation and prioritization, Natural Language Processing (NLP) for requirements parsing.	**CLO 4**	**6**
UNIT V		
Generative AI for Testing and Development Introduction to generative AI for software engineering,Using GitHub Copilot and ChatGPT for writing and debugging tests, Self-healing scripts and intelligent code suggestions, Future trends: autonomous testing, test bots	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Software Testing: Principles and Practices" by Srinivasan Desikan Gopalaswamy Ramesh

Reference Books:

1. "Foundations of Software Testing" by Dorothy Graham, Rex Black, and Erik van Veenendaal
2. "Python Testing with Pytest" by Brian Okken
3. "AI for Testing" by Tariq King and Jason Arbon

Online Resources/E-learning Resources:

1. Software Testing and Automation Specialization – Coursera
2. Generative AI for Software Developers – Coursera

Name of the Program:	BTECH CSE	Semester: 5	Level: UG
Course Name:	Project Phase I	Course Code/ Course Type	UBTCE405
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	2	-	2	4	20	-	30

Pre-Requisite:

1. Basics of Software Engineering and Computer Programming Concepts
2. Basics of Programming Language such as C, MATLAB, Python

Course Objectives (CO):	**The objectives of Project Phase I are:** 1. To comprehend the Product Development Process 2. To plan for various activities of the major project and channelize the work towards product development 3. To build, design and implement real-time applications using available platforms. 4. To inculcate research culture in students for their technical growth
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand the principles and building blocks of deep neural networksComprehend, plan, and execute the major project with appreciable research outcomes. 2. Design real-time applications considering emerging areas in technology 3. Prepare good quality technical reports based on the project 4. Demonstrate technical ideas and their relevance to current technology 5. Publish good quality papers in reputed journals and present their work in reputed conferences.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
1. Individual students must identify a real-time problem and develop an innovative solution under the guidance of a project mentor 2. Sponsored projects or project internships from reputed companies/ institutions are encouraged 3. Projects must be based on current technologies or research areas and should demonstrate societal or industrial relevance 4. Students should submit a detailed Project Report-I as part of term work, covering design methodology, implementation plans, and expected outcomes. 5. Students must aim for minimum 2 publications (preferably Scopusindexed) as part of the research output from the project work 6. Evaluation will include proposal presentation, mid-evaluation, documentation review, and final demo.	**CLO 1-5**	**30**
Total Hours		**30**

Name of the Program:	BTECH CSE	Semester: 8	Level: UG
Course Name:	DevOps	Course Code/ Course Type	UBTCE406/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Python Programming, Probability and Statistics, Linear Algebra, Machine Learning, Deep Learning Basics

Course Objectives (CO):	**The objectives of DevOps are:** 1. Understand the core concepts of DevOps, its relationship with Agile, CI/CD, and Linux essentials required for DevOps practices. 2. Apply version control practices using Git for efficient collaboration and project management in DevOps workflows. 3. Implement configuration management using Chef to automate infrastructure deployment and manage environments. 4. Explore containerization concepts and manage container-based applications using Docker. 5. Automate build processes using Maven for managing project dependencies, builds, and deployments.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Describe DevOps principles, CI/CD concepts, and Linux commands essential for DevOps environments. 2. Demonstrate Git operations including repository management, branching, merging, and version control strategies. 3. Configure infrastructure using Chef, manage nodes, roles, environments, and handle data bags for configuration management. 4. Create and manage Docker containers, custom images, and apply networking concepts for container orchestration. 5. Build, manage, and automate software projects using Maven with effective dependency and plugin management.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to DevOps and Linux Essentials : Define DevOps and its importance, DevOps history, goals, stakeholders, and key terminology, DevOps perspective and relationship with Agile, Lean, ITIL, SDLC models, DevOps tools overview and configuration management basics, Continuous Integration and Continuous Deployment (CI/CD) concepts, Introduction to Linux OS and its importance in DevOps, Basic Linux commands, Linux administration, environment variables, networking concepts, Linux server installation, RPM, and YUM package management	**CLO 1**	**9**
UNIT II		
Version Control using Git : Introduction to Version Control Systems: CVCS vs. DVCS, History, basics, and significance of Git, Git installation and initial setup on Linux and Windows, Core Git operations: repository creation, cloning, committing, fetching, pulling, remotes, Branching operations: creating, switching, merging branches	**CLO 2**	**9**

UNIT III		
Configuration Management with Chef : Overview of Chef and common Chef terminology (server, workstation, client, repository), Chef architecture and configuration concepts, Workstation setup, knife configuration, organization setup, Adding nodes and testing node setup using knife, Working with node objects, search, run lists, and environments, Managing roles, attributes, and creating custom attributes in cookbooks, Introduction to data bags: creation, management using CLI and Chef Console, sample data bags for user creation	**CLO 3**	**9**
UNIT IV		
Containerization with Docker : Introduction to Docker: concept, use cases, Docker vs. virtualization, Docker architecture and key components overview, Installing Docker on Linux and Windows platforms, Working with Docker Hub: downloading/uploading images, understanding containers, Running containers, executing commands, managing multiple containers, Creating and managing custom Docker images, Docker networking: container linking, exposing ports, container routing	**CLO 4**	**9**
UNIT V		
Build Automation using Maven : Introduction to Maven as a build tool, Maven installation and build requirements, Understanding Maven Project Object Model (POM) and builds (pom.xml), Maven build lifecycle: phases, goals, and structure, Maven repositories: local (.m2), global, and remote repositories, Understanding Group ID, Artifact ID, and Snapshot concepts, Managing dependencies and plugins in Maven builds	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. DevOps for Developers, Michael Hüttermann, ISBN: 978-1-4302-4569-8, Apress Berkeley, CA
2. DevOps: A Software Architect's Perspective, Len Bass, Ingo M. Weber, Liming Zhu, ISBN: 9780134049847, Addison-Wesley

Reference Books:

1. Building a DevOps Culture: Jennifer Davis, Katherine Daniels. Publisher: O'Reilly
2. DevOps for Dummies: Gene Kim, Kevin Behr, George, Publisher: John Wiley & Sons

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/learn/intro-to-devops
2. Coursera: https://www.coursera.org/specializations/packt-devops-complete-course

Name of the Program:	BTECH CSE	Semester: 8	Level: UG
Course Name:	DevOps Laboratory	Course Code/ Course Type	UBTCE407/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Basic Programming Skills (Python), Linear Algebra, Basic Machine Learning Concepts

Course Objectives (CO):	**The objectives of DevOps Laboratory are:** 1. Understand DevOps principles, Linux essentials, and the role of CI/CD in software development. 2. Apply version control techniques using Git for collaborative software development. 3. Implement configuration management and infrastructure automation using Chef. 4. Manage containerization of applications using Docker for consistent development and deployment environments. 5. Automate project builds and dependency management using Maven in DevOps workflows.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Execute Linux commands, manage environments, and handle software installations essential for DevOps practices. 2. Perform version control operations, branching, and merging using Git. 3. Configure Chef workstation, manage nodes, run lists, and roles for infrastructure automation. 4. Use Docker to run, manage containers, and create custom Docker images for application deployment. 5. Automate software project builds and manage dependencies using Maven effectively.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Linux Commands Practice	1	Execute basic Linux commands: directory creation, file manipulation, permissions, environment variables.	CLO 1	2
2	Package Installation	2	Install software packages using RPM and YUM package managers on Linux.	CLO 1	2
3	Git Repository Setup	3	Initialize a Git repository, clone, commit, push, and pull operations.	CLO 2	2
4	Git Branching and Merging	4	Create branches, switch between branches, and merge branches using Git.	CLO 2	2
5	Chef Workstation Setup	5	Configure Chef Workstation, knife setup, and connect it to the Chef server.	CLO 3	2

6	Manage Nodes and Roles	6, 7	Add nodes, define run lists, create roles, and assign roles to nodes.	CLO 3	4
7	Docker Image Pulling	8, 9	Pull Docker images from Docker Hub and run containers from these images.	CLO 4	4
8	Custom Docker Image	10, 11	Build a custom Docker image and run a container from the created image.	CLO4	4
9	Maven Project Build	12, 13	Create a Maven project, compile, and run using Maven build lifecycle commands.	CLO 5	4
10	Maven Dependency Management	14, 15	Add dependencies to the Maven POM file and manage project builds effectively.	CLO 5	4

Learning Resources:

Text Books:

1. DevOps for Developers, Michael Hüttermann, ISBN: 978-1-4302-4569-8, Apress Berkeley, CA
2. DevOps: A Software Architect's Perspective, Len Bass, Ingo M. Weber, Liming Zhu, ISBN: 9780134049847, Addison-Wesley

Reference Books:

1. Building a DevOps Culture: Jennifer Davis, Katherine Daniels. Publisher: O'Reilly
2. DevOps for Dummies: Gene Kim, Kevin Behr, George, Publisher: John Wiley & Sons

Online Resources/E-learning Resources:

1. Coursera: https://www.coursera.org/learn/intro-to-devops
2. Coursera: https://www.coursera.org/specializations/packt-devops-complete-course

Name of the Program:	BTECH CSE	Semester: 8	Level: UG
Course Name:	Research Methodology & IPR	Course Code/ Course Type	UBTCE408/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
2	-	-	2	2	20	30	-

Pre-Requisite:

1. Critical Thinking and Analytical Skills

Course Objectives (CO):	**The objectives of Research Methodology & IPR are:** 1. Learn research fundamentals to develop solid understanding of research ethics. 2. Learn various research designs and methodologies, including experimental, survey, and case study designs. 3. Enhance written and oral communication skills for presenting research proposals, findings, and conclusions. 4. Develop a comprehensive understanding of intellectual property rights, including patents, copyrights, trademarks, and trade secrets. 5. Gain knowledge of national and international laws and regulations governing intellectual property rights.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Demonstrate research problems and gain research ethics. 2. Use various research designs. 3. Explore the presentation skills in research proposals and writings. 4. Use the tools filing the patents and IPR. 5. Apply the different laws and regulations for IP rights.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Research Methodology : Understanding research, types of research, and the scientific method. Research ethics and integrity. **Problem Formulation and Literature Review :** Identifying research problems. Reviewing existing literature and formulating research questions.	**CLO 1**	**6**
UNIT II		
Research Design : Experimental design. Survey design. Case study design. Qualitative and quantitative research methods. **Data Collection and Analysis :** Methods of data collection (surveys, interviews, experiments, etc.). Data analysis techniques (qualitative and quantitative).	**CLO 2**	**6**
UNIT III		
Writing and Presenting Research : Research proposal writing. Academic writing style and citation. Presenting research findings: oral presentations and posters. **Research Project Management :** Time management. Resource allocation. Risk assessment and mitigation.	**CLO 3**	**6**

UNIT IV		
Introduction to Intellectual Property : Overview of intellectual property rights (patents, copyrights, trademarks, trade secrets). Importance of IPR in the context of technology and innovation. **Patents :** Basics of patent law and patentability criteria. Patent filing procedure. Patent searching and analysis.	**CLO 4**	**6**
UNIT V		
IPR Issues in Research and Development : IP management strategies for research institutions and companies. IP licensing and technology transfer. **International IPR Laws and Treaties :** Overview of international treaties like TRIPS Agreement. Comparison of IPR laws across different jurisdictions.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. Research Methodology: Methods and Techniques by C.R. Kothari
2. Research Methodology: A Step-by-Step Guide for Beginners by Ranjit Kumar
3. Intellectual Property Rights: Text and Cases" by V.K. Ahuja

Reference Books:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" by John W. Creswell and J. David Creswell
2. Intellectual Property: Patents, Trademarks, and Copyrights by Richard Stim

Online Resources/E-learning Resources:

1. https://www.coursera.org/search?query=research%20methodology
2. https://www.edx.org/search?q=research+methodology

Name of the Program:	BTECH CSE	Semester: 8	Level: UG
Course Name:	Generative Models and Applications	Course Code/ Course Type	UBTCEPE405/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Probability and Statistics, Linear Algebra, Machine Learning, Deep Learning (Basics)

Course Objectives (CO):	**The objectives of Generative models and applications are:** 1. Understand the theoretical foundations of generative modeling. 2. Learn popular generative model architectures and how they are trained. 3. Explore applications of generative models in vision, text, audio, and other domains. 4. Develop hands-on skills in implementing and evaluating generative models. 5. Analyze challenges like training instability, evaluation, and ethical implications.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand and compare different types of generative models and their mathematical foundations. 2. Implement and train basic VAE and GAN architectures using deep learning frameworks. 3. Analyze the strengths, weaknesses, and evaluation metrics of generative models. 4. Apply generative models to real-world problems in image, text, and audio domains. 5. Demonstrate awareness of ethical, social, and legal issues associated with generative AI.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Generative Modeling Discriminative vs Generative Models, Applications of Generative Models: Image Synthesis, Text Generation, Anomaly Detection, Probability Distributions: Joint, Marginal, Conditional, Maximum Likelihood Estimation (MLE) and KL Divergence, Latent Variable Models	**CLO 1**	**9**
UNIT II		
Variational Autoencoders (VAEs) Introduction to Autoencoders and Limitations, Probabilistic Encoders and Decoders, Variational Inference and ELBO, Reparameterization Trick, Conditional VAEs (CVAE), Applications: Denoising, Semi-supervised Learning	**CLO 2**	**9**

UNIT III		
Generative Adversarial Networks (GANs) GAN Architecture: Generator and Discriminator, Game-Theoretic Perspective, Nash Equilibrium, Loss Functions (JS divergence, Wasserstein distance), Training Challenges: Mode Collapse, Non-convergence, Variants: DCGAN, WGAN, Conditional GANs, StyleGAN, Applications: Image Generation, Super Resolution, Deepfakes	**CLO 3**	**9**
UNIT IV		
Diffusion Models and Autoregressive Models Motivation and Mathematical Foundations of Diffusion Models, Denoising Diffusion Probabilistic Models (DDPMs), Sampling and Training Techniques, Autoregressive Models: PixelRNN, PixelCNN, WaveNet, Transformer-based Generative Models: GPT, BERT (overview)	**CLO 4**	**9**
UNIT V		
Applications and Ethics of Generative AI Applications in Art, Music, Text, Healthcare, and Simulation, Evaluation Metrics: Inception Score, FID, BLEU, Perceptual Metrics, Human-AI Collaboration, Risks: Deepfakes, Bias Amplification, Misinformation, Responsible AI: Fairness, Explainability, Regulation	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
2. David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, 2nd Edition, O'Reilly Media, 2022.

Reference Books:

1. Mehdi Mirza and Simon Osindero, Conditional Generative Adversarial Nets, arXiv preprint (2014).
2. Jakub Tomczak & Max Welling, Introductory Guide to Variational Autoencoders (available online)
3. Ho et al., Denoising Diffusion Probabilistic Models, NeurIPS 2020.

Online Resources/E-learning Resources:

1. Coursera - GANs Specialization (DeepLearning.AI)
2. Stanford CS236: Deep Generative Models

Name of the Program:	BTECH CSE	Semester: 8	Level: UG
Course Name:	Generative Models and Applications Laboratory	Course Code/ Course Type	UBTCEPE407/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Basic Programming Skills (Python), Linear Algebra, Basic Machine Learning Concepts

Course Objectives (CO):	**The objectives of Generative Models and Applications Laboratory are:** 1. To introduce students to the foundational concepts of generative modeling. 2. To enable hands-on experience with popular generative models like VAEs, GANs, and diffusion models. 3. To develop practical skills in generating synthetic data using deep learning frameworks. 4. To explore real-world applications of generative models in domains like image synthesis, text generation, and anomaly detection. 5. To familiarize students with ethical considerations and limitations in generative AI.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand and implement basic generative modeling techniques. 2. Build and train different types of Generative Adversarial Networks (GANs). 3. Apply generative models to solve real-world problems in vision, NLP, and signal processing. 4. Evaluate and fine-tune generative models for improved outputs. 5. Demonstrate ethical use of generative technologies with awareness of societal impact.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Introduction to Autoencoders	1	Build a simple autoencoder to reconstruct MNIST images.	CLO 1	2
2	Variational Autoencoder (VAE)	2	Implement and visualize a VAE using the Fashion-MNIST dataset.	CLO 1	2
3	Introduction to GANs	3	Build a basic GAN for generating handwritten digits (MNIST).	CLO 2	2
4	DCGAN – Deep Convolutional GAN	4	Generate more realistic images using convolutional layers with the CIFAR-10 dataset.	CLO 2	2
5	Conditional GANs (cGANs)	5	Generate class-conditional images based on input labels.	CLO 3	2

6	CycleGAN for Image to Image Translation	6, 7	Convert images from one domain to another (e.g., horses ¡-¿ zebras).	CLO 3	4
7	Text Generation using GPT-style Models	8, 9	Generate synthetic text using a pre-trained GPT-2 or fine-tuned LLM.	CLO 4	4
8	Image Caption Generation	10, 11	Generate captions from images using a CNN-RNN pipeline.	CLO 4	2
9	Anomaly Detection using Autoencoders	12, 13	Detect outliers in tabular or image data using reconstruction error.	CLO 5	4
10	Exploring Diffusion Models	14, 15	Understand and use pretrained diffusion models like Stable Diffusion to generate high-quality images.	CLO 5	4

Learning Resources:

Text Books:

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville – MIT Press
2. "Probabilistic Deep Learning" by Oliver Duerr, Beate Sick, Elvis Murina – O'Reilly

Reference Books:

1. "Generative Deep Learning" by David Foster – O'Reilly Media
2. "GANs in Action" by Jakub Langr and Vladimir Bok – Manning
3. "Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili – Packt

Online Resources/E-learning Resources:

1. DeepLearning.AI - Generative AI Short Courses: https://www.deeplearning.ai/
2. Fast.ai Deep Learning Course: https://course.fast.ai/

Name of the Program:	BTECH CSE	Semester: 8	Level: UG
Course Name:	Natural Language Processing and LLM	Course Code/ Course Type	UBTCEPE406/PEC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Python Programming, Probability and Statistics, Linear Algebra, Machine Learning, Deep Learning Basics

Course Objectives (CO):	**The objectives of Natural Language Processing and LLM are:** 1. Understand fundamental concepts in NLP including text preprocessing, syntax, semantics, and discourse. 2. Explore statistical, neural, and transformer-based approaches to language modeling. 3. Gain hands-on experience with modern NLP tools and LLM frameworks. 4. Apply LLMs to solve real-world problems such as summarization, translation, and Q and A. 5. Discuss challenges and ethical concerns of deploying LLMs.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand the foundational principles and techniques used in Natural Language Processing. 2. Apply statistical and deep learning models for NLP tasks like classification, translation, and summarization. 3. Implement and fine-tune LLMs for various real-world NLP applications. 4. Analyze the performance and limitations of transformer-based architectures. 5. Evaluate ethical and societal implications of deploying LLMs in real-world systems.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Natural Language Processing Components of NLP: Syntax, Semantics, Pragmatics, Text Preprocessing: Tokenization, Lemmatization, POS Tagging, Stopword Removal, Language Modeling: N-gram Models, Smoothing, Word Embeddings: Word2Vec, GloVe, FastText, Evaluation Metrics: BLEU, ROUGE, Perplexity	**CLO 1**	**9**
UNIT II		
Traditional NLP and Classical Models Text Classification and Sentiment Analysis using Naive Bayes, SVM, Named Entity Recognition (NER), POS Tagging using CRFs and HMMs, Topic Modeling: LDA and Latent Semantic Analysis, Information Retrieval: TF-IDF, BM25, Machine Translation: Phrase-based SMT	**CLO 2**	**9**
UNIT III		
Deep Learning for NLP Neural Language Models: RNNs, GRUs, LSTMs, Sequence-to-Sequence Models with Attention, Bidirectional Language Modeling, Applications: Text Summarization, Chatbots, Text Generation, Introduction to Transfer Learning in NLP	**CLO 3**	**9**

UNIT IV		
Transformers and Large Language Models Transformer Architecture: Self-Attention, Multi-Head Attention, Positional Encoding, Pretrained LLMs: BERT, GPT, RoBERTa, T5, XLNet, Fine-tuning and Prompt Engineering, Evaluation of LLMs: Zero-shot, Few-shot, In-context Learning, Hands-on with Hugging Face Transformers	**CLO 4**	**9**
UNIT V		
Applications and Responsible Use of LLMs Applications: Conversational Agents, Code Generation, Document QA, Auto-Summarization, LLMs in Production: API Integration, Performance, Optimization, Limitations of LLMs: Hallucination, Bias, Data Leakage, Ethics in NLP: Fairness, Explainability, Data Privacy, Trends: Open-Source LLMs (LLaMA, Mistral, Falcon, Gemma), Multilingual LLMs	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Dan Jurafsky & James H. Martin, Speech and Language Processing, 3rd Edition Draft, 2023 (Available online)
2. Delip Rao & Brian McMahan, Natural Language Processing with PyTorch, O'Reilly, 2019

Reference Books:

1. Jacob Eisenstein, Introduction to Natural Language Processing, MIT Press, 2019
2. Andriy Burkov, Machine Learning Engineering for Production (MLOps), TrueShelf, 2021 (for deploying LLMs)
3. Kevin Lacker, Language Models are Few-Shot Learners (GPT-3 Paper)

Online Resources/E-learning Resources:

1. Natural Language Processing with Classification and Vector Spaces – Coursera (DeepLearning.AI)
2. Hugging Face Course – Transformers and NLP

Name of the Program:	BTECH CSE	Semester: 8	Level: UG
Course Name:	Natural Language Processing and LLM Laboratory	Course Code/ Course Type	UBTCEPE408/PCC
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Basic Programming Skills (Python), Linear Algebra, Basic Machine Learning Concepts

Course Objectives (CO):	**The objectives of Natural Language Processing and LLM Laboratory are:** 1. To introduce students to the foundational techniques of Natural Language Processing (NLP) and Large Language Models (LLM). 2. To provide hands-on experience with text processing, sentiment analysis, and modern NLP architectures like transformers. 3. To develop practical skills in using state-of-the-art models such as GPT-2, GPT-3, and BERT for text generation, classification, and summarization. 4. To explore the applications of NLP and LLMs in real-world problems like chatbots, information retrieval, and machine translation. 5. To emphasize the ethical implications of using NLP models and their limitations in practice.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Implement basic text processing techniques, such as tokenization, POS tagging, and Named Entity Recognition (NER). 2. Build NLP pipelines using popular libraries such as spaCy, NLTK, and Hugging Face Transformers. 3. Understand and apply transformer-based architectures like BERT, GPT, and T5 to solve various NLP tasks. 4. Create language models and fine-tune them for tasks like text classification, translation, and summarization. 5. Evaluate the performance of NLP models and address ethical concerns related to NLP and LLMs.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Text Preprocessing and Tokenization	1, 2	Implement text preprocessing steps (removal of stop words, stemming, lemmatization) using libraries like NLTK and spaCy.	CLO 1	4
2	Part-of-Speech (POS) Tagging and Named Entity Recognition (NER)	3	Use spaCy to perform POS tagging and NER on sample text data (e.g., news articles).	CLO 1	2
3	Word Embeddings (Word2Vec / GloVe)	4	Train and visualize word embeddings using Gensim's Word2Vec and GloVe embeddings.	CLO 2	2

4	Sentiment Analysis	5	Build a sentiment analysis model using Naive Bayes or deep learning techniques (LSTM or BERT) on movie reviews or Twitter data.	CLO2	2
5	Text Classification with Traditional Machine Learning	6, 7	Apply text classification techniques using TF-IDF and Naive Bayes or SVM classifiers on a labeled text dataset.	CLO3	4
6	Introduction to Transformer Networks	8, 9	Understand and implement the basic transformer architecture (like BERT) for text classification tasks.	CLO 3	4
7	Text Generation using GPT-2	10	Use Hugging Face Transformers to generate text using a pretrained GPT-2 model.	CLO 4	2
8	Question Answering with BERT	11	Implement a simple question-answering system using a BERT model on a given text.	CLO 4	2
9	Machine Translation using Transformer Models (T5 or MarianMT)	12, 13	Implement a basic machine translation pipeline using a pre-trained MarianMT model for translation between languages.	CLO 5	4
10	Fine-tuning Large Language Models	14, 15	Fine-tune a pre-trained GPT-2 or BERT model on a custom dataset for a specific NLP task (e.g., text summarization or dialogue generation).	CLO5	4

Learning Resources:

Text Books:

1. "Speech and Language Processing" by Daniel Jurafsky and James H. Martin – Pearson
2. "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper – O'Reilly Media

Reference Books:

1. "Hands-On Natural Language Processing with Python" by Rajendra Awasar – Packt Publishing
2. "Deep Learning for Natural Language Processing" by Palash Goyal, Sumit Pandey, Karan Jain – Springer
3. "Neural Network Methods in Natural Language Processing" by Yoav Goldberg – Morgan & Claypool Publishers

Online Resources/E-learning Resources:

1. Coursera - Natural Language Processing Specialization by DeepLearning.AI: https://www.coursera.org/specializations/natural-language-processing
2. Hugging Face Transformers Documentation: https://huggingface.co/docs/transformers/

Name of the Program:	BTECH CSE	Semester: 8	Level: UG
Course Name:	Project Phase II	Course Code/ Course Type	UBTCE409
Course Pattern:	2024	Version	1.3

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	6	-	6	12	100	-	100

Pre-Requisite:

1. Basics of Software Engineering and Computer Programming Concepts
2. Basics of Programming Language such as C, MATLAB, Python

Course Objectives (CO):	**The objectives of Project Phase II are:** 1. To comprehend the Product Development Process 2. To plan for various activities of the major project and channelize the work towards product development 3. To implement a technical solution using appropriate platforms and tools 4. To enhance research, documentation, and publication capabilities 5. To demonstrate ethical, societal, and professional responsibilities during development
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Comprehend, plan and execute a complete real-world project research outcomes. 2. Design innovative solutions using appropriate hardware/software platforms. 3. Prepare structured project documentation and technical reports 4. Demonstrate the implemented system and validate the results 5. Publish and present the work in reputed journals/conferences

Course Contents/Syllabus:

Sr. No.	Descriptors/Topics	Week Number	CLO	Hours
1	Guide allotment, application for sponsorship/internship, finalization of topic and platform, project planning	1, 2	CLO 1	24
2	Literature review, finalization of methodology and specifications, Review 1	3, 4, 5	CLO 2	36
3	Exploration of tools, implementation of block design, system flow validation, Review 2	6, 7, 8, 9	CLO 3	48
4	Module simulation and integration on selected platform, performance testing	10, 11, 12	CLO 4	36
5	Project report writing, copyright/paper publication, final demonstration and review	13, 14, 15	CLO 5	36
Total Hours		**180**		

Name of the Program:	BTECH CSE	Semester: 8	Level: UG
Course Name:	Virtual Reality	Course Code/ Course Type	UBTCE801
Course Pattern:	2025	Version	1.0

Assessment Scheme					Teaching Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	-	2	2	2	25	-	25

Pre-Requisite:

1. Basic programming knowledge
2. Interest in game design or immersive technologies

Course Objectives (CO):	**The objectives of Virtual reality are:** 1. To introduce the fundamental principles of Virtual Reality (VR) including hardware, software, and design considerations. 2. To explain how human perception and interaction influence the development of VR experiences 3. To develop skills in using VR development tools (Unity3D) for creating immersive content. 4. To understand and apply best practices in VR storytelling, environment design, and user engagement 5. To evaluate emerging applications of VR in entertainment, education, healthcare, and beyond
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Describe how virtual reality systems work, including the role of headsets, motion tracking, and rendering 2. Analyze how human sensory and cognitive systems affect VR experience quality and comfort 3. Build simple interactive VR applications using Unity3D and C. 4. Design user-friendly VR interfaces and interactive environments. 5. Assess the impact and potential of VR across various industries and propose innovative VR solutions.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Virtual Reality History and evolution of VR, Components of VR systems: HMDs, controllers, tracking, Types of VR: immersive, non-immersive, augmented, VR industry overview and future trends	**CLO 1**	**6**
UNIT II		
The Hardware and Software of VR Technical architecture: displays, optics, tracking sensors, Frame rates, field of view, latency and their impact, Operating systems and SDKs for VR, Introduction to Unity3D as a VR development platform	**CLO 2**	**6**
UNIT III		
Human Perception in VR Visual perception: stereoscopy, depth cues, motion sickness, Audio perception and spatial audio, Interaction design principles, Ergonomics and user comfort in VR environments	**CLO 3**	**6**

UNIT IV		
Unity Development for VR Introduction to Unity3D interface and components, Scene creation and VR object interactions, Scripting with C for event-driven interaction, UI elements and teleportation mechanics	**CLO 4**	**6**
UNIT V		
Security, I/O and Virtualization Case studies in VR: education, training, simulation, therapy, Ethical and social implications of immersive technology, Career pathways and industry certifications , Final project: Design and prototype a VR application.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. 1. "Understanding Virtual Reality: Interface, Application, and Design" by William R. Sherman and Alan B. Craig

Reference Books:

1. "Learning Virtual Reality" by Tony Parisi
2. "Unity Virtual Reality Projects" by Jonathan Linowes
3. "Augmented Human: How Technology Is Shaping the New Reality" by Helen Papagiannis

Online Resources/E-learning Resources:

1. Virtual Reality