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

Artificial Intelligence and Data Science
(Batch-2024-2028)

School of Engineering and Technology

Effective from

Academic Year 2024-25 Program Structure

April Version

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	15	14	14	12	7	7	75
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**	**20**	**21**	**21**	**21**	**21**	**21**	**167**

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Pimpri Chinchwad University
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PCET'S

PIMPRI CHINCHWAD UNIVERSITY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CSE AI AND DATA SCIENCE

B.Tech CSE (AI and Data Science)

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	2	-	1	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	50	-	-	50
ACUHV201 / ACCOI 201	AC	UHV II: Understanding Harmony / Constitution of India	2	-	-	-	2	50	-	-	50
Total			18	5	1	20	29	400	300	100	800

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-I: German
UFL201 B	Foreign Language-I: Japanese

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	PCC	Web Development Using Django (MOOC B3)	-	-	2	2	2	25	-	25	50
MOOCCE402	PCC	Foundations of Cybersecurity in Linux (MOOC B4)	-	-	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-II: German
UFL202 B	Foreign Language-II: Japanese

SEMESTER - V

Course Code	Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	Credits	Hrs	CIA	ESA	PR/ OR	Total
UBTDS319	PCC	Theory of Computation	2	-	1	3	3	40	60	-	100
UBTDS320	PCC	Artificial Intelligence Techniques	3	-	-	3	3	40	60	-	100
UBTDS321	PCC	Artificial Intelligence Techniques Lab	-	1	-	1	2	25	-	25	50
UBTDSPE319 / UBTD-SPE321	PEC	Program Elective I	3	-	-	3	3	40	60	-	100
UBTDSPE320 / UBTD-SPE322	PEC	Program Elective I Lab	-	1	-	1	2	25	-	25	50
UBTDS322	PCC	Data Science and Analytics	2	-	-	2	2	20	30	-	50
UBTDS323	PCC	Data Science and Analytics Lab	-	1	-	1	2	25	2	25	50
–	MIN	Multidisciplinary Minor - 2	2	-	-	2	2	20	30	-	50
MOOCDS501	PCC	Agile Project Management with Jira (MOOC B5)	-	-	2	2	2	25	-	25	50
MOOCDS502	PCC	Foundations of Blockchain and Java EE (MOOC B6)	-	-	2	2	2	25	-	25	50
UBTDS324	PROJ	Technical Seminar CSE AIDS	-	-	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
UBTDSPE319 & UBTDSPE321 – Program Elective-I			
UBTDSPE319	Data Communication and Computer Networking	UBTDSPE321	Foundation of Cloud Computing
UBTDSPE320 & UBTDSPE322 - Program Elective-I			
UBTDSPE320	Data Communication and Computer Networking Lab	UBTDSPE322	Foundation of Cloud Computing Lab

Foreign Language –III for Semester-V

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

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
UBTDS307	PCC	Data Modeling and Visualization	3	-	-	3	3	40	60	-	100
UBTDS308	PCC	Data Modeling and Visualization Lab	-	1	-	1	2	25	-	25	50
UBTDS309	PCC	Machine Learning Techniques	3	-	-	3	3	40	60	-	100
UBTDS310	PCC	Machine Learning Techniques Lab	-	1	-	1	2	25	-	25	50
UBTDSPE305/ UBTD-SPE307	PEC	Program Elective II	3	-	-	3	3	40	60	-	100
UBTDSPE306/ UBTD-SPE308	PEC	Program Elective II Lab	-	1	-	1	2	25	-	25	50
UBTDSPE309/ UBTD-SPE310	PEC	Program Elective III	3	-	-	3	3	40	60	-	100
MOOCDS601	PCC	System Software (MOOC B7)	-	-	2	2	2	25	-	25	50
MOOCDS602	PCC	Redhat Openstack Administration (MOOC B8)	-	-	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 / Logical Reasoning / Environmental Values	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
UBTDSPE305 & UBTDSPE307 – Program Elective-II			
UBTDSPE305	Advanced Algorithmic Techniques	UBTDSPE307	Cloud-Integrated AI Systems
UBTDSPE306 & UBTDSPE308-Program Elective-II			
UBTDSPE306	Advanced Algorithmic Techniques Lab	UBTDSPE308	Cloud-Integrated AI Systems Lab
UBTDSPE309 & UBTDSPE310 – Program Elective-III			
UBTDSPE309	Network Security and Cryptography	UBTDSPE310	Big Data Technologies

Foreign Language –IV for Semester-VI

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

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
UBTDS401	PCC	Deep Learning Techniques	3	-	-	3	3	40	60	-	100
UBTDS402	PCC	Deep Learning Techniques Lab	-	1	-	1	2	25	-	25	50
UBTDSPE401/ UBTDSPE403	PEC	Program Elective IV	3	-	-	3	3	40	60	-	100
UBTDSPE402/ UBTDSPE404	PEC	Program Elective IV Lab	-	1	-	1	2	25	-	25	50
–	MIN	Multidisciplinary Minor - 4	2	-	-	2	2	20	30	-	50
MOOCDS701	PCC	Software Testing and AI Automation (MOOC 9)	-	-	2	2	2	25	-	25	50
MOOCDS702	PCC	Solidity Mastery: Foundations to Advanced Smart Contracts Specialization (MOOC 10)	-	-	1	1	2	25	-	25	50
UBTDS403	INT/ OJT	Industry/ International/ Research INTERNSHIP	-	6	-	6	12	100	-	100	200
UBTDS404	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
UBTDSPE401 & MOOCCE701B: Program Elective-IV			
UBTDSPE401	Distributed Computing	UBTDSPE403	Business Intelligence
UBTML304 & UBTDS302-Program Elective-II			
UBTDSPE402	Distributed Computing Lab	UBTDSPE404	Business Intelligence 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
UBTDS405	PCC	Computational Intelligence	3	-	-	3	3	40	60	-	100
UBTDS406	PCC	Computational Intelligence Lab	-	1	-	1	2	25	-	25	50
UBTDS407	RM	Research Methodology & IPR	2	-	-	2	2	20	30	-	50
UBTDS408	PROJ	Major Project–II	-	6	-	6	12	100	-	100	200
UBTDSPE405/ UBTDSPE407	PEC	Program Elective V	3	-	-	3	3	40	60	-	100
UBTDSPE406/ UBTDSPE408	PEC	Program Elective V Lab	-	1	-	1	2	25	-	25	50
MOOCDS801	PEC	IBM DevOps and Software Engineering Professional Certificate (MOOC 11)	-	-	2	2	2	25	-	25	50
MOOCCE802	PCC	Building DApps in Ethereum Blockchain Specialization(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
UBTDSPE405 & UBTDSPE407: Program Elective V			
UBTDSPE405	Quantum Computing	UBTDSPE407	Natural Language Processing
UBTDSPE406 & UBTDSPE408: Program Elective V			
UBTDSPE406	Quantum Computing Lab	UBTDSPE408	Natural Language Processing Lab

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

B.TECH COMPUTER SCIENCE & ENGINEERING (AI & DATA SCIENCE)

SEMESTER-III

Name of the Program:	BTECH CSE - AI&DS	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 - AI&DS	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 of Data Structures & Algorithm 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.	CLO2	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 - AI&DS	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
3	-	-	3	3	40	60	-

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**	**9**
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**	**9**
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**	**9**

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**	**9**
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**	**9**
Total Hours		**45**

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 - AI&DS	Semester: 3	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	Practical1 : Command Line Argument	1	To write a python program that accept command line arguments as input and perform some operations.	CLO1	2
2	Practical 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.	CLO1	2
3	Practical 3: Control Statements	3	To write a python program to Solve problems using decision and looping statements.	CLO2	2
4	Practical 4: Linear Search	4	To write a python program to handle numerical operations using math and random number functions.	CLO3	2

5	Practical 5: Binary Search	5,6	To write a python program to perform linear search & Binary search using strings.	CLO3	4
6	Practical 6: Numerical Operations	7	To write a python program to perform lambda functions and list comprehension.	CLO4	2
7	Practical 7: User Defined Functions	8,9	To write a python program to Create user-defined functions with different types of function arguments with example.	CLO4	4
8	Practical 8: Packages and Modules	10,11	To write a python program to Create packages and import modules from packages to solve real problems.	CLO4	4
9	Practical 9: File Handling Operations	12,13	CTo write a python program to perform File manipulations- open, close, read, write, append and copy from one file to another.	CLO5	4
10	Practical 10: Exception Handling Operations	14,15	To write a python program to handle Exceptions using Python Built-in Exceptions.	CLO5	4

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 - AI&DS	Semester: 3	Level: UG
Course Name:	Digital Logic & Microprocessor	Course Code/ Course Type	UBTCE205A/OE1
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 - AI&DS	Semester: 3	Level: UG
Course Name:	Digital Logic & Microprocessor Lab	Course Code/ Course Type	UBTCE206A/OE1
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 - AI&DS	Semester: 3	Level: UG
Course Name:	Signal System	Course Code/ Course Type	UBTCE205 B
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 - AI&DS	Semester: 3	Level: UG
Course Name:	Signal System Laboratory	Course Code/ Course Type	UBTCE206B/OE1
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	6,7	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	4
7	Practical 7	8,9	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	4
8	Practical 8	10,11	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	4
9	Practical 9	12,13	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	4
10	Practical 10	14,15	Design and implement a complete adaptive visualization solution for a dataset (e.g., health data, IoT, education analytics)	CLO4	4

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 - AI&DS	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	-	1	3	3	40	60	-

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**	**9**
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**	**9**
UNIT III		
Algebraic structures: Algebraic structures, Semi group, Monoid, Group, abelian group, cyclic group, Coding Theory.	**CLO 3**	**9**

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**	**9**
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**	**9**
Total Hours		**45**

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 McGraw- Hill, 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 - AI&DS	Semester: 3	Level: UG
Course Name:	Operating System	Course Code/ Course Type	UBTCE208/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
3	-	-	3	3	40	60	-

Pre-Requisite:

1. Computer Organization and Architecture
2. Fundamentals of Data Structures

Course Objectives (CO):	**The objectives of Operating System are:** 1. To introduce basic concepts and functions of modern operating systems. 2. To comprehend the concept of process, thread management and scheduling. 3. To learn the concept of concurrency control. 4. To study various Memory Management techniques. 5. To know the concept of I/O and File management.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Comprehend the role of Modern Operating Systems. 2. Apply the concepts of process and thread scheduling. 3. Apply the concept of process synchronization, mutual exclusion and the deadlock. 4. Apply the concepts of various memory management techniques. 5. Make use of concept of I/O management and File system.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Overview Of Operating System : Operating System Objectives and Functions, The Evolution of Operating Systems, Developments Leading to Modern Operating Systems, Virtual Machines, Introduction to Linux OS, BASH Shell scripting: Basic shell commands.	**CLO 1**	**9**
UNIT II		
Process Management: Process: Concept of a Process, Process: Concept of a Process, Process States, Process Description, Process Control Threads: Processes and Threads, Concept of Multithreading, Types of Threads, Thread programming Using Pthreads. Scheduling: Types of Scheduling, Scheduling Algorithms, First Come First Served, Shortest Job First, Priority, Round Robin.	**CLO 2**	**9**
UNIT III		
Concurrency Control: Process/thread Synchronization and Mutual Exclusion: Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Operating System Support (Semaphores and Mutex). Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem, Inter-process communication (Pipes, Shared Memory). Deadlock: Principles of Deadlock, Deadlock Modeling, and Strategies to deal with deadlock: Prevention, Avoidance, Detection and Recovery. Example: Dining Philosophers Problem / Banker's Algorithm.	**CLO 3**	**9**

UNIT IV		
Memory Management: Memory Management: Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Page table structure, Segmentation Virtual Memory: Background, Demand Paging, Page Replacement (FIFO, LRU, Optimal), Allocation of frames, Thrashing.	**CLO 4**	**9**
UNIT V		
Input/Output And File Management: I/O Management and Disk Scheduling: I/O Devices, Organization of the I/O Function, I/O Buffering, Disk Scheduling (FIFO, SSTF, SCAN, C-SCAN, LOOK, C-LOOK). File Management: Overview-Files and File Systems, File structure. File Organization and Access, File Directories, File Sharing, Record Blocking, Secondary Storage Management.	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition,2014, ISBN-10: 0133805913 ISBN-13: 9780133805918.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons, Inc., 9th Edition,2012, ISBN 978-1-118-06333-0
3. Das, Sumitabha, UNIX Concepts and Applications, TMH, ISBN-10: 0070635463, ISBN-13: 978- 0070635463, 4th Edition.

Reference Books:

1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN- 10: 0596009526, ISBN-13: 978-0596009526
2. Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition.

Online Resources/E-learning Resources:

1. https://www.coursera.org/courses?query=operating
2. https://www.scaler.com/topics/course/free-operating-system-course/

Name of the Program:	BTECH CSE - AI&DS	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
-	2	-	2	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 - AI&DS	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	50	-	-	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:	BTECH CSE - AI&DS	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	50	-	-	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:	BTECH CSE - AI&DS	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	50	-	-	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, and et al: 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 - AI&DS	Semester: 3	Level: UG
Course Name:	UHV-II: Understanding Harmony	Course Code/ Course Type	ACUHV201/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	50	-	-	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. Menninger"s 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

COURSE SYLLABUS

B.TECH COMPUTER SCIENCE & ENGINEERING (AI & DATA SCIENCE)

SEMESTER-IV

Name of the Program:	BTECH CSE - AI&DS	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 - AI&DS	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 & DML commands.	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	11,12	Implementing Operations on relations using PL / SQL.	CLO5	4
12	Practical 12	13,14	Implementing Operations on relations using PL / SQL.	CLO5	4
13	Practical 13	15	Mini Project /Task	CLO 1,2,3,4,5	2

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 - AI&DS	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 — IIT Kharagpur
2. https://onlinecourses.nptel.ac.in/noc2

Name of the Program:	BTECH CSE - AI&DS	Semester: 4	Level: UG
Course Name:	Java Programming Laboratory	Course Code/ Course Type	UBTCE217/VSEC
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	Practical 1	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	Develop 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	12,13	Develop a Program to demonstrate Layout managers.	CLO5	4
11	Mini Project	14,15	Develop a Project using java.	CLO5	4

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, IIT Kharagpur
2. 2. https://onlinecourses.nptel.ac.in/noc22-cs47/preview

Name of the Program:	BTECH CSE - AI&DS	Semester: 4	Level: UG
Course Name:	Project Based on Digital and Technological Solutions	Course Code/ Course Type	UBTCE218/CEP
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	2	25	-	25

Pre-Requisite:

1. Basic knowledge of English

Course Objectives (CO):	**The the objective of Project Based on Digital and Technological Solutions are:** 1. Gain an understanding of emerging digital technologies and their potential applications in addressing societal challenges 2. Apply design thinking methodologies to identify user needs, define project requirements, and develop innovative solutions 3. Develop technical skills in software development, data analysis, and digital prototyping thinking power 4. Collaborate effectively in interdisciplinary teams to design, implement, and evaluate digital solutions 5. Demonstrate proficiency in project management techniques, including planning, budgeting, and resource allocation
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Gain an understanding of emerging digital technologies and their potential applications in addressing societal challenges 2. Apply design thinking methodologies to identify user needs, define project requirements, and develop innovative solutions 3. Develop technical skills in software development, data analysis, and digital prototyping 4. Collaborate effectively in interdisciplinary teams to design, implement, and evaluate digital solutions 5. Demonstrate proficiency in project management techniques, including planning, budgeting, and resource allocation

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Digital Innovation Overview of course objectives, expectations, and project guidelines. Introduction to design thinking and user-centered design principles. Case studies of innovative digital solutions and their impact	**CLO 1**	**10**
UNIT II		
Needs Assessment and Solution Design Methods for conducting user research and defining project requirements. Ideation and concept generation techniques for digital solutions. Prototyping and user testing methodologies	**CLO 2**	**10**

UNIT III		
Technology Selection and Development Overview of emerging digital technologies, including AI, IoT, and blockchain. Introduction to programming languages and development frameworks. Hands-on workshops on software development and digital prototyping tools	**CLO 3**	**10**
UNIT IV		
Project Planning and Management Project scoping, goal setting, and stakeholder analysis. Techniques for project planning, scheduling, and risk management. Budgeting and resource allocation for digital innovation projects	**CLO 4**	**10**
UNIT V		
Implementation and Testing Agile development methodologies and iterative prototyping. Quality assurance and testing strategies for digital solutions. Iterative feedback and refinement based on user testing	**CLO 5**	**10**
Evaluation and Impact Assessment Methods for evaluating the usability, effectiveness, and scalability of digital solutions. Data analysis techniques for measuring project outcomes and impact. Documentation and reporting of project findings and recommendation	**CLO 6**	**10**
Total Hours		**30**

Assessment

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 solution (20%)

Name of the Program:	BTECH CSE - AI&DS	Semester: 4	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 - AI&DS	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 - AI&DS	Semester: 4	Level: UG
Course Name:	Internet of Things	Course Code/ Course Type	UBTCE221A
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**	**9**
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**	**9**
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 - AI&DS	Semester: 4	Level: UG
Course Name:	Internet of Things Laboratory	Course Code/ Course Type	UBTCE221B/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. 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 - AI&DS	Semester: 4	Level: UG
Course Name:	Digital Image Processing	Course Code/ Course Type	UBTCE222A/OE-II
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 - AI&DS	Semester: 4	Level: UG
Course Name:	Digital Image processing Laboratory	Course Code/ Course Type	UBTCE222B/OE-II
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 - AI&DS	Semester: 4	Level: UG
Course Name:	Web Development Using Django	Course Code/ Course Type	MOOCCE401/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	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 - AI&DS	Semester: 4	Level: UG
Course Name:	Foundations of Cyber security in Linux	Course Code/ Course Type	MOOCCE402/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	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:	BTECH CSE - AI&DS	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**	**10**
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**	**9**
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**	**9**

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**	**9**
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**	**8**
Total Hours		**45**

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:	BTECH CSE - AI&DS	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:	BTECH CSE - AI&DS	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:

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, and et al: 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 - AI&DS	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. Menninger's 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

COURSE SYLLABUS

B.TECH COMPUTER SCIENCE & ENGINEERING (AI & DATA SCIENCE)

SEMESTER-V

Name of the Program:	BTECH CSE - AI&DS	Semester: 5	Level: UG
Course Name:	Theory of Computation	Course Code/ Course Type	UBTDS301/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
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**	**9**
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**	**9**
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**	**9**

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**	**9**
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**	**9**
Total Hours		**45**

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 - AI&DS	Semester: 5	Level: UG
Course Name:	Artificial Intelligence Techniques	Course Code/ Course Type	UBTDS302/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. Programming in C/C++ or Python
2. Data Structures and Algorithms
3. Discrete Mathematics / Logic

Course Objectives (CO):	**The objectives of Artificial Intelligence Techniques are:** 1. Understand the structure and behavior of intelligent agents 2. Apply various search techniques for problem-solving in AI 3. Represent knowledge using logic and perform inference using reasoning methods 4. Analyze and develop AI planning systems 5. Demonstrate the architecture of expert systems and fuzzy-based reasoning
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Formulate AI problems using appropriate search algorithms and evaluate their efficiency 2. Implement propositional and first-order logic for knowledge representation 3. Solve planning problems using STRIPS and other AI planning techniques 4. Design simple expert systems incorporating rule-based and fuzzy logic 5. Relate AI techniques to real-world domains like robotics, NLP, and healthcare

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Artificial Intelligence: Definition and Goals of AI: , History and Milestones in AI, Strong vs Weak AI, Symbolic vs Statistical AI Turing Test, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics.	**CLO 1**	**9**
UNIT II		
Problem Formulation: States, Goals, Actions, Transition Models, Uninformed Search Algorithms: BFS, DFS, Uniform Cost Search, Depth-Limited Search, Iterative Deepening, Informed Search Algorithms: Best-First Search, A* Search, Heuristics (Admissibility, Consistency), Game Playing: Minimax, Alpha-Beta Pruning, Constraint Satisfaction Problems.	**CLO 2**	**9**

UNIT III		
Knowledge Representation and Reasoning: Propositional Logic: Syntax, Semantics, Inference, First Order Logic (FOL): Syntax, Semantics, Quantifiers, Forward and Backward Chaining, Resolution and Unification, Knowledge-Based Agents and Rule-Based Systems.	**CLO 3**	**9**
UNIT IV		
Planning and Decision Making: Classical Planning: STRIPS, Planning Graphs, Forward vs Backward State-Space Search, Bayes Theorem, Certainty factors, Dempster-Shafer Theory, Bayesian Belief Networks.	**CLO 4**	**9**
UNIT V		
Expert Systems and Applications: Structure of Expert Systems: Knowledge Base, Inference Engine, Development Life Cycle of Expert Systems, Case Studies: MYCIN, DENDRAL, Fuzzy Logic Basics: Fuzzy Sets, Membership Functions, Fuzzy Inference Systems, Applications in Robotics, Healthcare, Finance, NLP.	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig, Pearson Education
2. Artificial Intelligence by Elaine Rich, Kevin Knight, Shivashankar B. Nair, Tata McGraw-Hill

Reference Books:

1. Artificial Intelligence by George F. Luger, Pearson
2. Introduction to Artificial Intelligence by Wolfgang Ertel, Springer
3. Intelligent Systems: Principles, Paradigms and Pragmatics by Robert J. Schalkoff

Online Resources/E-learning Resources:

1. NPTEL Course on Artificial Intelligence by IIT Madras: https://nptel.ac.in/courses/106105079
2. AI For Everyone – Coursera by Andrew Ng, Deeplearning.ai: https://www.coursera.org/learn/ai-for-everyone

Name of the Program:	BTECH CSE - AI&DS	Semester: 5	Level: UG
Course Name:	Artificial Intelligence Techniques Laboratory	Course Code/ Course Type	UBTDS303/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
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Control Structures & Functions in Python/Java
2. Familiarity with Search Algorithms
3. Basic OOP Concepts

Course Objectives (CO):	**The objectives of Artificial Intelligence Techniques Laboratory are:** 1. Implement AI problem-solving techniques such as uninformed and informed search 2. Simulate intelligent agent behaviors through basic programming 3. Develop knowledge-based reasoning systems using propositional and first-order logic 4. Apply AI planning and rule-based systems in simulations 5. Demonstrate fuzzy inference and basic expert systems for decision-making
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Write programs to solve classical AI problems using search algorithms 2. Simulate game-playing strategies using adversarial algorithms like Minimax 3. Represent knowledge using logic and implement forward/backward chaining 4. Create fuzzy logic–based controllers using defined rule sets 5. Design and test simple expert systems with inference engines

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical 1	1	1. Write a program to solve "Water Jug Problem".	CLO1	2
2	Practical 2	2	2. Implement Breadth-First and Depth-First search for solving puzzles (e.g., 8-puzzle, maze navigation).	CLO2	2
3	Practical 3	3	Solve the path-finding problem with heuristics (e.g., Manhattan or Euclidean)	CLO2	2
4	Practical 4	4	Solve N-Queens, Sudoku, or Map Coloring using backtracking with forward checking.	CLO3	2
5	Practical 5	5	Implement 2-player game like Tic-Tac-Toe or Connect 4 using Minimax.	CLO3	2
6	Practical 6	6,7	Encode knowledge base and evaluate queries using truth table or resolution method.	CLO4	4

7	Practical 7	8,9	Write a program to calculate Certainty Factors.	CLO4	4
8	Practical 8	10,11	Implement Bayes Theorem to computes the posterior probability.	CLO5	4
9	Practical 9	12,13	Use IF-THEN rules to simulate expert systems like medical diagnosis.	CLO5	4
10	Practical 10	14,15	Simulate a fuzzy controller (e.g., fan speed or temperature control)	CLO5	4
Total Hours					**30**

Learning Resources:

Text Books:

1. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig, Pearson
2. Artificial Intelligence by Elaine Rich, Kevin Knight, Shivashankar B. Nair, McGraw-Hill

Reference Books:

1. Prolog Programming for Artificial Intelligence by Ivan Bratko
2. Artificial Intelligence by George F. Luger, Pearson
3. AI Algorithms, Data Structures, and Idioms in Prolog, Lisp, and Java by George F. Luger

Online Resources/E-learning Resources:

1. NPTEL Lab-based AI Programming Course
2. AI Projects on GitHub – aima-python

Name of the Program:	BTECH CSE - AI&DS	Semester: 5	Level: UG
Course Name:	Data Communication & Computer Networking	Course Code/ Course Type	UBTDSPE301/PEC-I
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. Computer Fundamentals
2. Digital Electronics (binary, signals, encoding)
3. Operating Systems (basic networking concepts)

Course Objectives (CO):	**The objectives of Data Communication & Computer Networking are:** 1. Understand the fundamental components, signals, and transmission aspects of data communication systems 2. Explain the OSI and TCP/IP models and the functions of each layer, focusing on the physical layer concepts including encoding, transmissions, and conversions 3. Analyze and implement protocols for reliable data link operations including error detection, flow control, and media access 4. Design and troubleshoot network layer configurations using suitable addressing, subnetting, and routing algorithms and protocols 5. Evaluate and apply concepts in transport and application layer protocols, and assess the impact of emerging trends and fundamental security in networking
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Describe and distinguish among various signal types, transmission modes, impairments, and fundamental communication limits 2. Illustrate the architecture and operations of the OSI/TCP-IP models, and demonstrate understanding of physical layer encoding, conversions, and transmission media 3. Apply data link layer protocols for error detection/correction, flow control, and demonstrate media access techniques in simulated or design scenarios 4. Solve practical problems related to IP addressing, subnetting, routing, and configuration of layer 3 protocols 5. Compare transport and application layer protocols, explain flow and congestion control, and differentiate among networking security techniques and emerging trends

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Fundamentals of Data Communication: Components of a data communication system, Types of signals: Analog vs Digital, Transmission impairments: Attenuation, Noise, Distortion, Data rate limits: Nyquist and Shannon Theorems, Transmission modes: Simplex, Half-duplex, Full-duplex	**CLO 1**	**9**
UNIT II		
Physical Layer and OSI Overview: Physical Layer and OSI Overview): OSI reference model and TCP/IP model: architecture, layer functions, encapsulation, addressing, encoding methods: NRZ, Manchester, analog-to-digital conversion: sampling, quantization, PCM, digital-to-analog conversion: ASK, FSK, PSK, signal bandwidth and data rate relationship, transmission media: twisted pair, coaxial cable, optical fiber, wireless, line configuration: point-to-point, multipoint, physical topology: mesh, star, bus, ring, hybrid, switching techniques: circuit, packet, message switching	**CLO 2**	**9**
UNIT III		
Data Link Layer: framing and error detection: VRC, LRC, checksum, CRC, error correction: Hamming code, redundancy concepts, flow control mechanisms: stop-and-wait, sliding window protocols, medium access control protocols: ALOHA, CSMA/CD, CSMA/CA, token passing, polling, Ethernet IEEE 802.3: frame structure, operation principles, switches vs hubs, link-layer addressing: MAC addresses, overview of HDLC and PPP, LAN and WAN standards	**CLO 3**	**9**
UNIT IV		
Network Layer: IPv4 and IPv6 addressing: structure, address types, notations, subnetting and CIDR: concepts, calculations, routing algorithms: distance vector, link state (Dijkstra), Bellman-Ford, shortest path, flooding, broadcast, multicast, hierarchical routing, routing protocols: RIP, OSPF, BGP, ICMP, ARP, DHCP: functions and operation, datagram vs virtual-circuit switching, NAT basics, fragmentation and reassembly	**CLO 4**	**9**
UNIT V		
Transport, Session, Presentation, Application Layers: transport layer protocols: TCP, UDP, ports and sockets, TCP flow and congestion control: sliding window, three-way handshake, slow start, introduction to session and presentation layer responsibilities, data formatting, encryption basics, application layer protocols: HTTP, FTP, DNS, SMTP, POP, IMAP, Quality of Service: metrics, mechanisms, scheduling, introduction to firewalls and basic network security concepts, emerging concepts: SDN, MPLS, cloud networking basics	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Data and Computer Communications by William Stallings, Pearson
2. Computer Networking: A Top-Down Approach by Kurose & Ross, Pearson

Reference Books:

1. Data Communications and Networking by Behrouz A. Forouzan, McGraw-Hill
2. Computer Networks by Andrew S. Tanenbaum and David Wetherall
3. Communication Networks: Fundamental Concepts and Key Architectures by Alberto Leon-Garcia

Online Resources/E-learning Resources:

1. NPTEL: Computer Networks by IIT Kharagpur
2. Cisco Networking Academy Courses

Name of the Program:	BTECH CSE - AI&DS	Semester: 5	Level: UG
Course Name:	Data Communication & Computer Networking Laboratory	Course Code/ Course Type	UBTDSPE302/PEC-I
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
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Python Programming Language

Course Objectives (CO):	**The objectives of Data Communication & Computer Networking Laboratory are:** 1. Simulate and configure basic network topologies using Packet Tracer 2. Implement routing protocols and subnetting techniques 3. Configure services like DHCP, NAT, DNS, and VLANs on simulated networks 4. Analyze network behavior using tools like ping, traceroute, and Wireshark 5. Apply access control mechanisms and security configurations in network design
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Design and simulate LAN and WAN network scenarios using simulation tools 2. Apply static and dynamic routing protocols in multi-router environments 3. Configure and test network services such as DHCP and NAT 4. Use diagnostic tools to evaluate network performance and connectivity 5. Implement access lists and security policies in simulated environments

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical 1	1	Create a LAN with switches, routers, and PCs, Assign IP addresses and verify connectivity using ping	CLO1	2
2	Practical 2	2	Connect multiple routers and configure routing tables	CLO2	2
3	Practical 3	3	Configure RIP and OSPF; observe routing table changes	CLO2	2
4	Practical 4	4	Divide a class C network into multiple subnets, Implement subnet plan in a simulated network	CLO3	2
5	Practical 5	5	Use switches and routers to segment networks	CLO3	2
6	Practical 6	6,7	Set up a DHCP server to allocate dynamic IPs	CLO4	4

7	Practical 7	8,9	Implement Static and Dynamic NAT using a router	CLO4	4
8	Practical 8	10,11	Use Standard and Extended ACLs to permit/deny traffic	CLO5	4
9	Practical 9	12,13	Set up SSID, WPA2 security; simulate mobile client access	CLO5	4
10	Practical 10	14	Configure DNS mappings and simulate HTTP access	CLO5	2
11	Practical 11	15	Capstone Project (Smart Devices Case Study)	CLO5	2
Total Hours					**30**

Learning Resources:

Text Books:

1. Data and Computer Communications by William Stallings
2. Computer Networking: A Top-Down Approach by Kurose & Ross

Reference Books:

1. Data Communications and Networking by Behrouz A. Forouzan
2. Cisco Networking Essentials by Troy McMillan
3. Practical Packet Tracer Labs by Gary A. Donahue (Cisco Simulation Support)

Online Resources/E-learning Resources:

1. Cisco Packet Tracer Labs (NetAcad)
2. NPTEL: Computer Networks Lab – Simulations

Name of the Program:	BTECH CSE - AI&DS	Semester: 5	Level: UG
Course Name:	Foundation Cloud Computing	Course Code/ Course Type	UBTDSPE303/PEC-I
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. Computer Architecture and Virtualization Basics
2. Operating System Concepts (processes, memory)
3. Awareness of Internet Services and Protocols

Course Objectives (CO):	**The objectives of Foundation Cloud Computing are:** 1. Understand the basic concepts, characteristics, and service models of cloud computing 2. Explain virtualization technologies and their significance in the cloud environment 3. Describe cloud storage mechanisms and elastic computing models 4. Analyze resource provisioning, billing models, and cloud monitoring techniques 5. Evaluate emerging trends and security issues in cloud systems
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Classify cloud deployment and service models based on application requirements 2. Illustrate the architecture of virtual machines and containers 3. Compare different types of cloud storage and compute services across vendors 4. Analyze cloud billing, cost optimization, and resource scaling strategies 5. Discuss trends such as Edge Computing, Serverless, and Ethical Cloud Design

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Cloud Computing: Definition and Evolution of Cloud Computing, Cloud Characteristics: On-demand, Broad Network Access, Multi-tenancy, Traditional IT vs Cloud Computing, Cloud Service Models: IaaS, PaaS, SaaS, Deployment Models: Public, Private, Hybrid, Community	**CLO 1**	**9**
UNIT II		
Virtualization and Cloud Infrastructure Introduction to Virtualization: Benefits and Limitations, Hypervisors: Type I vs Type II, Virtual Machines vs Containers, Virtual Networking and Storage Concepts, Virtualization in AWS, Azure, and GCP	**CLO 2**	**9**
UNIT III		
Cloud Storage and Computing Services Cloud Storage: Block, File, and Object Storage, Introduction to Storage Services: S3, Google Cloud Storage, Azure Blob, Elastic Computing: AWS EC2, Azure VMs, Google Compute Engine, Serverless Computing: Concept, Advantages, Use Cases, Auto-scaling and Load Balancing Concepts	**CLO 3**	**9**

UNIT IV		
Cloud Platform Services and Cloud Management: Platform-as-a-Service (PaaS) Overview: Elastic Beanstalk, App Engine, Azure Web Apps, Resource Provisioning and Management, Metered Billing and Cost Optimization, Cloud Monitoring and Logging (CloudWatch, Stackdriver, Azure Monitor), Cloud Migration Strategies	**CLO 4**	**9**
UNIT V		
Cloud Trends, Standards, and Future Directions: Open Standards: OpenStack, CloudFoundry, Kubernetes (intro only), Cloud Design Patterns: Scalability, Redundancy, Fault Tolerance, Edge Computing and Fog Computing Overview, Cloud Use Cases: Education, Healthcare, IoT, Smart Cities, Ethical Issues: Vendor Lock-in, Data Ownership, Environmental Impact	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl
2. Cloud Computing: Principles and Paradigms by Rajkumar Buyya

Reference Books:

1. Architecting the Cloud by Michael J. Kavis
2. Cloud Computing Bible by Barrie Sosinsky
3. Cloud Computing: A Practical Approach by Anthony T. Velte, Toby J. Velte, Robert Elsenpeter

Online Resources/E-learning Resources:

1. NPTEL: Introduction to Cloud Computing – IIT Kharagpur
2. AWS Cloud Practitioner Essentials – Free Course

Name of the Program:	BTECH CSE - AI&DS	Semester: 5	Level: UG
Course Name:	Foundation of Cloud Computing Laboratory	Course Code/ Course Type	UBTDSPE304/PEC-I
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
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Virtual Machine Usage (VirtualBox, EC2)
2. Basic CLI (Linux/AWS CLI/Azure CLI)
3. File Management in OS & Web Console Operations

Course Objectives (CO):	**The objectives of Foundation of Cloud Computing Laboratory are:** 1. Configure and manage virtual machines and storage on cloud platforms 2. Use cloud service provider tools (AWS, Azure, GCP) to deploy basic applications 3. Implement cloud services like object storage, serverless functions, and load balancers 4. Monitor resources, set billing alerts, and understand usage metrics 5. Demonstrate secure and optimized use of cloud infrastructure
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Launch virtual machines and connect them using SSH in cloud environments 2. Work with cloud-based object storage systems for file hosting and delivery 3. Deploy and test simple applications using serverless compute services 4. Utilize monitoring tools to observe performance and generate cost estimates 5. Perform basic IAM configurations for access control and resource protection

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Set Up and Explore a Cloud Console (AWS / Azure / GCP)	1	Create a free account, familiarize with dashboard, regions, availability zones	CLO1	2
2	Provision and Connect to a Virtual Machine (EC2 / Azure VM / GCE)	2	Choose OS, set CPU/RAM/storage, connect via SSH	CLO1	2
3	Create and Configure Object Storage (e.g., S3 / Blob / GCS)	3	Create bucket, upload files, set permissions, generate public URLs	CLO2	2

4	Launch a Web Server on a Cloud VM (Apache/Nginx)	4	Install and host a static HTML page using a cloud-based instance	CLO2	2
5	Use Auto-Scaling Groups and Elastic Load Balancers (Conceptual or Live)	5	Demonstrate traffic balancing and instance scalability (demo possible via diagrams)	CLO3	2
6	Implement Identity and Access Management (IAM)	6	Create users/roles/policies and assign permission scopes	CLO3	4
7	Monitor and Log Cloud Resources (e.g., CloudWatch / Azure Monitor)	7	View usage statistics, logs, set alerts for CPU/memory thresholds	CLO4	4
8	Use a CLI Tool for Cloud Management (AWS CLI / Azure CLI / gcloud)	8	Launch, stop, and inspect instances or storage via terminal	CLO4	4
9	Deploy a Serverless Function (Lambda / Azure Function / GCP Function)	9	Write a simple "Hello Cloudör file processing function	CLO5	4
10	Create a Custom Virtual Private Cloud (VPC)	10	Define subnets, security groups, internet gateways (visually or via CLI)	CLO5	04
Total Hours					**30**

Learning Resources:

Text Books:

1. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl
2. Cloud Computing: Principles and Paradigms by Rajkumar Buyya

Reference Books:

1. Architecting the Cloud by Michael J. Kavis
2. Cloud Computing Bible by Barrie Sosinsky
3. Cloud Computing: A Practical Approach by Anthony T. Velte

Online Resources/E-learning Resources:

1. AWS Educate – Free Hands-On Labs
2. Microsoft Learn: Azure Fundamentals Lab Modules

Name of the Program:	BTECH CSE - AI&DS	Semester: 5	Level: UG
Course Name:	Data Science and Analytics	Course Code/ Course Type	UBTDS304/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
2	-	-	2	2	20	30	-

Pre-Requisite:

1. Basics of Statistics & Probability
2. Introduction to Programming (preferably Python)
3. Data Handling using Excel/CSV

Course Objectives (CO):	**The objectives of Data Science and Analytics are:** 1. Recognize and explain the foundational concepts, workflow, and lifecycle of data science and analytics, including the use of R and its core packages. 2. Import, organize, and manipulate various data formats and structures, handling tasks such as cleaning, transformation, and basic exploratory analysis using R. 3. Create and interpret data visualizations and summaries to identify patterns and trends through effective use of R's visualization tools and packages. 4. Apply and analyze statistical methods and simple machine learning models for inference, prediction, and clustering using R. 5. Develop and communicate complete data science solutions by integrating data preparation, analysis, modeling, and reporting in R through practical projects and reproducible reports.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Demonstrate proficiency in working with the R environment, scripts, projects, and basic data structures such as vectors, data frames, and tibbles. 2. Import, clean, and preprocess data from multiple sources (CSV, Excel, text files) and handle missing values and outliers using R functions and packages. 3. Construct and customize a variety of data visualizations (bar charts, histograms, scatterplots, boxplots, line graphs) and perform exploratory data analysis to summarize datasets. 4. Execute and evaluate statistical analyses, hypothesis testing, and model building (regression, classification, clustering), interpreting results with appropriate R functions. 5. Integrate and present a complete data analytics workflow—from data import and EDA

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Data Science and R: What is Data Science, applications, workflow, and lifecycle, installing R and RStudio, exploring the RStudio interface, creating and managing R scripts and projects, understanding data types including numeric, character, logical, and factor, working with variables, operators, and expressions in R, using data structures such as vectors, lists, matrices, arrays, data frames, and tibbles, importing data from CSV, Excel, and text files, exporting data to files, introduction to R packages like 'readr' and 'tibble'.	**CLO 1**	**6**
UNIT II		
Data Manipulation and Visualization: Data cleaning concepts: identifying and handling missing values and outliers, data transformation using dplyr (filter, select, mutate, arrange, summarize), reshaping data (pivot_longer, pivot_wider), data aggregation, introduction to EDA, principles of graphical representation, creating and customizing basic plots (bar, histogram, boxplot, scatterplot, line) with ggplot2.	**CLO 2**	**6**
UNIT III		
Statistical Analysis and Modeling: Descriptive statistics: measures of central tendency and dispersion, frequency tables, visual summaries, probability and probability distributions (normal, binomial), estimation, basic inferential methods: confidence intervals, hypothesis testing (t-test, chi-square, ANOVA), correlation and association analysis, introduction to the role of these concepts in practical data science problems.	**CLO 3**	**6**
UNIT IV		
Data Analytics and Interpretation: Introduction to the modeling process and problem framing, regression analysis (simple and multiple linear regression, interpretation of coefficients), classification concepts (logistic regression, introductory decision trees), model evaluation and validation (train-test split, cross-validation, confusion matrix, ROC, AUC, performance metrics), unsupervised learning: introduction to clustering (K-means, hierarchical), basics of dimensionality reduction (PCA), interpretation of results.	**CLO 4**	**6**
UNIT V		
Model Deployment, Interpretation, and Data Science Best Practices: Overview of model interpretation: understanding feature importance, explaining model outputs, model limitations and common pitfalls, reproducibility and documentation in data science (using reports and markdown in R), introduction to model deployment concepts (how data science models are taken to production, monitoring), introduction to responsible data science: bias and fairness, privacy/ethics, data-driven decision making, overview of collaboration in data science projects, communication of findings to stakeholders.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. "R for Data Science (2nd Edition)" by Hadley Wickham, Mine Çetinkaya-Rundel, and Garrett Grolemund (O'Reilly Media, 2023)
2. Modern Data Science with R (2nd Edition)" by Benjamin S. Baumer, Daniel T. Kaplan, and Nicholas J. Horton (Chapman and Hall/CRC, 2021)

Reference Books:

1. Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python, Book by Andrew Bruce, Peter Bruce, and Peter Gedeck
2. The Art of Data Science by Roger D. Peng and Elizabeth Matsui
3. Hands-On Programming with R by Garrett Grolemund
4. Advanced R by Hadley Wickham

Online Resources/E-learning Resources:

1. Foundations of R Software By Prof. Shalabh, IIT Kanpur
2. R for Data Science Online Book

Name of the Program:	BTECH CSE - AI&DS	Semester: 5	Level: UG
Course Name:	Data Science and Analytics Laboratory	Course Code/ Course Type	UBTDS305/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
-	1	-	1	2	25	-	25

Pre-Requisite:

1. R Programming Fundamentals
2. Descriptive Statistics
3. Data Types and File Handling

Course Objectives (CO):	**The objectives of Data Science and Analytics Laboratory are:** 1. Recognize and describe the R programming environment and basic R syntax for data analysis tasks. 2. Import, explore, and organize diverse datasets, demonstrating skills in data cleaning and preprocessing. 3. Summarize, visualize, and interpret data through descriptive statistics and graphical techniques. 4. Analyze datasets to identify patterns, conduct statistical testing, and justify analytical conclusions. 5. Develop and evaluate regression, classification, and clustering models, integrating results into a cohesive data science workflow.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Demonstrate the ability to operate R and RStudio, execute basic commands, and explain core data structures. 2. Import datasets into R, examine their structure, and perform data cleaning and preprocessing to prepare for analysis. 3. Compute and interpret summary statistics, generate relevant visualizations, and perform feature engineering using R. 4. Analyze data through exploratory techniques and hypothesis testing, interpreting and evaluating results. 5. Build and assess predictive models—regression, classification, or clustering—drawing insightful conclusions and documenting the process in an organized report.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical 1	1	LInstall R and RStudio, explore the interface (console, editor, environment, plots), run simple commands, create and assign variables, use basic data types, and perform basic arithmetic operations.	CLO1	2

2	Practical 2	2	Import a dataset into R, inspect its structure, summarize variable types and distributions, and identify any missing values. *Example datasets: Titanic, California Housing, Iris*	CLO2	2
3	Practical 3	3	Clean and preprocess a new dataset by removing duplicates, handling missing values, and standardizing data formats using appropriate R functions. *Example datasets: Housing Prices, Heart Disease, Students Performance*	CLO2	2
4	Practical 4	4	Generate and interpret descriptive statistics (mean, median, mode, standard deviation), and create basic visualizations such as histograms and scatterplots using R. *Example datasets: Iris, Diabetes, Mall Customers*	CLO3	2
5	Practical 5	5	Perform variable transformation (binning, encoding, scaling) and create new features or derived columns for deeper analysis. *Example datasets: Heart Disease, Superstore Sales, Netflix Movies*	CLO3	2
6	Practical 6	6	Conduct EDA to uncover patterns, correlations, and trends in the data, and visualize the findings with R plotting libraries. *Example datasets: Global Superstore, Students Performance, Boston Housing*	CLO4	2
7	Practical 7	7	Apply statistical tests (e.g., t-test, ANOVA, correlation) in R to answer relevant data-driven questions. *Example datasets: Students Performance, CO_2 Emissions, Retail*	CLO4	2
8	Practical 8	8,9	Build and evaluate a regression model (e.g., linear regression) to predict a numeric variable and interpret the results using R. *Example datasets: Boston Housing, Life Expectancy, California Housing*	CLO5	4
9	Practical 9	10,11	Perform a classification analysis (e.g., logistic regression, decision tree) and assess model accuracy using performance metrics such as confusion matrix or ROC curve in R. *Example datasets: Diabetes, Titanic, Heart Disease*	CLO5	4
10	Practical 10	12,13	Apply a clustering technique such as K-means in R, visualize cluster assignments, and interpret group characteristics. *Example datasets: Mall Customers, Iris, Retail Segmentation*	CLO5	4
Total Hours					**30**

Learning Resources:

Text Books:

1. "R for Data Science (2nd Edition)" by Hadley Wickham, Mine Çetinkaya-Rundel, and Garrett Grolemund (O'Reilly Media, 2023)
2. Modern Data Science with R (2nd Edition)" by Benjamin S. Baumer, Daniel T. Kaplan, and Nicholas J. Horton (Chapman and Hall/CRC, 2021)

Reference Books:

1. Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python, Book by Andrew Bruce, Peter Bruce, and Peter Gedeck
2. The Art of Data Science by Roger D. Peng and Elizabeth Matsui
3. Hands-On Programming with R by Garrett Grolemund
4. Advanced R by Hadley Wickham

Online Resources/E-learning Resources:

1. Swirl – Learn R in R (Interactive R Tutorials inside RStudio)
2. NPTEL: Data Science for Engineers – with R modules

Name of the Program:	BTECH CSE - AI&DS	Semester: 5	Level: UG
Course Name:	Agile Project Management with Jira	Course Code/ Course Type	MOOCDS501/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
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. Ägile Project Management with Jira"by David Harned
2. "Red Hat System Administration III"

Reference Books:

1. Ëssential Scrum: A Practical Guide to the Most Popular Agile Process"by Kenneth S. Rubin.
2. Ägile 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 - AI&DS	Semester: 5	Level: UG
Course Name:	Foundations of Blockchain and Java EE	Course Code/ Course Type	MOOCDS502/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
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. Ënterprise 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 - AI&DS	Semester: 5	Level: UG
Course Name:	Technical Seminar	Course Code/ Course Type	UBTDS306/PROJ
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
-	-	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. Perform literature survey related to the specific topics of interest 2. Evaluate the results of technical work 3. 3. Analyze how to write technical reports

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 - AI&DS	Semester: 5	Level: UG
Course Name:	Foreign Language-III: German	Course Code/ Course Type	UFL301A/AEC
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. 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		
Groß und kleine Gefühle 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 - AI&DS	Semester: 5	Level: UG/PG
Course Name:	Foreign Language-III: Japanese	Course Code/ Course Type	UFL301B/AEC
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	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 - AI&DS	Semester: 5	Level: UG
Course Name:	Aptitude And Logical Reasoning	Course Code/ Course Type	ACALR301/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: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.

COURSE SYLLABUS

B.TECH COMPUTER SCIENCE & ENGINEERING (AI & DATA SCIENCE)

SEMESTER-VI

Name of the Program:	BTECH CSE - AI&DS	Semester: 6	Level: UG
Course Name:	Data Modeling and Visualization	Course Code/ Course Type	UBTDS307/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. Applied Statistical Techniques
2. Introduction to Artificial Intelligence

Course Objectives (CO):	**The objectives of Data Modeling and Visualization are:** 1. To recall the concepts of data visualization to develop charts, maps, tables, and other visual representations of data. 2. To recognize visualization tools to conduct data analysis, especially exploration of an unfamiliar dataset. 3. To apply the concept of interactive dashboards to combine several visualizations into a cohesive and functional whole. 4. To analyze and design features animations techniques. 5. To evaluate various principles of visualization.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Students will be able to understand the basics of plotting techniques. 2. Explain the procedure various data visualization methods. 3. Apply knowledge of various animation types. 4. Analyze data the various principles of visualization. 5. Evaluate how to perform group operations.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Fundamentals of Data Modeling for Visualization: Types of Data: Categorical, Ordinal, Numerical, Temporal, Data Granularity and Hierarchies, Conceptual, Logical, and Analytical Models ,Business Metrics: KPI, Dimensions, Measures, Choosing the Right Aggregation: Sum, Avg, Percent of Total, etc.	**CLO 1**	**9**
UNIT II		
Principles of Visual Encoding: Pre-attentive Attributes: Color, Size, Shape, Position, Data-Ink Ratio and Minimalism in Charts, Visual Perception and Cognitive Load, Common Pitfalls: 3D charts, color misuse, misleading axes, Design for Purpose: Exploration vs Explanation.	**CLO 2**	**9**
UNIT III		
Chart Selection and Visualization Grammar: Visual Mapping of Variables to Chart Types, Univariate Visuals: Histogram, Box Plot, Strip Plot, Bivariate Visuals: Scatterplot, Bar, Line Chart, Multivariate Visuals: Heatmap, Bubble Chart, Parallel Coordinates, Time Series Plots and Seasonality Visualization	**CLO 3**	**9**

UNIT IV		
Visualization Tools and Dashboarding Concepts: Introduction to Tools: Power BI, Tableau, Looker Studio, Importing, Filtering, and Aggregating Data Interactivity: Filters, Slicers, Drilldowns, Tooltips, Dashboard Composition: Layout, KPIs, Design Heuristics, Data Storytelling Elements: Narrative, Context.	**CLO 4**	**9**
UNIT V		
Visual Ethics, Accessibility, and Applications: Avoiding Bias and Misrepresentation, Inclusive Visualization: Colorblind-friendly palettes, screen-reader support, Visualization in Various Domains: Healthcare, Finance, Retail Real-World Case Studies and Pitfalls, Capstone Design Review of Public Dashboards	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Storytelling with Data by Cole Nussbaumer Knaflic
2. Fundamentals of Data Visualization by Claus O. Wilke

Reference Books:

1. The Big Book of Dashboards by Steve Wexler, Jeffrey Shaffer, Andy Cotgreave
2. Information Dashboard Design by Stephen Few
3. Interactive Data Visualization for the Web by Scott Murray

Online Resources/E-learning Resources:

1. NPTEL: Visual Analytics – IIT Roorkee
2. Tableau Public Training Video

Name of the Program:	BTECH CSE - AI&DS	Semester: 6	Level: UG
Course Name:	Data Modeling and Visualization Laboratory	Course Code/ Course Type	UBTDS308/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
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Knowledge of C Programming and DSA

Course Objectives (CO):	**The objectives of Data Modeling and Visualization Laboratory are:** 1. Import, transform, and cleanse datasets using modern BI tools. 2. Create basic and advanced data visualizations for various data types. 3. Design interactive dashboards using filters, slicers, and visual KPIs. 4. Perform time-series and multivariate visual analysis for real-world datasets. 5. Build thematic dashboards that align with analytical objectives and user needs.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Load data into Power BI / Tableau / Looker Studio and perform preprocessing. 2. Create and justify chart types for quantitative and categorical variables. 3. Develop interactive dashboards integrating drill-downs and visual hierarchy. 4. Implement design elements that ensure accessibility and readability. 5. Build full dashboards from real datasets and present insights as stories.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Data Import and Cleansing in Tableau or Power BI	1	Import flat file, apply data types, rename fields, filter nulls	CLO1	2
2	Create Basic Visuals: Bar, Line, and Pie Charts	2	Use appropriate chart types and formatting for 1D and 2D data	CLO1	2
3	Histogram and Boxplot Construction	3	Analyze distribution, outliers, skewness visually	CLO2	2
4	Scatterplots and Bubble Charts	4	Visualize correlation and multivariate relationships	CLO2	2
5	Time Series Visualization	5	Plot trends with rolling averages, highlight seasonality	CLO3	2

6	Heatmaps and Tree Maps	6	Encode multiple dimensions using color/size	CLO3	2
7	Design Interactive Dashboards with Filters and Slicers	7	Add user-driven interactivity using drop-downs, buttons	CLO4	2
8	KPI Cards and Scorecards	8,9	Display dynamic metrics with thresholds and indicators	CLO4	4
9	Drill-down and Hierarchical Visualizations	10,11	Create region → state → city or year → quarter → month navigation	CLO5	4
10	Build a Thematic Dashboard for a Real Dataset	12,13	Complete case: e.g., COVID dashboard, sales performance, stock trends	CLO5	4
11	Mini project	14,15	Mini Project	CLO 1/2/3/4/5	4
Total Hours					**30**

Learning Resources:

Text Books:

1. Storytelling with Data by Cole Nussbaumer Knaflic
2. The Big Book of Dashboards by Steve Wexler, Jeffrey Shaffer, Andy Cotgreave

Reference Books:

1. Fundamentals of Data Visualization by Claus O. Wilke
2. Information Dashboard Design by Stephen Few
3. Data Visualisation: A Handbook for Data Driven Design by Andy Kirk

Online Resources/E-learning Resources:

1. Power BI Guided Learning – Microsoft Learn
2. Tableau Public: Free Certification & Resources

Name of the Program:	BTECH CSE - AI&DS	Semester: 6	Level: UG
Course Name:	Machine Learning Techniques	Course Code/ Course Type	UBTDS309/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. Applied Statistical Techniques
2. Introduction to Artificial Intelligence

Course Objectives (CO):	**The objectives of Machine Learning Techniques are:** 1. Understand the core principles and types of machine learning models. 2. Apply algorithms for supervised and unsupervised learning problems. 3. Implement evaluation techniques and cross-validation for performance analysis. 4. Explore neural network architectures and training methods. 5. Interpret and optimize models using tuning and explainability frameworks.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Identify appropriate learning techniques based on problem characteristics. 2. Apply classification and regression algorithms such as SVM, k-NN, Decision Trees. 3. Use clustering and dimensionality reduction methods like k-Means and PCA. 4. Describe and apply perceptrons and multilayer neural networks. 5. Evaluate model performance using confusion matrices, ROC, and explainability tools.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Foundations of Machine Learning: Machine Learning Paradigms: Supervised, Unsupervised, Reinforcement, Notion of Hypothesis Space, Overfitting, Underfitting, Cost Functions: MSE, Log Loss, Gradient Descent: Batch, Stochastic, Mini-Batch, Bias-Variance Tradeoff	**CLO 1**	**9**
UNIT II		
Supervised Learning–Classification and Regression: Decision Trees: ID3, Gini Index, Information Gain, Pruning, Ensemble Models: Random Forest, AdaBoost, Support Vector Machines: Maximal Margin Classifier, Kernel Trick, k-Nearest Neighbors (k-NN): Distance metrics, Curse of Dimensionality, Evaluation Metrics: Precision, Recall, F1-Score, ROC-AUC	**CLO 2**	**9**

UNIT III		
Unsupervised Learning: Clustering: k-Means (Lloyd's Algorithm), DBSCAN, Hierarchical Clustering (Agglomerative and Divisive), Dimensionality Reduction: Principal Component Analysis (PCA – math derivation), t-SNE, Evaluation: Silhouette Score, Davies-Bouldin Index	**CLO 3**	**9**
UNIT IV		
Neural Networks and Deep Learning Introduction: Perceptron Model: Single-layer learning, Multilayer Perceptron (MLP): Backpropagation Algorithm, Activation Functions: Sigmoid, Tanh, ReLU, Batch Normalization, Dropout, Early StoppingIntroduction to CNNs: Convolution, Pooling, Use Cases	**CLO 4**	**9**
UNIT V		
Model Tuning, Explainability, and Case Studies: Cross-Validation: k-Fold, Stratified Sampling, Hyperparameter Tuning: Grid Search, Random Search, Bayesian Optimization, Model Explainability: SHAP, LIME, Real-World Case Studies: Healthcare prediction, Fraud detection, Image recognition.	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron
2. Understanding Machine Learning: From Theory to Algorithms by Shai Shalev-Shwartz & Shai Ben-David

Reference Books:

1. Pattern Recognition and Machine Learning by Christopher M. Bishop
2. Machine Learning by Tom M. Mitchell
3. The Elements of Statistical Learning by Trevor Hastie, Robert Tibshirani, Jerome Friedman

Online Resources/E-learning Resources:

1. NPTEL: Machine Learning – IIT Kharagpur
2. Google Machine Learning Crash Course

Name of the Program:	BTECH CSE - AI&DS	Semester: 6	Level: UG
Course Name:	Machine Learning Techniques Laboratory	Course Code/ Course Type	UBTDS310/PEC
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
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Basics of Python
2. Basics R Language

Course Objectives (CO):	**The objectives of Design And Analysis of Algorithms Laboratory are:** 1. Understand the core principles and types of machine learning models. 2. Apply algorithms for supervised and unsupervised learning problems. 3. Implement evaluation techniques and cross-validation for performance analysis. 4. Explore neural network architectures and training methods. 5. Interpret and optimize models using tuning and explainability frameworks.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Identify appropriate learning techniques based on problem characteristics. 2. Apply classification and regression algorithms such as SVM, k-NN, Decision Trees. 3. Use clustering and dimensionality reduction methods like k-Means and PCA. 4. Describe and apply perceptrons and multilayer neural networks. 5. Evaluate model performance using confusion matrices, ROC, and explainability tools.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Implement Decision Tree and Random Forest Classifiers	1	Use scikit-learn to train on a classification dataset (e.g., Iris, Titanic), Display tree structure and feature importance	CLO1	2
2	Support Vector Machine for Binary and Multiclass Classification	2	Apply linear and RBF kernel SVM, Visualize decision boundaries	CLO1	2
3	k-Nearest Neighbors for Classification	3	Vary the k parameter, plot accuracy vs k, Analyze distance metrics (Euclidean, Manhattan)	CLO1	2
4	k-Means Clustering and DBSCAN	4	Apply clustering on unlabeled dataset (e.g., Mall Customers), Use silhouette scores and elbow method for evaluation	CLO1	2

5	Principal Component Analysis (PCA)	5	Visualize high-dimensional data in 2D/3D, Compare variance retained with different components	CLO5	2
6	Build and Train a Multilayer Perceptron (MLP) using Keras	6,7	Solve classification using MLP with 2+ hidden layers, Use early stopping and dropout regularization	CLO2	4
7	Hyperparameter Tuning using Grid Search and Randomized Search	8,9	Optimize max_depth, n_estimators, C, gamma using GridSearchCV	CLO4	4
8	Cross-Validation and Performance Evaluation	10,11	Use k-fold CV and report accuracy, precision, recall, F1-score, Create confusion matrix and ROC curve	CLO 4	4
9	Model Explainability using SHAP or LIME	12,13	Interpret feature contributions for tree or logistic regression models	CLO5	4
10	Mini-Project: End-to-End ML Pipeline	14,15	Data loading → preprocessing → model → evaluation → tuning → interpretation, Example domains: disease prediction, customer churn, or sentiment classification	CLO5	4
Total Hours					**30**

Learning Resources:

Text Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron
2. Understanding Machine Learning: From Theory to Algorithms by Shai Shalev-Shwartz & Shai Ben-David

Reference Books:

1. Python Machine Learning by Sebastian Raschka
2. Pattern Recognition and Machine Learning by Christopher Bishop
3. Introduction to Machine Learning with Python by Andreas Müller and Sarah Guido

Online Resources/E-learning Resources:

1. scikit-learn User Guide
2. Kaggle Learn: Machine Learning Track

Name of the Program:	BTECH CSE - AI&DS	Semester: 6	Level: UG
Course Name:	Advanced Algorithmic Techniques	Course Code/ Course Type	UBTDSPE305/ PEC
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 and DSA

Course Objectives (CO):	**The objectives of Advanced Algorithmic Techniques are:** 1. Describe and express performance analysis of various algorithms, Fundamentals of Data Structures and their applications. 2. Explain and demonstrate Divide and Conquer technique to provide solutions for well-known problems like searching, Sorting etc. 3. Discuss Greedy method and solve problems which are based on Greedy method such as Knapsack problem, Single-source Shortest Path, etc. 4. Use Dynamic Programming to solve problems like All Pairs Shortest paths, Travelling Salesperson (TSP), etc. and also compare with Greedy method. 5. Choose Backtracking Algorithms for solving N Queens, Sum of subsets Problems and compare /Contrast with Branch and Bound Technique.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Compare worst-case running time of algorithms and describe the fundamental of algorithmic problems. 2. Describe and apply problem solving techniques such as divide-and- conquer, greedy method, dynamic programming, etc. 3. Apply problem solving Optimization techniques. 4. Compare and contrast among various problem solving techniques. 5. Explain and demonstrate NP- completeness.

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 & Design of Algorithm. Horowitz & 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 - AI&DS	Semester: 6	Level: UG
Course Name:	Advanced Algorithmic Techniques Lab	Course Code/ Course Type	UBTDSPE306/PEC
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
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Knowledge of C Programming and DSA

Course Objectives (CO):	**The objectives of Advanced Algorithmic Techniques Laboratory are:** 1. Describe and express performance analysis of various algorithms, Fundamentals of Data Structures and their applications 2. Explain and demonstrate Divide and Conquer technique to provide solutions for well-known problems like searching, Sorting etc 3. Discuss Greedy method and solve problems which are based on Greedy method such as Knapsack problem, Single-source Shortest Path, etc. 4. Use Dynamic Programming to solve problems like All Pairs Shortest paths, Travelling SalesPerson (TSP), etc. and also compare with Greedy method 5. Choose Backtracking Algorithms for solving N-Queens, Sum of subsets Problems and compare /Contrast with Branch and Bound Technique
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Compare worst-case running time of algorithms and describe the fundamental of algorithmic problems. 2. Describe and apply problem solving techniques such as divide-and- conquer, greedy method, dynamic programming, etc. 3. Apply problem solving Optimization techniques. 4. Compare and contrast among various problem-solving techniques. 5. Explain and demonstrate NP- completeness

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Basic iterative algorithms	1	Basic iterative algorithms GCD algorithm, Fibonacci Sequences, Sequential and Binary Search.	CLO1	2
2	Basic iterative sorting algorithms	2	Basic iterative sorting algorithms: Bubble Sort, selection Sort, Insertion Sort.	CLO1	2
3	Binary Search	3	Binary Search with Divide and conquer approach	CLO2	2
4	Sorting Techniques	4	Merge Sort, Heap sort, Quick Sort, Randomized Quick Sort	CLO2	2
5	Selection Problem	5	Selection Problem with divide and Conquer approach	CLO3	2

6	Fractional Knapsack Problem	6	Fractional Knapsack Problem, Job sequencing with deadline, Kruskal's algorithm, Prims algorithm, Dijkstra's Algorithm	CLO3	2
7	Dynamic Programming	7	Implement the dynamic programming algorithms	CLO4	2
8	Backtracking	8,9	Algorithms using Backtracking approach	CLO4	4
9	Approximation Algorithm	10,11	Implement approximation Algorithm.	CLO5	4
10	Backtracking	12,13	Implement Backtracking and NP Completeness	CLO5	4
11	Mini project	14,15	Mini Project	CLO 1/2/3/4/5	4
Total Hours					**30**

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 - AI&DS	Semester: 6	Level: UG
Course Name:	Cloud-Integrated AI Systems	Course Code/ Course Type	UBTDSPE307/PEC-III
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 linear algebra
2. Proficiency in probability and statistics
3. Understanding of multivariate calculus

Course Objectives (CO):	**The objectives of Cloud-Integrated AI Systems are:** 1. Understand the architecture and components of AI workflows in cloud environments 2. Train machine learning models using cloud-native services 3. Deploy, scale, and monitor AI applications in production environments 4. Apply MLOps concepts to manage lifecycle and versioning of ML models 5. Analyze ethical, cost, and performance considerations in cloud-AI integration
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Describe cloud platforms and services for AI deployment and management 2. Implement training workflows using cloud tools like SageMaker, Azure ML, or GCP Vertex AI 3. Create APIs or endpoints to serve AI models for inference at scale 4. Apply model monitoring, retraining, and drift management strategies 5. Explore real-world AI solutions and governance practices in cloud-based systems

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Cloud-AI Integration Principles: What is AI-as-a-Service (AIaaS)?, Differences between On-Premise ML and Cloud-based ML, Introduction to Cloud AI platforms: AWS SageMaker, Azure ML, Google Vertex AI, Lifecycle of AI on Cloud: Data → Train → Deploy → Monitor, Introduction to MLOps, CI/CD for ML Pipelines	**CLO 1**	**9**
UNIT II		
Model Building and Training in Cloud: Data ingestion: Cloud storage, data preprocessing (ETL overview), Creating Jupyter Notebooks in the Cloud, Training Models: Built-in vs Custom training scripts, Distributed Training: Multi-GPU/TPU on Cloud, Cost optimization strategies for training large models	**CLO 2**	**9**

UNIT III		
Model Deployment and Serving Architectures: Batch, Real-Time, and Streaming Inference, Deploying Models as RESTful APIs using FastAPI, Flask on cloud instances, Containerization with Docker for ML models, Model Registry: Concept and usage (MLflow, SageMaker Model Registry), Edge Deployment Overview (AWS Greengrass, GCP Edge TPU)	**CLO 3**	**9**
UNIT IV		
Monitoring and Lifecycle Management: Performance Monitoring (latency, throughput, prediction accuracy), Concept Drift Detection and Retraining Pipelines, Logging and Version Control of Models, Auto-scaling and Load Balancing AI APIs, Pipeline Orchestration Tools: Vertex Pipelines, Kubeflow Pipelines, MLflow	**CLO 4**	**9**
UNIT V		
Real-World Use Cases and Ethical Governance: AI use cases across industries: Healthcare, Finance, E-commerce, NLP, Bias, Fairness, and Transparency in AI Systems, Security in AI APIs: IAM, Tokenization, Rate Limiting, Cost considerations and cloud billing for AI, Compliance and Governance: GDPR, HIPAA (overview only)	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron
2. Architecting the Cloud by Michael J. Kavis

Reference Books:

1. Machine Learning Engineering with MLflow by Emmanuel Raj
2. Cloud Computing: Principles and Paradigms by Rajkumar Buyya
3. Designing Data-Intensive Applications by Martin Kleppmann (for pipelines & data handling)

Online Resources/E-learning Resources:

1. AWS SageMaker Official Labs
2. Google Cloud Skills Boost – Vertex AI Path

Name of the Program:	BTECH CSE - AI&DS	Semester: 6	Level: UG
Course Name:	Cloud-Integrated AI Systems Laboratory	Course Code/ Course Type	UBTDSPE308/PEC
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
-	1	-	1	2	25	-	25

Pre-Requisite:

1. Knowledge of C Programming and DSA

Course Objectives (CO):	**The objectives of Cloud-Integrated AI Systems Laboratory are:** 1. Develop and train machine learning models using cloud-based environments 2. Deploy AI models as web services using APIs or managed endpoints 3. Containerize and host inference systems with scalability and automation 4. Monitor and manage deployed models using logging and feedback loops 5. Integrate CI/CD and version control into ML workflows using MLOps tools
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Set up cloud notebooks (e.g., SageMaker Studio, Azure ML Notebooks) for AI training 2. Train classification/regression models using cloud-native tools or scripts 3. Deploy models as RESTful APIs using FastAPI, Flask, or cloud endpoints 4. Monitor resource usage, request throughput, and prediction drift 5. Use MLflow or similar tools for experiment tracking and lifecycle management

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Explore and Set Up Cloud AI Environment	1	Configure and connect Jupyter Notebook to AWS SageMaker / Vertex AI / Azure ML, Import datasets from cloud storage (e.g., S3, GCS, Azure Blob)	CLO1	2
2	Train a Machine Learning Model in the Cloud	2	Use built-in algorithms or custom scikit-learn model, Visualize training metrics using the cloud console	CLO1	2
3	Deploy a Model as a REST API Endpoint	3	Create and expose endpoint from a trained model using cloud UI or CLI, Test using Postman or Python requests	CLO2	2
4	AutoML Workflow (No-code / Low-code)	4	Train and deploy a model using AutoML tools provided by GCP, Azure, or AWS	CLO2	2

5	Containerize and Deploy a Model using Docker	5	Create a Docker image of a simple model and deploy to Google Cloud Run or AWS Fargate	CLO3	2
6	Implement ML Pipeline with MLflow / Vertex Pipelines	6,7	Log experiments, model versions, and parameters	CLO3	4
7	Monitor and Retrain a Deployed Model	8,9	Set up alerts for performance drop (concept drift simulation)	CLO4	4
8	Distributed Training on GPU/TPU (using managed services)	10,11	Use cloud instances to train a large model faster and log GPU usage	CLO4	4
9	Version Control and Continuous Integration for ML	12,13	Integrate GitHub and set up CI/CD using GitHub Actions for ML model deployment	CLO5	4
10	Build a Real-Time Inference Dashboard	14,15	Use Streamlit/Flask + deployed endpoint to create a live demo app	CLO5	4
Total Hours					**30**

Learning Resources:

Text Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron
2. Machine Learning Engineering with MLflow by Emmanuel Raj

Reference Books:

1. Architecting the Cloud by Michael J. Kavis
2. MLOps Engineering at Scale by Carl Osipov
3. Designing Machine Learning Systems by Chip Huyen

Online Resources/E-learning Resources:

1. MLOps model management with Azure Machine Learning
2. Google Cloud Vertex AI End-to-End Lab

Name of the Program:	BTECH CSE - AI&DS	Semester: 6	Level: UG
Course Name:	Network Security and Cryptography	Course Code/ Course Type	UBTDSPE309/PEC-III
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. Applied Statistical Techniques
2. Python programming

Course Objectives (CO):	**The objectives of Network Security and Cryptography are:** 1. Understand the principles of network security and cryptographic techniques. 2. Apply classical and modern cryptography for secure communication. 3. Analyze public-key cryptosystems and digital signature schemes. 4. Evaluate message authentication mechanisms and secure protocols. 5. Identify network defense mechanisms like firewalls, VPNs, and IDS.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Explain the types of threats and vulnerabilities in network systems. 2. Demonstrate symmetric and asymmetric encryption algorithms like AES and RSA. 3. Implement key exchange techniques and message integrity protocols. 4. Understand protocols like SSL/TLS, IPSec, and their practical applications. 5. Analyze firewall architectures and VPN models for secure communication.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Foundations of Network Security: Need for Network Security, CIA Triad, Threats and Attacks: Interception, Interruption, Modification, Fabrication, Types of Attacks: Passive vs Active, DoS, MITM, Replay, Spoofing, Security Services: Authentication, Access Control, Data Integrity, OSI Security Architecture and Attack Surface	**CLO 1**	**9**
UNIT II		
Classical and Symmetric-Key Cryptography: Substitution and Transposition Ciphers (Caesar, Vigenère), Block Cipher Structure, Feistel Networks, DES: Design and Limitations, Triple DES and AES (Structure, S-boxes, Key Expansion), Block Cipher Modes of Operation: ECB, CBC, CFB, OFB, CTR	**CLO 2**	**9**
UNIT III		
Public-Key Cryptography and Key Exchange: Principles of Public Key Cryptography, RSA Algorithm: Key Generation, Encryption, Decryption, Security, Diffie-Hellman Key Exchange, ElGamal Encryption (conceptual), Digital Signatures: RSA, DSS (Digital Signature Standard)	**CLO 3**	**9**

UNIT IV		
Message Authentication and Network Security Protocols: Message Authentication Codes (MAC), HMAC, Cryptographic Hash Functions: MD5, SHA-2, SHA-3, SSL/TLS Protocol: Record and Handshake Layer, IP Security (IPSec): AH and ESP, Email Security: PGP and S/MIME (flow, formats)	**CLO 4**	**9**
UNIT V		
Firewalls, VPNs, IDS, and Emerging Concepts: Packet Filtering and Stateful Firewalls, Application-level Gateway and Proxy Firewall, Virtual Private Networks (VPN): Tunneling, IPsec-based VPNs, Intrusion Detection and Prevention Systems (IDS/IPS), Introduction to Honeypots, Zero Trust Security, and SIEM	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Cryptography and Network Security by William Stallings
2. Network Security Essentials by William Stallings

Reference Books:

1. Applied Cryptography by Bruce Schneier
2. Network Security and Cryptography by Bernard Menezes
3. Principles of Information Security by Michael E. Whitman, Herbert J. Mattord

Online Resources/E-learning Resources:

1. NPTEL: Introduction to Cryptography and Network Security – IIT Kharagpur
2. Cybrary – Cryptography and Network Security Training

Name of the Program:	BTECH CSE - AI&DS	Semester: 6	Level: UG
Course Name:	Big Data Analytics	Course Code/ Course Type	UBTDSPE311/PEC-III
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. Operating Systems (file systems and memory)
2. Database Management Systems
3. Basics of Python/Java for scripting

Course Objectives (CO):	**The objectives of Big Data Analytics are:** 1. Understand the architecture and challenges of big data systems. 2. Describe distributed storage and computation using Hadoop and HDFS. 3. Apply data processing paradigms such as MapReduce and Apache Spark. 4. Use high-level tools like Hive, Pig, and HBase for querying big data. 5. Analyze real-time architectures and cloud-based big data deployment models.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Explain big data characteristics, ecosystems, and architecture components. 2. Demonstrate data storage and retrieval using HDFS and its CLI commands. 3. Develop data transformation pipelines using MapReduce and Spark RDDs/DataFrames. 4. Create structured queries and analytics workflows using Hive/Pig. 5. Compare Lambda and Kappa architectures for streaming and batch processing.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Big Data Ecosystem: Definition, Characteristics of Big Data: 5Vs, Challenges in Big Data Storage and Processing, Traditional vs Distributed Systems, Hadoop Ecosystem Overview: HDFS, YARN, MapReduce, Introduction to NoSQL: Document, Key-Value, Column-based, Graph	**CLO 1**	**9**
UNIT II		
Distributed Storage with HDFS: HDFS Architecture: Blocks, NameNode, DataNode, Data Replication and Fault Tolerance, File Read/Write Operations and HDFS CLI Commands, Data Ingestion Tools: Apache Sqoop, Apache Flume, Role of HDFS in Modern Pipelines	**CLO 2**	**9**
UNIT III		

Data Processing Models – MapReduce and Spark: MapReduce Programming Paradigm: Map, Shuffle, Reduce, Example Jobs: Word Count, Sorting, Joins, Apache Spark Architecture: RDD, DAG, Lazy Evaluation, Spark DataFrames and SparkSQL, Comparison of Spark with MapReduce	**CLO 3**	**9**
UNIT IV		
Ecosystem Tools: Hive, Pig, HBase: Hive: Architecture, Query Language (HQL), Partitioning, Bucketing, Pig: Data Flow Model and Basic Scripting, HBase: Column-oriented Storage, Use Cases, CRUD Operations, Real-time Search with ElasticSearch (Intro Only), Zookeeper: Coordination Services for Big Data Tools	**CLO 4**	**9**
UNIT V		
Big Data Applications and Architectures: Lambda Architecture: Batch + Real-time Layers, Kappa Architecture for Stream Processing, Introduction to Apache Kafka and Spark Streaming, MLlib Overview: Spark Machine Learning Library (without theory), Big Data in Cloud: AWS EMR, GCP Dataproc, Azure HDInsight, Emerging Trends: Data Lakes, Data Mesh, Federated Architectures	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Hadoop: The Definitive Guide by Tom White
2. Big Data: Principles and Paradigms by Rajkumar Buyya

Reference Books:

1. Learning Spark by Jules S. Damji, Tathagata Das
2. Data-Intensive Text Processing with MapReduce by Jimmy Lin and Chris Dyer
3. Data Analytics with Hadoop by Benjamin Bengfort et al.

Online Resources/E-learning Resources:

1. Big Data Computing – NPTEL Course
2. Hadoop and Spark Hands-on Tutorials – edX/IBM

Name of the Program:	Foreign Language	Semester: 6	Level: UG/PG
Course Name:	Foreign Language-IV: German	Course Code/ Course Type	UFL302 A/VSEC
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. Hadoop Ecosystem Awareness
2. CLI Experience with HDFS and Linux
3. Spark/PySpark Programming Basics

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:	Foreign Language-Iv: Japanese	Course Code/ Course Type	UFL302B/VSEC
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. 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