Artificial Intelligence and Data Science Department

Vision

To produce exclusive software professionals who shall effectively contribute to the leveraging field of Artificial Intelligence and Data Science.

Mission

We will achieve our Vision by:

- Providing Excellent Infrastructure facilitating the students and faculty members with recent trends and technologies.
- Imparting High-Quality Education to the students also instigating them with ethical and moral values.
- Enabling students to enhance their research abilities to address various society-oriented issues through Innovative projects
- Collaborating with various Industries to make students industry ready

PEO Program Educational Objectives

PEO 1: Ability to understand, apply, analyse, design models and applications for all the real-world scenarios related to Artificial Intelligence and Data Science. (PO 1, 2, 3)

PEO 2: Practice engineering in a broader aspect and exhibit professional leadership qualities in their field. (PO 4, 5, 6)

PEO 3: Enhancing technological competence to withstand the challenges in the volatile IT industry. (PO 7, 8, 9)

PEO 4: To be committed in Life-long research and Learning activities that supports societal development. (PO 10, 11, 12)

PSO Program Specific Outcomes:

PSO 1: - Practically Applying the skills & knowledge acquired to various Inter/Multi/Trans disciplinary problem areas. (PEO 1, 2)

PSO 2: - Enrich Leading abilities in the field of Artificial Intelligence and Data Science to qualify for employability. (PEO 3, 4)

Artificial Intelligence and Data Science Department

PO Programme Outcomes

Learners / Students of Artificial Intelligence and Data Science Engineering Programme Graduates are expected to have attained & will be able to:

01. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

02. Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

03. 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.

04. 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.

05. 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.

06. The engineer and society: Demonstrate understanding of contemporary knowledge of engineering to assess societal, health, safety, legal and cultural issues and the consequent responsibilities.

07. 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.

08. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

09. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities, write effective reports, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the ability to engage in independent and life-long learning in the broadest context of technological change.

Head of Department
Artificial Intelligence & Data Science

Annasaheb Dange
College of Engineering and Technology
Ashta

An Autonomous Institute affiliated to Shivaji University
Kolhapur

Curriculum Contents

S.Y. B. Tech.
ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEM III

(Academic Year 2022 - 2023)
Updated

Teaching and Evaluation Scheme
B. Tech: III Semester

Course Code	Course	Teaching Scheme				Evaluation Scheme				
							Theory Marks		Practical Marks	
		L	T	P	Credits	Scheme	Max.	Min. for Passing	Max.	Min. for Passing
0ADPC201	Discrete Mathematics and Theory of Computation	3	1	0	4	ISE I	10		--	--
						MSE	30		--	--
						ISE II	10	40	--	--
						ESE	50	20	--	--
0ADPC202	Data Structures	3	0	0	3	ISE I	10		--	--
						MSE	30		--	--
						ISE II	10	40	--	--
						ESE	50	20	--	--
0ADPC203	Operating System	3	0	0	3	ISE I	10		--	--
						MSE	30		--	--
						ISE II	10	40	--	--
						ESE	50	20	--	--
0ADPC204	Biology and Data Science	3	0	0	3	ISE I	10		--	--
						MSE	30		--	--
						ISE II	10	40	--	--
						ESE	50	20	--	--
0CCHS502	Psychology	2	0	0	2	ISE- I	25	10	--	--
						ISE- II	25	10	20	--
0ADPC251	Data Structures Laboratory	0	0	2	1	ISE	--		25	10
						ESE	POE		50	20
0ADPC252	Operating System Laboratory	0	0	2	1	ISE	--		25	10
						ESE	POE		50	20
0ADPC253	Python for Data Science	2	0	2	3	ISE	--		50	20
						ESE	POE		50	20
0CCMC503	Environmental Studies	2	-	-	-	Audit				
VAC-3	Value Added Course-3	2	-	-	-	Audit				
	Total	**20**	**1**	**6**	**20**	**Total**	**450**		**250**	
	Total Contact Hours/ Week: 27 Hrs					**Total = 450 + 250 = 700**				

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	2	-	-	18	-	-	-
Cumulative Sum	4	13	18	22	-	-	-

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NDCET

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Department of Artificial Intelligence and Data Science

Class	B. Tech., Sem. III
Course Code and Course Title	0ADPC201- Discrete Mathematics and Theory of Computation
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial	3/1
Credits	4
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPC201_1	Proficiently calculate permutations and combinations to solve given problems using appropriate formulas.
0ADPC201_2	Proficiently solve problems of mathematical logic and set theory using appropriate formulas/laws.
0ADPC201_3	Accurately Build finite state machines for regular language or regular expression over a given alphabet and convert one form of finite state machine to another form by using appropriate conversion method.
0ADPC201_4	Proficiently Construct grammars (context free/ regular) for given language (context free/ regular) over a given alphabet and convert given context free grammar in CNF Form by using conversion method.
0ADPC201_5	Accurately Build deterministic and non-deterministic pushdown automata for given language or grammar over a given alphabet and stack symbols.
0ADPC201_6	Proficiently Construct Turing Machines for given language, function over a given alphabet and tape symbols.

Course Contents:		
Unit No.	**Unit Name**	**Contact Hours**
Unit 1	**Permutations, Combinations and Discrete Probability:** Permutations and Combinations: rule of sum and product, Permutations, Combinations, Discrete Probability, Conditional Probability, Bayes' Theorem	06 Hrs.
Unit 2	**Mathematical logic:** Introduction, statements and notations, connectives – negation, Conjunction, disjunction, conditional, bi-conditional, Statement formulas and truth tables, well-formed formulas, Tautologies, Equivalence of formulas, Duality law, Tautological implications, functionally complete sets of connectives, other connectives, Normal and principal normal forms	07 Hrs.

Unit 3	**Set theory and Algebraic systems:** Basic concepts of set theory, operations on sets, ordered pairs, Cartesian Product, relation, properties of binary relations, matrix and graph representation, partition and covering of set, equivalence relation, composition of relations, POSET and Hasse diagram, Function – definition, types Algebraic Systems, homomorphism, Semigroups and Monoids, properties and examples, Groups: Definition and examples	09 Hrs.
Unit 4	**Mathematical Induction, Regular Languages & Finite Automata** Regular expressions and corresponding regular languages, examples and applications, Finite automata-definition and representation, Non-deterministic F.A.,NFA with null transitions, Equivalence of FA's , NFA's and NFA's with null transitions.	08 Hrs.

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Unit 5	**Grammars and Languages**	06 Hrs.
	Types of Languages, Derivation and ambiguity, Union, Concatenation and *'s of CFLs, eliminating production & unit productions from CFG, Eliminating useless variables from a context Free Grammar. CNF Notation.	
Unit 6	**Push Down Automata and Turing Machines**	07 Hrs.
	PDA Definition, Deterministic PDA & types of acceptance, Equivalence of CFG's & PDA's. TM- Models of computation, definition of Turing Machine as Language acceptors, combining Turing Machines, Computing a function with a TM	

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Discrete Mathematical Structures with application to Computer Science (Unit 2,3)	J. P. Tremblay & R. Manohar	Tata MGH International	-	2007
2	Elements of Discrete Mathematics (Unit 1)	C. L. Liu and D. P. Mohapatra	SiE Edition, TataMcGraw- Hill	4th	2013
3	Introduction to languages & theory of computations (Unit 4,5,6)	John C. Martin	Tata McGraw Hill Edition	3rd	2007
4	Introduction to Automata Theory, Languages and computation	John E. Hopcraft, Rajeev Motwani, Jeffrey D. Ullman	Pearson Edition	3rd	2006

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Discrete Mathematics and its Applications	Kenneth H. Rosen (AT&T Bell Labs) (mhhe.com/rosen)	Tata Mc Graw Hill	7th	2012
2	Discrete Mathematics, Schaum's outlines.	SemyourLipschutz, MarcLipson	Tata Mc Graw Hill	3th	2012
3	Introduction to theory of computations	Michael Sipser	Cengage Learning	3rd	2012
4	Theory of Computation- A problem solving Approach	Kavi Mahesh	Wiley india	1st	2005

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Class	S Y B. Tech Sem III
Course Code & Course Title	0ADPC202 - Data Structures
Prerequisite/s	**0ADES151** - Problem Solving Using C
Teaching Scheme (Lecture/Practical/Tutorial/Drawing)	03/00/00/00
Total Contact Hours: Theory/Practical/Tutorial/Drawing	42/00/00/00 Hours
Credits	03
Evaluation Scheme: ISE-I/MSE/ISE-II/ESE	10/30/10/50
Subject In charge:-	

Course Outcomes (COs) : The students will be able to:	
0ADPC202_1	Describe fundamentals in data structures
0ADPC202_2	Explain the fundamental concepts of structuring, managing and organizing the data using linear data structures with ADTs
0ADPC202_3	Apply appropriate solution to solve the problem using linear data structure
0ADPC202_4	Explain the fundamental concepts of structuring, managing and organizing the data using nonlinear data structures with ADTs
0ADPC202_5	Apply appropriate solution to solve the problem using nonlinear data structure
0ADPC202_6	Compare and analyze different data structure algorithms and searching, sorting methods using concepts like complexity

Course Contents:

Unit No	Unit Name	Contact Hours
Unit 1	**Basics of Data Structures:** Algorithm, ADT, Space and Time Complexity, Direct and Indirect recursion, analysis of recursive functions e.g. Towers of Hanoi	4 Hrs
Unit 2	**Lists** Definition, representation, operations, implementation and applications of singly, doubly and circular linked lists.	9 Hrs
Unit 3	**Stack and Queue** Stacks as ADT, operations, representation using static and dynamic structures, applications of stack Queue as ADT, operations, representation using static and dynamic structures, circular queue, priority queue, double ended queue.	8 Hrs
Unit 4	**Searching and Sorting Techniques** Linear search, binary search, Internal and External Sorts, bubble sort, selection sort, insertion sort, merge sort, quick sort, radix sort, heap sort. Hashing – Definition, hash functions, overflow, collision, Collision resolution techniques, Open addressing, Chaining.	9 Hrs
Unit 5	**Trees** Basic terminology, representation, binary tree, traversal methods, binary search tree, AVL search tree, Heaps- Operations and their applications, Introduction to M-way trees.	7 Hrs
Unit 6	**Graphs** Basic concept of graph theory, storage representation: adjacency matrix, adjacency list, adjacency multi-lists, graph traversal techniques- BFS and DFS	5 Hrs

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Data Structures- A Pseudocode Approach with C	Richard F. Gilberg and Behrouz A. Forouzon	Cengage Learning	2nd	2004
2	Data Structures with C Schaum's Outlines Series	S. Lipschutz	Tata McGraw-Hill	-	2017
3	Data Structure using C	Reema Thareja	Oxford	2nd	2014

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ndcet

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Department of Artificial Intelligence and Data Science

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Data Structure using C	A. M. Tanenbaum, Y. Langsam, M. J. Augenstein	Prentice-Hall Of India Pvt. Limited	-	2003
2	Understanding Pointers in C	Yashavant Kanetkar	BPB Publication	1st	2009
3	C and Data Structures	N. B. Venkateshwarlu, E. V. Prasad	S. Chand and Company	-	2010
4	Let Us C	Yashavant Kanetkar	BPB Publication	15th	2016

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Annasaheb Dange College of Engineering and Technology, Ashta
Department of Artificial Intelligence and Data Science

Class	B. Tech, Sem. III
Course Code and Course Title	0ADPC203- Operating System
Prerequisite/s	0ADES151
Teaching Scheme: Lecture/Tutorial	3/0
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPC203_1	Analyze basic concepts of operating system and their structures to compare various operating systems using various OS parameters.
0ADPC203_2	Analyze issues related to inter process communication, process scheduling and resource management with the help of different scheduling algorithm.
0ADPC203_3	Develop appropriate solution to solve critical section problem by using accurate operating system algorithm.
0ADPC203_4	Use deadlock avoidance techniques and Memory management techniques with suitable algorithm to handle a deadlock situation and memory management in OS.
0ADPC203_5	Synthesize the concepts of I/O management, file system implementation and problems related to security and protection using appropriate security parameters.

Course Contents:

Sr. No.	Unit Name	Contact Hours
Unit 1	**Overview** Introduction to Operating Systems, Operating System functions, Computer System organization, Operating System Architecture, Operating System Structure, Operating System operations, Types of Operating Systems, Operating System Services, User - Operating System interface, System calls, Types of system Calls, System programs, Kernel, Types of kernel.	06 Hrs.
Unit 2	**Process Management** Process concept: Process scheduling, Operations on processes, Inter-process communication, Multi-Threaded Programming: Overview, Multi-Threaded Models, Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple-Processor scheduling	09 Hrs.
Unit 3	**Process Synchronization** Background, Mutual Exclusion, the critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of Synchronization	06 Hrs.
Unit 4	**Deadlock** System model, deadlock characterization, methods for handling deadlocks, deadlock preventions, deadlock avoidance, deadlock detection, deadlock recovery.	07 Hrs.
Unit 5	**Memory Management** Memory Management Strategies: Background, swapping, contiguous memory allocation, paging, structure of the page table, Segmentation. Virtual Memory Management: Background, demand paging, copy-on-write, page replacement	07 Hrs.
Unit 6	**Storage Management& I/O Subsystem** File System: File concept, access methods, directory and disk structure, file-system mounting, file sharing, protection, Overview of I/O system, I/O hardware, Application I/O interface, Kernel I/O subsystem.	07 Hrs.

Text Books:

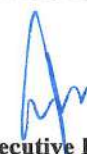| Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Operating System Concepts [Unit 1-6]	Silberschatz, Galvin,	John Wiley	8	2009
02	Operating systems concepts and design [Unit 1]	Dhananjay M Dhamdhere	Tata McGraw Hill	2	2006
03	Operating Systems - A Concept Based approach	Dhananjay M Dhamdhere	Tata McGraw Hill	3	2007
04	Understanding Operating System	Understanding Operating System	Ann McHoes & Ida M. Flynn,(Thomson)	6	2014

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Operating System A Design Oriented Approach	Charles Crowley	Tata McGraw Hill	1st	2001
02	Operating System with Case Studies in Unix, Netware and Windows NT	Achyut S. Godbole	Tata McGraw Hill	5th	2007
03	Operating Systems: Internals and Design Principles	William Stallings	Pearson Education International	8th	2014

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Class	B. Tech, Sem. III
Course Code and Course Title	0ADPC204 - Biology and Data Science
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE1/ MSE/ ISE2/ ESE	10/30/10/50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADPC204_1	Explain Biological classification, cell basics, molecular analysis, neurobiology, genomics etc.
0ADPC204_2	Discuss various biological signals and its significance.
0ADPC204_3	Illustrate about genomes and genomics analysis using data science tools.
0ADPC204_4	Demonstrate bioinspired computational applications.

Course Contents:

Unit 1	**Introduction (Text Book 1)** Need of Biology for Engineers – Role of biology in development of technology, major discoveries inspired by biology, Biological Classification - Kingdom Monera, Kingdom Protista, Kingdom Fungi, Kingdom Plantae, Kingdom Animalia, Viruses (PHI) **Cell: The Basic Unit of Life (Text Book 1)** What is a Cell?, Basic Properties of Cells, An Overview of Cell, Prokaryotic Cells, Eukaryotic Cells, Cell Cycle and Cell Division, M Phase, Meiosis, Cell Differentiation	08 Hrs.
Unit 2	**Biochemistry and Molecular Analysis (Text Book 1)** Chemical Composition of Living Forms, Analysis of Chemical Composition, Carbohydrates, Amino acids and Proteins, Nucleic Acids, Lipids, Nature of Bonding and Qualitative Tests	06 Hrs.
Unit 3	**Basic Neuroscience (Text Book 4)** Introduction, Anatomy of the Nervous System - Central Nervous System; Peripheral Nervous System, Cellular Anatomy of the Nervous System – Neurons and its characteristics; Anatomy of Neurons; Cellular Functions of Glia, Introduction to Methods of Neuroscience - Imaging Brain Activity - CT scan; Diffusion tensor imaging; CLARITY, Imaging Brain Function - Electroencephalography (EEG); Positron emission tomography (PET scan); Functional magnetic resonance imaging (fMRI), Imaging the Cells of the Nervous System – Microscopy; Staining	07 Hrs.
Unit 4	**Biological Signals (Text Book 3)** Introduction, Bioelectric Events and their Signals, Signals Produced by Biomechanical Systems, Signals Produced by Biomaterials, Cellular Signals, Image as a Signal	06 Hrs.
Unit 5	**Genomics and Data Science Technology for Genomics (Text Book 2 - Coursera)** Why genomics, what is genomics, what is computational genomics, Just enough molecular biology, The genome, Writing a DNA sequence, Central dogma, Transcription, Translation, DNA structure and modifications, Next generation sequencing, Applications of sequencing, What is reproducibility? Methods, software, analysis and applications, Why you should care about statistics, Types of genomics analysis questions, The central dogma of inference, What is analysis code?, Testing, Multiple testing, The central dogma of prediction, Types of variation in genomics, Experimental design, Confounding, Power and sample size, Correlation and causation, Researcher degrees of freedom Introduction to Biopython, Tools for Genomic data science	10 Hrs.
Unit 6	**Microbiology and Applications (Text Book 1)** Microorganisms, Growth Kinetics, Culture Media, Sterilization, Microscopy, Applications of Microbiology, Immunology and Immunity, Cancer Biology, Stem Cell	05 Hrs.

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Biology for Engineers	Wiley Editorial	Wiley	--	2022
02	Introduction to Genomic Technologies	Steven Salzberg	Johns Hopkins University, Coursera	--	2022
03	Understanding the Human Machine - A Primer for Bioengineering	Max E. Valentinuzzi	World Scientific Publishing Co. Pte. Ltd.	--	2004
04	Open Neuroscience Initiative	Austin Lim	DePaul University	1st	2021

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Biology for Engineers	Chakraborty Tanushree. Akhtar, Nasim	PHI Learning Pvt. Ltd.	--	2022
02	Foundations of Neuroscience	Casey Henley	Michigan State University Libraries	Open	--

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Course Details:

Class	B. Tech, Sem. III
Course Code and Course Title	0CCHS502- Psychology
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	2/0/0
Credits	02
Evaluation Scheme: ISE I/ ISE II	25/25

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0CCHS502_1	Explain using psychology theories, the necessity and significance of various parts of psychology.
0CCHS502_2	Describe importance of psychology in the organization and human nature that takes place in a group or individually within an organization.
0CCHS502_3	Apply emotional intelligence, time management, and stress management techniques in their daily activities.
0CCHS502_4	Analyze different case studies that use different leadership styles and approaches.

Course Contents:

Unit No.	Unit Name	Contact Hrs
Unit 1	**Psychology** – Introduction and Need of psychology in the organization, What is Organizational Behavior	2
Unit 2	**Emotional Intelligence (EI)** – Definition of EI, components of EI, Activities	6
Unit 3	**Time Management**– Need and importance of Time management for an individual, Effective steps of Time Management, role of procrastination in Time management, Types of Procrastination, Effects of Procrastination, Techniques to stop procrastination, activities	6
Unit 4	**Leadership** – importance of leadership, styles of leadership, The Leader Trait Approach, The Behavior Approach, Path-Goal Theory: How Leaders Motivate Followers, Leader and Mood, Gender and Leadership, Ethical Leadership	6
Unit 5	**Attitude and Job Satisfaction** – Components of Attitude, Relationship between Attitude and Behavior, Job attitude, Causes of Job satisfaction, outcomes of Job satisfaction, Impact of Job dissatisfaction, activities	2
Unit 6	**Stress Management** – meaning of stress, sources and consequences of stress nature of stressors, Stress Management Techniques, activities.	6

Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Organizational Behavior- An Evidence-Based Approach	Fred Luthan	McGraw-Hill/Irwin	12th	2011
2	Essentials of Organizational Behavior	Stephen P. Robbins Timothy A. Judge Katherine E. Breward	Pearson	-	2018
3	Essentials of organizational Behavior	Stephen P. Robbins	Prentice Hall	7th	2002

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4	Understanding and Managing Organizational Behavior	Jennifer M. George Gareth R. Jones	Pearson	6th	2012
5	Emotional Intelligence at Work A Professional Guide	Dalip Singh	Response Books A division of Sage Publications	3rd	2006

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Emotional Intelligence at Work A Professional Guide	Dalip Singh	Response Books A division of Sage Publications	3rd	2006
2	Positive Psychology Applications in Work, Health and Well-being	Updesh Kumar Archana Vijay Parkash	Pearson India Education	-	2016

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Course Details:

Class	B. Tech, Sem. III
Course Code and Course Title	0ADPC251 - Data Structures Laboratory
Prerequisite/s	0ADES151
Teaching Scheme: Practical	2
Credits	01
Evaluation Scheme: ISE / ESE	50/ 50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADPC251_1	Demonstrate fundamentals in data structures using programming language
0ADPC251_2	Apply appropriate algorithm to solve problems using linear and nonlinear data structures like stack, queue, trees, graphs
0ADPC251_3	Analyze searching and sorting techniques to solve problems using complexity
0ADPC251_4	Develop a solution to solve case study based problems using data structure concepts.

Course Contents:

Expt. No.	Title of Experiment	Contact Hours
1	Programs based on array, function, pointer, structures	2 Hrs
2	Singly Linked List	2 Hrs
3	Doubly Linked List	2 Hrs
4	Circular Linked List	2 Hrs
5	Stack ADT – Static and Dynamic	2 Hrs
6	Queue ADT – Static and Dynamic	2 Hrs
7	Stack application, circular and double ended queue	2 Hrs
8	Searching – Linear, Binary and Hashing	2 Hrs
9	Sorting – Bubble, Selection, Insertion,	2 Hrs
10	Sorting – Merge and Quick	2 Hrs
11	Binary Search Tree, Traversal of Trees	2 Hrs
12	Graph using adjacency list and traversal	2 Hrs

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Data Structures- A Pseudocode Approach with C	Richard F. Gilberg and Behrouz A. Forouzon	PWS Publishing Company	2nd	2004
2	Data Structures with C Schaum's Outlines Series	S. Lipschutz	Tata McGraw-Hill	-	2017
3	Data Structure using C	Reema Thareja	Oxford	2nd	2014

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Data Structure using C	A. M. Tanenbaum, Y. Langsam, M. J. Augenstein	Prentice-Hall Of India Pvt. Limited	-	2003
2	Understanding Pointers in C	Yashavant Kanetkar	BPB Publication	1st	2009
3	C and Data Structures	N. B. Venkateshwarlu, E. V. Prasad	S. Chand and Company	-	2010
4	Let Us C	Yashavant Kanetkar	BPB Publication	15th	2016

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Course Details:

Class	B. Tech, Sem. III
Course Code and Course Title	0ADPC252 - Operating System Laboratory
Prerequisite/s	0ADES151
Teaching Scheme: Practical	2
Credits	01
Evaluation Scheme: ISE / ESE	50/ 50

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPC252_1	Demonstrate the installation and various features of operating systems.
0ADPC252_2	Implement programs related to the process Scheduling, memory allocation techniques for the given problem
0ADPC252_3	Develop appropriate solution to solve critical section problem by using accurate operating system algorithm.
0ADPC252_4	Design solution to solve memory allocation related problems using Contiguous and Non- Contiguous memory allocation techniques.
0ADPC252_5	Identify appropriate commands to perform given task using various standard libraries in the operating system.

Course Contents:

1.	Installation of Multiple Operating System.
2.	Study and demonstration of basics of Linux/UNIX commands.
3.	Program based on CPU Scheduling Algorithms.
4.	Program to demonstrate critical section and mutual exclusion.
5.	Program based on Bankers algorithm for Deadlock Avoidance.
6.	Program based on Bankers Algorithm for Deadlock Prevention.
7.	Program based on Page Replacement Policies.
8.	Program to simulate Paging technique of memory management.
9.	Program based on various I/O System calls of UNIX operating System.
10.	Program to simulate producer-consumer problem using semaphores.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	The design of Unix Operating System	Maurice J. Bach	(PHI)	1st	2006
02	A practical Guide to Linux commands, Editors and shell programming	Mark G. Sobell	Pearson Education India	3rd	2013
03	Operating Systems concepts and design	Milan Milenkovic	TMGH	2nd	2001

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Linux System Programming	Robert Love	SPD, O' REILLY	2nd	2007
02	Unix concepts and administration	Sumitabha Das	TMGH	4th	2006
03	A practical Guide to Unix system V	Mark G. Sobell	Benjamin cummings Pub.	2nd	2005

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Class	SY B.Tech Sem III
Course Code and Course Title	0ADPC253 **Python for Data Science**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial /Practical	02/0/02
Credits	03
Evaluation Scheme: ISE / ESE	

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPC253_1	Apply various fundamentals concept of python programming to solve real world problems by using IDLE.
0ADPC253_2	Apply modular approach like OOP, functions, Exception handling, file handling to solve various real world scenarios using Python IDE.
0ADPC253_3	Apply various inbuilt functions of NumPy Library for efficient storage and data operations by using IDE.
0ADPC253_4	Analyze the data using different in built functions of Pandas by using IDE.
0ADPC253_5	Design and develop micro project to solve real world problems by using python programming.

Course Syllabus

Course Contents:		
Unit 1	**Basics of Python** Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Control Statement: if statement, if, elif else statement Repetitive Control Statement: While loop, for loop, The range statement Selection Control Statement: Break & continue, Else clause	05 Hrs.
Unit 2	**Modular Programming:** Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes **Function:** What is function, Define a function, Pass arguments, Arguments with default values, Arbitrary arguments, Local and global variables, Return a value from function, Mathematical functions, Random number functions, Mathematical constants, Recursive functions	05 Hrs.
Unit 3	**Exception Handling, File Handling** Errors, Exception handling with try, handling multiple exceptions, writing your own exception **File Handling:** File handling modes, reading files, writing snd spending to files, Handling file exceptions, The with statement.	03 Hrs
Unit 4	**Introduction To Numpy and scikit learn:** NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray-Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-Sorting. Introduction scikit learn library for data science.	06 Hrs.
Unit 5	**Data Manipulation with Pandas:** Introduction to pandas Data Structures: Series, DataFrame, Essential Functionality: Dropping Entries- Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.	04 Hrs.

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Unit 6	Data Cleaning, Preparation and Visualization	05 Hrs.
	Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. **Plotting with pandas:** Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.	

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to computing and Problem Solving with Python	Jeeva Jose and SojanLal	Khanna Book Publishing Co. (P) Ltd	1	2016
02	Programming Python	Mark Lutz	O'reilly	2	2001
03	Introduction to Programming using Python"	Y. Daniel Liang	Pearson	--	2012
04	Python Data Science Handbook: Essential Tools for Working with Data	JakeVanderPlas	O'Reilly	--	2017

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Core Python Programming	Wesley J. Chun	Prentice Hall	--	2006
02	Learning Python	Mark Lutz,	O'reilly	4th	2009

Experiments List:

1	Implement basic Python programs to demonstrate fundamental concepts by reading input from console.
2	Implement Python programs to demonstrate decision control and looping statements.
3	Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve any given problem
4.	Implement OOP concepts like Data hiding and Data Abstraction.
5.	Create user-defined functions with different types of function arguments
6.	Perform File manipulations operations- open, close, read, write, append and copy from one file to another.
7.	Handle Exceptions using Python Built-in Exceptions
8.	Implement various in built functions of NumPy library.
9.	Create Pandas Series and DataFrame from various inputs.
10.	Import any CSV file to Pandas DataFrame and perform the following: (a) Visualize the first and last 10 records (b) Get the shape, index and column details (c) Select/Delete the records(rows)/columns based on conditions. (d) Perform ranking and sorting operations. (e) Do required statistical operations on the given columns. (f) Find the count and uniqueness of the given categorical values. (g) Rename single/multiple columns.
11.	Import any CSV file to Pandas DataFrame and perform the following: (a) Handle missing data by detecting and dropping/ filling missing values. (b) Transform data using apply() and map() method. (c) Detect and filter outliers. (d) Perform Vectorized String operations on Pandas Series. (e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.

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Course Details:

Class	B. Tech, Sem. III
Course Code and Course Title	0CCMC503- **Environment Studies**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	2/0/0
Credits	0
Evaluation Scheme: ISE	(Audit)
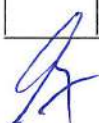
Course Outcomes:
Upon successful completion of this course, the student will be able to:

0CCMC503_1	**Examine** multidisciplinary nature of environmental science to showcase correlation with other fields with the help of case studies.
0CCMC503_2	**Choose** best alternatives for natural resources to exhibit its importance for future depending on criteria like availability, price and advantages.
0CCMC503_3	**Select** proper methods of ecosystem conservation to protect threatened species of plants and animals taking into consideration criterion like its advantages, effects.
0CCMC503_4	**Analyze** remedies to control types of pollution for minimizing effects of pollution on human and environments with the help of its effectiveness, suitability and case studies.
0CCMC503_5	**Compare** environmental protection acts for understanding its importance based on its silent features.
0CCMC503_6	**Prepare** a technical report to highlight importance of environment in human life by using techniques like survey, case studies, mini project.

Course Contents:

Unit No.	Unit name	Contact Hrs.
Unit 1	**Nature of Environmental Studies** Definition, scope and importance. Multidisciplinary nature of environmental studies, Need for public awareness.	02 Hrs.
Unit 2	**Natural Resources and Associated Problems** a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people, b) Water resources: Use and over-utilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and non-renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy, f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.	04 Hrs.
Unit 3	**Ecosystems** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem:- a)Forest ecosystem, b)Grassland ecosystem, c)Desert ecosystem, d)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	04 Hrs.
Unit 4	**Biodiversity and its conservation** Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation. Western Ghat as a biodiversity region. Hot-spots of biodiversity. Threats to biodiversity habitat loss, poaching of wildlife, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	05 Hrs.

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Unit 5	**Environmental Pollution** Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.	04 Hrs.
Unit 6	**Social Issues and the Environment** Disaster management: floods, earthquake, cyclone, tsunami and landslides Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issue and possible solutions. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products.	03 Hrs.
Unit 7	**Environmental Protection** From Unsustainable to Sustainable development Environmental Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Population Growth and Human Health, Human Rights	06 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Environmental Studies	Dr. B. S. Chauhan	University Science Press, New Delhi	1st	2008
2	Environmental Studies	Dr. P. D. Raut	S. U. Kolhapur	3rd	2011
3	Environmental Studies	Anindita Basak	PEARSON	1st	2017

Reference Books:

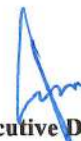| Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning Singapore	2nd	2005
02	Elements of Environmental Science and Engineering	P. Meenakshi	Prentice Hall of India Private Limited, New Delhi	-	2006
03	Environmental Science – working with the Earth	G. Tyler Miller Jr	Thomson Brooks /Cole	11th	2006

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Annasaheb Dange
College of Engineering and Technology
Ashta

An Autonomous Institute affiliated to Shivaji University
Kolhapur

Curriculum Contents

S.Y. B. Tech.
ARTIFICIAL INTELLIGENCE AND
DATA SCIENCE

SEM IV

(Academic Year 2022 - 2023)
updated

ADCET
Annasaheb Dange College of Engineering and Technology, Ashta
Department of Artificial Intelligence and Data Science

Teaching and Evaluation Scheme
B. Tech: IV Semester

Course Code	Course	Teaching Scheme				Scheme	Theory Marks		Practical Marks	
		L	T	P	Credits		Max.	Min. for Passing	Max.	Min. for Passing
0ADBS205	Statistics, Probability and Fuzzy Logic	3	1	0	4	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADPC206	Software Engineering for Data Science	3	0	0	3	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADPC207	Database Management System	3	0	0	3	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADPE2**	Professional Elective-I	3	0	0	3	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0CCHS504	Universal Human Values- I	2	0	0	2	ISE I	25	10 20	--	--
						ISE II	25	10	--	--
0ADPC254	Database Management System Laboratory	0	0	2	1	ISE	--		25	10
						ESE	POE		50	20
0ADPC255	Web Technology	2	0	2	3	ISE	--		50	20
						ESE	POE		50	20
0ADPR256	Innovation/Prototype	0	0	2	1	ESE	PR		25	10
0CCMC505	Constitution of India	2	0	0	-	Audit				
VAC-4	Value Added Course-4	2			-	Audit				
Total		**20**	**1**	**6**	**20**		**450**		**200**	
Total Contact Hours/ Week: 27 Hrs						**Total = 450 + 200 = 650**				

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	2	4	-	10	3	-	1
Cumulative Sum	6	17	18	32	3	-	1

Professional Elective - I	
0ADPE208	Ethics in AI and Data Science
0ADPE209	Microprocessor and Microcontroller
0ADPE210	Sensors for Engineering Applications
0ADPE211	Advanced Data Structure

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Course Details:

Class	S. Y. B. Tech., Sem.-IV
Course Code and Course Title	0ADBS205 **Statistics, Probability and Fuzzy Logic**
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial	3/1
Credits:	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:	
0ADBS205_1	Apply statistical techniques to interpret the given data.
0ADBS205_2	Solve problems in probability theory using distributions and test of hypothesis.
0ADBS205_3	Construct different fuzzy sets using basic definitions of fuzzy sets.
0ADBS205_4	Use the extension principle on fuzzy numbers/sets to develop arithmetic operations.

Course Contents:

Unit No.	Name of the Unit	Contact Hours
Unit 1	**Measures of Central Tendency:** 1.1 Arithmetic Mean 1.2 Geometric Mean 1.3 Harmonic Mean 1.4 Median 1.5 Mode 1.6 Partition values: Quartiles, Deciles and Percentiles	06 Hrs.
Unit 2	**Measures of Dispersion:** 2.1 Concept of dispersion 2.2 Range 2.3 Quartile Deviation 2.4 Mean Deviation 2.5 Mean Square Deviation 2.6 Variance and Standard Deviation 2.7 Moments 2.8 Skewness by Karl Pearson's method 2.9 Kurtosis	08 Hrs.
Unit 3	**Probability Distribution** 3.1 Random variable 3.2 Binomial Distribution 3.3 Poisson Distribution 3.4 Normal Distribution.	07 Hrs.
Unit 4	**Statistical Interference- Test of Hypothesis** 4.1 Sampling distributions 4.2 Testing of Hypothesis 4.3 Level of Significance 4.4 Testing of Significance for large sample 4.5 Testing of Significance for small sample: Students t-distribution and Chi-Square Test	07 Hrs.
Unit 5	**Introduction to Fuzzy sets.** 5.1 Basic concepts of Fuzzy Sets 5.2 Crisp Set and Fuzzy Set 5.3 Membership Functions 5.4 Basic operations on fuzzy sets 5.5 Properties of fuzzy sets.	07 Hrs.
Unit 6	**Fuzzy Arithmetic** 6.1 Fuzzy Numbers 6.2 Fuzzy Cardinality 6.3 Operations on Fuzzy Numbers 6.4 Fuzzy Equations of Type $A + X = B$ and $A.X = B$.	07 Hrs.

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Higher Engineering Mathematics	Dr. B. S Grewal	Khanna Publishers	44th	2018
02	A Text Book of Engineering Mathematics (For Unit 1)	N. P. Bali, Manish Goyal	Laxmi Publications(P) Ltd	8th	2011
03	Advanced Engineering Mathematics	H. K. Dass	S. Chand	22nd	2018
04	Fuzzy Sets & Fuzzy Logic Theory and Applications (For Unit 2 & 3)	George J. Klir and Bo Yuan	PHI Learning Private Limited	-	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Probability and Statistics for Computer Science	James L. Johnson	Wiley	1st	2008
02	Probability and Statistics for Engineers	Dr. J. Ravichandran	Wiley	1st	2012
03	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley Publishers	9th	2013
04	Fuzzy Logic with Engineering Applications	Timothy J. Ross	Wiley	3rd	2013

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Class	B. Tech, Sem. IV
Course Code and Course Title	0ADPC206- Software Engineering for Data Science
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADPC206_1	**Design** a solution to solve a given problem using software engineering models
0ADPC206_2	**Build** software requirement specifications and project plan to solve a given problem through analyzing the problem statement
0ADPC206_3	**Develop** a software system design to solve a given problem using structured or function-oriented design methodology.
0ADPC206_4	**Test** the functioning of given program to check correctness of code using test cases.
0ADPC206_5	**Identify** appropriate standard for a given process to maintain software reliability and quality using quality standards like ISO 9000, CMM etc.

Course Contents:

Unit No.	Unit Name	Contact Hrs
Unit 1	**Software Processes and Agile Methodology** Software Process, Software Development Process Models, Agile software development - Agile methods, Plan-driven and agile development, Extreme programming, Scaling agile methods	08Hrs
Unit 2	**Software Requirements Analysis and Specification** Software Requirement, Problem Analysis, Requirements Specification, Functional Specification with Use Cases, validation.	06Hrs
Unit 3	**Planning a Software Project** Process Planning, Effort Estimation, Project Scheduling and Staffing, Software Configuration Management Plan, Quality Plan, Risk Analysis & Management.	07 Hrs
Unit 4	**Function Oriented Design** Design Principles, Module-Level Concepts, Design Notation and Specification, Structured Design Methodology	07 Hrs
Unit 5	**Coding and Testing** Programming Principles and Guidelines, Coding Process, Testing Fundamentals, Black-Box Testing, White-Box Testing.	07Hrs
Unit 6	**Software Reliability and Quality Management** Software Reliability, Software Quality, Software Quality Management System, ISO 9000, SEI CMM	07Hrs

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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	An integrated approach to S/W engineering	Pankaj Jalote	Narosa Publishers	3rd	2011
2	Fundamentals of Software Engineering	Rajib Mall	PHI	3rd	2009
3	Software Engineering	Jawadekar W.S.	TMGH	7th	2007

Reference Books:

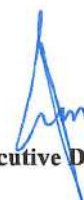| Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Software Engineering	Ian Sommerville	Pearson	10th	2016
2	Software Engineering: Practitioner's Approach	Roger S. Pressman	McGraw Hill	7th	2010
3	Software Engineering principles and practices	RohitKhuran	Vikas Publishing House Pvt. ltd	2nd	2010

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Course Details:

Class	B. Tech., Sem. IV
Course Code and Course Title	0ADPC207- Database Management System
Prerequisite/s	0ADPC202: **Data Structures**
Teaching Scheme: Lecture/Tutorial	2/0
Credits	02
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADPC207_1	Explain different concepts of database and conceptual database design, relational algebraic SQL and normalization.
0ADPC207_2	Design ER model for given system and prepare the relational database schema for the using integrity constraints, validate it by applying different normalization techniques.
0ADPC207_3	Summarize SQL queries in pure languages to access essential information from the database.
0ADPC207_4	Describe file organization concepts of indexing for efficient system performance, transaction management and concurrency control.
0ADPC207_5	Use concepts of indexing, concurrency protocols and recovery algorithms with real-world examples.

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction to databases and ER Model** **Introduction:** Introduction to database, advantages and applications, Database View - Levels of data abstraction, Data models, Database System Architecture. **ER Model:** Entity concept, Entity set, Relationship sets, Relationship types, Keys, Features of ER Model –Generalization, Specialization, aggregation	07 Hrs.
Unit 2	**Relational Model and SQL** **Relational Model:** Relational model concept, Relational Database structure, Conversion of ER model into Relational schemas, Relational algebra queries **SQL:** Introduction to SQL, Data definition statements with constraints, Insert, Update and Delete, Set operations, Group by and having aggregate functions, clauses, Nested Queries, Joins.	8 Hrs.
Unit 3	**Functional Dependency and Normalization** Importance of a good schema, Motivation for normalization forms, Atomic domains and 1NF, Dependency- functional dependencies, closure of a set of FD's, Concepts of 2NF, 3NF and BCNF, Decomposition algorithms, Multivalued dependencies, Join dependencies.	08 Hrs.
Unit 4	**Data Storage & Indexing** Data storage and its types, file organization, organization of records into files, Data Dictionary, Database Buffer **Indexing:** Concept, Ordered Indices-Primary, Secondary, Multilevel, hashing, Hash Indices, Dynamic hashing.	07 Hrs.
Unit 5	**Transaction Management & Concurrency Control** **Transaction Processing:** Transaction processing concept, ACID properties, Transaction states, Implementation of atomicity, isolation and durability, Serializability, **Concurrency Control:** Lock-based protocols, Timestamp - based Protocols, Validation -based Protocols, Deadlock handling.	07 Hrs.
Unit 6	**Recovery System** Failure classification, Storage structure, Implementation of stable and Atomicity, Log based recovery, Checkpoints, Shadow paging, crash recovery.	05 Hrs.

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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Database system concepts	A. Silberschatz, H.F. Korth, S. Sudarshan	McGraw Hill Education	6th	2011
2	Database Systems - Design, Implementation and Management	Rob & Coronel	Thomson Course Technology	5th	2008
3	Database Systems- A practical approach to Design, Implementation	Thomos Connolly, Carolyn Begg	Pearson Education	4th	2009

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Database Systems: Design, Implementation and Management	Peter Rot'. Carlos Coronel	Cengage Learning	7th	2014
2.	Fundamentals of Database Systems	Ramez Elmasri and Shamkant Navathe	Pearson Education	4th	2007
3.	Principles of Database System	J. D. Ullman	Galgotia publications	1st	2011

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Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	0ADPE208 **Ethics in AI and DS**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	3/0/0
Credits:	03
Evaluation Scheme: ISE-I/MSE/ISE-II/ESE	10/30/10/50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADPE208_1	Explain Responsibility in the ethics of technology for privacy
0ADPE208_2	Analyze anonymity and data validity with the help different case studies.
0ADPE208_3	Explain algorithmic fairness and Societal Consequences and Code of Ethics
0ADPE208_4	Design ethical frameworks for different real-life applications
0ADPE208_5	Discuss issues and challenges regarding AI policies

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction to Ethics** What are Ethics? History, Concept of Informed Consent, Data Ownership **Introduction to Ethics of AI,** Responsibility in the ethics of technology	06 Hrs.
Unit 2	**Privacy** Privacy, History of Privacy, Degrees of Privacy, Modern Privacy Risks, Case Study: Targeted Ads Case Study: The Naked Mile Case Study: Sneaky Mobile Apps	06 Hrs.
Unit 3	**Anonymity and Data Validity** Anonymity, De-identification Has Limited Value, Case Study: Credit Card Statements, Validity, Choice of Attributes and Measures, Errors in Data Processing, Errors in Model Design, Managing Change, Case Study: Three Blind Mice, Case Study: Algorithms and Race, Case Study: Algorithms in the Office, Case Study: German Wings Crash, Case Study: Google Flu	09 Hrs.
Unit 4	**Algorithmic Fairness** Algorithmic Fairness, Correct but Misleading Results, P Hacking, Case Study: High Throughput Biology, Case Study: Geopricing, Case Study: Your Safety Is My Lost Income **Societal Consequences and Code of Ethics** Societal Impact, Ossification, Surveillance, Case Study: Social Credit Scores, Case Study: Predictive Policing, Code of Ethics, Case Study: Algorithms and Facial Recognition	07 Hrs.
Unit 5	**Case-studies, examples and ethical frameworks** Ethics of autonomous vehicles, Autonomous weapons and the digitalization of conflicts, Digital medicine, Sustainability and environmental impact, Cybersecurity and AI	07 Hrs.
Unit 6	**Issues and challenges** Human decisions and AI, Human decisions and AI, what is the value of privacy in information society? What is the value of privacy in information society? Moralizing technologies Governance and policies **AI policies** Ethics of AI: a paradigmatic change	07 Hrs.

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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Artificial Intelligence - The Practical Legal Issues	Buyers John	Law brief publishing	2nd Edition	2019
2	The Ethics of AI	Alberto Chierici	Atlantic	1st	2021

Other Books/E-material

Sr. No	Title	Author	Publisher
01	Coursera video lectures	Coursera Author	https://www.coursera.org/learn/ethics-of-artificial-intelligence
02	Coursera video lectures	Coursera Author	https://www.coursera.org/learn/data-science-ethics

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Course Details:

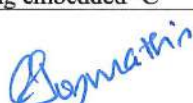| Class	B. Tech, Sem.-IV
Course Code and Course Title	0ADPE209- Microprocessor and Microcontroller
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	3/0/0
Credits:	03
Evaluation Scheme: ISE-I/MSE/ISE-II/ESE	10/30/10/50

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPE209_1	**Explain** the architecture of 8085, 8051 and PIC16f877 to understand PIN configuration of each processor.
0ADPE209_2	**Compare** microprocessor and microcontrollers for analyzing interfacing between peripheral devices.
0ADPE209_3	**Design** Pin description of 8051 microcontroller to understand the internal design and features of 8051 microcontroller by using advanced simulator.
0ADPE209_4	**Interface** stepper motor, DC motor and on board peripheral to communicate with 8051 and PIC using trainer kit.
0ADPE209_5	**Write** programs over 8085 microprocessor, 8051 and PIC microcontroller in assembly and C using instruction set.

Course Contents:

Sr. No.	Unit Name	Contact Hours
Unit 1	**Microprocessor Architecture and Microcomputer System** Microprocessor Architecture and its operation- Microprocessor initiated operations, internal operation, and Peripheral operation. Memory- Flip-flop or latch as storage element, memory map and addresses, memory and Instruction fetch, memory classification, Input and output devices.	6 Hrs
Unit 2	**8085 Microprocessor Architecture** The 8085 MPU, Microprocessor communication and bus timing, De-multiplexing address and Data bus, Generating control signals, The 8085Architecture, and 8085 based microcomputer-machine cycles and bus timing, op-code fetch machine cycle, memory read and write machine cycle.	7 Hrs
Unit 3	**8085 assembly language programming** The 8085 programming model, instruction classification, instruction and data format, Writing and execution of assembly language program. The 8085 instruction-data transfer operations, addressing modes, Arithmetic operation, Flag concept and cautions, Logic operations, Branch operations.	8 Hrs
Unit 4	**Introduction to 8 Bit Microcontroller 8051** Difference between general purpose microprocessor and microcontrollers, Introduction to MCS51family, Architecture of 8051, Functional pin out diagram of 8051, Reset circuit, Machine cycle, oscillator circuit, programming model, memory organization, instruction set, addressing modes, assembly language programming, Boolean instructions.	7 Hrs
Unit 5	**Architecture of PIC microcontroller & instruction set** CPU architecture: Harvard architecture & pipelining, program memory considerations, register file structure, instruction set, addressing modes: immediate, direct, Indirect CPU registers: status word, FSR, INDF, PCLATH, PCL, assembly language programming, Pin diagram of 16f8xx,features of PIC	8 Hrs
Unit 6	**Embedded 'C' Programming for 8051** Introduction to compiler, assembler, debugger, interpreter, C data types, I/O programming, programming for LCD, LED, DC motor , stepper motor using embedded 'C'	6 Hrs

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Microprocessor Architecture – programming and applications with 8085	Ramesh Gaonkar	Penram International	4th	2007
2	The INTEL Microprocessors - Architecture, Programming and Interfacing	Barry B. Brey S	PHI Ltd	8th	2010
3	The 8051 Microcontroller and Embedded systems using assembly and C	Mazidi & D Mackinlay	Pearson Education	2nd	2011
4	Design with PIC microcontrollers	John B Peatman	Pearson Education	1st	2012

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Microprocessors and Microcontrollers	N. Senthi Kumar, M. Saravanan and S. Jeevananthan	Oxford University Press	2nd	2001
2	Microprocessor 8086: Architecture, Programming and Interfacing	Mathur Sunil	PHI Publication	4th	2011
3	8051 Microcontroller	Subrata Ghoshal	Pearson Education	1st	2010
4	8051 microcontroller	Kenneth J Ayala	Cencage Learning	3rd	2012

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Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	0ADPE210 Sensors for Engineering Applications
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	3/0/0
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADPE210_1	Identify sensors, actuators, Micro sensors and Micro actuators to solve a problem using sensor fundamentals and its characteristics.
0ADPE210_2	Use Microsensors and Microactuators to solve the problems in different scenarios using Arduino IDE.
0ADPE210_3	Design a solution for given problem using sensors and ESP32 with Arduino IDE.
0ADPE210_4	Design sensor system for real world applications using Raspberry Pi.
0ADPE210_5	Connect sensors and actuators with ESP32 to solve a problem using pin description of ESP32 microcontroller.

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Sensor fundamentals and Characteristics** Introduction, Basic principles of sensor, sensor classification, Understanding various sensors, sensor selection and characteristics: Range, resolution, sensitivity, error, precision, repeatability, linearity and accuracy, impedance response time and backlash, Performance measures of sensors.	6 Hrs.
Unit 2	**Types of sensors and their applications** Temperature sensor, Proximity sensors, Infrared sensor, Ultrasonic sensor, Light sensor, Smoke and Gas sensor, Alcohol sensor, Humidity sensor, automobile sensor, home appliance sensors. Real time application of sensors, Technologies related to sensors: Metal detector, Global Positioning system, Blood Glucose monitoring, Photoelectric sensor.	7 Hrs.
Unit 3	**Actuators** Definition, types and selection of Actuators, Working principle of actuators, Linear actuators, Rotary actuators, Logical and continuous actuators, Pneumatic actuator, Hydraulic actuators- control valves, Electrical actuating system: solid state switched, solenoids, electric motors- principle of operation and its application, DC motors, AC motors, Synchronous motors , Stepper motors.	8 Hrs.
Unit 4	**Micro Sensors and Micro Actuators** Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors. Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.	8 Hrs.
Unit 5	**Introduction to ESP32 and Raspberry Pi** Overview of ESP32 and its features, Block diagram of ESP32, Specifications, Layout, Pin description for ESP32, Understanding concepts of Arduino, Setting up an ESP32 with Arduino IDE, Introduction to Raspberry Pi.	7 Hrs.
Unit 6	**Case Studies** Sensors and actuators in Smart cities, Agriculture, Health Care, Activity Monitoring, Weather monitoring system, Forest fire detection.	6 Hrs.

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Sensors and Actuators in Mechatronics, Design and Applications	Andrzej M. Pawlak	CRC Press, Taylor & Francis group	1st	2007
2	Hand Book of Modern Sensors: Physics, Designs and Application	Jacob Fraden	Springer	5th	2016
3	Sensors and Transducers	Patranabis. D	Wheeler publisher	4th	1994

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Mechatronic systems, Sensors and Actuators Fundamentals and Modelling	Robert H. Bishop	Taylor & Francis Group	1st	2006
2	Micro actuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures	Massood Tabib and Azar	Kluwer academic publishers, Springer	1st	1997
3	Microsystem Technology and Microbotics	Sergej Fatikow and Ulrich Rembold	Springer	1st	1997
4	ESP32 web server with Arduino IDE, step–by–step project guide	Rui Santos and Sara Santos	-	-	-

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Annasaheb Dange College of Engineering and Technology, Ashta
Department of Artificial Intelligence and Data Science

Class	B. Tech, Sem. IV
Course Code and Course Title	0ADPE211- Advanced Data Structures
Prerequisite/s	Data Structures, Computer Algorithms
Teaching Scheme: Lecture/Tutorial	03/0/0
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPE211_1	Describe various advanced data structure techniques such as advanced linked list, advanced trees, graphs.
0ADPE211_2	Describe various hashing techniques and collision resolution techniques.
0ADPE211_3	Demonstrate the knowledge of advanced data structures in solving problems.
0ADPE211_4	Analyze the algorithms and compare the working of various data structures.
0ADPE211_5	Evaluate the performance of various data structures with help of different case studies.

Course Contents:		
Unit 1	**Advanced Linked List** Memory Efficient Doubly Linked List, XOR Linked List, Skip List, Self-Organizing List	6 Hrs.
Unit 2	**Advanced Trees** Segment Tree, Binary Indexed Tree, Binary Search Tree, Self-Balancing BST, Red Black Tree, Splay Tree	9 Hrs.
Unit 3	**Data Structure Transformations** Making Structures Dynamic, Making Structures Persistent **Data Structures for Strings** Tries and Compressed Tries, Dictionaries Allowing Errors in Queries, Suffix Trees, Suffix Arrays	6 Hrs.
Unit 4	**Graph Problem**: Edge Coloring, Vertex coloring, Max flow- mincut theorem, Probabilistic models	7 Hrs.
Unit 5	**Dynamic Graphs**: Link Cut Trees, Preferred Path Decomposition, Dynamic Connectivity, Euler Tour Trees.	8 Hrs.
Unit 6	**Hashing** Hashing, Collision resolution techniques, Cuckoo Hashing	6 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to Algorithms	Thomas H Cormen, Charles Leiserson, Ronald Rivest	PHI	3rd	2009
02	Computational Geometry- Algorithms and Application	Mark De Berg, Otfried Cheong, Marks Overmars	Springer	3rd	2008
03	Advanced Data Structure	Erik Demaine	MIT Open Courseware	-	-

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Computational Geometry in C	Joseph O'Rourke	Cambridge University Press	-	-
02	Graph Theory	Reinhard Diestel	Spinger-Verlag	-	2000
03	Advanced Data Structures	Peter Brass	Cambridge University Press	-	-

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Class	S.Y, B. Tech, Semester. - IV (Common to all Programs)
Course Code and Course Title	**0CCHS504 / 1CCHS504 / 2CCHS504** **Universal Human Values- I**
Prerequisite/s	Students Induction Program (SIP)
Teaching Scheme: Lecture/Tutorial	02/00
Credits	02
Evaluation Scheme: ISE I/ ISE II	25/25

	Course Outcomes (COs):
	Upon successful completion of this course, the student will be able to:
1	Integrate the process of self-exploration to achieve Harmony in the human being's based on Holistic perspective of value education.
2	Understanding Harmony in human being, family, society and nature /existence, based on methods to fulfill human aspiration
3	Apply the human values for maintaining the relationships with oneself and others using the principals of harmony
4	Adopt the methods of maintaining harmony with the society, nature, and its existence by utilizing the human order systems.

Course Contents

Unit No.	Course Contents	Hours
Unit 1	**Introduction to Value Education** Introduction, Need, Purpose and motivation for the course, recapitulation from Universal Human Values-I **Self-Exploration**–what is it? - Its content and process; 'Natural Acceptance' and **Experiential Validation**- as the process for self-exploration. **Continuous Happiness and Prosperity**- A look at basic Human Aspirations, **Right understanding**, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.	04
Unit 2	**Understanding Happiness and Prosperity** **Understanding Happiness** and Prosperity correctly, **Prevailing sources of happiness**, Prosperity and its implications Method to fulfil the human aspirations: understanding and living in harmony at various levels.	04
Unit 3	**Understanding Harmony in the Human Being - Harmony in Myself** **Understanding human** being as a co-existence of the sentient 'I' and the material 'Body', **Understanding the needs of Self ('I') and 'Body'** - happiness and physical facility **Understanding the Body as an instrument of 'I'** (I being the doer, seer and enjoyer) **Understanding the characteristics and activities of 'I' and harmony in 'I'** **Understanding the harmony of I with the Body**: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health.	06

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Unit 4	**Understanding Harmony in the Family - Harmony in Human-Human Relationship** 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 **Understanding the meaning of Trust**; Difference between intention and competence **Understanding the meaning of Respect**, Difference between respect and differentiation; **Peer Pressure** the Concerns and its Resolution the other salient values in relationship.	07
Unit 5	**Understanding Harmony in the Society** **Understanding the harmony in society**: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals **Human order systems** and dimensions	04
Unit 6	**Understanding Harmony in the Nature and Existence** **Understanding the harmony in the Nature,** Inter-connectedness and mutual fulfilment among the four orders of nature, recyclability and self-regulation in nature	03

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Understanding Human Being, Nature and Existence Comprehensively	UHV Team	UHV	1st	2022
02	A Foundation Course in Human Values and Professional Ethics	R. R. Gaur, R Asthana, G P Bagaria	Excel Books	2nd	2019
03	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics	R. R. Gaur, R Asthana, G P Bagaria	Excel Books,	2nd	2019
04	Human Values	A.N Tripathy	New Age International	2nd	2006

Reference Books / Handbooks

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria	Excel Books	3rd	2010
02	Indian Ethos and Modern Management: Amalgam of the Best of the Ideas from the East and the West	B.L. Bajpai	New Royal Book	1st	2004
03	Small Is Beautiful	E. FSchumacher	Hartley & Marks	1st	1999
04	An Introduction to Ethics	William Lilly	Allied	1st	1967

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Class	S.Y. B. Tech, Sem. IV
Course Code and Course Title	0ADPC254 - Database Management System Laboratory
Prerequisite/s	--
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / ESE	25/ 50

Course Outcomes (COs):
Upon successful completion of laboratory practice, the student will be able to:

0ADPC254_1	Interpret given problem statement of an enterprise, identify need, analyze the problem and design ER model for the enterprise as well as prepare the relational database schema identifying its integrity constraints.
0ADPC254_2	Demonstrate the installation and configuration of Oracle /MySQL / SQL Server.
0ADPC254_3	Apply the Structured Query language for database definition and manipulation and also use PL/SQL constructs.
0ADPC254_4	Experiment different hashing techniques, transaction processing and concurrency control.
0ADPC254_5	Follow professional and ethical principles during laboratory work in a team for laboratory activities.

Expt. No.	Title of Experiment
1.	Drawing an E-R Diagram for any organization.
2.	Converting E-R diagram into Relational Tables.
3.	Installation and Demonstration of DBMS Oracle / MySQL / SQL Server / PostgreSQL etc.
4.	Study and Implementation of Data Definition Language (DDL) Queries (e.g. create, alter and drop tables).
5.	Study and Implementation of Data Manipulation Language (DML) Queries (e.g. insert, delete, update and select statements).
6.	Study and Implementation of Basic SQL SELECT statement for displaying / extracting data from single table or multiple tables.
7.	Study and implementation of SQL constructs for aggregating data, use of group by, having clauses.
8.	Study and implementation of nested sub-queries, complex queries, views and Joins.
9.	Study and Implementation of Triggers.
10.	Study and Implementation of Functions and Stored Procedures.
11.	Implementation of Database connectivity with object oriented language (Java).
12.	Few aspects of authorization such as creating and managing users, roles, granting and revoking of privileges etc.
13.	Creating Indices for the tables, implementing static hashing.
14.	Study of Transaction processing and concurrency control techniques.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Database system concepts	A. Silberschatz, H.F. Korth, S. Sudarshan	McGraw Hill Education	6th	2011
02	Database Systems- A practical approach to Design, Implementation and Management	Thomos Connolly, Carolyn Begg	Pearson Education.	4th	2009
03	Database Systems – Design, Implementation and Management	Rob & Coronel	Thomson Course Technology	5th	2008
04	Database Management Systems	Raghu Ram Krishnan	McGraw Hill	3rd	2002

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Database Systems	Ramez Elmasri and Shamkant Navathe	Pearson Education	5th	2007
02	Database Systems: Design, Implementation and management	Peter Rof, Carlos Coronel	Cengage Learning	7th	2014
03	Principles of Database Systems	J. D. Ullaman	Galgotia publications	1st	2011
04	SQL: A Complete Reference	Alexis Leon, Mathews Leon	McGraw Hill Education	1st	2002

Other Books/E-material

Sr. No	Title	Author	Publisher
01	NPTEL video lectures	NPTEL Author	www.nptel.ac.in

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Annasaheb Dange College of Engineering and Technology, Ashta
Department of Artificial Intelligence and Data Science

Course Syllabus:

Class	B. Tech, Sem. IV
Course Code and Course Title	0ADPC255 - Web Technology
Prerequisite/s	Computer Network And JAVA
Teaching Scheme: Lecture/Tutorial/Practical	2/0/2
Credits	3
Evaluation Scheme: ISE/ESE	50/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPC255_1	Construct a basic website using HTML and CSS.
0ADPC255_2	Design a web application for different sized screens using Bootstrap , Javascript and ReactJS
0ADPC255_3	Develop a web application for given problem statement using NodeJs, ExpressJS and MongoDB.
0ADPC255_4	Plan, develop, debug, and implement interactive client-side and server-side web applications for real time problems using client side and server side web techniques.

Course Contents:		
Unit 1	**Responsive web design with HTML5** HTML5 Basics, Tables, Lists, Working with Link, Image Handling, Frames, iFrame, HTML Forms for user Input, New Form Elements, HTML5 Client-Side Storage	04 Hrs
Unit 2	**CSS3** CSS-Introduction, CSS-Syntax, CSS-Text Fonts, CSS-Lists Tables, CSS-Box Model , CSS-Display Positioning, CSS-Floats, Color, Gradients, Background Images, and Masks, Border and Box Effects, Working with Colors, Layout: Columns, Flex Box, Implementing CSS3, Transforms, Transitions, and animations	04 Hrs
Unit 3	**Bootstrap and JavaScript** Introduction to Bootstrap, Bootstrap Grid, Bootstrap, Components, Bootstrap Plugins, JavaScript Fundamentals BOM (Browser Object Model),DOM (Document Object Model),AJAX Development, Typescript, MotionUI.	06 Hrs.
	ReactJS React Introduction, React Essential Features and Syntax, React Components, Props and State, Styling Components, Debugging React Apps, React Component lifecycle ,React Component in Details, HTTP Requests/AJAX Calls, React Routing, React Forms and Form Validation, Deploying React App to the Web Testing React apps with JEST.	04Hrs.
Unit 5	**NodeJS** Introduction to NodeJS, Setup Dev Environment, Event Loop, Node JS Modules, Node Package Manager, Creating Web server, File System, Debugging Node JS Application Events. ExpressJs, Routing, Template engines, Middleware, Web Application components, Error handling, Testing application Express application.	06Hrs.
Unit 6	**MongoDB** MongoDB – Overview, CRUD Operations, Basic Operations, Aggregations, Indexing, Replication and Sharding.	04 Hrs.

Experiment List:	
1	Programs based on newly introduced elements of HTML5.
2	Programs based on Typography and background properties of CSS3, animation effect by using the transition feature of CSS.
3	Programs based on JavaScript operators, functions and objects.
4	Programs based on Jquery selectors, Jquery events.
5	Program to demonstrate concept of DTD and its types.
6	XSLT styles-sheet to convert XML document to HTML.
7	program to implement PHP variables, Expression, arrays, control structure
8	Design a web form and validate it using PHP using regular expressions

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9	Design a web page to perform CRUD operations on MySQL database using PHP
10	Write a program to manage session in PHP
11	Installation of CMS and designing web pages using CMS.
12	CMS theming and plugins

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Advanced Internet Technology	Deven Shah	Dreamtech Press	1st	2015
02	XML in a Nutshell	ElliotteRustyHarold, W. Scott Means	O'Reilly Publication	3rd	2004
03	Web Technologies: Black book	Kogent Learning Solutions Inc.	Dreamtech Press	1st	2009
04	Web Content Management	Deane Barker	O'Reilly Media	1st	2016

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Learning PHP, MySql, Java Script, CSS and HTML5	Robin Nixon	O'really	3rd	2014
02	Learning PHP, MySql, Java Script with JQuery, CSS and HTML5	Robin Nixon	O'really	4th	2012
03	Search Engine Optimization All-in-One for Dummies	Bruce Clay	John Wiley & Sons	3rd	2015
04	Learning Responsive Web Design: A Beginner's Guide	Clarissa Peterson	O'Reilly Media, Inc.	1st	2014

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Course Details:

Class	B. Tech., Sem. IV
Course Code and Course Title	0ADPR256- Innovation/Prototype
Prerequisite/s	
Teaching Scheme: Lecture/Tutorial/Practical	0/0/2
Credits	2
Evaluation Scheme: ISE I / MSE / ISE II / ESE	0/0/0/25

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPR256_1	Proficiently Apply the innovative thinking techniques to empathize the customer through arranging survey and/or interview
0ADPR256_2	Accurately Identify and Formulate the solution for real world problem using innovative technique
0ADPR256_3	Proficiently Create and Exhibit Prototype, for defined real world problem using innovative approach
0ADPR256_4	Accurately Comply & Test developed prototype for defined real world problem to meet user's requirements
0ADPR256_5	Routinely Adapt professional skills and ethical practices to provide a reliable solution for defined real world problem through participating in team activities

Course Contents:

1.	**Design thinking for innovation** Introduction of design thinking process, innovation and their role, Process of thinking in right direction, Incubation, Final ideation, Brain Storming, Psychological aspect of creativity.
2.	**Human and Culture Centered Design** Design for Society, better existing design, Design for change Cultural change, social change, Life style change
3.	**Visual communication and sketching** Anyone can sketch, expression of thinking and problem solving through sketch and graphic design.
4.	**Prototyping & Fabrication** Process of Prototype design, Problems of different stages in prototype design, refines Prototype, Finalize Prototype
5.	**Engineering aspect of design** Electrical, Mechanical, Design, Material, Aspect, Safety and Reliability aspect
6.	**Introduction of Startup with entrepreneurship approach:** What is entrepreneurship, being an entrepreneurship, Challenges and possibilities of Entrepreneurship? How to Start up, Start-up Fundamental, Being Successful.

Experiments:

8-10 experiments based on above topics will be conducted

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Understanding Design Thinking, Lean, and Agile	Jonny Schneider	O'Reilly	---	2017
02	Engineering Design	John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson	Cengage learning	2nd	2013.
03	Design for How People Think	John Whalen	O'Reilly	---	2019

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Creative Confidence: Unleashing the Creative Potential Within Us All	Kelley, D. & Kelley, T	New York: William Collins	--	2014
02	The Design of Business: Why Design Thinking is the Next Competitive Advantage	Roger Martin	Harvard Business Press	--	2009
03	Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School	Idris Mootee	John Wiley & Sons	--	2013

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Course Details:

Class	Sem.-IV
Course Code and Course Title	0CCMC505, Constitution of India
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial	02/00
Credits	--
Evaluation Scheme: ISE	Audit

Course Objectives (COs): -
The course aims to,

1	To acquaint the students with legacies of constitutional development in India.
2	To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
3	To channelize students' thinking towards basic understanding of Government of the Union and Government of the States.
4	To channelize students' thinking towards basic understanding of the Judiciary. Regulation to Information acts.

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0CCMC505_1	**Explore** the basic features and modalities about Indian constitution.
0CCMC505_2	**Differentiate** the functioning of Indian parliamentary system at the center and state level.
0CCMC505_3	**Explain** different aspects of Indian Legal System and its related bodies.
0CCMC505_4	**Identify** different laws and regulations related to engineering practices.
0CCMC505_5	**Correlate** role of engineers with different organizations and governance models.

Course Contents:

Unit 1	**Constitution** Structure and Principles Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947,	02 Hrs
Unit 2	**Making of Indian Constitution** Enforcement of the Constitution, Meaning and importance of Constitution Making of Indian Constitution – Sources, Salient features of Indian Constitution, Preamble.	02 Hrs
Unit 3	**Fundamental Rights** Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies.	02 Hrs
Unit 4	**Fundamental Duties** Directive Principles-Definition, State to secure a social order for the promotion of welfare of the people, Certain principles of policy to be followed by the State, Equal justice and free legal aid, Right to work, to education and to public assistance in certain cases.	02 Hrs
Unit 5	**Regulation to Information** Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act	03 Hrs
Unit 6	**Business Organizations and E-Governance** Sole Traders, Partnerships Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Role of I.T. professionals in Judiciary	03 Hrs

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	The Constitution of India	Dr. B. R. Ambedkar	Law literature Publications	---	2020
02	Introduction to the Constitution of India	Durga Das Basu	Gurgaon; Lexis Nexis	23rd	2018
03	Governance in India	M. Laxmikanth	Mc Graw Hill Publications Delhi	3rd	2021
04	The Constitution of India	P.M. Bakshi	Lexis Nexis	---	2019

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to the Constitution of India	Durga Das Basu	Gurgaon; LexisNexis	23rd	2018
02	The Constitutional Law of India,	J.N. Pandey	Allahabad; Central Law Agency	55th	2018
03	Constitution of India (Full Text)	India.gov.in	National Portal of India	---	---
04	India's Constitution	M.V.Pylee	S. Chand Publications New Delhi	16th	2017

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ADCET

Annasaheb Dange College of Engineering and Technology
Artificial Intelligence and Data Science Department

Teaching and Evaluation Scheme
T.Y.B. Tech: Semester-V

Course Code	Course	L	T	P	Credits	Scheme	Theory (Marks) Max.	Theory (Marks) Min. for Passing	Practical (Marks) Max.	Practical (Marks) Min. for Passing
0ADOE301	Open Elective-I	3	--	--	3	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADPC302	Design and Analysis of Algorithms	3	--	--	3	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADPC303	AI Search Methods for Problem Solving	3	--	--	3	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADPC304	IoT Embedded Systems for AI	3	--	--	3	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADHS506	Entrepreneurship	--	--	2	1	ISE I	25	10	20	--	--
						ISE II	25	10		--	--
0ADPC351	Design and Analysis of Algorithms Laboratory	--	--	2	1	ISE	--	--	25	10
						ESE	--	POE	50	20
0ADPC352	IoT Embedded Systems for AI Laboratory	--	--	2	1	ISE	--	--	25	10
0ADPC353	Data Handling and Visualization Laboratory	2	0	2	3	ISE	--		50	20
						ESE		POE	50	20
0ADPE35*	Professional Elective-II	2	--	2	3	ISE	--	--	50	20
						ESE	--	POE	50	20
0ADPR357	Inplant Training/ Internship	--	--	--	1	ESE	--	PR	50	20
0ADCC398	Value Added Course-5	2			-	Audit				
Total		18	-	10	22	**Total**	450		350	

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Total Contact Hours/Week: 28 hrs		Total=450+350=800

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	1	-	-	14	3	3	1
Cumulative Sum	7	17	18	46	6	3	2

Open Elective-I		Professional Elective - II	
0ADOE301	Introduction to Data Science	0ADPE354	Data Science using R
		0ADPE355	Data Annotations
		0ADPE356	Databases and SQL for Data Science with Python

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Course Details:

Class	TY B. Tech., Sem. V
Course Code and Course Title	0ADOE301 Open Elective - Introduction to Data Science
Prerequisite/s	Database Concepts
Teaching Scheme: Lecture/Tutorial/Practical	3/0/0
Total Contact Hours:	42 Hours
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADOE301_1	Illustrate different sources of data and storage management techniques of data.(K2)
0ADOE301_2	Illustrate data preprocessing techniques.(K2)
0ADOE301_3	Explain recent trends in data science and identify methods used in data science. (K2)
0ADOE301_4	Implement data visualization techniques on different data sets. (K3)
0ADOE301_5	Analyze data by using different statistical techniques. (K4)

Course Contents:		
Unit No.	**Unit Name**	**Contact Hours**
Unit 1	**Introduction to core concepts and technologies:** Introduction, Terminology, data science process, data science toolkit, Typesof data, Example applications	06 Hrs.
Unit 2	**Data collection and management:** Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.	08 Hrs.
Unit 3	**Data Preprocessing:** Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.	07 Hrs.
Unit 4	**Data analysis:** Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Correlation, Linear Regression, Least Squares,	07 Hrs.

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	Residuals, Regression Inference.		
Unit 5	**Data visualization:** Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, visual encodings.		07 Hrs.
Unit 6	**Recent trends:** Recent trends in various data collection and analysis techniques, various visualization techniques, Case Study, application development methods used in data science.		07 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Data Mining Concepts and Techniques	Jiawei Han, MichelineKamber and Jian Pei	Morgan Kaufmann	Third Edition	
2	Computational and Inferential Thinking, The Foundations of Data Science	AdhikariAni and DeNero John	UC Berkeley Division of Computing, Data Science, and Society		2023
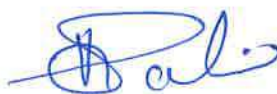
Reference Books:

Sr. No	Title	Author	Publisher	Edition	Yearof Edition
1	Doing Data Science, Straight Talk From The Frontline	O'Neil Cathy and Schutt Rachel	The Frontline. O'Reilly		
2	Mining of Massive Datasets. v2.1	Leskovek Jure, RajaramanAnand and Ullman Jeffrey	Cambridge University Press		

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Course Details:

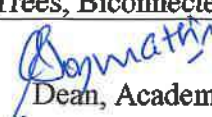| Class	TY B. Tech., Sem. V
Course Code &Course Title	**0ADPC302 Design and Analysis of Algorithms**
Prerequisite/s	Data Structures
Teaching Scheme: Lecture/Tutorial/Practical	3/0/0
Total Contact Hours:	42 Hours
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50
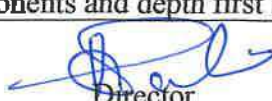
Course Outcomes (COs) :	
Upon successful completion of the course, the students will be able to:
0ADPC302_1	**Explain** different design methods of algorithm. (K^2)
0ADPC302_2	**Explain** solvability, unsolvability of a problem and computational models of parallel algorithm. (K^2)
0ADPC302_3	**Apply** different design methods of algorithm. (K^3)
0ADPC302_4	**Apply** different search techniques for efficient graph traversal. (K^3)
0ADPC302_5	**Analyze** complexity of different algorithm designs. (K^4)

Course Contents:		
Unit 1	**Divide and Conquer Method** Recurrence Equations and their solution, Randomized Algorithms, The general method, Binary search, Finding the maximum and minimum, Merge sort, Quick sort, Selection, Convex Hull.	08 Hrs.
Unit 2	**The Greedy Method** The general method, Knapsack problem, Job sequencing with deadlines, minimum-cost spanning trees – Prim's and Kruskal's Algorithms, Optimal storage on tapes, Graph coloring problem, Single source shortest path.	06 Hrs.
Unit 3	**Dynamic Programming** The general method, Multistage graphs, All pair shortest paths, Optimal binary search trees, 0/1 knapsack, Reliability design, Traveling Salesperson problem.	07 Hrs.
Unit 4	**Basic Traversal and Search Techniques** Techniques for Graphs, AND/OR graphs, Connected components and Spanning Trees, Biconnected components and depth first search	07 Hrs.

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Unit 5	**Branch & Bound, Backtracking and Infeasibility** **Introduction to Branch & Bound** **Backtracking:** The general method, 8-queen problem, sum of subsets, Hamiltonian Cycle, Graph Coloring **Infeasibility:** P and NP-classes, NP-hard problems	09 Hrs.
Unit 6	**Parallel Computational models** PRAM, MESH, HYPERCUBE - Fundamental Algorithms	05 Hrs.

Text Books:
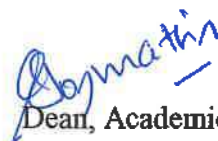
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Computer Algorithms	Ellis Horowitz, SatrajSahani, SaguthevarRajasejaran	University Press	2	2008
02	Introduction to Algorithms	Thomas Cormen, Charles Leiserson, Ronald RIvest, Clifford Stein	PHI	3	2009
03	Algorithms in a Nutshell	G. T. Heineman, G. Pollice, S. Selkow	O'Reilly	1	2008
04	Fundamentals of algorithms	G. Brassard, P. Brately	Pearson Education	1	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	The Design and Analysis of Algorithms	Aho, Hopfcraft and Ullman	Pearson Education	1	2000
02	Algorithms	Kenneth Berman, Jerome Paul	CENAGE Learning	1	2010
03	Algorithms	Robert S., Kevin W.	Pearson Education	4	2014
04	Introduction to Design and Analysis of Algorithms	AnanyLevitin	Pearson Education	1	2008

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Course Details:

Class	TY B. Tech., Sem. V
Course Code and Course Title	0ADPC303 AI: Search Methods For Problem Solving
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	3/0/0
Total Contact Hours:	42 Hours
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADPC303_1	**Identify** various searching techniques for solving AI problems (K1)
0ADPC303_2	**Discuss** knowledge representation methodologies in AI (K2)
0ADPC303_3	**Explain** search methods that agents can employ for problem solving(K2)
0ADPC303_4	**Demonstrate** planning methods in AI (K3)
0ADPC303_5	**Analyze** rule based search methods and deduction as search(K4)

Course Contents:		
Unit No.	**Unit Name**	**Contact Hours**
Unit 1	**Introduction:** History, Turing Test, Winograd Schema Challenge, Language and Thought, Wheels & Gears Introduction: Philosophy, Mind, Reasoning, Computation, Dartmouth Conference, The Chess Saga, Epiphenomena	06 Hrs.
Unit 2	**State Space Search:** Depth First Search, Breadth First Search, Depth First Iterative Deepening **Heuristic Search:** Best First Search, Hill Climbing, Solution Space, TSP, Escaping Local Optima, Stochastic Local Search	07 Hrs.
Unit 3	**Population Based Methods:** Genetic Algorithms, SAT, TSP, emergent Systems, Ant Colony Optimization **Finding Optimal Paths:** Branch & Bound, A*, Admissibility of A*, Informed Heuristic Functions **Game Playing:** Game Theory, Board Games and Game Trees, Algorithm Minimax, AlphaBeta and SSS	08 Hrs.

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Unit 4	**Space Saving Versions of A*:** Weighted A*, IDA*, RBFS, Monotone Condition, Sequence Alignment, DCFS, SMGS, Beam Stack Search **Automated Planning:** Domain Independent Planning, Blocks World, Forward &Backward Search, Goal Stack Planning, Plan Space Planning	08 Hrs.
Unit 5	**Rule Based Expert Systems:** Production Systems, Inference Engine, Match-Resolve-Execute, Rete Net **Problem Decomposition:** Means Ends Analysis, Algorithm Graph plan, Algorithm AO	06 Hrs.
Unit 6	**Deduction as Search:** Logic, Soundness, Completeness, First Order Logic, Forward Chaining, Backward Chaining **Constraint Processing:** CSPs, Consistency Based Diagnosis, Algorithm Backtracking, Arc Consistency, Algorithm Forward Checking	07 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Yearof Edition
1	A First Course in Artificial Intelligence	Deepak Khemani	McGraw Hill Education (India)	-	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Yearof Edition
1	Heuristic Search: Theory and Applications	Stefan Edelkamp and Stefan Schroedl	Morgan Kaufmann	-	2011
2	Artificial Intelligence: The Very Idea, A Bradford Book	John Haugeland	The MIT Press	-	1985
3	Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence	Pamela McCorduck	A K Peters/CRC Press	2nd	2004
4	Theory of Computation- A problem solving Approach	ZbigniewMichalewicz and David B. Fogel	Springer	2nd	2004

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Course Details:

Class	TY B. Tech., Sem. V
Course Code and Course Title	**0ADPC304** **IoT Embedded System for AI**
Prerequisite/s	Python
Teaching Scheme: Lecture/Tutorial/Practical	3/0/0
Total Contact Hours:	42 Hours
Credits	03
Evaluation Scheme: ISE	10/30/10/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPC304 _1	**Understand** the fundamental of IoT (K1)
0ADPC304 _2	**Explain** various contemporary IOT communication protocols for transport, discovery and routing (K2)
0ADPC304 _3	**Describe** the embedded systems design techniques and use of Internet for communication. (K1)
0ADPC304 _4	**Illustrate** the mechanism of controls and sensing using IoT technology (k3)
0ADPC304 _5	**apply** formal method, testing, verification, validation and simulation techniques and tools (k3)
0ADPC304 _6	**Design** IoT applications using Arduino/Raspberry Pi /open platform(K4)

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**IoT Enabling Technologies** Sensor Networks, Sensors and actuators, Analog/Digital Conversion, Communication Protocols, Embedded Computing Systems, Cloud Computing	07 Hrs.
Unit 2	**IoT Communication Protocols** Communication stack for IoT, Machine to machine communication (M2M), Introduction to various protocols such as Message Queue Telemetry Transport (MQTT), Constrained Application Protocol (CoAP), 6LoPAN Routing protocols, autonomous routing, hierarchical architectures and routing protocols to connect with infrastructure networks.	07 Hrs.

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Unit 3	**Embedded processors for IOT** Raspberry Pi: Raspberry Pi board and its processor, Programming the Raspberry Pi using Python, Communication facilities on Raspberry Pi (I2C,SPI, UART), Interfacing of sensors and actuators.	07 Hrs.
Unit 4	**Embedded Software Development** Real time operating systems, Kernel architecture: hardware, task/process control subsystem, device drivers, file subsystem, system calls, embedded operating systems, programming languages: assembly languages, high level language.	07 Hrs.
Unit 5	**IoT Data generation and storage** IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API	07 Hrs.
Unit 6	**Applications of IoT, case studies** Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense	07 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Internet of Things	Jeeva Jose	Khanna Book Publishing Company	-	2021
2.	The Internet of Things	Samuel Greengard	MIT Press	1st	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Yearof Edition
1	Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3	Peter Waher	Packt Publishing Ltd	1st	2018

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Course Details:

Class	TY B. Tech., Sem. V
Course Code and Course Title	**0ADHS506- Entrepreneurship**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial /Practical	0/0/2
Credits	1
Evaluation Scheme: ISE –I/ISE-II	25/25

Course Outcomes (COs):

0ADHS506_1	**Understanding** of the scope of an entrepreneur (K^2).
0ADHS506_2	**Explain** areas of development, financial assistance by the institutions (K^4)
0ADHS506_3	**Apply** To Learn methods of taxation and tax benefits, etc
0ADHS506_4	**Develop** systematic process to select and screen a business idea
0ADHS506_5	**Design** strategies for successful implementation of ideas

Course Contents

Unit-1	**ENTREPRENEURSHIP** Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.	2
Unit-2	**MOTIVATION** Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self-Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives	2
Unit-3	**BUSINESS SMALL ENTERPRISES** Definition, Classification – Characteristics, Ownership Structures –Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies	3
Unit-4	**FINANCING AND ACCOUNTING** Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis,	2

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	Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.	
Unit-5	**SUPPORT TO ENTREPRENEUR** Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.	3
Unit-6	**Start-up Valuation** Start-up Valuation techniques, human resource management, Succession planning, growth strategies, Incubator/TBI.	2

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	"Entrepreneurial Development"	S.S.Khanka	S.Chand& Co. Ltd. Ram Nagar, New Delhi	2	1999.
02	Entrepreneurship – Theory, process and practices	Kuratko&Hodgetts	Thomson learning	6	2009

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Entrepreneurship	Hisrich R D and Peters M P	Tata McGraw-Hill	5	2012
02	Entrepreneurship theory at cross roads: paradigms and praxis	Mathew J Manimala	Dream tech	2	2006
03	Entrepreneurship and innovation	Rabindra N. Kanungo	Sage Publications	--	1998

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Course Details:

Class	TY B. Tech., Sem. V
Course Code and Course Title	**0ADPC351 Design and Analysis of Algorithms Laboratory**
Prerequisite/s	Data structure
Teaching Scheme: Lecture/Tutorial/Practical	0/0/2
Credits	01
Evaluation Scheme: ISE/ESE	25/50

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPC351_1	**Apply** different design methods of algorithm. (K^2)
0ADPC351_2	**Interpret** the time and space complexity of algorithms and assess their efficiency.(K^2)
0ADPC351_3	**Implement** algorithms using a programming language and validate their correctness.(K3)
0ADPC351_4	**Analyze** complexity of different algorithm designs. (K^4)
0ADPC351_5	**Evaluate** the impact of algorithmic decisions on the overall performance of applications.(K5)

Course Contents:		Hours
1	Programs based on Finding the maximum and minimum using iterative version and divide & conquer method. Compare the time complexity of both.	2Hrs
2	Program based on Convex Hull.	2Hrs
3	Program based on general method of Greedy Method.	2Hrs
4	Program based on Greedy Method.	2Hrs
5	Program based on minimum-cost spanning trees.	2Hrs
6	Program based on General method of Dynamic Programming.	2Hrs
7	Program based on Dynamic Programming.	2Hrs
8	Program based on general method of backtracking.	2Hrs
9	Program based on backtracking.	2Hrs
10	Program based on AND/OR graph.	2Hrs
11	Using Open MP, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements.	2Hrs
12	Micro project	2Hrs

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Let Us C	YashwantKanetkar	BPB	3	2011
02	Fundamentals of Computer Algorithms	Ellis Horowitz, SatrajSahani, SaguthevarRajasejaran	University Press	2	2008
03	Data Structures- A Pseudo code Approach with C	Richard F. Gilberg and Behrouz A. Forouzon	PWS Publishing Company	2	2004
04	Introduction to Algorithms	Thomas Cormen, Charles Leiserson, Ronald RIvest, Clifford Stein	PHI	3	2009

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	The Design and Analysis of Algorithms	Aho, Hopfcraft and Ullman	Pearson Education	1	2000
02	Algorithms	Kenneth Berman, Jerome Paul	CENAGE Learning	1	2010
03	Algorithms	Robert S., Kevin W.	Pearson Education	4	2014
04	Introduction to Design and Analysis of Algorithms	AnanyLevitin	Pearson Education	1	2008

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Course Details:

Class	TY B. Tech., Sem. V
Course Code and Course Title	**0ADPC352 IoT Embedded system for AI Laboratory**
Prerequisite/s	Python
Teaching Scheme: **Lecture/Tutorial/Practical**	0/0/2
Credits	01
Evaluation Scheme: ISE	25

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADPC352 _1	**Understand** the concept of embedded system and its architectural features(k2)
0ADPC352 _2	**Explain** Integrate/Interface real world field devices with microcontrollers.(k4)
0ADPC352 _3	**Apply** the power Operating System for embedded applications(k3)
0ADPC352 _4	**Analyze**: real world signals and perform remote process monitoring utilizing the concept of IoT(k4)
0ADPC352 _5	**Design**: Design and implement IoT enabled embedded control strategy for a given application.(k6)
0ADPC352 _6	**Design**: Design and Implement a given application case study.(K6)

Course Contents:		Hours
1	To interface LED and LCD to Arduino Uno or Raspberry Pi	2Hrs
2	To interface temperature sensor to Arduino Uno or Raspberry Pi and display temperature on LCD	2Hrs
3	To interface Wi Fi module to Arduino Uno or Raspberry Pi using the Remote XY application	2Hrs
4	To control devices connected to Arduino Uno by Application created using Remote XY	2Hrs
5	Turn your smartphone into an IoT device using the IBM Watson IoT Platform cloud-hosted service.	2Hrs
6	To create a Things Speak account for uploading the sensors data.	2Hrs
7	To implement MQTT protocol	2Hrs
8	To control the actuator from cloud	2Hrs
9	To Interface any type of sensor Using Arduino Uno board or Raspberry Pi and upload sensor data to Cloud	2Hrs
10	To design IoT applications using Arduino/Raspberry Pi /open platform	2Hrs
11	Micro project	2Hrs

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Text Books:

Title	Author	Publisher	Edition	Year of Edition
"Internet of Things"	Jeeva Jose	Khanna Book Publishing Company		2021
"The Internet of Things"	Samuel Greengard	MIT Press	1st Edition	2015
"Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3"	Peter Waher	Packt Publishing Ltd	1st Edition	2018

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3	Peter Waher	Packt Publishing Ltd	1st	2018

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Course Details:

Class	TY B. Tech., Sem. V
Course Code &Course Title	**0ADPC353 Data Handling And Visualization Laboratory**
Prerequisite/s	Python programming for data science
Teaching Scheme	2/0/2
Total Contact Hours:	28 + 28 Hours
Credits	03
Evaluation Scheme: ISE / ESE	50/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPC353_1	**Analyze** the concept of single variable ,numerical summaries(k4)
0ADPC353_2	**Identify** the relationships between variables and Articulate the transformations(k1)
0ADPC353_3	**Analyze** the concept of visualization, networks, graphs, maps(k4)
0ADPC353_4	**Correlate** data sets main characteristics, often using graphics and otherdata visualization methods.(k4)
0ADPC353_5	**Discover** the way to visually represent connections between entities in data, social data analysis.(k5)

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction To Data Handling** Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series	04 Hrs.
Unit 2	**Working With Two Variable And ThreeVariable** Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations - Introducinga Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data.	05 Hrs.

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Unit 3	**Introduction To Data Visualization** The Seven Stages of Visualizing Data - Getting Started with Processing - Mapping - Time Series - Connections and Correlations - Scatterplot Maps - Trees, Hierarchies, and Recursion ,Networks and Graphs ,Acquiring Data ,Parsing Data	05 Hrs.
Unit 4	**Visualization Design And Tools** visual display of quantitative information, data-ink maximization, graphical design, exploratory data analysis, heat map, SVG , Visualization tools: Line plots, area plots, histogram, bar charts, pie charts, bubble plots, waffle charts,word clouds	04 Hrs.
UNIT 5	**Collaboration** Graph Visualization and Navigation, Online Social Networks, Social Data Analysis, Collaborative Visual Analytics, Text, Map, Geospatial data, 2-D Graphics, 3-D Graphics, Photorealism, Non-Photorealism, the human retina: Perceiving Two Dimensions	05 Hrs.
Unit 6	**Techniques and Applications** Basic Data Exploration Techniques - Basic Data Visualization Techniques - Visualizing Geographic Data with gmap, United States - Case Study – Single Family Residential Home and Rental Values, Introduction of web crawling	05 Hrs.

Experiment List:

Expt. No.	Title of Experiment	Contact Hours
1	Learn how to collect data via web-scraping, APIs and data connectors from suitable sources as specified by the instructor.	2 Hrs.
2	Perform various types of data cleaning operations on the data collected in previous lab using data exploration, imputation etc.,	2 Hrs.
3	Perform dimensionality reduction on a given dataset and create various visualizations like histograms, scatter-plots, etc.	2 Hrs.
4	Perform association analysis on a given dataset and evaluate its accuracy.	2 Hrs.
5	Build a recommendation system on a given dataset and evaluate its accuracy.	2 Hrs.
6	Build a time-series model on a given dataset and evaluate its accuracy.	2 Hrs.

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7	Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.	2 Hrs.
8	Perform text mining on a set of documents and visualize the most important words in visualization such as word cloud.	2 Hrs.
9	Perform the Population Density Estimation for Alpha Diversity, Beta Diversity, and Gamma Diversity.	2 Hrs.
10	Perform the Data visualization for Correlogram, Interactive Time series Visualization, Interactive Sunburst charts	2 Hrs.
11	Perform the Task Interactive Plot with Plotly& Basic Interactive Binned Scatter Plot with Altair	2 Hrs.
12	Hands on to perform Box Plots, Histograms, Pie charts, Bar charts, X-Y Plots, Heat maps.	2 Hrs.
13	Micro project	2 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Visualization Analysis and Design	Tamara Munzner	CRC Press		2014
2	Interactive data visualization for the web	Scott Murray	Reilly Media	Second Edition	2017
3	Introduction to data visualization tools	Dr. S. Karpagavalli	Blue Hill publishers		2020
4	Beginner's Guide for Data Analysis using R Programming,	Jeeva Jose	Khanna Publishing		2019.

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Exploring Data: An Introduction to Data Analysis for Social Scientists	Catherine Marsh, Jane Elliott	Wiley Publications.	2nd Edition,	2008.
2	Data Visualization Handbook	by J. Koponen, J. Hildén	CRC Press	-	2019
3	The Book of Trees: Visualizing Branches of Knowledge	by M. Lima, Princeton	Architectural Press	-	2014

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Course Details:

Class	TY B. Tech., Sem. V
Course Code and Course Title	0ADPE354 Professional Elective II Data science using R
Prerequisite/s	Database, python
Teaching Scheme: Lecture / Tutorial / Practical	2/0/2
Total Contact Hours:	28 + 28 Hours
Credits	3
Evaluation Scheme: ISE / ESE	50/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPE354_1	**Identify** the data science concepts
0ADPE354_2	**Articulate** the concept the DATA in data science ,types of data
0ADPE354_3	**Interpret** the basic concepts of R language
0ADPE354_4	**Illustrate** the data analysis and preprocessing concept
0ADPE354_5	**Articulate** visualization with R concepts
0ADPE354_6	**Discover** the Inferential Statistics with R

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction To Data Science** Introduction to Data Science, Introduction, Definition, Data Science in various fields, Examples, Impact of Data Science, Data Analytics Life Cycle, Data Science Toolkit, Data Scientist, Data Science Team Understanding	04 Hrs.
Unit 2	**Foundation of Data** Data: Introduction, Types of Data: Numeric, Categorical Graphical, High Dimensional Data, Classification of digital Data: Structured, Semi-Structured and Un-Structured, Example Applications. Sources of Data: Time Series, Transactional Data, Biological Data, Spatial Data, Social Network Data, Data Evolution.	05 Hrs.
Unit 3	**Basics of R** Introduction to R, Features of R, Environment, R Studio. Basics of R-Assignment, Modes, Operators, special numbers, Logical values, Basic Functions, R help functions, R Data Structures - Control Structures. Vectors-Operations on Vectors. Matrices -Creating Matrices - Lists - Creating List , General List Operations , Data	05 Hrs.

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	Frames - Creating Data Frames- Adding , Removing , Applying Special functions to Data Frames	
Unit 4	**Data Processing & Analysis** Input / Output, Reading and Writing datasets in various formats, Functions, Functions on Function Object, Environment-Closures Recursion. Exploratory Data Analysis, Data Pre-processing, Central Tendency, Variability - Mean - Median - Range - Variance - Summary - Handling Missing values and Outliers - Normalization	04 Hrs.
UNIT 5	**Matrices, List, Data Frames** Matrices - Creating Matrices - Adding or Removing rows/columns - Reshaping - Operations - Special functions on Matrices. Lists - Creating List, General List Operation, And Special Functions - Recursive Lists.Data Frames - Creating Data Frames - Naming - Accessing - Adding - Removing - Applying Special functions to Data Frames - Merging Data Frames- Factors and Tables.	05 Hrs.
Unit 6	**Inferential Statistics with R** Inferential Statistics with R, Implementation in R -, functions on lm (), predict (), plotting and fitting regression line. Regression - Introduction -comparison with simple linear regression, Correlation Matrix, F-Statistic, Target variables Vs Predictors, Identification of significant features, Basic Visualizations, Advanced Visualizations and Creating 3D plots.	05 Hrs.

Experiment List:

Expt. No.	Title of Experiment	Contact Hours
1	Installing R and R studio, Create a folder DS_R and make it a working directory, installing the "ggplot2", "caTools", "CART" packages	2 Hrs.
2	Basic operations in R, variables, datatypes, Operators	2 Hrs.
3	Implementation of a given matrix to a 1 dimensional array, create an 3 dimensional array of 24 elements using the dim() function	2 Hrs.
4	Implementation of create a blank matrix. Write R program to create amatrix taking a given vector of numbers as input. Display the matrix.	2 Hrs.
5	Implementation of create a correlation matrix from a data frame of same data type.	2 Hrs.

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6	Implementation of create a vector, add two vectors of integers type, find Sum, Mean and Product of a Vector	2 Hrs.
7	Implementation of Data Frame and its corresponding operators and functions	2 Hrs.
8	Implementation of Reading data from the files and writing output back to the specified file	2 Hrs.
9	Implementation of Visualizations - Bar, Histogram, Box, Line, scatter plot, etc.	2 Hrs.
10	Implementation of Linear and multiple Linear Regression	2 Hrs.
11	Fitting regression line	2 Hrs.
12	Micro-project: students work in team on any socially relevant problem that needs a Data science using R based solution, and evaluate the model performance	2 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	R programming for data science	Roger D Peng	Lean pub	-	2014
2	Practical Data Science with R	Nina Zumel, John Mount	Manning Publications	-	2014
3	Beginning R - The Statistical Programming Language John	Mark Gardener	Wiley & Sons, Inc	-	2012.
4	An Introduction to R	W. N. Venables, D. M. Smith	-	Version 3.1.0	2013.

	Reference Books:				
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Beginning R - The Statistical Programming Language	Mark Gardener	John Wiley & Sons, Inc	-	2012
2	Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics	Nathan Yau	Wiley	-	2011
3	The Book of R	Tilman M. Davies	No starch press	-	2015

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Course Details:

Class	TY B. Tech., Sem. V
Course Code and Course Title	0ADPE355- Data Annotations
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	2/0/2
Total Contact Hours:	28 + 28 Hours
Credits	03
Evaluation Scheme: ISE /ESE	50/50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADPE355_1	**Explain** concepts of data annotation, Benefits of data annotation, Applications of data annotations in machine learning.
0ADPE355_2	**Understanding** the concepts of data labelling, data labelling approaches, working of data labelling.
0ADPE355_3	**Use** concept of Text annotation, image annotation, video annotation, audio and key point annotation in real world example.
0ADPE355_4	**Summarize** use of annotation in real world application.

Course Contents:		
Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction to data annotation** Introduction to annotation, Manual vs. Automated Data Annotation, Benefits of data annotation, Applications of data annotations in machine learning, Future of Data Annotation, Annotation and Feature Engineering.	04 Hrs.
Unit 2	**Data Labeling** Introduction to data labeling ,un label data vs label data, Supervised learning, Unsupervised learning Semi-supervised learning, Human-in-the-Loop(HITL),data labeling approaches, common types of data labeling, Working of data labeling.	05 Hrs.

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Unit 3	**Text annotation** Text annotation-Basics of Text Annotation, Types of Text Annotation ,Working of text annotation, use cases of text annotation, uses of text annotation	05 Hrs.
Unit 4	**Image annotation** Image annotation-Basics of image annotation, need of image annotation, types of image annotation, image annotation techniques, image annotation use cases	04 Hrs.
UNIT 5	**Video annotation** Video annotation-Introduction to video annotation, purpose of video annotation in machine learning, how video annotation works, Challenges and critical considerations in video annotation.	05 Hrs.
Unit 6	**Audio Annotation and Key-point Annotation** Audio Annotation- Introduction to audio annotation, Importance of audio annotation, Different types of audio annotation Key-point Annotation-Introduction to key point annotation, use cases and challenges, annotate data with key points	05 Hrs.
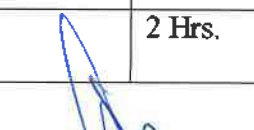
Experiment List:

Expt. No.	Title of Experiment	Contact Hours
1	To Perform the Data Annotation & Audio Annotation for existing data.	2 Hrs.
2	To perform Semantic Segmentation & Image Annotation	2 Hrs.
3	To perform object detection and Segmentation of Instance	2 Hrs.
4	Image Annotation for Bounding Boxes, Polygonal Segmentation	2 Hrs.
5	Image Annotation to Perform 3D Image data representation	2 Hrs.
6	To perform the Data Attributes operations using data annotation	2 Hrs.
7	To perform the Data Validation attributes commands	2 Hrs.
8	To Perform the Versatility for Set of Text, Image, Audio, Video	2 Hrs.
9	To Perform the Open Source Data Annotation & Labeling Tools	2 Hrs.
10	To Perform Multi Model & Multi Domain Text Annotation Tools	2 Hrs.
11	To Perform Image Annotation Tools 3D Slicer, CATMAID, COCO Annotator	2 Hrs.
12	Case Study about Other Annotation Tools	2 Hrs.

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Natural Language Annotation for MachineLearning: A Guide to Corpus-Building forApplications	James Pustejovsky, Amber Stubbs	O'Reilly Media	1st	2012
02	Provenance andAnnotation of Data and Processes	Luc Moreau , Juliana Freire, David Koop	Springer		2008

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Course Details:

Class	TY B. Tech., Sem. V
Course Code and Course Title	0ADPE356- Databases and SQL for DS with Python
Prerequisite/s	Database Management System
Teaching Scheme: Lecture/Tutorial/Practical	2/0/2
Total Contact Hours:	28+28 Hours
Credits	03
Evaluation Scheme: ISE /ESE	50/50

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPE356_1	**Understand** the key techniques and theory for SQL Queries
0ADPE356_2	**Understand** the basics of using Database and Engineering Basics
0ADPE356_3	**Apply** the Theoretical Knowledge of Data Science and SQL
0ADPE356_4	**Analysis** the various Platform and analyses the Python basics
0ADPE356_5	**Apply** the Data Interconnectivity between SQL and Python

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Distributed Databases** Distributed Systems – Introduction – Architecture – Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing.	04 Hrs.
Unit 2	**Spatial And Temporal Databases** Active Databases Model – Design and Implementation Issues - Temporal Databases - Temporal Querying - Spatial Databases: Spatial Data Types, Spatial Operators and Queries – Spatial Indexing and Mining – Applications -- Mobile Databases: Location and Handoff Management, Mobile Transaction Models – Deductive Databases - Multimedia Databases..	05 Hrs.

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Unit 3	**Nosql Databases** NoSQL -- CAP Theorem – Sharding - Document based – MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding–Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types – HIVE: Data types, Database Operations, Partitioning – HiveQL – Orient DB Graph database – Orient DB Features	05 Hrs.
Unit 4	**XML Databases** Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying – XPath – XQuery	04 Hrs.
Unit 5	**IR / Web Databases** IR concepts – Retrieval Models – Queries in IR system – Text Preprocessing – Inverted Indexing – Evaluation Measures – Web Search and Analytics – Current trends, WebDB.	05 Hrs.
Unit 6	**Sqlite with Python** Uses of SQLite-Insert Data-Types of Clauses (ORDER BY, LIMIT, JOIN, INSERT, WHERE)-Virtual machine-Code Generator-B-Tree, Page cache- Parser-Tokenizer.	05 Hrs.

Expt. No.	Title of Experiment	Contact Hours
1	NOSQL Exercises -MongoDB – CRUD Operations-Indexing-Sharding Cassandra: Table Operations, CRUD Operations, CQL Types, HIVE: Data types, Database Operations, Partitioning – HiveQL, Orient DB Graph database ,Orient DB Features	2 Hrs.
2	MySQL Database Creation, Table Creation, Query	2 Hrs.
3	MySQL Replication – Distributed Databases	2 Hrs.
4	Spatial data storage and retrieval in MySQL	2 Hrs.
5	Temporal data storage and retrieval in MySQL	2 Hrs.
6	Object storage and retrieval in MySQL	2 Hrs.
7	XML Databases , XML table creation, XQuery FLWOR expression	2 Hrs.
8	Mobile Database Query Processing using open source DB (MongoDB/MySQL etc)	2 Hrs.

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9	Using SQLite Commends perform Indexes, triggers, views	2 Hrs.
10	To Use SQLite perform to implement Database adapter.	2 Hrs.
11	To Use SQLite perform Joins & Grouping & Set operations	2 Hrs.
12	Micro Project for connecting SQLite with Python to perform MongoDB, CRUD, MY SQL, XML	2 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Database Systems	Thomas M. Connolly, Carolyn E. Begg,	Pearson Education	6th -	201 5.
2	Fundamentals of Database Systems,	Rich and Knight	The McGraw Hill	3rd	201 7

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	"DATABASE MODELING AND DESIGN - Logical Design"	Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish,	, Morgan Kaufmann Publishers	5th	201 1
2	"Database System Concepts"	. Abraham Silberschatz, Henry F Korth, S Sudharshan,	Tata McGraw Hill,	6th	201 1

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Course Details:

Class	TY B. Tech., Sem. V
Course Code and Course Title	0ADPR357-Inplant Training / Internship
Prerequisite/s	Project Work
Teaching Scheme: Lecture/Tutorial/Practical	---
Credits	01
Evaluation Scheme: ESE	50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPR357_1	Analyze about the Various Soft Skills such as time management.
0ADPR357_2	Understand the Knowledge level Skills, attributes for the students
0ADPR357_3	Apply the Project Knowledge participate and collaborate new CAS Projects
0ADPR357_4	Understand and Improve their Knowledge and Skills Career Development
0ADPR357_5	Analyze the Industries fulfill the Related Knowledge and working environment

Course Contents:
The Students Undergone for One Month Internships under Curriculum Credits **Project Load** Maximum 10 Students have allocated for One Faculty 6:4 Ratio **Mode of Assessment** This Subject Content of the Internships emerging with thrust areas, the completion of work and the submission of report and assessment should be done at the end of Part-I

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Course Details:

Class	B. Tech., Sem. V
Course Code and Course Title	**0ADCC398/VAC-5/Reasoning and Soft Skills Part-I**
Prerequisite/s	VAC-4
Teaching Scheme: Lecture/Tutorial/Practical	2/0/0
Credits	02
Evaluation Scheme: ISE I / MSE / ISE II /ESE	--

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADCC398_1	**Understand** to Provide Students an Understanding of the Expectations
0ADCC398_2	**Analyse** and Improve the Employability skills
0ADCC398_3	**Apply** the Knowledge of Industry aspects
0ADCC398_4	**Understand** and Improve the Employability Skills of Students
0ADCC398_5	**Apply** and ability holistic perspective gain more knowledge

Course Contents:		
Unit No.	**Unit Name**	**Contact Hours**
Unit 1	Basic Permutation n Combination Advance Permutation n Combination	4 Hrs.
Unit 2	Probability Application of Probability	4 Hrs.
Unit 3	Cubes, Dices & cube painting Syllogism	4 Hrs.
Unit 4	Mensuration 3D Circle & Triangle	4 Hrs.
Unit 5	Resume writing & resume making Interview Techniques	4 Hrs.
Unit 6	Closed Test & advanced Grammar Synonyms & Antonyms	4 Hrs.

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Artificial Intelligence and Data Science Department

Teaching and Evaluation Scheme

T.Y.B. Tech: Semester-VI

Course Code	Course	Teaching Scheme				Evaluation Scheme					
							Theory (Marks)			Practical (Marks)	
		L	T	P	Credits	Scheme	Max.	Min. for Passing		Max.	Min. for Passing
0ADOE305	Open Elective-II	3	-	-	3	ISE I	10		40	--	--
						MSE	30			--	--
						ISE II	10			--	--
						ESE	50	20		--	--
0ADPC306	Computer Vision	3	-	-	3	ISE I	10		40	--	--
						MSE	30			--	--
						ISE II	10			--	--
						ESE	50	20		--	--
0ADPC307	Cloud Computing	3	-	-	3	ISE I	10		40	--	--
						MSE	30			--	--
						ISE II	10			--	--
						ESE	50	20		--	--
0ADPC308	Machine Learning	3	-	-	3	ISE I	10		40	--	--
						MSE	30			--	--
						ISE II	10			--	--
						ESE	50	20		--	--
0ADPE3**	Professional Elective-III	3	-	-	3	ISE I	10		40	--	--
						MSE	30			--	--
						ISE II	10			--	--
						ESE	50	20		--	--
0ADHS507	Universal Human Values-2	2	-	-	2	ISE I	25	10	20	--	--
						ISE-II	25	10		--	--
0ADPC358	Computer Vision Laboratory	-	-	2	1	ISE	--	--		25	10
						ESE	--	POE		50	20
0ADPC359	Cloud Computing Laboratory	-	-	2	1	ISE	--	--		25	10
						ESE	--	OE		25	10
0ADPC360	Machine Learning Laboratory	-	-	2	1	ISE	--	--		25	10
						ESE	--	POE		50	20
0ADPE36*	Professional Elective-III Laboratory	-	-	2	1	ISE	--	--		25	10

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NDCET

0ADPR364	Minor Project	--	--	2	1	ISE	--	--	25	10
						ESE	--	PR	50	20
0ADCC399	Value Added Course-6	2	-	-	-	Audit				
Total		**19**	**--**	**10**	**22**	**Total**	**550**		**300**	
Total Contact Hours/Week: 29 hrs						**Total=550+300=850**				

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	02	-	-	12	04	03	01
Cumulative Sum	9	17	18	58	10	06	03

Students should complete internship/industrial training for minimum of four weeks at the end of the semester-VI during summer vacation. The evaluation will be done in semester-VII.

Open Elective-II	
0ADOE305	Deep Learning

Professional Elective - III		Professional Elective – III Laboratory	
0ADPE309	Game Theory In AI	0ADPE361	Game Theory In AI Laboratory
0ADPE310	Intelligent Precision Agriculture	0ADPE362	Intelligent Precision Agriculture Laboratory
0ADPE311	Artificial Intelligence and Robotics	0ADPE363	Artificial Intelligence and Robotics Laboratory

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	**0ADOE305 Open Elective – II Deep Learning**
Prerequisite/s	Machine Learning Basic calculus (derivatives) Basic linear algebra (matrices, vectors) Basic probability and statistics
Teaching Scheme: Lecture/Tutorial /Practical	3/0/0
Total Contact Hours:	42 Hours
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):

0ADOE305_1	**Describe** the fundamentals of neural networks (K2)
0ADOE305_2	**Design** feed forward networks with back propagation (K3)
0ADOE305_3	**Develop** different deep learning models for given tasks (K3)
0ADOE305_4	**Formulate**& analyze the correct parameters and hyper-parameters of
0ADOE305_5	**Build** real-world applications using deep learning mechanisms and demonstrate effectively with verbal and written skills (K6)

Course Contents

Course Contents:		
Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction** Shallow feed forward neural networks representation: Multilayer perceptron (MLP),representation power of MLPs, Activation functions: linear & nonlinearactivation functions, Derivatives of activation functions	7 Hrs.
Unit 2	**Optimization Techniques:** Gradient descent and the back propagation algorithm, Saddle point problem in neural networks, the vanishing gradient problem and ways to mitigate it, Regularization methods (dropout, drop connect, batch normalization), RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent	7 Hrs.

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Unit 3	**Convolutional Neural Networks (CNN):** Introduction to CNN, blocks of CNN, Transfer Learning, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing CNNs, Guided Back propagation, Fooling Convolutional Neural Networks.	7 Hrs.
Unit 4	**Auto encoders:** Auto encoders, Regularization in auto encoders, Denoisingautoencoders, Sparse auto encoders, Contractive auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods.	7 Hrs.
Unit 5	**Case Study& Applications of Deep Learning Applications of Deep LearningComputer Vision:** Image segmentation, object detection, automatic image captioning, Classification using Convolutional Neural Networks	7 Hrs.
Unit 6	**Applications of Deep Learning to NLP :** Introduction to NLP and Vector Space Model of Semantics, **Word Vector Representations:** Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW) **Applications of Deep Learning to Unsupervised Learning**	7 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Deep Learning	Ian Good fellow	The MIT Press	-	2016
2	Pattern Recognition and Machine Learning	T2. Bishop, C. , M.,	Springer	1st edition	2006
3	Neural Networks: A Systematic Introduction	Raúl Rojas	-	-	1996

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Deep Learning with Python	Francois Chollet,	Manning Publications	1st	2017

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	**0ADPC306 Computer Vision**
Prerequisite/s	Fundamentals of Digital Image Processing
Teaching Scheme: Lecture/Tutorial /Practical	3/0/0
Total Contact Hours:	42 Hours
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):	
0ADPC306_1	Explain the underlying theories and algorithms used in computer vision
0ADPC306_2	Apply the concepts of color image processing, fundamentals of texture analysis, object recognition methods, video processing concepts, 3D imaging
0ADPC306_3	Analyze problems and algorithms to build solutions to the real world computer vision problems
0ADPC306_4	Design algorithms and evaluate results with justification
0ADPC306_5	Understand the concept of Image Enhancement & Applications

Course Contents

Unit No.	Unit Name	Contact Hours
Unit 1	**Color Image Processing** Color Fundamentals, Color models, Gray level to color transformations, Basics of Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation	07 Hrs.
Unit-2	**Texture Analysis** Definition, Types of texture, Texels, Texture analysis – concept and categories, Approaches to texture analysis, Statistics, Texture descriptors - statistical - Auto-correlation, co-occurrence matrices and features, edge density and direction, local binary partition, Law's texture energy measures, Wavelets and texture analysis.	08 Hrs.

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Unit-3	**Representation & Description** Representation, Boundary Descriptors, Regional Descriptors, Use of Principal components for description, Relational Descriptors.	06 Hrs.
Unit-4	**Object Recognition & Restoration** Object Recognition: Object Detection Vs recognition, Patterns and Pattern Classes, Knowledge Representation, Statistical Pattern Recognition, Neural Nets, Syntactic Pattern Recognition, Optimization Techniques in Recognition. Restoration: Image Restoration Model, Noise Models, Restoration using spatial filtering, Reduction using frequency domain filtering..	07 Hrs.
Unit-5	**Moving Object Detection and Tracking** Introduction, Background Modeling, Connected Component Labeling, Shadow Detection, Single Object Tracking, Discrete Kalman Filtering, Particle-filter based tracking, Mean-shift tracking, Segmentation tracking via graph cuts	07 Hrs.
Unit-6	**3D Vision** Introduction to 3D imaging and its applications. Study of any Research Paper(s) based on the current trends in 3D imaging or any case study.	07 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Yearof Edition
1	Digital Image Processing	Gonzalez R. C., Woods R. E	PHI, Second Edition	-	2002
2	Digital Image Processing and Computer Vision	Sonka Milan, Vaclav Hlavac, Boyle	Cengage Learning	3rd	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Yearof Edition
1	Digital Image Processing	S. Jayaraman, S. Esakkirajan, T. Veerkumar	Tata McGraw Hill	3rd	2010
2	Computer Vision – A Modern approach.	D. A. Forsyth, J. Ponce	Pearson Education, Prentice Hall		2005

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	**0ADPC307 Cloud Computing**
Prerequisite/s	Computer Organization & Databases
Teaching Scheme: Lecture/Tutorial /Practical	3/0/0
Total Contact Hours:	42 Hours
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):	
0ADPC307_1	Interpret the basic concepts of Cloud Computing and there evaluation
0ADPC307_2	Analyze the service oriented architecture. Identify the virtualization, Virtualization flexibility in disaster recovery.
0ADPC307_3	Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models
0ADPC307_4	Understand the concepts of inter cloud, Identify the cloud Security challenges
0ADPC307_5	Recognize the Hadoop and Map Reduce, identify the levels of federation, services, future of federation
0ADPC307_6	Interpret the what are the vitalization system, attacks in data security, IAM Architecture

Course Contents		
Unit No.	**Unit Name**	**Contact Hours**
Unit-1	**Introduction** Introduction to Cloud Computing , Definition of Cloud , Evolution of Cloud Computing ,Underlying Principles of Parallel and Distributed Computing , Cloud Characteristics , Elasticity in Cloud , On-demand Provisioning.	07 Hrs.
Unit-2	**Cloud Enabling Technologies** Service Oriented Architecture ,REST and Systems of Systems , Web Services ,Basics of Virtualization ,Types of Virtualization ,ImplementationLevels of Virtualization , Virtualization Structures , Tools and Mechanisms, Virtualization of CPU – Memory – I/O Devices ,Virtualization Support and Disaster Recovery.	07 Hrs.
Unit-3	**Cloud Architecture, Services And Storage** Layered Cloud Architecture Design ,NIST Cloud Computing Reference	07 Hrs.

	Architecture , Public, Private and Hybrid Clouds , IaaS, PaaS ,SaaS ,Cloud Storage ,Storage-as-a-Service , Advantages of Cloud Storage ,Cloud Storage Providers.		
Unit-4	**Resource Management And Security In Cloud** Inter Cloud Resource Management , Resource Provisioning and Resource Provisioning Methods ,Global Exchange of Cloud Resources ,Security Overview ,Cloud Security Challenges ,Software-as-a-Service Security ,Security Governance , Virtual Machine Security IAM , Security Standards		07 Hrs.
Unit-5	**Cloud Technologies And Advancements** Hadoop, Map Reduce -- Virtual Box , Google App Engine, Programming Environment for Google App Engine ,Open Stack, Federation in the Cloud, Four Levels of Federation, Federated Services and Applications ,Future of Federation.		07 Hrs.
Unit-6	**Cloud Security** Virtualization System, Specific Attacks: Guest hopping, VM migration attack, hyper jacking. Data Security and Storage, Identity and Access Management (IAM) - IAM Challenges, IAM Architecture and Practice.		07 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Distributed and Cloud Computing, From Parallel Processing to the Internetof Things"	Kai Hwang, Geoffrey C. Fox	Morgan Kaufmann Publishers	2nd	2012
2	Cloud Computing: Implementation,Management and Security	John W James F. Ransome	CRC Press	3rd	2017

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Mastering Cloud Computing	Buyya, Vecchiola and Selvi	McGraw Hill Education	2nd	2017
2	Cloud Computing: A Practical Approach", McGraw Hill Education	Toy Velte, Antony Velte	Tata Mcgraw Hill	2nd	2009
3	Cloud Application Architectures: Building Applications and Infrastructure	George Reese			2009

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	**0ADPC308 Machine Learning**
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial /Practical	3/0/0
Total Contact Hours:	42 Hours
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):

0ADPC308_1	**Understand** the machine learning concepts
0ADPC308_2	**Understand** the supervised and unsupervised learning algorithms in ML
0ADPC308_3	**Implement** the Regression and classification algorithms
0ADPC308_4	**Solve** machine learning problems using advance machine learning technique.
0ADPC308_5	Use different machine learning libraries

	Course Contents:	
Unit No.	**Unit Name**	**Contact Hours**
Unit 1	**Machine Learning Basics** Introduction to Machine Learning (ML) , Essential concepts of ML – ,Types of learning , Machine learning methods based on Time , Dimensionality ,Linearity and Non linearity Early trends in Machine learning.	7 Hrs.
Unit 2	**Supervised Learning** **What is supervised learning** **Regression:** K-Nearest Neighbor, Linear Regression, Logistic Regression, Ridge Regression, Bayesian Linear Regression **Classification:** – k-Nearest Neighbors , Decision Trees ,Random Forest model ,Support Vector Machines.	7 Hrs.

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Unit 3	**Unsupervised Learning** Mixture Models and EM ,K-Means Clustering – Dirichlet Process Mixture Models ,Spectral Clustering ,Hierarchical Clustering, The Curse of Dimensionality ,Dimensionality Reduction , Principal Component Analysis ,Latent Variable Models(LVM) ,Latent Dirichlet Allocation (LDA).	7 Hrs.
Unit 4	**Advanced Learning** Reinforcement Learning ,Representation Learning , Neural Networks , Active Learning , Ensemble Learning , Bootstrap Aggregation , Boosting , Gradient Boosting Machines	7 Hrs.
Unit 5	**Machine Learning In Practice** Ranking , Recommendation System , Designing and Tuning model pipelines- Performance measurement , Azure Machine Learning , Open-source Machine Learning libraries , Amazon's Machine Learning Tool Kit: Sage maker	7 Hrs.
Unit 6	**Applications Of Machine Learning** Image Recognition, Speech Recognition, Email spam and Malware Filtering, Online fraud detection, Medical Diagnosis.	7 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Introduction to Machine Learning	EthemAlpaydin	Prentice Hall of India	3rd Edition	2015
2	Master machine learning algorithms	Jawson Browleen	Machine Learning Mastery, 2016	-	2016
3	Introduction to Machine Learning	Prentice Hall of India,	-	3rd Edition	2015
4	Machine Learning	Tom Mitchell	McGraw-Hill	-	2017

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer Publications	-	2011
2	Artificial Intelligence: A Modern Approach	Stuart Jonathan Russell	Prentice Hall	3rd Edition	2020
3	Machine Learning Dummies	John Paul Muller, Luca Massaron	Wiley Publications	2016 Edition	2021

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	0ADPE309 Professional Elective III: Game Theory in AI
Prerequisite/s	Neural Networks & Fuzzy logic& Natural Language processing
Teaching Scheme: Lecture/Tutorial /Practical	3/0/0
Total Contact Hours:	42 Hours
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):	
0ADPE309_1	Analyze the concept of Games and Solutions appropriation tools
0ADPE309_2	Understand the basics of Game theory to provide insights.
0ADPE309_3	Study the basic concepts for Fundamentals of SQL Language
0ADPE309_4	Apply the Theoretical Knowledge of Computer Science and Computational
0ADPE309_5	Understands the various Platform and Games application

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction:** Introduction Making rational choices: basics of Games strategy preferences payoffs Mathematical basics Game theory Rational Choice Basic solution concepts-non-cooperative versus cooperative games Basic computational issues finding equilibrium and learning in games- Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets)	07 Hrs.
Unit-2	**Games with Impact Information** Games with Imperfect Information- Bayesian Games Motivational Examples-General Definitions- Information aspects Illustrations- Extensive Games with	07 Hrs.

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	Imperfect Information Strategies- Nash Equilibrium Repeated Games- the Prisoner's Dilemma Bargaining-Games with Perfect Information — Strategic games — prisoner's dilemma, matching pennies - Nash equilibria —mixed strategy equilibrium — zero-sum games	
Unit-3	**Games with Imperfect Information** Games with Imperfect Information- Bayesian Games -Motivational Examples- General Definitions - Information aspects - Illustrations -Extensive Games with Imperfect - Information - Strategies -Nash Equilibrium -Repeated Games -The Prisoner's Dilemma- Bargaining.	09 Hrs.
Unit-4	**Mechanism Design** Aggregating Preferences Social Choice Formal Model -Voting Existence of social functions –Ranking systems Protocols for Strategic Agents: Mechanism Design Mechanism design with unrestricted preference.	07 Hrs.
Unit-5	**Non-Cooperative Game Theory**- Self-interested agents - Games in normal Form-Analyzing games: from optimality to equilibrium - Computing Solution Concepts of Normal - Form Games- Computing Nashequilibria of two-player, zero-sum games -Computing Nash equilibria of two players, general- sum games - Identifying dominated strategies	07 Hrs.
Unit-6	**AI Game Playing and CSP** Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP	05 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	An Introduction to Game Theory.	M. J. Osborne,	Oxford University Press,	3rd	2012
2	Game Theory	M. Machler, E. Solan, S. Zamir,	Cambridge University Press	-	2013
3	Algorithmic Game Theory	N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani,	Cambridge University Press	-	2017
4	Games of Strategy,	A.Dixit and S. Skeath,	W W Norton & Co Inc,	2nd	2004

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	"Game Theory in Wireless and Communication Networks"	Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes	Cambridge University, Press		2012

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	**0ADPE310 Professional Elective III: Intelligent precision Agriculture**
Prerequisite/s	--
Teaching Scheme: Lecture / Tutorial / Practical	3/0/0
Total Contact Hours:	42 Hours
Credits	3
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPE310_1	**Understand** the applications of AI in agriculture
0ADPE310_2	**Understand** how a greenhouse can be automated and its advantages.
0ADPE310_3	**Analyze** weather models, their inputs and applications.
0ADPE310_4	**Implement** AI tools and techniques in agriculture
0ADPE310_5	**Developing** innovative processes, products, and technologies to meet the challenges in agriculture and farming practices

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction To Precision Farming** History of Mechanized Agriculture - Farming Operations and Related Machines - Tillage, Planting Cultivation, and Harvesting, Agricultural Automation	07 Hrs.
Unit 2	**Precision Agriculture** Sensors – types and agricultural applications, Global Positioning System (GPS) - GPS for civilian use, GIS and mapping software, Yield mapping systems, Crop production modeling, Indian Geo Systems	07 Hrs.
Unit 3	**Environment Control Systems** Artificial light systems, management of crop growth in greenhouses, simulation of CO_2 consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production.	07 Hrs.

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Unit 4	**Agricultural Systems Management and Public Policies** Agricultural systems – managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Research& Development, Need for improved measurement methods, New approaches to research in agriculture	07 Hrs.
Unit 5	**Weather Prediction Models** Importance of climate variability and seasonal forecasting, Understanding and predicting world's climate system, Global climatic models and their potential for seasonal climate forecasting, General systems approach to applying seasonal climate forecasts.	07 Hrs.
Unit 6	**AI Tools and Techniques** expert systems like IS, DIS, Crop Doctor(CD), Drone technology using AI for agriculture, Image Processing, ecommerce, e-governance, Artificial intelligence and decision support systems.	07hrs

Text Books:

Sr.No	Title	Author	Publisher	Edition	Yearof Edition
1	Precision Agriculture in the 21st Century	National Research Counci	National Academies Press, Canada	-	1997
2	Engineering Principles of Agricultural Machines	Ajit K. Srivastava, Carroll E. Goering, Roger P. Rohrbach, Dennis R. Buckmaster	ASAE Publication,	-	2006
3	Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation	Daniel Tal, John Altschuld	John Wiley & Sons, Inc.	-	2021

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Reference Books:

Sr.No	Title	Author	Publisher	Edition	Yearof Edition
1	Agricultural Systems Management	Peart R.M., and Shoup W. D.	Marcel Dekker, New York	-	2004
2	Applications of Seasonal Climate	Hammer, G.L., Nicholls, N., and Mitchell, C.,	Springer, Germany	-	2000

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	0ADPE311- Professional Elective III: Artificial Intelligence and Robotics
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial	3/0/0
Total Contact Hours:	42 Hours
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:
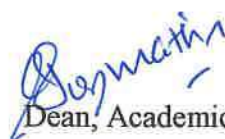
0ADPE311_1	Understand the concept of Artificial Intelligence and methods of solving problems using Artificial Intelligence (k2).
0ADPE311_2	Apply appropriate AI methods to solve assembly problem (k3).
0ADPE311_3	Identify appropriate AI planning methods to solve a given problem (k4).
0ADPE311_4	Implement basic AI algorithms for Speech recognition and making decisions(k5)
0ADPE311_5	Develop learning algorithms for autonomous driving tasks (k5).

Course Contents:		
Unit No.	**Unit Name**	**Contact Hours**
Unit 1	**Introduction** Types of Robot–Technology–Robot classifications and specifications-controls, operations, Sensors - work cell - Programming languages. History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents.	08 Hrs.
Unit 2	**Problem Solving:** Solving problems by searching –Informed search and exploration–Constraint satisfaction problems–Adversarial search, knowledge and reasoning–knowledge representation – first order logic.	07 Hrs.

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Unit 3	**Planning** Planning with forward and backward State space search – Partial order planning – Planning graphs– Planning with propositional logic – Planning and acting in real world.	06 Hrs.
Unit 4	**Reasoning** Uncertainity – Probabilistic reasoning–Filtering and prediction–Hidden Markov models–Kalman filters– Dynamic Bayesian Networks, Speech recognition, making decisions.	07 Hrs.
Unit 5	**Learning** Forms of learning – Knowledge in learning – Statistical learning methods – reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception. Usage of learning algorithms in autonomous driving tasks	07 Hrs.
Unit 6	**Ai In Robotics** Introduction to Genetic algorithm (GA) and Artificial Neural Network (ANN). Robotic assembly sequence planning and generation using AND/OR Graph and GA. Robotic perception, localization, mapping- configuring space, planning uncertain movements, Application of ANN in industrial and mobile robots.	07 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Artificial Intelligence: A modern approach	Stuart Russel	Pearson Education	-	2009
2	Artificial Intelligence: A guide to Intelligent Systems	Negnevitsky, M,	Harlow: Addison-Wesley,		2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Artificial Intelligence: Foundations of Computational Agents	David L. Pooleand Alan K. Mackworth	Cambridge University Press		2010
2	Artificial Intelligence: A Systems Approach	Tim Jones M,	Jones & Bartlett Learning.	1st edition	2008

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3	A first course in Artificial Intelligence	Deepak Khemani	McGraw Hill, India		2018

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	An Introduction to Artificial Intelligence	Prof. Mausam	IIT Delhi
2.	Artificial Intelligence	Prof. Sudeshna Sarkar	IIT Kharagpur
3.	Introduction to Robotics	Prof. Asokan T, Prof. Balaraman Ravindran, Prof. Krishna Vasudevan	IIT Madras
4.	Robotics	Prof. Dilip Kumar Pratihar	IIT Kharagpur

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Annasaheb Dange College of Engineering and Technology
Artificial Intelligence and Data Science Department

Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	0ADHS507 Universal Human Values- II
Prerequisite/s	Students Induction Program (SIP), UHV-I
Teaching Scheme: Lecture/Tutorial/Practical	2/0/0
Total Contact Hours:	28 Hours
Credits	02
Evaluation Scheme: ISE I/ ISE II	25/25

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADHS507_1	Integrate the process of self-exploration to achieve Harmony in the human being's based on Holistic perspective of value education.
0ADHS507_2	Understanding Harmony in human being, family, society and nature /existence, based on methods to fulfill human aspiration
0ADHS507_3	Apply the human values for maintaining the relationships with oneself and others using the principals of harmony
0ADHS507_4	Adopt the professional ethics as an individual based on holistic understanding of harmony
0ADHS507_5	Apply the holistic technologies and strategies for one self-based on universal human orders.

Course Contents:		
Unit No.	Course Contents	Hours
Unit 1	**Introduction to Universal Human Value** Content and Process for Value Education, Self-Exploration, Basic Human Aspirations of Continuous Happiness and Prosperity, Correct priority of Right understanding, Relationship and Physical Facility, Holistic development	04
Unit 2	**Harmony in the Human Being** Human being as a co-existence of the self and Body. Needs, activities, response of self and body. Sanyam and Health	03

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Unit 3	**Understanding Harmony in the Family and Society** **Harmony in Human -Human Relationship**, Nine universal values in relationships and Justice in relationship. **Understanding the harmony in the society**: comprehensive Human Goals, human order systems and dimensions. **Process of Development** - In an environment of Relationship and domination Understanding the harmony in the society (society being an extension of family): comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.	07
Unit 4	**Harmony in the Nature and Existence** - Whole existence as Coexistence **Understanding the harmony in the Nature**, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. **Understanding Existence as Co-existence** of mutually interacting units in all pervasive space, Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	06
Unit 5	**Implications of Holistic Understanding of Harmony on Professional Ethics** **Natural acceptance of human values**, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, **Competence in professional ethics**: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.	04

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Unit 6	Case studies of typical holistic technologies and Strategies Case studies of typical holistic technologies, management models and production systems **Strategy for transition from the present state to Universal Human Order:** a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations	04

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Understanding Human Being, Nature and Existence Comprehensively	UHV Team	UHV	1st	2022
02	A Foundation Course in Human Values and Professional Ethics	R. R. Gaur, R Asthana, G P Bagaria	Excel Books	2nd	2019
03	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics	R. R. Gaur, R Asthana, G P Bagaria	Excel Books,	2nd	2019
04	Human Values	A.N Tripathy	New Age International	2nd	2006

Reference Books / Handbooks

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria	Excel Books	3rd	2010
02	Indian Ethos and Modern Management: Amalgam of the Best of the Ideas from the East and the West	B.L. Bajpai	New Royal Book	1st	2004
03	Small Is Beautiful	E. F Schumacher.	Hartley & Marks	1st	1999
04	An Introduction to Ethics	William Lilly	Allied	1st	1967

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	0ADPC358 Computer Vision Laboratory
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	0/0/2
Credits	01
Evaluation Scheme: ISE / ESE	25/50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADPC358_1	Apply the concepts of color image processing, fundamentals of texture analysis
0ADPC358_2	Implement object recognition methods, video processing concepts, 3D imaging
0ADPC358_3	Compare different algorithms and build solutions to the real world computer vision problems.
0ADPC358_4	Understand the Fundamental Image Processing Techniques for Computer Vision
0ADPC358_5	Apply knowledge of computer vision to real life scenarios.

Course Contents:

Expt. No.	Title of Experiment	Contact Hours
1.	Image Classification: Implement a convolutional neural network (CNN) to classify images into different categories (e.g., cats vs. dogs, digits, or various objects).	4 Hrs.
2.	Object Detection: Use models like YOLO (You Only Look Once) or Faster R-CNN to detect and locate multiple objects within an image.	4 Hrs.
3.	Facial Recognition: Develop a system to recognize and identify individuals' faces from images or live video streams.	4 Hrs.
4.	Image Segmentation: Utilize techniques like U-Net or Mask R-CNN to segment images into meaningful regions or identify specific objects' boundaries.	4 Hrs.
5.	Image Super-Resolution: Enhance the resolution of low-resolution images using deep learning models to generate higher-quality versions.	4 Hrs.
6.	Optical Character Recognition (OCR): Build a system that can extract text from images or documents and convert it into editable text.	4 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Digital Image Processing	Gonzalez R. C., Woods R. E	PHI, Second Edition	2nd	2002

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2	Digital Image Processing	Sonka Milan, Vaclav Hlavac,	Cengage Learning	3rd	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Digital Image Processing	S. Jayaraman, S. Esakkirajan, T. Veerkumar	Tata McGraw Hill	-	2010
2	Computer Vision – A Modern approach	D. A. Forsyth, J. Ponce,	Pearson Education, Prentice Hall,		2005
3	Computer Vision	Linda Shapiro, George C. Stockman	Prentice Hall	-	2000

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and CourseTitle	**0ADPC359 Cloud Computing Laboratory**
Prerequisite/s	-
Teaching Scheme: **Lecture/Tutorial/Practical**	0/0/2
Credits	1
Evaluation Scheme:ISE/ESE	25/25

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0ADPC359_1	**Analyze** virtual box with different OS and virtual machine (k4)
0ADPC359_2	**Understanding** the concept of Virtual Machine and Use of Google app engine (k3)
0ADPC359_3	**Remembering** the Google Search Engine & Articulate GAE for web application (k3)
0ADPC359_4	**Executing** the cloud scenario (k3)
0ADPC359_5	**Building** Hadoop node and simple application(k6)
0ADPC359_6	**Analyze** case studies of cloud scenarios (k4)

Course Contents:		Contact hours
1.	Introduction to cloud computing.	2 Hrs
2.	Install Virtual box /VMware Workstation with different flavors of Linux or windows OSon top of windows7 or 8.	2 Hrs
3.	Install a C compiler in the virtual machine created using virtual box and execute SimplePrograms	2 Hrs
4.	Install Google App Engine. Create hello world app and other simple web applicationsusing python/java.	2 Hrs
5.	Use GAE launcher to launch the web applications.	2 Hrs
6.	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is notpresent in CloudSim.	2 Hrs
7.	Find a procedure to transfer the files from one virtual machine to another virtual machine	2 Hrs
8.	Find a procedure to launch virtual machine using trystack (Online Openstack DemoVersion)	2 Hrs
9.	Install Hadoop single node cluster and run simple applications like wordcount.	2 Hrs
10.	Use GAE launcher to launch the web applications.	2 Hrs
11	Case Study: PAAS(Facebook, Google App Engine)	2 Hrs

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12.	Case Study: Student can undertake any one case study on public or private cloud	2 Hrs	

Text Books:

Sr. No	Title	Author	Publisher	Edition	Yearof Edition
1	Distributed and Cloud Computing, From Parallel Processing to the Internet of Things"	Kai Hwang, Geoffrey C. Fox	Morgan Kaufmann Publishers		2012
2	Cloud Computing: Implementation, Management and Security	John W James F. Ransome	CRC Press		2017

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Yearof Edition
1	Mastering Cloud Computing	Buyya, Vecchiola and Selvi	McGraw Hill Education	-	2017
2	Cloud Computing: A Practical Approach", McGraw Hill Education	Toy Velte, Antony Velte	Tata Mcgraw Hill	-	2009
3	Cloud Application Architectures: Building Applications and Infrastructure in the Cloud	George Reese	-	-	2009

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Course Details:

Class	T. Y. B. Tech. / Semester VI
Course Code and Course Title	0ADPC360 Machine Learning Laboratory
Prerequisite/s	Probability and Programming languages.
Teaching Scheme: Lecture/Tutorial/Practical	0/0/2
Credits	1
Evaluation Scheme: ISE /POE	25/50

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPC360_1	Analyze the use of machine Learning libraries,& Preprocessing techniques(K3)
0ADPC360_2	Use of Support vector machine (k3)
0ADPC360_3	Articulate the use of neural network(k3)
0ADPC360_4	Executing a Bayesian network (k3)
0ADPC360_5	Building character recognition using Multilayer Perceptron (k6)
0ADPC360_6	Building machine learning algorithm for problem solving (k6)

	Course Contents:	Contact hours
1.	Write a python program to import and export data using Pandas library functions	2 Hrs
2.	Demonstrate various data pre-processing techniques for a given dataset	2 Hrs
3.	Implement the concept of decision trees with suitable data set from real world problemand classify the data set to produce new sample.	2 Hrs
4.	Detecting Spam mails using Support vector machine	2 Hrs
5.	Implement facial recognition application with artificial neural network	2 Hrs
6.	Study and implement Amazon toolkit: Sage maker	2 Hrs
7.	Implement character recognition using Multilayer Perception	2 Hrs
8.	Implement the non-parametric Locally Weighted Regression algorithm in order to fitdata points. Select appropriate data set for your experiment and draw graphs.	2 Hrs
9.	Implement sentiment analysis using random forest optimization algorithm	2 Hrs
10.	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	2 Hrs
11.	Choose best machine learning algorithm to implement online fraud detection	2 Hrs
12.	Mini-project: students work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance	2 Hrs

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Introduction to Machine Learning	EthemAlpaydin	Prentice Hall of India	3rd Edition	2015
2	Master machine learning algorithms	Jawson Browleen	Machine Learning Mastery, 2016	-	2016
3	Introduction to Machine Learning	Prentice Hall of India,		3rd Edition	2015
4	Machine Learning	Tom Mitchell	McGraw-Hill	-	2017

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer Publications	-	2011
2	Artificial Intelligence: A Modern Approach	Stuart Jonathan Russell	Prentice Hall	3rd Edition	2020
3	Machine Learning Dummies	John Paul Muller, Luca Massaron	Wiley Publications	2016 Edition	2021

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	0ADPE361 Game theory in AI Laboratory
Prerequisite/s	-
Teaching Scheme: Lecture /Tutorial /Practical	0/0/2
Credits	01
Evaluation Scheme: ISE	25

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPE361_1	**Understand** the notion of strategic thinking and rational choice by using the tools of game theory, and modeling applications
0ADPE361_2	**Introduce** the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory,
0ADPE361_3	**Apply** game theory in searching, auctioning and trading.
0ADPE361_4	**Analyze** and **Distinguish** a game situation from a pure individual decision problem
0ADPE361_5	**Understand** the Sequential game tree, backward induction to solve problems.

Course Contents:

Expt. No.	Title of Experiment	Contact Hours
1	Write a Game theory Code for AI The Prisoner's Dilemma Game theory problem	2 Hrs
2	Write a AI Code to satisfy Rock-Paper-Scissors Game theory problem	2 Hrs
3	Write a AI Code for Violations of Nash Equilibrium Game theory problem	2 Hrs
4	Write a AI Code for Logic Regression with Linear Effects & OLS with Non-Linear Effects	2 Hrs
5	Write a OLS with Linear Effects including Subject Fixed Effects	2 Hrs
6	Write a CODE Games with infinite strategy sets & C condensed Best Response Digraphs for Symmetric Games	2 Hrs
7	Implementation of Alpha-Beta Tree Search for any game search problem	2 Hrs
8	Develop an Elementary Chabot for any suitable customer interaction application	2 Hrs
9	Implementation of Greedy Search Algorithm for the following application: Single-Source Shortest Path algorithm.	2 Hrs
10	Implementation of A* Search Algorithm for any game search problem	2 Hrs

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11	Implementation of Greedy Search Algorithm for the followingapplication: Single-source Shortest path problem.	2 Hrs
12	Write a Code for Prisoner's dilemma.	2 Hrs

Text Books:
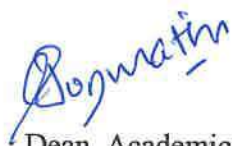
Sr. No	Title	Author	Publisher	Edition	Yearof Edition
1	An Introduction to Game Theory.	M. J. Osborne,	Oxford University Press,	3rd	2012
2	Game Theory	M. Machler, E. Solan, S. Zamir,	Cambridge University Press	-	2013
3	Algorithmic Game Theory	N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani,	Cambridge University Press	-	2017
4	Games of Strategy,	A.Dixit and S. Skeath,	W W Norton & Co Inc,	2nd	2004

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Yearof Edition
1	"Game Theory in Wireless and Communication Networks"	Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes	Cambridge University, Press		2012

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Course Details:

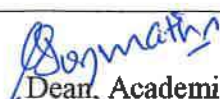| Class	TY B. Tech., Sem. VI
Course Code and Course Title	0ADPE362 **Intelligent Precision Agriculture Laboratory**
Prerequisite/s	-
Teaching Scheme: Practical	0/0/2
Credits	1
Evaluation Scheme: ISE	25

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPE362_1	Understanding the Basic Principles of Mendalian Inheritance
0ADPE362_2	To demonstrate an ability to engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems.
0ADPE362_3	To demonstrate an understanding of and appreciation for the importance of the impact of globalization and diversity
0ADPE362_4	To understand and analyze the current events and issues that are occurring in agriculture and how they affect futuristic agriculture
0ADPE362_5	Knowledge of Weather codes and Symbols, Reading and Recording of weather and climatic data

Course Contents:		
Expt. No.	**Title of Experiment**	**Contact Hours**
1	Soil and water monitoring system using AI, GPS and ZigBee	2 Hrs
2	Soil fertility map by GIS	2 Hrs
3	Monitoring the crop from plantation to cultivation	2 Hrs
4	Fertilizer sprayers using Arduino	2 Hrs
5	Monitoring using Arduino	2 Hrs
6	Multispectral remote sensing for soil mapping	2 Hrs
7	Creation of productivity and management zone by GIS	2 Hrs
8	VRT technique for fertilizer recommendation.	2 Hrs
9	Agriculture survey by GPS and DGPS	2 Hrs
10	Implementation of A* Search Algorithm for any game search problem	2 Hrs

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11	Drone based experiment	2 Hrs
12	Micro Project	2 Hrs

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	National Research Council, "Precision Agriculture in the 21st Century",	H. Krug, Liebig	National Academies Press,	Second Edition	1997

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	"Agricultural Systems Management	Hammer, G.L., Nicholls, N., and Mitchell, C.,	Marcel Dekker,	2ND	2004
2	"Applications of Seasonal Climate"	Peart, R.M., and Shoup, W. D.,	Springer, Germany	2ND	2000

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	**0ADPE363- Artificial Intelligence and Robotics Laboratory**
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	0/0/2
Credits	01
Evaluation Scheme: ISE	25

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPE363_1	Use of any robotic simulation software to model the different types of robots and calculate work volume for different robots (k3)
0ADPE363_2	Apply Feature Extraction, Image pre-processing algorithm in real time robot(k3).
0ADPE363_3	Analyze and implement search strategies (k4).
0ADPE363_4	Evaluate systems with logical reasoning (k5)
0ADPE363_5	Evaluate systems with probabilistic reasoning (k5)

Course Contents:

Expt. No.	Title of Experiment	Contact Hours
1	Implement basic search strategies – 8-Puzzle, 8 - Queens problem, Cryptarithmetic	2 Hrs
2	Implement A* Search algorithm	2 Hrs
3	Implement AO* Search algorithm.	2 Hrs
4	Implement Minimax algorithm for game playing (Alpha-Beta pruning)	2 Hrs
5	Implement propositional model checking algorithms	2 Hrs
6	Robot programming and simulation for pick and place.	2 Hrs
7	Robot programming and simulation for Color identification.	2 Hrs
8	Robot programming and simulation for Shape identification.	2 Hrs
9	Robot programming and simulation for writing practice/3D printing.	2 Hrs
10	Robot programming and simulation for multi process	2 Hrs
11	Study on different kinds of vision sensors and lighting techniques.	2 Hrs
12	Micro project: Pre-processing techniques in image processing.	2 Hrs

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	A Classical Approach to Artificial Intelligence	M.C. Trivedi	Khanna Book Publishing	-	2019 .
2	Artificial Intelligence.	Rich and Knight	The McGraw Hill	3rd	2017
3	Introduction to AI Robotics	Robin R. Murphy	MIT press	2nd	2001
4	Robotics: Everything You Need to Know About Robotics from Beginner to Expert	Peter McKinnon	Create space Independent Publishing Platform	-	2016

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Artificial Intelligence: A modern approach	Stuart Russel	Pearson Education	-	2010
2	Artificial Intelligence	Luger	Pearson Education	-	2002
3	Robotics, Vision and Control: Fundamental Algorithms in MATLAB	Peter Corke	Springer	:	2011
4	Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques	Francis X. Govers	Packt Publishers	-	2018

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Course Details:

Class	TY B. Tech., Sem. VI
Course Code and Course Title	**0ADPR364- Minor Project**
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	0/0/2
Credits	01
Evaluation Scheme: ISE/ESE	25/50

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:
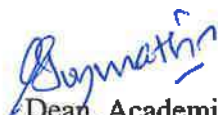
0ADPR364_1	**Identify** Specific Problem Statement from a selected domain. (K3)
0ADPR364_2	**Analyze** the hardware and/or software requirements of the proposed work (k4).
0ADPR364_3	**Identify** and use relevant tools and technologies for documentation, designing coding,testing and debugging software/hardware retaining to their major project (k3)
0ADPR364_4	**Defend** or argue or appraise the results obtained during project work **(K5)**
0ADPR364_5	**Design** and construct a software system, component or process to meet desired needs (k6)

Course Details

1.	Mini project topics and the work for these groups in the batch shall be divided into mini project groups.
2.	Mini project topics and the work for these groups in the hatch shall be guided by a teacher for the batch, preferably on one of the topics which is selected by the students in his/her domain
3.	Allematively, a group may select another topics of relevance in consultation with senior students and teachers.
4.	A group shall undertake IBM TGMC (The Great Mind Challenge) projects, past Smart India Hackathon, KPIT Sparkle topic or the topic related to the courses the students have studied/studying
5.	The teacher shall periodically assess the performance of individual student in the mini project jointly with a teacher of another batch.
6.	Project group shall submit hardcopy of project report along with related code and documentation in soft form at the end of the semester.

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Artificial Intelligence and Data Science Department

Course Details:

Class	B. Tech., Sem. VI
Course Code and Course Title	0ADCC399/VAC-6/Reasoning and Soft Skills Part-II
Prerequisite/s	VAC
Teaching Scheme: Lecture/Tutorial/Practical	2/0/0
Credits	02
Evaluation Scheme: ISE I / MSE / ISE II /ESE	--

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADCC399_1	**Understand** to Provide Students an Understanding of the Expectations
0ADCC399_2	**Analyze** and Improve the Employability skills
0ADCC399_3	**Apply** the Knowledge of Industry aspects
0ADCC399_4	**Understand** and Improve the Employability Skills of Students
0ADCC399_5	**Apply** and ability holistic perspective gain more knowledge

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	Advance Probability Advance Permutation Combination	5 Hrs
Unit 2	Statement Assumption Syllogism	5 Hrs.
Unit 3	Mixed Bar Graph, Pie Chart Data Interpretation (Avg & Ratio Proportion based)	4 Hrs.
Unit 4	Gaming Round OR Capgemini Part 1 Gaming Round OR Capgemini Part 2	4 Hrs.
Unit 5	Company Specific Revision for Arithmetic (S.T.D., Time Rate Work) Revision of Calendar Reminder theorem Power Cycle	5 Hrs.
Unit 6	Verbal Ability Revision Part 1 Verbal Ability Revision Part 2 Interview Etiquettes & Grooming	5 Hrs.

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Annasaheb Dange
College of Engineering and Technology
Ashta

An Autonomous Institute affiliated to Shivaji University
Kolhapur

Curriculum Structure

B. Tech.
ARTIFICIAL INTELLIGENCE AND
DATA SCIENCE

SEM VII & SEM VIII

(Academic Year 2024- 2025)

Annasaheb Dange College of Engineering and Technology
Artificial Intelligence and Data Science Department

Teaching and Evaluation Scheme
B. Tech: Semester-VII

Course Code	Course	Teaching Scheme				Evaluation Scheme				
							Theory (Marks)		Practical (Marks)	
		L	T	P	Credits	Scheme	Max.	Min. for Passing	Max.	Min. for Passing
0ADOE401	Open Elective-III	3	--	--	3	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADPC402	Big Data Analytics	3	--	--	3	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADPC403	Deep Learning	3	--	--	3	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADPC404	Digital Transformation Using AI/ML with Cloud	2	--	--	2	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADPE4**	Professional Elective-IV	3	1	--	4	ISE I	10		--	--
						MSE	30	40	--	--
						ISE II	10		--	--
						ESE	50	20	--	--
0ADHS409	Project Management and Finance	2	--	--	2	ISE-I	25	10	--	--
						ISE-II	25	10	--	--
0ADPC451	Big Data Analytics Laboratory	--	--	2	1	ISE	--	--	25	10
						ESE	--	POE	50	10
0ADPC452	Deep Learning Laboratory	--	--	2	1	ISE	--	--	25	10
						ESE	--	POE	50	10
0ADPC453	Digital Transformation Using AI/ML with Cloud Laboratory	--	--	2	1	ISE	--	--	25	10

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0ADPR454	In-Plant Training	---	--	--	1	ESE	--	PR	50	20
0ADPR455	Project (Phase-I)	---	--	4	2	ISE	--	--	25	10
						ESE	--	PR	50	20
VAC-7	Value Added Course-7	2			-	Audit				
Total		**18**	**1**	**10**	**23**	**Total**	**550**		**300**	
Total Contact Hours/Week: 29 hrs						**Total=550+300=850**				

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	02	-	-	11	04	03	03
Cumulative Sum	11	17	19	69	14	09	05

Open Elective-III		Professional Elective - IV	
0ADOE401	Genetic Algorithms	0ADPE405	Data Warehousing and Business Intelligence
		0ADPE406	Natural Language Processing
		0ADPE407	Genetic Algorithms and Quantum AI
		0ADPE408	AI in Healthcare

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Artificial Intelligence and Data Science Department

Teaching and Evaluation Scheme
B. Tech: Semester-VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme				
							Theory (Marks)		Practical (Marks)	
		L	T	P	Credits	Scheme	Max	Min. for Passing	Max	Min. for Passing
0ADOE410	Open Elective-IV ^ (MOOC)	3	--	--	3	ISE I	10	20		
						MSE	30			
						ISE II	10			
						ESE	50	20		
0ADPE4**	Professional Elective-V # (MOOC)	3	--	--	3	ISE I	10	20		
						MSE	30			
						ISE II	10			
						ESE	50	20		
0ADPR455	Internship / Project (Phase-II)	--	--	20	10	ISE		--	100	40
						ESE	--	--	200	80
Total		**06**	**-**	**20**	**16**	**Total**	**200**		**300**	
Total Contact Hours/Week: 26 hrs						**Total=200+300=500**				

Course Category	HS	BS	ES	PC	PE	OE	PR	Total
Credits	--	--	--	--	03	03	10	
Cumulative Sum	11	17	19	69	17	12	15	160
Credits(Institute)	11	23	18	65	16	12	15	160
Credits (AICTE)	12	25	24	48	18	18	15	160

^ Students has to choose subjects from interdisciplinary domains like Intellectual Property Rights, Business Management etc. for Open Elective
# Students has to choose subjects from platform such as SWAYAM, NPTEL, EDX etc. in Artificial Intelligence and Data Science domain for Professional Elective

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Artificial Intelligence and Data Science Department

Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	**0ADOE401** Genetic Algorithms
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	3/0/0
Total Hours	42
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADOE401_1	**Understand** the principles and mechanisms of genetic algorithms(K2)
0ADOE401_2	**Apply** genetic algorithms to solve optimization problems(K3)
0ADOE401_3	**Analyze** the performance of genetic algorithms(K4)
0ADOE401_4	**Explore** advanced topics in genetic algorithms and machine learning(K3)

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction to genetic algorithms:** Mathematical Foundations :The fundamental theorem Schema Processing at work : An example by hand revisited, The two armed and k-armed Bandit problem , The Building Block Hypothesis	08 Hrs.
Unit 2	**Computer Implementation of Genetic Algorithm:** Data structures, Reproduction, crossover, and Mutation, Mapping Objective functions to Fitness form, Fitness Scaling, Coding	07 Hrs.
Unit 3	**Computer Implementation of Genetic Algorithm:** A multi parameter mapped Fixed point Coding , Discretisation, Constraints Application of Genetic Algorithms	06 Hrs.
Unit 4	**Advanced Operators and Techniques in Genetic Search:** Dominance, Diploidy and Abeyance Inversion and other reordering Operators, Other Micro, Operators, Niche and Speciation, Multi Objective Optimization, Knowledge Based Techniques.	07 Hrs.
Unit 5	**Introduction to Genetics Based Machine Learning:** Classifier System, Rule and Message system, Apportionment of Credit Algorithm : The Bucket Brigade, Genetic Algorithm, A simple Classifier system, Results using simple classifier system	07 Hrs.

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Unit 6	Applications of Genetics Based Machine Learning : The rise of GBML, Development of CS- 1, The first Classifier System, Smith's Poker Player, Other early GBML Efforts.	07 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Genetic Algorithms in Search, Optimization & Machine Learning	David e Goldberg	Pearson	3rd	2012
2	Learning Genetic Algorithms with Python	Ivan Gridin	BPB publication	1st	2021

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Genetic Algorithms in Search, Optimization & Machine Learning	David e Goldberg	Addison Wesley	1st	1989
2	Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications	S. Rajasekaran g. A. Vijayalakshmi Pai	Prentice Hall of India	2nd	2017

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Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	0ADPC402 Big Data Analytics
Prerequisite/s	Database Management System
Teaching Scheme: Lecture/Tutorial/Practical	3/0/0
Total Hours	42
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPC402_1	Solve examples using probability theory (K^3)
0ADPC402_2	Explain components of the business intelligence environment and discuss the structure of the decision-making process.(K^2)
0ADPC402_3	Examine big data and Hadoop Ecosystem tools (K^4)
0ADPC402_4	Summarize the framework with respect to Hadoop (K^2)
0ADPC402_5	Apply Machine Learning Techniques using R. (K^3)

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction to Statistics and Probability:** The Engineering method and statistical thinking, Collecting Engineering data: retrospective study, Observation, Designed experiments, Introduction and framework: Population, Sample, Observations, Variables, Data collection Sample space and events: Random Experiments, Sample Space, Events, Interpretation of probability: Introduction, Axioms of probability, Random variables	08Hrs
Unit 2	**Business Intelligence and decision support system** Effective and timely decisions, Data, Information and Knowledge, The role of mathematical models, Business intelligence architectures: Cycle of business intelligence analysis, Enabling factor in business intelligence projects, Development of business intelligence system, Ethics of business intelligence, Definition of system, Representation of the decision-making process, Definition of decision support system, Development of decision support system	07 Hrs
Unit 3	**Overview of Big Data** Introduction to Big Data, Evolution of Big Data, Structure of Big Data Elements of Big Data, Big Data Analytics, Careers in Big Data, Future of Big Data	06 Hrs

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Unit 4	**Understanding Hadoop Ecosystem**	08 Hrs
	Hadoop Distributed System: Physical Organization of Compute Nodes, Large Scale File System Organization, Map Reduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of Map Reduce Execution, Coping With Node Failures. , Hadoop YARN, Introducing HBase , Hive, Pig and Pig Latin.	
Unit 5	**Understanding Map Reduce and HBase**	07 Hrs
	The map reduce Framework, Techniques to Optimize Map Reduce Jobs Use of MapReduce, Role of HBase in Big Data Processing, Exploring the Big data Stack, Virtualization and Big Data	
Unit 6	**Data Analytics with R**	06 Hrs
	Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Big Data Analytics with BigR.	

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Applied Statistics and Probability for Engineers	Douglas C. Montgomery And George C. Runger	John Wiley & Sons, Inc	7th	2018
2.	Big data Black Book	DT Editorial	Dreamtech Press Edition	1st	2016

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Hadoop : The Definitive Guide	Tom White	O'REILLY Publication	3rd	2015
2.	Big Data and Analytics	Seema Acharya and Subhashini Chellappan	Wiley India	1st	2015
3.	Introductory statistics with R	Peter Dalgaard	Springer	2nd	2018

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Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	0ADPC403 Deep Learning
Prerequisite/s	Machine Learning
Teaching Scheme: Lecture/Tutorial/Practical	3/0/0
Total Hours	42
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPC403_1	**Describe** the fundamentals of neural networks (K2)
0ADPC403_2	**Design** feed forward networks with back propagation (K3)
0ADPC403_3	**Develop** different deep learning models for given tasks (K3)
0ADPC403_4	**Formulate** the correct parameters and hyper-parameters of developed model for getting improved performance (K4)
0ADPC403_5	**Build** real-world applications using deep learning mechanisms and demonstrate effectively with verbal and written skills (K6)

Course Contents:

Unit No	Unit Name	Contact Hours
Unit.1	**Introduction to neural networks -** Neural Networks Basics - Functions in Neural networks – Activation function, Loss function - Function approximation - Classification and Clustering problems - Deep networks basics - Shallow neural networks – Activation Functions – Gradient Descent – Back Propagation	6 Hrs.
Unit 2	**Deep Neural Networks(DNNs)** Introduction to Neural Networks :The Biological Neuron, The Perceptron, Multilayer Feed-Forward Networks , Training Neural Networks :Back propagation and Forward propagation Activation Functions :Linear ,Sigmoid, Tannh, Hard Tanh, Softmax, Rectified Linear, Loss Functions :Loss Function Notation , Loss Functions for Regression , Loss Functions for Classification, Loss Functions for Reconstruction, Hyper parameters: Learning Rate, Regularization, Momentum, Sparsity.	8 Hrs.
Unit 3	**Convolution Neural Network(CNN)** Introduction, CNN architecture overview, The Basic Structure of a Convolutional Network- Padding, Strides, Typical Settings, the ReLU layer, Pooling, Fully Connected Layers, The Interleaving between Layers, Local Response Normalization, Training a Convolutional Network	7 Hrs.

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Unit 4	**Recurrent networks-** Recurrent Neural Networks - Bidirectional RNNs, Encoder, Decoder, Sequence-to-Sequence Architectures, Deep Recurrent Networks, Auto encoders - Bidirectional Encoder Representations from Transformers (BERT).	6 Hrs.
Unit 5	**Deep Generative Models** Introduction to deep generative model, Boltzmann Machine, Deep Belief Networks, Generative adversarial network (GAN), discriminator network, generator network, types of GAN, Applications of GAN networks	8 Hrs.
Unit 6	**Reinforcement Learning** Introduction of deep reinforcement learning, Markov Decision Process, basic framework of reinforcement learning, challenges of reinforcement learning, Dynamic programming algorithms for reinforcement learning, Q Learning and Deep Q-Networks, Deep Q recurrent networks, Simple reinforcement learning for Tic-Tac-Toe.	7 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Deep Learning	Goodfellow, I., Bengio, Y.,,Courville	MIT Press	2nd	2016
2.	Neural Networks and deep learning	Charu C. Aggarwal	Springer International Publishing	1st	2018

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Fundamentals of Deep Learning	Nikhil Buduma	O'Reilly	1st	2017
2.	Deep Learning: A Practitioner's Approach	Josh Patterson & Adam Gibson	O'Reilly (Greyscale Indian Edition)	1st	2016
3.	Neural Network from Scratch using Python	Harrison Kinsley & Daniel Kukiela	Manning	1st	2017

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Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	0ADPC404 Digital transformation using AI/ML with cloud
Prerequisite/s	Machine Learning
Teaching Scheme: Lecture/Tutorial/Practical	2/0/0
Total Hours	28
Credits	02
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPC404_1	**Understand** the role of AI/ML and cloud computing in digital transformation.(K2)
0ADPC404_2	**Explore** AI/ML algorithms and techniques applicable to different business domains.(K3)
0ADPC404_3	**Learn** how to leverage cloud platforms for scalable and cost-effective AI/ML solutions.(K2)
0ADPC404_4	**Analyze** case studies of successful AI/ML-driven digital transformations.(K4)
0ADPC404_5	**Develop** strategies for implementing AI/ML initiatives within organizations(K5)

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction to Digital Transformation with AI/ML** Definition and significance of digital transformation with AI/ML Key components: AI, ML, and cloud computing Trends and challenges in AI/ML-driven digital transformation	04 Hrs.
Unit 2	**Foundations of AI and ML** Overview of AI and ML concepts and techniques, Supervised, unsupervised, and reinforcement learning, Deep learning and neural networks	05 Hrs.
Unit 3	**Cloud Computing for AI/ML** Introduction to cloud computing platforms (e.g., AWS, Azure, Google Cloud)Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)Cloud-based tools and services for AI/ML development and deployment	05 Hrs.
Unit 4	**AI/ML Applications in Business** AI/ML use cases across various industries (e.g., healthcare, finance, retail) Predictive analytics and forecasting, Natural Language Processing (NLP) and sentiment analysis	04 Hrs.
Unit 5	**AI/ML Implementation Strategies** Data preparation and feature engineering, Model selection and evaluation	05 Hrs.

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	Deployment strategies: cloud-based deployment pipelines, containerization, and orchestration	
Unit 6	**AI Ethics and Governance** Ethical considerations in AI/ML development and deployment, Bias and fairness in AI algorithms, Regulatory frameworks and compliance requirements	05 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	The Fourth Industrial Revolution	Klaus Schwab	World Economic Forum®	-	2016
2.	Cloud Computing: Concepts, Technology & Architecture	Thomas Erl	PHI	-	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	AI in Practice: A Blueprint for Digital Transformation	Bernard Marr and Matt Ward	Wiley	-	2019

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Artificial Intelligence and Data Science Department

Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	**0ADPE405** Professional Elective IV-Data Warehousing and Business Intelligence
Prerequisite/s	Database Concepts
Teaching Scheme :Lecture/Tutorial/Practical	3/1/0
Total Contact Hours:	42Hours
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPE405_1	**Summarize** Trends in Data Warehousing (K2)
0ADPE405_2	**Implement** Architecture and Infrastructure of data warehousing(K3)
0ADPE405_3	**Illustrate** the business intelligence essentials(K2)
0ADPE405_4	**Implementation** of Decision support systems(K3)
0ADPE405_5	**Analyze** Mathematical models for decision-making and Marketing Models (K4)

Course Contents:

Unit No	Unit Name	Contact Hours
Unit 1	**Trends in Data warehousing** Escalating Need for Strategic Information, Data Warehousing—The Only Viable Solution, Overview of the Components, features of Data Warehouse, Metadata in the Data Warehouse, Significant Trends, Web-Enabled Data Warehouse	07 Hrs.
Unit 2	**Architecture and Infrastructure of data warehousing** Understanding Data Warehouse Architecture, Distinguishing Characteristics, Architectural Framework, Technical Architecture, Infrastructure Supporting Architecture, Hardware and Operating Systems, Database Software, Collection of Tools	07 Hrs.
Unit 3	**Role of Metadata and Data Design** Importance of metadata-A Critical Need in the Data Warehouse, Why Metadata is Vital for End-Users, Why Metadata is Essential for IT, Automation of Warehousing Tasks, Establishing the Context of Information, Metadata Types by Functional Areas, Business Metadata, Technical Metadata, Requirements to Data Design, The STAR Schema	07Hrs

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Unit 4	**Introduction to Business Intelligence** Introduction of Business Intelligence, Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures- Cycle of a business intelligence analysis, Enabling factors in business intelligence projects, Development of a business intelligence system, Ethics and business intelligence	07 Hrs.
Unit 5	**Decision support systems** Definition of systems, Representation of the decision-making process-Rationality and problem-solving, The decision-making process, Types of decisions, Approaches to the decision-making process, Evolution of information systems, decision support system, Development of a decision support system	07 Hrs.
Unit 6	**Mathematical models for decision making and Marketing Model** Structure of mathematical models, Development of a model-Problem identification, Model formulation, Development of algorithms, Implementation and test, Classes of models-Predictive models, Pattern recognition and learning models, Optimization models, Project management models, Risk analysis models, Waiting, line models, Marketing models: Relational marketing, Sales force management,	07 Hrs

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Fundamentals of Business Intelligence	Wilfried Grossmann, Stefanie Rinderle-Ma	Springer	1St	2015
2	Data warehousing fundamentals	Paulraj ponniah	Wiley	2nd	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Business Intelligence: Data Mining and Optimization for Decision Making	Carlo Vercellis	Wiley	2nd	2009
2	Fundamentals of Data Warehouses	Matthias Jarke, Maurizio Lenzerini, Yannis Vassiliou, PanosVassiliadis	Springer	2nd	2013

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Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	**0ADPE406** Natural Language Processing
Prerequisite/s	Machine Learning
Teaching Scheme: Lecture/Tutorial /Practical	3/1/0
Total Contact Hours:	42
Credits	4
Evaluation Scheme: ISE I /MSE/ ISE II /ESE	10/30/10/50

Course Outcomes(COs):

Upon successful completion of the course, the students will be able to:

0ADPE406_1	**Understand** the fundamental concepts of NLP, challenges and issues in NLP (K2)
0ADPE406_2	**Illustrate** various language models syntax, semantics and algorithms (K4)
0ADPE406_3	**Illustrate** various language modeling techniques (K4)
0ADPE406_4	**Integrate** the NLP techniques for the information retrieval task and recognition in real-world NLP applications(K3)
0ADPE406_5	**Use** NLP tools and techniques for text-based processing of natural languages (K3)

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction** Natural Language Processing, Programming languages Vs Natural Languages, Finite automata for NLP, Stages of NLP, Challenges and Issues(Open Problems) in NLP Basics of text processing: Tokenization, Stemming, Lemmatization, Part of Speech Tagging	6 Hrs.
Unit 2	**Language Syntax and Semantics** Morphological Analysis: Types of Morphemes, Inflectional morphology &Derivational morphology, Morphological parsing with Finite State Transducers (FST) Syntactic Analysis: Syntactic Representations of Natural Language, Parsing Algorithms, Probabilistic context-free grammars, and Statistical parsing Semantic Analysis: Lexical Semantic, Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy, Word Net, Word Sense Disambiguation (WSD), Dictionary based approach, Latent Semantic Analysis	7 Hrs.

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Unit 3	**Language Modelling** Probabilistic language modeling, Markov models, Generative models of language, Log-Liner Models, Graph-based Models N-gram models: Simple n-gram models, Estimation parameters and smoothing, Evaluating language models, Word Embeddings/ Vector Semantics: Bag-of-words, TFIDF, word2vec, doc2vec, Contextualized representations (BERT) Topic Modelling: Latent Dirichlet Allocation (LDA), Latent Semantic Analysis, Non Negative Matrix Factorization, LLM, Chat Gpt	8 Hrs.	
Unit 4	**Information Retrieval using NLP** Information Retrieval: Introduction, Vector Space Model Named Entity Recognition: NER System Building Process, Evaluating NER System Entity Extraction, Relation Extraction, Reference Resolution, Co reference resolution, Cross Lingual Information Retrieval, Hugging Face Library	7 Hrs.	
Unit 5	**NLP Tools and Techniques** Prominent NLP Libraries: Natural Language Tool Kit (NLTK), spaCy, TextBlob, Gensim etc. Linguistic Resources: Lexical Knowledge Networks, WordNets, Indian Language WordNet (IndoWordnet), VerbNets, PropBank, Treebanks, Universal Dependency Treebanks Word Sense Disambiguation: Lesk Algorithm Walker's algorithm, WordNets for Word Sense Disambiguation	8 Hrs.	
Unit 6	**Applications of NLP** Machine Translation: Rule based techniques, Statistical Machine Translation (SMT), Cross Lingual Translation Sentiment Analysis, Question Answering, Text Entailment, Discourse Processing, Dialog and Conversational Agents, Natural Language Generation	6 Hrs.	

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Publication
1	"Speech and Language Processing: An Introduction to Natural Language Processing", Computational Linguistics and Speech Recognition"	Jurafsky / Martin	PEARSON Publication	3rd	Feb 2024
2	"Foundations of Statistical Natural Language Processing", Cambridge	Christopher Manning Hinrich Schuetze	MA: MIT Press	-	1999

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit	Steven Bird, Ewan Klein, Edward Loper	O'Reilly Publication	-	2009
2	Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data	Dipanjan Sarkar	Apress Publication ISBN: 97814842238 71	-	2016
3	The Handbook of Computational Linguistics and Natural Language Processing	Alexander Clark	Wiley Blackwell Publications		2010

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Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	**0ADPE407** Genetic Algorithms and Quantum Computing
Prerequisite/s	Design and Analysis of Algorithm
Teaching Scheme: Lecture/Tutorial/Practical	3/1/0
Total Contact Hours:	42
Credits	4
Evaluation Scheme: ISE I / MSE / ISE II /ESE	10/30/10/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPE407_1	**Understand** the concepts of Genetic algorithms and its working (K2)
0ADPE407_2	**Distinguish** Genetic algorithms on the basis of characteristics (K3)
0ADPE407_3	**Analyze** operators and techniques in genetic algorithms (K4)
0ADPE407_4	**Use** efficient quantum algorithms (K3)
0ADPE407_5	**Apply** quantum algorithms and information science for basic problems (K3)

Course Contents:

Unit No	Unit Name	Contact Hours
Unit 1	**Basics of Genetic Algorithm** Mathematical Foundations, The Fundamental Theorem, Schema Processing, Basics of Genetic Algorithms (GAs), Basic Concepts and Working Principle, Procedures and Flowchart of GA, Genetic Representations (Encoding), Initialization and selection, Genetic operators, Mutation, Generational Cycle, Traditional algorithm vs genetic algorithm,	7 Hrs.
Unit 2	**Computer Implementation of Genetic Algorithm** Simple GA, Data Structures in Genetic Algorithm, schema theorem, Classification of genetic algorithm, Reproduction, Crossover, and Mutation Operations, Mapping Objective Functions to Fitness Forms, Fitness Scaling Techniques, Coding Methods, Multi-parameter Mapped Fixed Point Coding, Discretization and Handling Constraints, Applications of Genetic Algorithms	8 Hrs.
Unit 3	**Advanced Operators and Techniques in Genetic algorithms** Dominance, Diploidy, and Abeyance Operators, Inversion and Other Reordering Operators, Other Micro-Operators Niche and Speciation Techniques, Multi-Objective Optimization with Genetic Algorithms, Knowledge-Based Techniques	6 Hrs.

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		Holland Classifier Systems, Genetic Programming, Convergence Analysis of Genetic Algorithms	
Unit 4	**Fundamental Concepts of Quantum Computing** Introduction to Quantum Mechanics: Complex Numbers and Geometrical Representations, Complex Vector Spaces, Inner Products, and Hilbert Spaces, Hermitian and Unitary Matrices, Tensor Products of Vector Spaces, Bits and Qubits: Qubit Operations, Quantum Circuit Composition		7 Hrs.
Unit 5	**Quantum Computing Algorithms** Quantum Parallelism, Quantum Evolution, Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Simon's Periodicity Algorithm Grover's Search Algorithm, Shor's Factoring Algorithm, Application of Entanglement, Teleportation, Superdense Coding		8 Hrs.
Unit 6	**Quantum Information Science** Quantum Noise and Quantum Operations, Distance Measures for Quantum Information, Quantum Error-Correction, Entropy and Information, Quantum Information Theory, Quantum Programming Languages, Probabilistic and Quantum Computations, Introduction to Quantum Cryptography and Quantum Information Theory		6 Hrs.

Text books				
Title	**Author**	**Publisher**	**Edition**	**Year of Edition**
Learning Genetic Algorithms with Python	Ivan Gridin	BPB publication	1st	2021
Introduction to Genetic Algorithms	Mitchell Melanie	MIT press	5th	1999
Quantum Computation and Quantum Information	Michael A. Nielsen and Isaac L. Chuang	Cambridge University Press.	10th	2010

Reference books				
Title	**Author**	**Publisher**	**Edition**	**Year of Edition**
Genetic Algorithms in Search, Optimization & Machine Learning	David e Goldberg	Addison Wesley	1st	1989
Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications	S. Rajsekaran and G.A. Vijaya Lakshmi Pai	Prentice Hall of India	2nd	2017

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Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	**0ADPE408** AI in Healthcare
Prerequisite/s	Foundation of AI, Machine Learning
Teaching Scheme: Lecture/Tutorial /Practical	3/1/0
Total Contact Hours:	42
Credits	3
EvaluationScheme:ISE1/MSE/ISE II/ ESE	10/30/10/50

Course Outcomes(COs):	
Upon successful completion of this course, the student will be able to:	
0ADPE408_1	**Understand** AI in health care, there workflow.(K2)
0ADPE408_2	**Analyze** AI tools and techniques in health care(K4)
0ADPE408_3	**Examine** AI in Diagnosis and Treatment(K4)
0ADPE408_4	**Illustrate** AI in Patient Care and Monitoring & operation& Data Management and Security(K3)
0ADPE408_5	**Reviewing** Case Studies and Applications(K2)

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction to AI in Healthcare** History and evolution of AI in healthcare, Pioneering AI Projects in Healthcare: Initial AI applications in medical diagnosis and treatment, Significant early AI systems like MYCIN and INTERNIST-I,AI Workflow in Healthcare: Data collection and preprocessing, Model training and evaluation., Deployment and monitoring of AI models in healthcare settings, Ethical and legal considerations in AI applications in healthcare	7Hrs.
Unit 2	**AI Techniques and Tools** Machine learning (supervised, unsupervised, and reinforcement learning),Deep learning and neural networks, Natural Language Processing (NLP) in healthcare, Tools and frameworks for AI in healthcare (e.g., TensorFlow, PyTorch)	7 Hrs.
Unit 3	**AI in Diagnosis and Treatment** AI for medical imaging (radiology, pathology): Benefits of AI in Medical Imaging, Challenges and Considerations, Predictive analytics in diagnosis, AI-driven personalized medicine, Robotic surgery and AI-assisted procedure	7 Hrs.

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Unit 4	**AI in Patient Care and Monitoring & operation** Remote patient monitoring systems, AI in chronic disease management, Wearable technology and health tracking, Virtual health assistants and chat bots, AI in healthcare administration and management, Optimization of hospital workflows, Predictive analytics for resource allocation, I in healthcare logistics and supply chain management.	8 Hrs.
Unit 5	**Data Management and Security** Big data in healthcare, Data privacy and security in healthcare AI applications, Interoperability and data integration, Standards and protocols for healthcare data	7 Hrs.
Unit 6	**Case Studies and Applications** Successful AI implementations in healthcare, Challenges and limitations of AI in healthcare, Future trends and innovations in healthcare AI, real-world case studies. The Future Of Artificial Intelligence In The Health Sector	6 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	AI in Health: A Leader's Guide to Winning in the New Age of Intelligent Health System	Tom Lawry	CRC Press/Taylor & Francis Group,	1st	2020
2	Artificial Intelligence in Healthcare: AI, Machine Learning, and Deep and Intelligent Medicine Simplified for Everyone	Dr Parag Suresh Mahajan	-	General Edition	2022

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Artificial Intelligence for Health and Health Care	Dolores Derrington	Jason the mitre corporation	General Edition	2017

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Annasaheb Dange College of Engineering and Technology
Artificial Intelligence and Data Science Department

Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	0ADHS409 Project Management and Finance
Prerequisite/s	Software Engineering for Data science
Teaching Scheme: Lecture/Tutorial/Practical	2/0/0
Total Hours	28
Credits	02
Evaluation Scheme: ISE I / ISE II	25/25

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

0ADHS409_1	**Understand** the concept of Project Management (K^2)
0ADHS409_2	**Judge** Team building and leadership skills through project management functions(K^4)
0ADHS409_3	**Prepare** total project management plan and risk management plan including individual participant's role. (K3)
0ADHS409_4	**Estimate** costing and pricing of project based on organizational requirements. (K^4)
0ADHS409_5	**Determining** financial goals of the project(K^3)

Course Contents:

Unit No.	Unit Name	Contact Hours
Unit 1	**Introduction to Project Management** Introduction, Understanding Project Management, Differing Views of Project Management, General Systems Management, Project Management Life Cycle	04 Hrs.
Unit 2	**Project Management Functions** Controlling, Directing, Project Authority, Barriers to Project Team Development, Team Building as an Ongoing Process, Leadership in a Project Environment, Life-Cycle Leadership, Organizational Impact, Employee–Manager Problems, Management Pitfalls, Communications, Project Review Meetings, Project Management Bottlenecks	06 Hrs.
Unit 3	**Planning** General Planning, Life-Cycle Phases, Proposal Preparation, Understanding Participants' Roles, Project Planning, The Planning Cycle, Work Planning Authorization, Project Plan, Total Project Planning	04 Hrs.
Unit 4	**Risk Management** Definition of Risk, Definition of Risk Management, Risk Management Process, Plan Risk Management, Plan Risk Management, Risk Identification, Risk Analysis, Qualitative Risk Analysis, Quantitative Risk Analysis	04 Hrs.
Unit 5	**Pricing and Estimating** Global Pricing Strategies, Types of Estimates, Pricing Process, Organizational Input Requirements, Labor Distributions, The Pricing Review Procedure, Estimating Pitfalls, Estimating High-Risk Projects, Project Risks, Life-Cycle Costing (LCC)	06 Hrs.

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Unit 6	Financial Management	04 Hrs.
	Meaning, Nature and Scope of Finance, Financial Goal: Profit Maximization vs Wealth Maximization, Finance Functions-Investment Decision, Financing Decision, Dividend Decision, Liquidity Decision	

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Project Management: A Systems Approach to Planning, Scheduling, and Controlling	Harold Kerzner	Willey	13th	2022
2	Fundamentals of Financial Management	R. P. Rostogi	Taxmann Publications Private Limited	7th	2024

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Advanced Project Portfolio Management and the PMO	Gerald I. Kendall, Steven C. Rollins	J. Ross Publishing	-	2003
2	Fundamental of Financial Management	S K Gupta , R K Sharma	OSR Publishers Odisha	1st	2022

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Annasaheb Dange College of Engineering and Technology
Artificial Intelligence and Data Science Department

Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	OADPC451 Big Data Analytics Laboratory
Prerequisite/s	Data Base Management System
Teaching Scheme: Lecture/Tutorial/Practical	0/0/2
Credits	01
Evaluation Scheme: ISE /ESE	25/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPC451_1	Demonstrate the need of Data Analytics(K3)
0ADPC451_2	Use Hadoop-related tools such as Map Reduce, Pig, and Hive for big data analytics. (K3)
0ADPC451_3	Make Use of R programming for data processing (K3)

List of Experiments	
1	Installation of Hadoop
2	Implement the following file management tasks in Hadoop: Adding files and directories, Retrieving files, Deleting files
3	Implement word count MapReduce program to understand Map Reduce Paradigm. • Find the number of occurrence of each word appearing in input file(s) • Performing a MapReduce Job for word search count (look for specific keywords in file)
4	Implement of Matrix Multiplication with Hadoop Map Reduce
5	Develop a MapReduce to analyze weather data set and print whether the day is shiny or cloudy.
6	Use of Hadoop Hive DDL commands, like create database, View database, Drop database
7	Use of Hadoop Hive DML commands like Insert, delete, update, data retrieval queries.
8	Implement queries to sort and aggregate the data in a table using HiveQL.
9	Install Pig then implement Pig Latin scripts to sort, group, join, project, and filter your data
10	Implementation of create, read and write R datasets.
11	Manipulating and processing data in R-merging datasets ,sorting data, putting data into shape
12	Micro-project: students work in team on any application of Hadoop, and evaluate the model performance

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Big Data and Analytics	Seema Acharya and Subhashini Chellappan	Wiley India	1st	2015
2.	Big data Black Book	DT Editorial	Dreamtech Press	1st	2016
3.	Data mining Introductory and Advanced topics	Margaret H. Dunhain	Pearson Education	3rd	2008

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	R For Data Science	Hadley Garrett Grolemund Wickham	O'REILLY	1st	2016
2.	Analytics in a Big Data World: The Essential Guide to DataScience and its Applications	Bart Baesens	John Wiley & Sons	1st	2014
3.	Big-Data-Analytics-with-R-and-Hadoop	Vignesh Prajapati	PACKT	1st	2013

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Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	**0ADPC452** Deep learning Laboratory
Prerequisite/s	Machine Learning
Teaching Scheme: Lecture/Tutorial/Practical	0/0/2
Credits	01
Evaluation Scheme: ISE / ESE	25/50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPC452_1	**Apply** deep neural network for simple problems(K3)
0ADPC452_2	**Implement** Convolution Neural Network for image processing (K3)
0ADPC452_3	**Apply** Recurrent Neural Network and its variants for text analysis (K3)
0ADPC452_4	**Analyze** generative models for data augmentation (K4)
0ADPC452_5	**Develop** a real world application using suitable deep neural networks.(K5)

List of Experiments	
1	Implement Auto encoder for Dimensionality reduction on sample dataset.
2	Implement character and Digit Recognition using ANN.
3	Implement the analysis of X-ray image using auto encoders
4	Implement Speech Recognition using pytorch
5	Develop a code to design object detection and classification for traffic analysis using CNN
6	Designing and developing model for Text generation using LSTM
7	Implement image augmentation using deep RBM.
8	Designing and developing model for Auto encoder for classification
9	Implement bidirectional encoder representations from transformers (bert) model
10	Micro project

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Deep Learning Ian	Goodfellow	The MIT Press	---	2006
02	Pattern Recognition and Machine Learning	Bishop C. M.	Springer	1st	2006
03	NeuralNenvorlis: A Systematic Introduction	Rafrl Rojas	-	-	1996

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Fundamentals of Deep Learning	Nikhil Buduma	O'Reilly	1st	2017
2.	Deep Learning: A Practitioner's Approach	Josh Patterson & Adam Gibson	O'Reilly (Greyscale Indian Edition)	1st	2016

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Annasaheb Dange College of Engineering and Technology
Artificial Intelligence and Data Science Department

Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	0ADPC453 Digital transformation using AI/ML with cloud Laboratory
Prerequisite/s	Machine Learning
Teaching Scheme: Lecture/Tutorial/Practical	0/0/2
Credits	01
Evaluation Scheme: ISE	25

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPC453_1	**Understand** and Apply digital transformation strategy(K2)
0ADPC453_2	**Develop** problem-solving skills by applying AI/ML techniques(K5)
0ADPC453_3	**Analyze** data using AI/ML models(K4)

List of Experiments	
1	Introduction to Cloud Platforms
2	To perform Cloud-based AI/ML Development Environment Setup
3	To perform Data Preparation and Exploration
4	To perform Building and Training ML Models
5	To Deploy ML Models on Cloud
6	To perform Real-time Data Processing with Stream Processing
7	To perform Binary classification (e.g., spam detection)
8	To perform Reinforcement Learning for Control Systems
9	To perform Edge Computing for AI/ML
10	Case study on AI Ethics and Fairness

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Deep Learning	Ian Good fellow, Yoshua Bengio, and Aaron Courville	MIT Press	-	2016
2.	The Fourth Industrial Revolution	Klaus Schwab	World Economic Forum®	-	2016
3.	Cloud Computing: Concepts, Technology & Architecture	Thomas Erl	PHI	-	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	AI in Practice: A Blueprint for Digital Transformation	Bernard Marr and Matt Ward	Wiley	-	2019

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Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	**0ADPR454** In-Plant Training
Prerequisite/s	-
Teaching Scheme: **Lecture/Tutorial/Practical**	-
Total Hours	-
Credits	01
Evaluation Scheme: ESE	50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPR454_1	**Analyze** about the various soft skills such as time management
0ADPR454_2	**Understand** the knowledge level skills ,attribute for the students
0ADPR454_3	**Apply** the knowledge participate and collaborate new CAS projects
0ADPR454_4	**Understand** and improve their Knowledge and skills career development
0ADPR454_5	**Analyze** the industries fulfill the related skills career development

Course Contents:
The students Undergone for 15 days **In-Plant Training** under Curriculum credits **Mode of Assessment** This subject content of the internship emerging with thrust areas, the completion of work and the submission of report and assessment should be done at the end of part-I

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Class	Final Year B. Tech., Sem. VII
Course Code and Course Title	**0ADPR455 Project (Phase-I)**
Prerequisite/s	-
Teaching Scheme: **Lecture/Tutorial/Practical**	0/0/4
Total Hours	-
Credits	02
Evaluation Scheme: ISE	25

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
0ADPR455_1	**Identify** and formulate the real-world problem for the project in the field of their own interest (K2)
0ADPR455_2	**Survey** technical literature, blogs, documents about latest technological trends etc. to come-up with an innovative idea for technical project (K2)
0ADPR455_3	**Analyze** the hardware and/or software requirements of the proposed work(K4)
0ADPR455_4	**Identify** and use relevant tools(from industry)and technologies for documentation, designing, coding, testing and debugging the software, hardware pertaining to the project (K3)
0ADPR455_5	**Defend** or argue or appraise the results obtained during project work (K.5)
0ADPR455_6	**Design** the prototype of the selected idea (K6)

Course Contents:

- Project work is to be carried out in the group of three to four students.
- Develop team building skills. On the contrary, Students must learn how to adjust with unknown team members and get the work done.
- Pre-project is intended to help the students become better learners and better engineers.
- The students shall select the project by reviewing the literature in the domain of their interest and with the consultation of the respective supervisor/guide and approval from the department and submit the brief document discussing outline of the project with clear objectives
- The students are encouraged to acquire and exercise professional skills such as inter- personal communication, presentation skills etc.
- The students shall be exposed to all the standard tools used in the industry with help of industry experts.

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- The skills that students acquired during project are intended to make them better prepared for accomplishing their Major project with a great success.
- The students are supposed to learn to manage time to achieve the scheduled milestones of their project work.
- Students should maintain a project log book containing weekly progress of the project.
- During semester project will be evaluated progress-wise as per the project calendar provided by the department.
- The students will prepare a prototype of their work by the end of the semester and it will be showcased along with a technical poster in the event organized by the department.
- Project report should be prepared using Latex/word and submitted in soft and hard form

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Annasaheb Dange
College of Engineering and Technology
Ashta

An Autonomous Institute affiliated to Shivaji University
Kolhapur

Curriculum Structure

B. Tech.
ARTIFICIAL INTELLIGENCE AND
DATA SCIENCE

SEM VII & SEM VIII

(Academic Year 2024- 2025)

Annasaheb Dange College of Engineering and Technology
Artificial Intelligence and Data Science Department

Teaching and Evaluation Scheme
B. Tech: Semester-VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks)		Practical (Marks)	
							Max	Min. for Passing	Max	Min. for Passing
0ADOE410	Open Elective-IV ^ (MOOC)	3	--	--	3	ISE I	10	20		
						MSE	30			
						ISE II	10			
						ESE	50	20		
0ADPE4**	Professional Elective-V # (MOOC)	3	--	--	3	ISE I	10	20		
						MSE	30			
						ISE II	10			
						ESE	50	20		
0ADPR455	Internship / Project (Phase-II)	--	--	20	10	ISE		--	100	40
						ESE	--	--	200	80
Total		**06**	**-**	**20**	**16**	**Total**	**200**		**300**	
Total Contact Hours/Week: 26 hrs						**Total=200+300=500**				

Course Category	HS	BS	ES	PC	PE	OE	PR	Total
Credits	--	--	--	--	03	03	10	
Cumulative Sum	11	17	19	69	17	12	15	160
Credits(Institute)	11	23	18	65	16	12	15	160
Credits (AICTE)	12	25	24	48	18	18	15	160

^ Students has to choose subjects from interdisciplinary domains like Intellectual Property Rights, Business Management etc. for Open Elective
# Students has to choose subjects from platform such as SWAYAM, NPTEL, EDX etc. in Artificial Intelligence and Data Science domain for Professional Elective

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Class	Final Year B. Tech., Sem. VIII
Course Code and Course Title	0ADPR455 Internship/Project (Phase-II)
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	0/0/20
Total Hours	-
Credits	10
Evaluation Scheme: ISE/ESE	100/200

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

0ADPR455_1	**Identify**, formulate and solve a problem.(K1)
0ADPR455_2	**Analyze** the hardware and/or software requirements of the system(K4)
0ADPR455_3	**Use** different tools available in the market or design, coding, testing and deployment and documentation (K3)
0ADPR455_4	**Design** and construct a hardware and/or software system, component, or process to meet desired requirements of the problem undertaken. (K6)

Course Contents:

- Industry* or Institute Project is the task based work leading to partial or complete solution to a problem identified by industry / institute. This final year project is intended to work on real-world problem solving and hence the students may be allowed to work as interns at various industries or institutes of national importance or the research labs.
- If the students opt for internships at industry, they will work on the problem statements defined by industry with contribution from internal mentor as well. The students who opt for in-house project will be encouraged to formulate the own ideas to solve the real-world problems in the domain of their interests leading to concrete solution to the problem in the institute premises. OR they can be part of any live ongoing research project in the department. The topics being selected should be from the thrust areas and sub-domains of computer science and engineering. The ideas sponsored by industry to be implemented at institute will also be encouraged. Also, it is advised that the students opting for in-house projects should extend their ides identified in pre-project phase in semester VII.
- Irrespective of Industry sponsored project to be implemented at industry or in-house project, project group will select a project topic with consent from guide and approval from the department and submit the brief document discussing outline of the project with clear objectives. The students are required to undergo literature survey, formulate the problem and propose a methodology to achieve the objectives.
- Project work should involve analytical, experimental, design or combination of

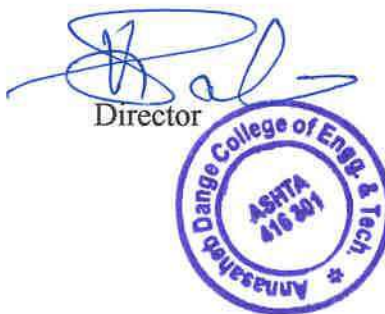HOD   Dean Academics   Director   Executive Director

these in the area of Computer Science and Engineering; multi-disciplinary work is also encouraged.

- Students should maintain a project log book containing weekly progress of the project.
- The project evaluation committee will evaluate the project throughout the semester. The progress of the project will be monitored and assessed as per the project calendar provided by the department.
- On completion of the work, students should prepare an article and should submit the same to national / international conference, research symposiums, and national / international peer reviewed journals. The students should participate in the project exhibitions/ competitions in and outside the institute at state/national level.
- On completion of the work, a project report should be prepared using Latex and the soft and print copy of the same should be submitted to the department.
- Students need to undergo all the modes of evaluation scheduled by the department time-to-time.

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