



**Annasaheb Dange
College of Engineering and Technology
Ashta**
An Autonomous Institute affiliated to Shivaji University
Kolhapur

Curriculum Structure

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

SEM III & SEM IV

(Academic Year 2023- 2024)

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

Teaching and Evaluation Scheme

S. Y. B. Tech Semester IV[#]

Course Code	Course Name	Teaching Scheme					THEORY						PRACTICAL						GRAND TOTAL	
		L		T		P	Credits	ISE		MSE + ESE		Total	Min	ISE		ESE		Total		Min
				Max	Min			MSE	ESE	Min	Max			Min	Max	Min	Max			
1ADBS209	Statistics Probability and Fuzzy Logic	3	-	-	3	-	-	40	16	30	30	24	100	40	-	-	-	-	-	100
1ADPC210	Database Management Systems	3	-	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200	
1ADPC211	Data Analytics	2	-	2	3	40	16	30	30	24	100	40	50	20	-	-	50	20	150	
1ADPE21*	Professional Elective - I	2	-	-	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100	
1ADAI216	Minor Course - 1 [^]	2	-	-	2	50	20	30	30	24	100	40	-	-	-	-	-	-	100	
1ADVS219	Web Technology	1	-	2	2	-	-	-	-	-	-	-	50	20	50	20	100	40	100	
1ADHS218	Environmental Studies	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50	
1ADHS217	Universal Human Values	2	-	-	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50	
1ADEL220	Innovation / Prototype	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50	
1ADCC221	Aptitude and Reasoning Part - II	-	-	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50	
	Total Contact Hours	17	0	10	22														950	

[#] All Students Should Undergo Inplant Training / Internship for a Minimum of 15 Days During the 4th Semester Vacation Period

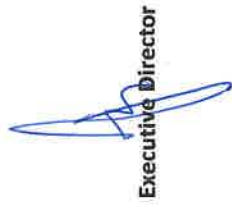
[^] Multi Disciplinary Minor

Professional Elective - I	
1ADPE212	Ethics in Artificial Intelligence and Data Science
1ADPE213	Microprocessors and Microcontrollers
1ADPE214	Sensors for Engineering Applications
1ADPE215	Advanced Data Structures


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Class	S Y B. Tech Sem IV
Course Code & Course Title	1ADBS209 Statistics, Probability and Fuzzy Logic
Prerequisite/s	-
Teaching Scheme (Lecture/ Tutorial /Practical)	3/0/0
Credits	3
Evaluation Scheme Theory: ISE/ MSE/ ESE	40/30/30

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
1ADBS209_1	Apply statistical techniques to interpret the given data.
1ADBS209_2	Solve given problems by using probability distribution
1ADBS209_3	Using test of hypothesis to assess plausibility of given sample data
1ADBS209_4	Construct different fuzzy sets using basic definitions of fuzzy sets.
1ADBS209_5	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: Arithmetic Mean, Geometric Mean, Harmonic Mean, Median, Mode Partition values: Quartiles, Deciles and Percentiles	06 Hrs.
Unit 2	Measures of Dispersion: Concept of dispersion, Range, Quartile Deviation, Mean Deviation, Mean Square Deviation, Variance and Standard Deviation, Moments, Skewness by Karl Pearson's method, Kurtosis	07 Hrs.
Unit 3	Probability Distribution Random variable, Binomial Distribution, Poisson Distribution, Normal Distribution.	06 Hrs.
Unit 4	Statistical Interference- Test of Hypothesis Sampling distributions, Testing of Hypothesis, Level of Significance Testing of Significance for large sample, Testing of Significance for small sample: Students t-distribution and Chi- Square Test	07 Hrs.
Unit 5	Introduction to Fuzzy sets. Basic concepts of Fuzzy Sets, Crisp Set and Fuzzy Set, Membership Functions, Basic operations on fuzzy sets, Properties of fuzzy sets.	07 Hrs.
Unit 6	Fuzzy Arithmetic Fuzzy Numbers, Fuzzy Cardinality, Operations on Fuzzy Numbers, Fuzzy Equations of Type $A + X = B$ and $A.X = B$.	06 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	44 th	2018
02	A Text Book of Engineering Mathematics (For Unit 1)	N. P. Bali, Manish Goyal	Laxmi Publications(P) Ltd	8 th	2011
03	Advanced Engineering Mathematics	H. K. Dass	S. Chand	22 nd	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	1 st	2008
02	Probability and Statistics for Engineers	Dr. J. Ravichandran	Wiley	1 st	2012
03	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley Publishers	9 th	2013
04	Fuzzy Logic with Engineering Applications	Timothy J. Ross	Wiley	3 rd	2013


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Class	S Y B. Tech Sem IV
Course Code & Course Title	1ADPC210- Database Management Systems
Prerequisite/s	Data structures
Teaching Scheme (Lecture/ Tutorial /Practical)	3/0/2
Credits	4
Evaluation Scheme Theory: ISE/ MSE/ ESE	40/30/30
Evaluation Scheme Practical: ISE/ ESE	50/50

Course Outcomes (COs):

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

1ADPC210_1	Explain different concepts of database and conceptual database design, relational algebraic SQL and normalization.
1ADPC210_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.
1ADPC210_3	Summarize SQL queries in pure languages to access essential information from the database.
1ADPC210_4	Describe file organization concepts of indexing for efficient system performance, transaction management and concurrency control.
1ADPC210_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	06 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.	07 Hrs.
Unit 3	Functional Dependency and Normalization Importance of a good schema, Motivation for normalization forms, Atomic domains and INF, Dependency- functional dependencies, closure of a set of FD's, Concepts of 2NF, 3NF and BCNF, Decomposition algorithms, Multivalued dependencies, Join dependencies.	07 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,	07 Hrs.


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	hashing, Hash Indices, Dynamic hashing.	
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.

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

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	6 th	2011
2	Database Systems - Design, Implementation and Management	Rob & Coronel	Thomson Course Technology	5 th	2008
3	Database Systems- A practical approach to Design, Implementation	Thomos Connolly, Carolyn Begg	Pearson Education	4 th	2009


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Reference Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1.	Database Systems: Design, Implementation and Management	Peter Rot'. Carlos Coronel	Cengage Learning	7 th	2014
2.	Fundamentals of Database Systems	Ramez Elmasri and Shamkant Navathe	Pearson Education	4 th	2007
3.	Principles of Database System	J. D. Ullman	Galgotia publications	1 st	2011
4.	SQL: A Complete Reference	Alexis Leon, Mathews Leon	McGraw Hill Education	1 st	2002



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Class	S Y B. Tech Sem IV
Course Code & Course Title	1ADPC211- Data Analytics
Prerequisite/s	Data structures, Python for Data Science
Teaching Scheme (Lecture/ Tutorial /Practical)	2/0/2
Credits	3
Evaluation Scheme Theory: ISE/ MSE/ ESE	40/30/30
Evaluation Scheme Practical: ISE	50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
1ADPC211_1	Understand the concept of sampling
1ADPC211_2	Apply the knowledge to derive hypotheses for given data
1ADPC211_3	Understand the concept of hypotheses
1ADPC211_4	Demonstrate the skills to perform various test on given data
1ADPC211_5	Analyze the ANOVA test in various samples
1ADPC211_6	Articulate the concept regression stats models

Course Contents:		
Unit No.	Unit Name	Contact Hours
Unit 1	INFERENCE STATISTICS Data analysis vs Data Analytics Types of analytics Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Samples, Random sampling, probability and statistics, sampling distribution, Creating a sampling distribution, hypothesis, Types of hypothesis	5Hrs
Unit 2	T-TEST t-test for one sample, sampling distribution of t, t-test procedure, degrees of freedom, estimating the standard error, case studies t-test for two independent samples, sampling distribution, test procedure, p-value, estimating effect size, t-test for two samples	5Hrs
Unit 3	ANALYSIS OF VARIANCE F-test least ANOVA, estimating effect size ,multiple comparisons, Two-factor experiments ,three f-tests ,two factor-ANOVA ,other types of ANOVA	4Hrs
Unit 4	PREDICTIVE ANALYTICS Linear least squares, Implementation, goodness of fit, testing a linear model, weighted resampling Regression using stats models, multiple regression, logistic regression, Time series analysis	4Hrs
Unit 5	ESTIMATION THEORY Unbiased estimators – Method of moments – Maximum likelihood estimation - Curve fitting by principle of least squares.	4Hrs
Unit 6	APPLICATION OF ANALYTICS Web Analytics-Basics, URLS-Cookies, search Analytics –Internal search, SEO and PPC Health care Analytics –Advanced data analytics for health care, computer assisted medical image analysis system, Mobile Imaging and analytics for biomedical data	4Hrs


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Course Contents:	
1	Download, install and explore the features of, Jupyter environment
2	Download, install and explore the features of, colab environment, understand the Anaconda
3	Working with Numpy arrays
4	Working with Pandas data frames
5	Perform various types of data cleaning operations on the data collected in previous lab using data exploration, imputation etc.
6	Perform dimensionality reduction on a given dataset and create various visualizations like histograms, scatter-plots, etc.
7	Implement Linear and logistic Regression
8	Perform association analysis on a given dataset and evaluate its accuracy.
9	Build a recommendation system on a given dataset and evaluate its accuracy.
10	Build a time-series model on a given dataset and evaluate its accuracy.
11	Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India
12	Micro Project / Apply and explore various plotting functions on UCI data sets. a. Normal curves b. Density and contour plots c. Correlation and scatter plots

Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Statistical inference for data science	Brain Cuffo	Lean pub	-	2016
2	statistics" 11 TH Edition	Robert S Witte John S. Witte	Wiley publication	-	2017
3	Think stats: Exploratory data analysis in python	Allen B. Downey	Green tea press	-	2014
4	Web Analytics The Art of Online Accountability and Science Of Customer	Avinash Kaushik	Centricity, Sybex	1st edition	2009
5	Data Science Fundamentals and Practical Approaches	Gypsy Nandi, Rupam Sharma	BPB Publications	-	2020.
6	The Data Science Handbook	Field Cady, John Wiley & Sons			2017


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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Python data science hand book	Jake Vanderplas	O Reilly	-	2016
2	Big Data Analytics made easy	Dr.Laxmi Prasad	Notion Press	-	2016
3	Healthcare data analytics	Chandan K Reddy and Charu C Agarwal	Taylor & Francis	-	2015
4	A Semantic Web Primer	Paul Groth, Frank van Harmelen, Rinke Hoekstra,	MIT press	Third edition	2012


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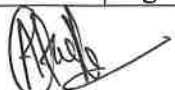

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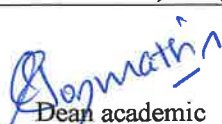

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Class	S Y B. Tech Sem IV
Course Code & Course Title	1ADPE212 Ethics in Artificial Intelligence and Data Science
Prerequisite/s	Design Thinking
Teaching Scheme (Lecture/ Tutorial /Practical)	2/0/0
Credits	2
Evaluation Scheme Theory: ISE/ MSE/ ESE	40/30/30

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
1ADPE212_1	Explain Responsibility in the ethics of technology for privacy
1ADPE212_2	Analyze anonymity and data validity with the help different case studies.
1ADPE212_3	Explain algorithmic fairness and Societal Consequences and Code of Ethics
1ADPE212_4	Design ethical frameworks for different real-life applications
1ADPE212_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	04 Hrs.
Unit 2	Privacy Privacy, History of Privacy, Degrees of Privacy, Modern Privacy Risks, Case Study: Targeted Ads, Sneaky Mobile Apps	04 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, Case Study: Three Blind Mice, Case Study: Algorithms and Race, Case Study: Algorithms in the Office,	05 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	05 Hrs.
Unit 5	Case-studies, examples and ethical frameworks Ethics of autonomous vehicles, Autonomous weapons and the digitalization of conflicts, Digital medicine, Sustainability and	04 Hrs.


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	environmental impact, Cybersecurity and AI	
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	04Hrs.

Text Books:					
Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Artificial Intelligence - The Practical Legal Issues	Buyers John	Law brief publishing	2 nd Edition	2019
2	The Ethics of AI	Alberto Chierici	Atlantic	1 st	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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Class	S.Y.B.Tech Sem IV
Course Code & Course Title	1ADPE213 Microprocessors and Microcontrollers
Prerequisite/s	Analog Electronics, Digital Electronics
Teaching Scheme (Lecture/ Tutorial /Practical)	2/0/0
Credits	2
Evaluation Scheme Theory: ISE/ MSE/ ESE	40/30/30

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1ADPE213_1	Explain the architecture of 8085, 8051 and PIC16f877 to understand PIN configuration of each processor.
1ADPE213_2	Compare microprocessor and microcontrollers for analyzing interfacing between peripheral devices.
1ADPE213_3	Design Pin description of 8051 microcontroller to understand the internal design and features of 8051 microcontroller by using advanced simulator.
1ADPE213_4	Interface stepper motor, DC motor and on board peripheral to communicate with 8051 and PIC using trainer kit.
1ADPE213_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-,memory classification, Input and output devices.	4Hrs
Unit 2	8085 Microprocessor Architecture The 8085 MPU, Microprocessor communication and bus timing, De-multiplexing address and Data bus, Generating control signals, The 8085 Architecture, and 8085 based microcomputer-machine cycles and bus timing, op-code fetch machine cycle,	4Hrs
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.	5Hrs
Unit 4	Introduction to 8 Bit Microcontroller 8051 Difference between general purpose microprocessor and microcontrollers, Introduction to MCS51 family, 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.	4Hrs


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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	5Hrs
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'	4Hrs

Text Books:

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

Reference Books:

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


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Class	S Y B. Tech Sem IV
Course Code & Course Title	1ADPE214 Sensors for Engineering Applications
Prerequisite/s	Analog electronics, Digital electronics
Teaching Scheme (Lecture/ Tutorial /Practical)	2 / 0 / 0
Credits	2
Evaluation Scheme Theory: ISE/ MSE/ ESE	40/30/30

Course Outcomes (COs):

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

1ADPE214_1	Identify sensors, actuators, Micro sensors and Micro actuators to solve a problem using sensor fundamentals and its characteristics.
1ADPE214_2	Use Micro sensors and Micro actuators to solve the problems in different scenarios using Arduino IDE.
1ADPE214_3	Design a solution for given problem using sensors and ESP32 with Arduino IDE.
1ADPE214_4	Design sensor system for real world applications using Raspberry Pi.
1ADPE214_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.	4 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.	4 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.	5 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	5 Hrs.


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	sensors. Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators	
Unit 5	Introduction to ESP32 and Raspberry Pi Overview of ESP32 and its features, Block diagram of ESP32, Specifications, Layout, Pin description for ESP32, Introduction to Raspberry Pi.	4 Hrs.
Unit 6	Case Studies Sensors and actuators in Smart cities, Agriculture, Health Care, Activity Monitoring, Weather monitoring system, Forest fire detection.	4 Hrs.

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	1 st	2007
2	Hand Book of Modern Sensors: Physics, Designs and Application	Jacob Fraden	Springer	5 th	2016
3	Sensors and Transducers	Patranabis. D	Wheeler publisher	4 th	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	1 st	2006
2	Micro actuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures	Massood Tabib and Azar	Kluwer academic publishers, Springer	1 st	1997
3	Microsystem Technology and Microbotics	Sergej Fatikow and Ulrich Rembold	Springer	1 st	1997
4	ESP32 web server with Arduino IDE, step-by-step project guide	Rui Santos and Sara Santos	-	-	-


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Class	S Y B. Tech Sem IV
Course Code & Course Title	1ADPE215 Advanced Data Structures
Prerequisite/s	Data Structures
Teaching Scheme (Lecture/ Tutorial /Practical)	2/0/0
Credits	2
Evaluation Scheme Theory: ISE/ MSE/ ESE	40/30/30

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1ADPE215_1	Describe various advanced data structure techniques such as advanced linked list, advanced trees, graphs.
1ADPE215_2	Describe various hashing techniques and collision resolution techniques.
1ADPE215_3	Demonstrate the knowledge of advanced data structures in solving problems.
1ADPE215_4	Analyze the algorithms and compare the working of various data structures.
1ADPE215_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	4Hrs.
Unit 2	Advanced Trees Segment Tree, Binary Indexed Tree, Binary Search Tree, Self-Balancing BST, Red Black Tree, Splay Tree	5 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,	4 Hrs.
Unit 4	Graph Problem: Edge Coloring, Vertex coloring, Max flow- mincut theorem, Probabilistic models	4 Hrs.
Unit 5	Dynamic Graphs: Link Cut Trees, Preferred Path Decomposition, Dynamic Connectivity, Euler Tour Trees.	4 Hrs.
Unit 6	Hashing Hashing, Hashing techniques, Open Addressing for Collision Handling. Index Mapping, Collision resolution techniques, Cuckoo Hashing	5 Hrs.



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Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to Algorithms	Thomas H Cormen, Charles Leiserson, Ronald Rivest	PHI	3 rd	2009
02	Computational Geometry- Algorithms and Application	Mark De Berg, Otfried Cheong, Marks Overmars	Springer	3 rd	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 Sem IV
Course Code & Course Title	1ADAI216 Foundations of Artificial Intelligence (Minor course-I)
Prerequisite/s	Problem Solving Using C
Teaching Scheme (Lecture/ Tutorial /Practical)	2/0/0
Credits	2
Evaluation Scheme Theory: ISE/ MSE/ ESE	40/30/30

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
1ADAI216_1	Understand the basics of Artificial Intelligence
1ADAI216_2	Develop fundamental understanding of different problem-solving methods and search strategies
1ADAI216_3	Apply Knowledge Representation and Planning in Knowledge based systems
1ADAI216_4	Demonstrate ideas behind software agents to solve a problem
1ADAI216_5	Design applications for NLP that use Artificial Intelligence

Course Contents:		
Unit No.	Unit Name	Contact Hours
Unit 1	AI Introduction Introduction – Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to AI problems.	04 Hrs.
Unit 2	PROBLEM SOLVING METHODS Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Constraint Satisfaction Problems (CSP) - Backtracking Search - Optimal Decisions in Games – Alpha - Beta Pruning -Games that include an element of chance.	05 Hrs.
Unit 3	SOFTWARE AGENT SYSTEMS Introduction to Logical Agents, Uncertainty-Probability -Inference-Independence and Bayes' Rule- Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining	04 Hrs.
Unit 4	KNOWLEDGE REPRESENTATION First order logic, Syntax and semantics for first order logic, Knowledge engineering in first order logic, Inference in First order logic, prepositional versus first order logic– Unification and Lifting – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation	05 Hrs.


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Unit 5	Planning Classical Planning- algorithms for Classical Planning- Heuristics for planning- hierarchical planning- non-deterministic domains- time, schedule and resources- analysis	04hrs
Unit 6	APPLICATIONS AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot	04 Hrs.

Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Artificial Intelligence –A Modern approach	Stuart J. Russell, Peter Norwig,	Pearson Education	3rd	2016
2	Artificial Intelligence	Elaine Rich and Kevin Knight	Tata McGraw Hill Publishing Company, New Delhi,	-	2014

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Prolog: Programming for Artificial Intelligence,	I. Bratko	Addison-Wesley Educational Publishers Inc.,	Fourth edition	2015
2	The Quest for Artificial Intelligence	Nils J. Nilsson	Cambridge University Press	6th	2013
3	Artificial Intelligence: Foundations of Computational Agents	David L. Poole and Alan K. Mackworth	Cambridge University Press	-	2012
4	Multi Agent Systems	Gerhard Weiss	MIT Press	Second Edition	2013


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Class	S.Y, B. Tech, Semester. -IV
Course Code and Course Title	1ADHS217 Universal Human Values
Prerequisite/s	Students Induction Program (SIP)
Teaching Scheme: Lecture/Tutorial	02 / 00
Credits	02
Evaluation Scheme Theory: ISE	50

Course Outcomes (COs):

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

1ADHS217_1	Integrate the process of self-exploration to achieve Harmony in the human being's based on Holistic perspective of value education.
1ADHS217_2	Understand Harmony in human being, family, society and nature /existence, based on methods to fulfill human aspiration.
1ADHS217_3	Apply the human values for maintaining the relationships with oneself and others using the principals of harmony.
1ADHS217_4	Adopt the methods of maintaining harmony with the society, nature, and its existence by utilizing the human order systems.

Course Contents:

Sr. No.	Unit Name	Contact Hours
Unit 1	<p>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.</p>	4Hrs
Unit 2	<p>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.</p>	4Hrs
Unit 3	<p>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’</p>	5Hrs


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	(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.	
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.	6Hrs
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	4Hrs
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	3Hrs

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


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



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Class	S. Y. B. Tech, Sem.-IV
Course Code and Course Title	1ADHS218 Environmental Studies
Prerequisite/s	--
Teaching Scheme: (Lecture/ Tutorial /Practical)	2/0/0
Credits	2
Evaluation Scheme Theory: ISE	50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
1ADHS218 _1	Comprehend the concepts and principles of sustainable development and its importance in environmental preservation.
1ADHS218 _2	Explain ethical and legal responsibility of an engineer and his role in effective implementation of sustainable activities through EIA and EMS in the corporate sector.
1ADHS218 _3	Predict impact of contemporary issues (Population Explosion, Climate change, Environmental pollution) on the environment.
1ADHS218 _4	Classify and analyze different types of environmental pollution, understand their causes and effects, and propose control measures.
1ADHS218 _5	Prepare a technical report highlighting importance of environment in human life by using techniques like survey, case studies, mini project.

Course Contents:		
The main objective of the course is to infuse an understanding of the various environmental concepts on scientific basis in the functional area of Engineering and technology. The course will provide a foundation to critically assess the approaches to pollution control, environmental and resource management, sustainable development, cleaner technologies, Environmental Legislation based on an understanding of the fundamental, environmental dimensions. The course will help to explore the modern concept of green industry and the impact of excess human population, globalization, and climate change on the environment.		
Unit No.	Title	Hrs.
Unit 1	Introduction to Environment and concept of Sustainable development: Natural and Built Environment, Environmental Education: Definition, Scope, Objectives and importance. Components of the Environment: Atmosphere, Hydrosphere, Lithosphere and Biosphere. Biological Diversity: Introduction, Values of biodiversity, Threats to biodiversity, Conservation of biodiversity. Sustainable development goals, pillars of sustainable development.	4Hrs
Unit 2	Energy and Natural Resources Energy Scenario: Conventional Energy Sources and Non- Conventional Energy Sources, Urban problems related to energy. Future projections of Energy Demand, Utilization of various Energy Sources. Natural Resources: Food, Water, Forest, Geological, Equitable Use of Resources for Sustainable lifestyle. Concept of life cycle analysis.	5Hrs
Unit 3	Introduction to global environmental issues, Impact of modernization Climate change: Global warming, Ozone depletion, Acid Rain etc. Environmental Impact: Impact of Modern agriculture on the Environment, Impact of Mining on the Environment, Impact of modern development on the Environment. Case study.	4Hrs


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Unit 4	Environmental Pollution and control measures Definition, Causes, effects and control measures of, Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. E waste management. Role of an individual in prevention of pollution.	5Hrs
Unit 5	Environmental Management and Legislation Environmental ethics: Introduction, Ethical responsibility, issues and possible solutions. Environmental Management: Introduction to Environmental Impact Assessment, Environmental Management System: ISO 14001 Standard, Environmental Auditing, National and International Environmental protection agencies pertaining to Environmental Protection. Introduction to Environmental Legislation.	4Hrs
Unit 6	Cleaner technology: Consumerism and Waste Products, Green buildings, Green products, Minimization of Hazardous Products, Reuse of Waste, By-products, Rainwater Harvesting, Translocation of trees. Some Success Stories. Role of Information Technology in Environment protection.	4Hrs

Assessment methods:

01. Mini Project (in a group of 4 to 5 students): 15 marks

Mini Project should be based upon:

a. Recent technology relevant to Environment protection

OR

b. Case study on polluted sites.... Urban/Rural/Industrial/Agricultural

OR

c. Life cycle analysis of any product.

(Mini project report submission is mandatory)

02. Seminar : 10 Marks

Topic should be from the content of the course.

Text Books					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Environmental Studies	Anindita Basak	PEARSON	First edition	2017
02	Environmental Studies	N.K Uberoi	Excel Books Publications New Delhi,	First edition	2005.
03	Environmental Studies from crisis to cure	R. Rajagopalan	Oxford university press,	Second edition	2011

Reference Books / Handbooks					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Environmental Science:	William Cunningham	WCB/McGraw	Fifth	1999


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Class	S Y B. Tech Sem III
Course Code & Course Title	1ADVS219 Web Technology
Prerequisite/s	OOP, Database management
Teaching Scheme (Lecture/ Tutorial /Practical)	1/0/2
Credits	2
Evaluation Scheme Practical: ISE/ESE	50/50

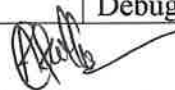
Course Outcomes (COs):

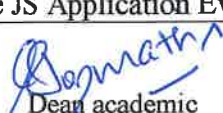
Upon successful completion of this course, the student will be able to:

1ADVS219_1	Construct a basic website using HTML and CSS.
1ADVS219_2	Design a web application for different sized screens using Bootstrap ,Javascript and ReactJS
1ADVS219_3	Develop a web application for given problem statement using NodeJs, ExpressJS and MongoDB.
1ADVS219_4	Plan, develop, debug, and implement interactive client side and server side web applications for real time problems using client side and serverside web techniques.
1ADVS219_5	Build scalable web apps quickly and efficiently using appropriate toolkits and framework.

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.	05 Hrs.
Unit 4	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.	05Hrs.


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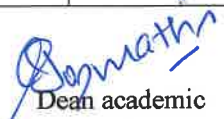



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	ExpressJs, Routing, Template engines, Middleware, Web Application components, Error handling, Testing application Express application.	
Unit 6	MongoDB MongoDB – Overview, CRUD Operations, Basic Operations, Aggregations, Indexing, Replication and Sharding.	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
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	Micro project / CMS theming and plugins

Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Advanced Internet Technology	Deven Shah	Dreamtech Press	1 st	2015
02	XML in a Nutshell	ElliotteRustyHarold, W. Scott Means	O'Reilly Publication	3 rd	2004
03	Web Technologies: Black book	Kogent Learning Solutions Inc.	Dreamtech Press	1 st	2009
04	Web Content Management	Deane Barker	O'Reilly Media	1 st	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	3 rd	2014
02	Learning PHP, MySql, Java Script with JQuery, CSS and HTML5	Robin Nixon	O'really	4 th	2012

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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
03	Search Engine Optimization All-in-One for Dummies	Bruce Clay	John Wiley & Sons	3 rd	2015
04	Learning Responsive Web Design: A Beginner's Guide	Clarissa Peterson	O'Reilly Media, Inc.	1 st	2014



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Class	S Y B. Tech Sem IV
Course Code & Course Title	1ADEL220 Innovation/ Prototype
Prerequisite/s	Design Thinking
Teaching Scheme (Lecture/ Tutorial /Practical)	0/0/2
Credits	1
Evaluation Scheme Practical: ISE	50

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
1ADEL220_1	Proficiently Apply the innovative thinking techniques to empathize the customer through arranging survey and/or interview
1ADEL220_2	Accurately Identify and Formulate the solution for real world problem using innovative technique
1ADEL220_3	Proficiently Create and Exhibit Prototype, for defined real world problem using innovative approach
1ADEL220_4	Accurately Comply & Test developed prototype for defined real world problem to meet user's requirements
1ADEL220_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:		
Unit 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.	26 Hrs
Unit 2	Human and Culture Centered Design Design for Society, better existing design, Design for change Cultural change, social change, Life style change	
Unit 3	Visual communication and sketching Anyone can sketch, expression of thinking and problem solving through sketch and graphic design	
Unit 4	Prototyping & Fabrication Process of Prototype design, Problems of different stages in prototype design, refines Prototype, Finalize Prototype	
Unit 5	Engineering aspect of design Electrical, Mechanical, Design, Material, Aspect, Safety and Reliability aspect	
Unit 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


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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	2 nd	2013.
03	Design for How People Think	John Whalen	O'Reilly	---	2019

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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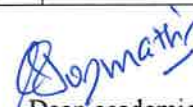
Class	S Y B. Tech Sem IV
Course Code & Course Title	1ADCC221 Aptitude and Reasoning Part-II
Prerequisite/s	Basic mathematics
Teaching Scheme (Lecture/Tutorial/ Practical)	0/0/2
Credits	1
Evaluation Scheme Practical: ISE	50

Course Outcomes (COs) : The students will be able to:	
1ADCC221_1	Solve problems based on HCF, LCM, Interest, Clock, Cubes and Puzzles
1ADCC221_2	Solve problems based on Coding and Decoding, Seating Arrangements and Venn diagrams.
1ADCC221_3	Solve problems based on Ratio Proportion, Partnership, Allegation, Divisibility and Number Theory
1ADCC221_4	Demonstrate presentations using concepts delivered on confidence building and time management skills.

Course Contents		
Unit No	Unit Name	Contact Hours
Unit 1	HCF LCM, Simple Interest, Compound Interest	4 Hrs
Unit 2	Coding- Decoding, Seating Arrangement Venn Diagrams	4 Hrs
Unit 3	Clocks, Cubes, Puzzles,	4 Hrs
Unit 4	Ratio Proportion, Partnership	4 Hrs
Unit 5	Confidence Building, Time Management	4 Hrs
Unit 6	Allegation, Divisibility and Number Theory	4 Hrs
	Self-Study Module	6 Hrs

Text Books:						
Unit No					Unit Name	Contact Hours
Sr. No	Title	Author	Publisher	Edition	Year of Edition	Sr. No
1	R.S. Agarwal (Quantitative aptitude)	R.S. Agarwal	S Chand	-	2019	1
2	R.S. Agarwal (Verbal & Non-verbal Reasoning)	R.S. Agarwal	S Chand	-	2010	2


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3	Wren & Martin (Verbal, Grammar)	P.C.Wren	S Chand	-	2017	3
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Reference Books:						
Sr. No	Title	Author	Publisher	Edition	Year of Edition	Sr. No
1	APTIPEDIA (Quantitative, Logical, Verbal Aptitude)	Face	Wiley	-	2017	1
2	Wiley (Quantitative Aptitude)	P.A.Anand	Maestro	-	2015	2

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