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	Teaching Scheme				Evaluation Scheme				
							Theory (Marks)		Practical (Marks)	
		L	T	P	Credits	Scheme	Max.	Min. for Passing	Max.	Min. for Passing
0ADOE301	Open Elective-I	3	--	--	3	ISE I	10		--	--
						MSE	30		--	--
						ISE II	10	40	--	--
						ESE	50	20	--	--
0ADPC302	Design and Analysis of Algorithms	3	--	--	3	ISE I	10		--	--
						MSE	30		--	--
						ISE II	10	40	--	--
						ESE	50	20	--	--
0ADPC303	AI Search Methods for Problem Solving	3	--	--	3	ISE I	10		--	--
						MSE	30		--	--
						ISE II	10	40	--	--
						ESE	50	20	--	--
0ADPC304	IoT Embedded Systems for AI	3	--	--	3	ISE I	10		--	--
						MSE	30		--	--
						ISE II	10	40	--	--
						ESE	50	20	--	--
0ADHS506	Entrepreneurship	--	--	2	1	ISE I	25	10	--	--
						ISE II	25	10	20	--
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.

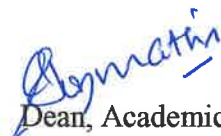HoD   Dean, Academics   Director   Executive Director

	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		

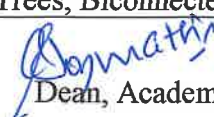HoD   Dean, Academics   Director   Executive Director
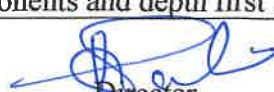
Course Details:

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:
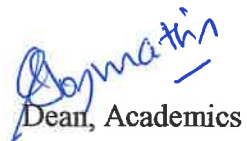
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Computer Algorithms	Ellis Horowitz, SatrajSahani, SaguthevarRajasejaran	University Press	2	2008
02	Introduction to Algorithms	Thomas Cormen, Charles Leiserson, Ronald RIvest, Clifford Stein	PHI	3	2009
03	Algorithms in a Nutshell	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	Year of Edition
1	A First Course in Artificial Intelligence	Deepak Khemani	McGraw Hill Education (India)	-	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of 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:

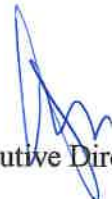| Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Entrepreneurship	Hisrich R D and Peters M P	Tata McGraw-Hill	5	2012
02	Entrepreneurship theory at cross roads: paradigms and praxis	Mathew J Manimala	Dream tech	2	2006
03	Entrepreneurship and innovation	Rabindra N. Kanungo	Sage Publications	--	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 ofboth.	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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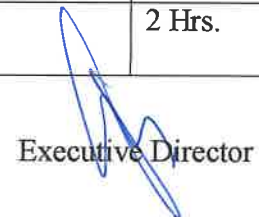|		
Unit 3	**Text annotation** Text annotation-Basics of Text Annotation, Types of Text Annotation ,Working of text annotation, use cases of text annotation, uses of text annotation	05 Hrs.
Unit 4	**Image annotation** Image annotation-Basics of image annotation, need of image annotation, types of image 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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