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-2025-2029)

School of Engineering and Technology

Effective from

Academic Year 2025-26 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	12	10	10	8	4	4	54
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)			4	4	4	4	3	3	22
	Total	**21**	**21**	**21**	**21**	**21**	**21**	**21**	**21**	**168**

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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)

(2025 Pattern)

SEMESTER - III

Course Code	Type	Course Name	TEACHING SCHEME					ASSESSMENT SCHEME			
			THY	PR	TU	Credits	Hrs	CIA	ESA	PR/ OR	Total
UBTDS201	PCC	Data Structures and Algorithms	3	-	-	3	3	40	60	-	100
UBTDS202	PCC	Data Structures and Algorithms Laboratory	-	1	-	1	2	25	-	25	50
UBTDS203	PCC	Python Programming	3	-	-	3	3	40	60	-	100
UBTDS204	PCC	Python Programming Laboratory	-	1	-	1	2	25	-	25	50
UBTDSOE201 & UBTD-SOE203	OE	Open Elective-I	3	-	-	3	3	40	60	-	100
UBTDSOE202 & UBTD-SOE204	OE	Open Elective-I Lab	-	1	-	1	2	25	-	25	50
UBTDS205	PCC	Discrete Structures	2	-	-	2	2	20	30	-	50
UBTDS206	PCC	Computer Organization and Architecture	2	-	-	2	2	20	30	-	50
MOOCDS301	PCC	Operating System (MOOC B1)	-	-	2	2	2	25	-	25	50
MOOCDS302	PCC	Linux, Open Shift & System Administration Fundamentals (MOOC B2)	-	-	2	2	2	25	-	25	50
UBTDS207	CEP	Community Engineering Project	-	1	-	1	2	25	-	25	50
UFL201	AEC	Foreign Language I	2	-	-	-	2	-	-	-	-
ACUHV201 / ACCOI 201	AC	UHV II: Understanding Harmony / Constitution of India	2	-	-	-	2	-	-	-	-
Total			17	4	4	21	29	310	240	150	700

List of Open Elective I: Semester-III

Course Code	Elective-A	Course Code	Elective-B
UBTDS205 OE-Open Elective-I			
UBTDSOE201	Digital Logic and Microprocessor	UBTDSOE203	Signal System
UBTDS206 OE-Open Elective-I Lab			
UBTDSOE202	Digital Logic and Microprocessor Lab	UBTDSOE204	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
UBTDS210	PCC	Database Management System	3	-	-	3	3	40	60	-	100
UBTDS211	PCC	Database Management System Laboratory	-	1	-	1	2	25	-	25	50
UBTDS212	PCC	Java Programming	3	-	-	3	3	40	60	-	100
UBTDS213	PCC	Java Programming Laboratory	-	1	-	1	2	25	-	25	50
UBTDS214	CEP	Project Based on Digital and Technological Solutions	-	1	-	1	2	25	-	25	50
UBTDS215	PCC	Applied Statistical Techniques	3	-	-	3	3	40	60	-	100
UBTDSOE205 / UBTD-SOE207	OE	Open Elective-II	3	-	-	3	3	40	60	-	100
UBTDSOE206 / UBTD-SOE208	OE	Open Elective-II Lab	-	1	-	1	2	25	-	25	50
MOOCDS401	PCC	Web Development Using Django (MOOC B3)	-	-	2	2	2	25	-	25	50
MOOCDS402	PCC	Foundations of Cybersecurity in Linux (MOOC B4)	-	-	1	1	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			18	4	4	21	29	310	240	150	700

List of Open Elective II: Semester-IV

Course Code	Elective-A	Course Code	Elective-B
UBTDS221 OE-OPEN ELECTIVE-II			
UBTDSOE205	Internet of Things	UBTDSOE207	Digital Image Processing
UBTDS222 OE-OPEN ELECTIVE-II LAB			
UBTDSOE206	Internet of Things Lab	UBTDSOE208	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	Software Engineering and Project Management (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 / Professional Ethics	2	-	-	-	2	-	-	-	-
Total			18	3	4	21	28	305	270	125	700

List of Program Elective II & III: Semester-VI

Course Code	Elective-A	Course Code	Elective-B
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:	Level: UG
Course Name:	Data Structures and Algorithms	Course Code/ Course Type	UBTDS201/PCC
Course Pattern:	2025	Version	1.0

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

Pre-Requisite:

1. Knowledge of C Programming

Course Objectives (CO):	**The objectives of Data Structures and Algorithms are:** 1. Understand the fundamental concepts of data structures and algorithm analysis. 2. Apply standard searching and sorting algorithms to solve computational problems. 3. To understand and implement various types of linked lists for efficient dynamic data storage and manipulation 4. To apply the concepts, operations, and applications of stack and queue data structures. 5. To Implement Non-Linear Data Structures like Trees and graphs for solving complex hierarchical and network-based problems.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Understand the foundational concepts of data structures and algorithmic strategies such as divide & conquer and greedy methods for problem solving. 2. Implement and analyze standard searching and sorting algorithms, and evaluate their performance across different scenarios. 3. Develop and manipulate various types of linked lists to manage dynamic data structures efficiently. 4. Apply the concepts of stacks and queues, including their types and applications in algorithmic problem solving. 5. Construct and traverse tree and graph structures using appropriate algorithms for hierarchical and network-based computations.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction, Arrays, and Strings: Introduction to data structures, abstract data types (ADTs), Data structure classification, Problem Solving, Introduction to algorithms, pseudocode, algorithm complexity, basic algorithmic notations, and algorithmic design strategies: - Divide & Conquer and Greedy algorithm. Arrays, linear and multidimensional arrays, and core operations such as traversal, insertion, deletion, and searching. Sparse matrices. String processing, String storage, basic operations (comparison, concatenation, substring search)	**CLO 1**	**9**

UNIT II		
Searching and Sorting: Searching: Techniques of searching—Linear and Binary search Sorting—Types—Internal and External and Sort Stability and efficiency Sorting methods: bubble sort, insertion sort, selection sort, quick sort, and merge sort. Comparison of all sorting methods. Analysis of all sorting methods for Best, worst, and average cases	**CLO 2**	**9**
UNIT III		
Linked Lists Introduction to linked lists and types of linked lists: singly linked lists, circular linked lists, doubly linked lists, and doubly circular linked lists. Primitive operations on linked lists—creation, traversal, insertion, deletion, concatenation, searching, and sorting	**CLO 3**	**9**
UNIT IV		
Stacks & Queues: Introduction to stacks and queues, concepts, memory representations (arrays and linked lists), and fundamental operations (push, pop, and peek for stacks; enqueue and dequeue for queues). Applications of stacks: expression evaluation (infix, postfix, prefix), parenthesis matching, recursion (concepts, types of recursion), and backtracking algorithm. Types of queues: ordinary queues, circular queues, priority queues, and double-ended queues.	**CLO 4**	**9**
UNIT V		
Trees and Graphs: Concept and terminology, Types of trees, tree representations using arrays and linked lists, and operations such as creation, insertion, and deletion. Binary search trees and conversion between general and binary trees, various tree traversal methods (inorder, preorder, and postorder), both recursive and non-recursive. Graph : Introduction, basic terminology, and representations using adjacency matrices and adjacency lists. Graph traversal algorithms: Breadth First Search (BFS) and Depth First Search (DFS) Spanning trees, minimal spanning tree algorithms (Prim's and Kruskal's), and shortest path algorithms such as Dijkstra's method.	**CLO 5**	**9**
Total Hours		**45**

Learning Resources:

Text Books:

1. Seymour Lipschutz, "Data Structures", Schaum's Outline Series.
2. Sartaj Sahni, Ellis Horowitz, "Data Structures and Algorithms in C", Universities Press.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", CareerMonk Publications.

Online Resources/E-learning Resources:

1. https://nptel.ac.in/courses/106102064 Data Structures and Algorithms, IIT Delhi, Prof. Naveen Garg.
2. https://nptel.ac.in/courses/106106127 Programming, Data Structures and Algorithms, IIT Madras, Dr. N.S. Narayanaswamy.

Name of the Program:	BTECH CSE - AI&DS	Semester: 5	Level: UG
Course Name:	Data Structures and Algorithms Laboratory	Course Code/ Course Type	UBTCDS202/PCC
Course Pattern:	2025	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 & Algorithms Laboratory are:** 1. Develop hands-on skills for implementing fundamental data structures like arrays and strings. 2. Apply and compare various searching and sorting algorithms using practical coding approaches. 3. Implement dynamic data structures like linked lists for effective data manipulation. 4. Design and execute stack, queue, and binary search tree operations for real-time applications. 5. Implement graph and tree algorithms for traversal and pathfinding using adjacency structures.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Demonstrate basic operations on arrays and strings through programming exercises. 2. Implement and analyze searching and sorting algorithms for performance and correctness. 3. Apply linked list structures (singly, doubly) in solving real-world data organization problems. 4. Construct and manipulate stack, queue, and binary search tree structures using C++. 5. Implement graph-based algorithms such as DFS, BFS, and minimum spanning tree algorithms.

Practical Plan:

Practical Number	Practical Title	Week Number	Details	CLO	Hours
1	Practical 1 :	1,2	To implement and demonstrate basic array operations (insertion, deletion, traversal, and searching) and fundamental string manipulations.	CLO1	4
2	Practical 2:	3,4	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: 1. Linear search 2. Binary search	CLO1	4

3	Practical 3:	5	WAP to sort an array of N elements using Selection sort and Insertion sort	CLO2	2
4	Practical 4:	6,7	WAP to sort an array of N elements using Bubble sort and Quick sort	CLO2	4
5	Practical 5:	8,9	WAP to perform insertion and deletion in a single and double linked list	CLO3	4
6	Practical 6:	10	WAP to demonstrate push, pop, traverse operations performed on stack	CLO3	2
7	Practical 7:	11	WAP to implement linear / circular queues using arrays.	CLO4	2
8	Practical 8:	12	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.	CLO4	2
9	Practical 9:	13	Write a program to implement Depth First Search / Breadth First Search Algorithm	CLO5	2
10	Practical 10:	14,15	Write a program to implement a minimum spanning tree	CLO5	4

Learning Resources:

Text Books:

1. Seymour Lipschutz, "Data Structures", Schaum's Outline Series.
2. Sartaj Sahni, Ellis Horowitz, "Data Structures and Algorithms in C", Universities Press.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", CareerMonk Publications.

Online Resources/E-learning Resources:

1. https://nptel.ac.in/courses/106102064 Data Structures and Algorithms, IIT Delhi, Prof. Naveen Garg.
2. https://nptel.ac.in/courses/106106127 Programming, Data Structures and Algorithms, IIT Madras, Dr. N.S. Narayanaswamy.

Name of the Program:	BTECH CSE - AI&DS	Semester: 3	Level: UG
Course Name:	Python Programming	Course Code/ Course Type	UBTDS203/PCC
Course Pattern:	2025	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: 5	Level: UG
Course Name:	Python Programming Laboratory	Course Code/ Course Type	UBTDS204/PCC
Course Pattern:	2025	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	Practical 1 : 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	4	To write a python program to perform linear search & Binary search using strings.	CLO3	2
6	Practical 6: Numerical Operations	6	To write a python program to perform lambda functions and list comprehension.	CLO4	2
7	Practical 7: User Defined Functions	7	To write a python program to Create user-defined functions with different types of function arguments with example.	CLO4	2
8	Practical 8: Packages and Modules	8	To write a python program to Create packages and import modules from packages to solve real problems.	CLO4	2
9	Practical 9: File Handling Operations	9	CTo write a python program to perform File manipulations- open, close, read, write, append and copy from one file to another.	CLO5	2
10	Practical 10: Exception Handling Operations	10	To write a python program to handle Exceptions using Python Built-in Exceptions.	CLO5	2

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	UBTDSOE201/OE
Course Pattern:	2025	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	UBTDSOE202/OE
Course Pattern:	2025	Version	1.0

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

Pre-Requisite:

1. Basic knowledge of Programming in C

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

Practical Plan:

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

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

Learning Resources:

Text Books:

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

Reference Books:

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

Online Resources/E-learning Resources:

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

Name of the Program:	BTECH CSE	Semester: 3	Level: UG
Course Name:	Signal System	Course Code/ Course Type	UBTDSOE203/OE
Course Pattern:	2025	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	UBTDSOE204/OE
Course Pattern:	2025	Version	1.0

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

Pre-Requisite:

1. Signal theory, Math

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

Practical Plan:

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

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

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 Structures	Course Code/ Course Type	UBTDS205/PCC
Course Pattern:	2025	Version	1.0

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

Pre-Requisite:

1. Determinants, Matrices, Limits, continuity, Differentiation

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

Course Contents/Syllabus:

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

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

Learning Resources:

Text Books:

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

Reference Books:

1. Kenneth H. Rosen, "Discrete Structures and its Applications", Tata McGraw- Hill, 8th Edition, 2018, ISBN 978-1259676512.
2. Dr. K. D. Joshi, "Foundations of Discrete Structures", 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 - AIDS	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**	**9**
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: 3	Level: UG
Course Name:	Operating System	Course Code/ Course Type	MOOCDS301/PCC
Course Pattern:	2025	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:

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

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

Course Contents/Syllabus:

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

UNIT III		
Memory ManagementContiguous and non-contiguous memory allocation, Paging and segmentation, Virtual memory and page replacement algorithms (FIFO, LRU), Swapping and memory fragmentation	**CLO 3**	**6**
UNIT IV		
File Systems and Storage ManagementFile concepts, file access methods, and direc- tory structure, Disk scheduling algorithms (FCFS, SSTF, SCAN), File system implemen- tation: FAT, i-nodes, Mounting, allocation methods, and protection. .	**CLO 4**	**9**
UNIT V		
Security, I/O and VirtualizationI/O structure, polling vs. interrupt-driven I/O, DMA and device drivers, OS-level security: authentication, access control, Basics of virtualization and containers.	**CLO 5**	**9**
Total Hours		**30**

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:	Linux, OpenShift & System Administration Fundamentals	Course Code/ Course Type	MOOCDS302 / PCC
Course Pattern:	2025	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 operating systems and networking concepts

Course Objectives (CO):	**The objectives of Linux, OpenShift & System Administration Fundamentals are:** 1. To provide foundational knowledge of Linux operating systems and system administration. 2. To introduce OpenShift as a platform for developing and deploying containerized applications. 3. To equip students with practical skills for managing Linux systems, including installation, configuration, and troubleshooting. 4. To integrate container orchestration principles with real-world applications using OpenShift. 5. To prepare students for entry-level certifications in Linux system administration and container management.
Course Learning Outcomes (CLO):	**Students would be able to:** 1. Demonstrate proficiency in basic Linux commands and shell scripting. 2. Install, configure, and manage a Linux system for users, processes, and file systems 3. Develop and deploy containerized applications using OpenShift. 4. Apply fundamental system administration skills, including user management and system security. 5. Troubleshoot and resolve common issues in Linux and containerized environments.

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I Linux Fundamentals		
Overview of Linux Operating System(Linux Distributions,Kernel and Shell Basics,),Command Line Essentials (File System Navigation,File Manipulation Commands (ls, cp, mv, rm, chmod, chown), Text Editors and Utilities (Introduction to vi/vim,grep, sed, awk for Text Processing), Basic Shell Scripting -(Creating and Executing Shell Scripts,Using Variables and Conditionals,Hands-on Exercise: Write and execute shell scripts for file management tasks).	**CLO 1**	**6**
UNIT II Linux System Administration Essentials		

Installing Linux and Managing Boot Process –(Partitioning and Filesystems,GRUB Configuration) ,User and Group Management (Adding, Deleting, and Modifying Users and Groups,Permissions and Access Control Lists (ACLs)),Process and Service Management-(Monitoring and Managing Processes (ps, top, kill),Starting, Stopping, and Enabling Services with systemctl), Basic Network Configuration –(Configuring IP Addresses and Hostnames,Understanding Network Tools (ping, netstat, ss) Hands-on Exercise: Install a Linux system and configure basic services).	**CLO 2**	**6**
UNIT III Introduction to OpenShift Applications		
Understanding Containers and OpenShift Basics-(Introduction to Containers and Kubernetes,OpenShift Architecture and Features),Deploying Applications on OpenShift-(Creating Projects and Deployments,Managing Pods and Services),OpenShift CLI and Web Console -(Using oc Commands for Deployment,Configuring Applications via OpenShift Console),Scaling and Managing Applications-(Horizontal and Vertical Scaling,Managing ConfigMaps and Secrets,Hands-on Exercise: Deploy a simple web application on OpenShift using the CLI and Web Console).	**CLO 3**	**6**
UNIT IV Advanced Linux System Administration		
File System and Storage Management –(Creating and Managing Partitions and Logical Volumes (LVM),Mounting File Systems and NFS Configuration),System Security-(Configuring Firewall and SELinux Policies,Managing SSH Access and Key-Based Authentication),Backup and Restore Techniques -(Using tar, rsync, and cron for Scheduled Backups), Troubleshooting Linux Systems – (Analyzing Logs and Diagnosing Boot Issues,Common Commands for Problem Resolution,Hands-on Exercise: Configure LVM and set up secure remote access using SSH).	**CLO 4**	**6**
UNIT V Integration and Capstone Project		
Integrating Linux with OpenShift – (Managing Linux Nodes in an OpenShift Cluster,Monitoring and Logging in OpenShift and Linux), OpenShift Application Lifecycle Management-(Building and Deploying Containerized Applications with CI/CD,Using Operators for Application Management),Performance Optimization-(Optimizing System Resources in Linux,Managing Resource Quotas in OpenShift), Capstone Project: -Deploy and manage a multi-tier application on OpenShift using Linux administration techniques.	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

1. "Red Hat RH124: Red Hat System Administration I" (Official Course Material)
2. "Red Hat DO101: Introduction to OpenShift Applications" (Official Course Material).

Reference Books:

1. "Linux Bible" by Christopher Negus.
2. "UNIX and Linux System Administration Handbook" by Evi Nemeth, Garth Snyder, Trent R. Hein, and Ben Whaley
3. "Kubernetes Up & Running" by Brendan Burns, Joe Beda, and Kelsey Hightower
4. "OpenShift for Developers: A Guide for Kubernetes Application Development" by Grant Shipley and Graham Dumpleton
5. "Pro Linux System Administration" by Dennis Matotek, James Turnbull, and Peter Lieverdink

Name of the Program:	BTECH CSE - AI&DS	Semester: 3	Level: UG
Course Name:	Community Engineering Project	Course Code/ Course Type	UBTDS207/CEP
Course Pattern:	2025	Version	1.0

Teaching Scheme					Assessment Scheme		
Theory	Practical	Tutorial	Total Credits	Hours	CIA (Continuous Internal Assessment)	ESA (End Semester Assessment)	Practical/ Oral
-	1	-	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:	2025	Version	1.0

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

Pre-Requisite:

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

Course Contents/Syllabus:

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

UNIT IV		
Kleidung und Mode Speak about cloths and shopping, lead a discussion during cloths shopping, discussion in departmental store, understand and research information about Berlin, Grammar – Separable and non-separable verbs	**CLO 4**	**6**
UNIT V		
Tag für Tag & Zeit mitFreunden: Clock timings, To speak about family and friends, Daily routine To speak about free time activity, to understand the specific information from the text, to order and to pay in a restaurant Grammar – Possessivarticle, Modalverbs, use of on,at,from. . . till, Seprable verbs and past tense	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

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

Reference Books:

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

Online Resources/E-learning Resources:

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

Name of the Program:	BTECH CSE - AI&DS	Semester: 3	Level: UG/PG
Course Name:	Basic Japanese language skill	Course Code/ Course Type	UFL201B/AEC
Course Pattern:	2025	Version	1.0

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

Pre-Requisite:

1. Desire to get acquainted with the Japanese language.

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

Course Contents/Syllabus:

Descriptors/Topics	CLO	Hours
UNIT I		
Introduction to Japanese Language – Introduction of script, culture, History of script ,Speaking : Self introduction, listening : short video skit on self-introduction	**CLO 1**	**6**
UNIT II		
Introduction of Hiragana Script - Writing : Hiragana script, Speak : Basic sentences, General vocabulary : Months , Days of the week ,Basic numbers, colours	**CLO 2**	**6**
UNIT III		
Basic Sentence formation -Basic sentence structure : Affirmative and Negative , General vocabulary: about family	**CLO 3**	**6**

UNIT IV		
Time and verbs –Speaking : Talking about routine, Writing: routine using verbs and time, reading : A clock	**CLO 4**	**6**
UNIT V		
Introduction of Katakana and basic kanji – Affirmative present ,past & future Reading : English words, country names Writing : Basic Kanji	**CLO 5**	**6**
Total Hours		**30**

Learning Resources:

Text Books:

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

Reference Books:

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

Online Resources/E-learning Resources:

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

Name of the Program:	BTECH CSE - AI&DS	Semester: 3	Level: UG
Course Name:	Constitution of India	Course Code/ Course Type	ACCOI201/AC
Course Pattern:	2025	Version	1.0

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

Pre-Requisite:

1. NIL

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

Course Contents/Syllabus:

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

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

Learning Resources:

Text Books:

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

Reference Books:

1. "SamvidhanaOdu" - for Students & Youths by Justice HN NagamohanDhas, Sahayana, kerekon
2. "Constitution of India, Professional Ethics and Human Rights" by Shubham Singles, Charles E. Haries, 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:	2025	Version	1.0

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

Pre-Requisite:

1. NIL

Course Objectives (CO):	**The objectives of 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	UBTDS210/PCC
Course Pattern:	2025	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. 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**	**9**
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**	**9**

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

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	UBTDS211/PCC
Course Pattern:	2025	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	Implementing Operations on relations using PL / SQL.	CLO5	2
12	Practical 12	12	Implementing Operations on relations using PL / SQL.	CLO5	2
13	Practical 13	13	Mini Project /Task	CLO 1,2,3,4,5	6

Learning Resources:

Text Books:

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

Reference Books:

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

Online Resources/E-learning Resources:

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

Name of the Program:	BTECH CSE - AI&DS	Semester: 4	Level: UG
Course Name:	Java Programming	Course Code/ Course Type	UBTDS212/PCC
Course Pattern:	2025	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 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**	**9**
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**	**9**
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**	**9**
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**	**9**
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**	**9**
Total Hours		**45**

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	UBTDS213/PCC
Course Pattern:	2025	Version	1.0

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

Pre-Requisite:

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

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

Practical Plan:

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

7	Practical 7:	9	Develop a Program to demonstrate Database handling.	CLO4	2
8	Practical 8:	10	Develop a Program to demonstrate Network Programming.	CLO5	2
9	Practical 9:	11	Develop a Program to demonstrate Applet structure and event handling.	CLO5	2
10	Practical 10:	12	Develop a Program to demonstrate Layout managers.	CLO5	2
11	Mini Project	13&14	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	UBTDS214/CEP
Course Pattern:	2025	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:	Applied Statistical Techniques	Course Code/ Course Type	UBTDS215/PCC
Course Pattern:	2025	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**	**9**
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	UBTDSOE205/OE
Course Pattern:	2025	Version	1.0

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

Pre-Requisite:

1. Computer Networks and Security

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

Course Contents/Syllabus:

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

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

Learning Resources:

Text Books:

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

Reference Books:

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

Online Resources/E-learning Resources:

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

Name of the Program:	BTECH CSE - AI&DS	Semester: 4	Level: UG
Course Name:	Internet of Things Laboratory	Course Code/ Course Type	UBTDSOE206/OE
Course Pattern:	2025	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	UBTDSOE207/OE
Course Pattern:	2025	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	UBTDSOE208/OE
Course Pattern:	2025	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	2
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	2
12	Practical 12:	14,15	Compress image using DCT / Wavelet transform.	CLO5	2

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	MOOCDS401/PCC
Course Pattern:	2025	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**	**9**
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	MOOCDS402/PCC
Course Pattern:	2025	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 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**	**9**
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:	2025	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:	2025	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**	**10**
UNIT II		
System of demonstrative words Minna no Nihongo lesson no. 1,2 & 3 **CLO 2**	**9**	
UNIT III		
Minna no Nihongo lesson no. 4T(Write and Speak basic sentences in correct tenses)	**CLO 3**	**9**
UNIT IV		
Reading : Basic conversation using particles Listening : conversation related to particles Speaking : Sentences about give, lend, teach, receive	**CLO 4**	**9**
UNIT V		
Tenses Writing : Affirmative present ,past & future Negative present ,past,& future sentences Writing : About Routine	**CLO 5**	**8**
Total Hours		**45**

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:	2025	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:	2025	Version	1.0

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

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