Dr. N.G.P. ARTS AND SCIENCE COLLEGE

(An Autonomous Institution, Affiliated to Bharathiar University, Coimbatore)
Approved by Government of Tamil Nadu and Accredited by NAAC with 'A++' Grade (3rd Cycle-3.64 CGPA)
Dr. N.G.P. - KalapattiRoad, Coimbatore-641048, Tamil Nadu, India
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REGULATIONS 2024-25 for Post Graduate Programme (Outcome Based Education model with Choice Based Credit System)

Master of Science in Computer Science with Data Analytics Degree

(For the students admitted during the academic year 2024-25 and onwards)

Programme: M. Sc. (Computer Science with Data Analytics) Eligibility

Candidates for admission to the first year of the **Master of Science (Computer Science with Data Analytics)** Degree Programme shall be required to have passed in B.Sc. Computer Science/ B.C.A. / B.Sc. Computer Technology / B.Sc. Information Technology / B.Sc. Information Sciences / B.Sc. Information Systems / B.Sc. Software Systems / B.Sc. Software Sciences / B.Sc. Applied Sciences (Computer Science / Computer Technology) / B.Sc. Electronics / B.Sc. Mathematics of any University in Tamil Nadu or an Examination accepted as equivalent thereto by the Academic council, subject to conditions as may be prescribed are permitted to appear and qualify for the **Master of Computer Science with Data Analytics Degree Examination** of this College after a programme of study of two academic years.

Programme Educational Objectives

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. Exhibit technical proficiency in Data Analytics to solve real world problems.
2. Engage in successful careers in industry, research and public service.
3. Employ cutting edge tools and technologies for decision making and remain self-motivated and lifelong learners.
4. Practice profession with ethics, integrity, leadership and social responsibility
5. Apply knowledge in areas of Data Analytics for research and entrepreneurship

PROGRAMME OUTCOMES

On the successful completion of the program, the following are the expected outcomes.

PO Number	PO Statement
PO1	Ability to apply knowledge of Computer Science, Mathematics and Statistics to solve problem
PO2	Ability to model, analyze, design, visualize and realize physical systems or processes of increasing size and complexity
PO3	Ability to select appropriate methods and tools for data analysis in specific organizational contexts
PO4	Ability to analyze very large data sets in the context of real world problems and interpret results
PO5	Ability to exhibit soft skills and understand professional and social responsibilities

M.Sc. Computer Science with Data Analytics Credit Distribution

Part	Subjects	No. of Papers	Credit		Semester No.
III	Core	11	3 x 5 = 15 8 x 4 = 32	47	I - III
	Core Practical	06	6 x 2 =12	12	I - III
	DSE	03	03 x 04 = 12		I - III
	EDC	01	01 x 04 = 04		I
	Industrial Training	01	01 x 02 = 02		III
	Core Project	01	01 x 15 = 15		IV
TOTAL CREDITS			**92**		

PG
CURRICULUM

M.Sc Computer Science with Data Analytics
AY 24-25

Course Code	Course Category	Course Name	L	T	P	Duration		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
First Semester												
24DAP1CA	Core I	Principles of Data Science and Python	4	1	-	5	60	3	25	75	100	5
24MTP1EA	EDC I	Mathematical Foundations of Data Science	4	1	-	5	60	3	25	75	100	4
24DAP1CB	Core II	Design and Analysis of Algorithms	4	-	-	4	48	3	25	75	100	4
24CSP1CB	Core III	Advanced Java	4	-	-	4	48	3	25	75	100	4
24DAP1CP	Core Practical I	Python Programming	-	-	4	4	48	3	40	60	100	2
24CSP1CQ	Core Practical II	Advanced Java	-	-	4	4	48	3	40	60	100	2
24DAP1DA	DSE -I	Digital Image Processing	4	-	-	4	48	3	25	75	100	4
24DAP1DB		Information Retrieval				4	48					
24DAP1DC		Web Intelligence				4	48					
		Total	20	2	8	30	360	-	-	-	700	25

Course Code	Course Category	Course Name	L	T	P	Duration		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Second Semester												
24DAP2CA	Core IV	Artificial Intelligence	4	1	-	5	60	3	25	75	100	5
24DAP2CB	Core V	Data Mining	4	1	-	5	60	3	25	75	100	4
24DAP2CC	Core VI	Information and Network Security	4	-	-	4	48	3	25	75	100	4
24DAP2CD	Core VII	Advanced Database Management Systems	4	-	-	4	48	3	25	75	100	4
24DAP2CP	Core Practical III	R for Data Analytics	-	-	4	4	48	3	40	60	100	2
24DAP2CQ	Core Practical IV	Advanced Database Management Systems	-	-	4	4	48	3	40	60	100	2
24DAP2DA	DSE –II	Customer Analytics	4	-	-	4	48	3	25	75	100	4
24DAP2DB		Natural Language Processing				4	48					
24DAP2DC		Advanced Statistics				4	48					
		Total	20	2	8	30	360	-	-	-	700	25

Course Code	Course Category	Course Name	L	T	P	Duration		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Third Semester												
24DAP3CA	Core VIII	Machine Learning	4	1	-	5	60	3	25	75	100	5
24DAP3CB	Core IX	Internet of Things and Applications	4	-	-	4	48	3	25	75	100	4
24DAP3CC	Core X	Cloud Computing	4	-	-	4	48	3	25	75	100	4
24DAP3CD	Core XI	Big Data Analytics	4	1	-	5	60	3	25	75	100	4
24DAP3CP	Core Practical V	Machine Learning	- -	-	4	4	48	3	40	60	100	2
24DAP3CQ	Core Practical VI	Big Data Analytics and Visualization	-	-	4	4	48	3	40	60	100	2
24DAP3TA	IT	Industrial Training	-	-	-	-	-	3	40	60	100	2
24DAP3DA	DSE –III	Business Intelligence and Information Visualization	4	-	-	4	48		25	75	100	4
24DAP3DB		Modern Databases				4	48					
24DAP3DC		Deep Learning				4	48					
		Total	20	2	8	30	360	-	-	-	800	27

Course Code	Course Category	Course Name	L	T	P	Duration		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Fourth Semester												
24DAP4CV	Core XII	Project Work	-	-	-	-	-	3	80	120	200	15
		Total	-	-	-	-	-	-	-	-	200	15
												92

BoS Chairman/HoD
Department of Computer Science with Data Analytics
Dr. N. G. P. Arts and Science College
Coimbatore – 641 048

Dr.N.G.P. Arts and Science College
APPROVED
10th AC - 17th GB
2.4.24 17.4.24

Academic Council
CHAIRMAN
Dr.N.G.P. Arts and Science College

DISCIPLINE SPECIFIC ELECTIVE

Students shall select the desired course of their choice in the listed elective course during Semesters I to IV

Semester I (Elective I)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	24DAP1DA	Digital Image Processing
2.	24DAP1DB	Information Retrieval
3.	24DAP1DC	Web Intelligence

Semester II (Elective II)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	24DAP2DA	Customer Analytics
2.	24DAP2DB	Natural Language Processing
3.	24DAP2DC	Advanced Statistics

Semester III (Elective III)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	24DAP3DA	Business Intelligence and Information Visualization
2.	24DAP3DB	Modern Databases
3.	24DAP3DC	Deep Learning

EXTRA CREDIT COURSES

Self-study paper offered by the Mathematics Department

S. No.	Course Code	Course Title
1.	24DAPSSA	Business Analytics
2.	24DAPSSB	Professional Ethics

Semester - I
CORE I: PRINCIPLES OF DATA SCIENCE AND PYTHON

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24DAP1CA	PRINCIPLES OF DATA SCIECNE AND PYTHON	CORE	48	12	-	5

Preamble	This course has been designed for students to learn and understand • Concepts of Data Science • Understand about Python Programming • Plotting and Visualization in Python
Prerequisite	Basic Programming skills

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom'sTaxonomy Knowledge Level
CO1	Understand the principles of data science	K2
CO2	Understand the techniques for Data Handling	K2
CO3	Apply Numpy and Pandas to perform numerical operations	K3
CO4	Apply the concepts of Python for Data Aggregation and Wrangling	K3
CO5	Create the visualization concepts in Python	K6

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Introduction: Benefits of Data Science - Facets of Data –Big data eco system and data science - Data science process: Steps in data science process - Retrieving data – Data preparation – Data exploration – Data modeling – Presentation - Case Study	12	Text Book
II	Problems when handling large data – General techniques for handling large data – General Programming dealing with Large Data Sets – Steps in big data – Distributing data storage and processing with Frameworks- Applications in Data Science - Case Study – Assessing risk when loaning money	12	Text Book
III	Introduction to NumPy - Understanding the N - dimensional data structure -Creating NumPy arrays - Basic operations and manipulations on N-dimensional arrays - Indexing and Slicing-Advanced Indexing – Pandas: Mathematical Functions– Statistical Functions – Search, Sorting and Counting Functions –Matrix Library	12	Text Book
IV	Introduction: GroupBy Mechanics – Data Aggregation – Groupwise Operations and Transformations – Pivot Tables and Cross Tabulations – Date and Time- Date Type tools – Time Series Basics – Data Ranges - Frequencies and Shifting - Combining and Merging DataSets – Reshaping and Pivoting – Data Transformation – String Manipulation, Regular Expressions	12	Text Book
V	Introduction: Data Acquisition by Scraping web applications – Submitting a form - Fetching web pages – CSS Selectors. Visualization: Visualization In Python: Matplotlib package – Plotting Graphs – Controlling Graph – Adding Text – More Graph Types – Getting and setting values - Plotting with Pandas and seaborn - Line plots - Bar Plots -Histogram and Density Plots - scatter or point plots - facet grids and categorical data	12	You Tube Videos
	Total	60	

Text Book	**1.**	Davy Cielen, Arno D.B. Meysmen, Mohamed Ali, 2020, "Introducing Data Science", Dream Tech Press (UNITS I,II))
	2.	Wes Mc Kinney, 2020, "Python for Data Analysis", 5th Edition, O'Reilly (UNITS III, IV, V)
Reference Books	**1.**	John V Guttag, 2016, "Introduction to Computation and Programming Using Python", 2nd Edition., MIT press]
	2.	Gypsy Nandi, Rupam Kumar Sharma, 2020, "Data Science Fundamentals and Practical Approach, BPB
	3.	Zed Shaw, 2014, "Learn Python the Hard Way", 3rd Edition, Addison-Wesley, USA,
	4.	Fabio Nelli, 2018, "Python Data Analytics", Second Edition, Apress, NewYork,

Journal and Magazines	https://www.pythonpapers.com/ https://www.pythonweekly.com/
E-Resources and Website	https://www.python.org/ https://www.linkedin.com/learning/paths/master-python-for-data-science-16361344 https://www.edx.org/learn/python

Learning Method	Chalk and Talk/Assignment/Seminar/Online Compiler

Focus of the Course	Skill Development/ Employability

Semester - I
EDC : MATHEMATICAL FOUNDATIONS OF DATA SCIENCE

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24MTP1EA	MATHEMATICAL FOUNDATIONS OF DATA SCIENCE	EDC	48	12	-	4

Preamble	This course has been designed for students to learn and understand • Data numerically and visually • The knowledge of testing of hypothesis for small and large samples which plays an important role in real life applications • Data-based claims and quantitative arguments
Prerequisite	Knowledge on Basic Mathematics

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom'sTaxonomy Knowledge Level
CO1	Make use of the concepts of probability which can describe real life phenomenon	K2
CO2	Apply discrete and continuous probability distributions in the relevant application areas	K3
CO3	Learn how to develop correlation and regression model and apply for the specific perspective data in appropriate manner	K3
CO4	Analyze a best estimator with reference to the different criteria in case of real-life applications	K4
CO5	Learn the details and complexities of Analysis of Variance (ANOVA)	K4

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓				
CO2	✓		✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Introduction - Probability Defined - Importance of the Concept of Probability - Calculation of Probability - Theorems of Probability - Addition Theorem - Multiplication Theorem - Conditional Probability - Bayes Theorem - Mathematical Expectation	10	Text Book
II	Introduction - Binomial Distribution-Fitting a Binomial Distribution- Poisson Distribution - Fitting a Poisson Distribution - Normal Distributions - Fitting a Normal Curve.	10	Text Book
III	Correlation - Scatter Diagram Method - Graphic Method- Karl Pearson's Coefficient of Correlation -Spearman's coefficient of Correlation - Regression Analysis - Regression Lines - Regression Equations -Regression Equation of Y on X - Regression Equation of X on Y	12	Text Book
IV	Introduction - Hypothesis Testing - Standard Error and Sampling Distribution - Estimation - Tests of Significance for Large Samples - Difference between small and large samples - Two tailed test for difference between the means of two samples -Standard Error of the difference between two standard deviations - Tests of significance for small samples - Assumption of Normality - Student's t distribution - Application of the t Distribution	14	NPTEL
V	Introduction- Chi-Square test- F-Test -Applications of F-Test - Analysis of Variance - Assumptions -Technique of Analysis of Variance - One-Way Classification - Analysis of Variance in Two-Way Classification Model	14	You Tube Videos
	Total	60	

Text Book	**1.**	Gupta S.P,2017, "Statistical Methods", 45th Edition, Sultan Chand and Sons, New Delhi
Reference Books	**1.**	Ronald E. Walpole,2018, "Probability and Statistics", 9th Edition, Pearson Education South Asia
	2.	Sheldon M. Ross, 2017, "Introductory Statistics", 4th Edition, Academic Press,United States
	3.	Vijay K. Rohatgi A.K, MD. Ehsanes Saleh, 2015, " An introduction toProbability and Statistics", 3rd Edition, John Wiley and Sons, New Delhi
	4.	Sheldon M. Ross, 2017, "A first course in Probability", 5th Edition, PHI, NewJersey

Journal and	https://www.worldscientific.com/worldscinet/bms

Magazines	
E-Resources and Website	https://resources.nu.edu/statsresources/Chi-Square https://nptel.ac.in

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development

Semester - I

CORE II: DESIGN AND ANALYSIS OF ALGORITHMS

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24DAP1CB	DESIGN AND ANALYSIS OF ALGORITHMS	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • Design and analysis of algorithm techniques • Analyze the efficiency of different algorithmic solutions • Implementation and evaluation of complex algorithms
Prerequisite	Knowledge on Computer Programming Fundamentals

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom'sTaxonomy Knowledge Level
CO1	Understand the fundamentals of algorithms and data structures	K2
CO2	Apply Divide and Conquer approach using various sorting algorithms	K3
CO3	Analyze Greedy algorithm design technique and its applications	K4
CO4	Interpret Dynamic Programming paradigms to solve real-world problems	K2
CO5	Implement Backtracking, Branch and Bound techniques to solve complex problems	K3

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓		
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Algorithm Definition – Analyzing and Designing algorithms – Performance Analysis - Asymptotic Notations - Time and Space complexity of an algorithm using O Notation. Elementary Data Structures: Stacks and Queues – Linked lists.	08	Text Book
II	Introduction: Strassen's Algorithm for Matrix Multiplication - Sorting and Order Statistics: Heap sort – Algorithm – Priority Queues – Quick Sort – Description, Performance and Analysis – Merge sort.	10	Text /Reference Book
III	The General Method - Knapsack Problem - Minimum Cost Spanning Trees – Prim's Algorithm – Kruskal's Algorithm - Optimal Storage On Tapes– Optimal Merge Patterns - Single Source Shortest Paths – Dijkstra's Algorithm.	10	Text Book
IV	The General Method – All-Pairs Shortest Paths – Warshall's and Floyd's Algorithm – Single-Source Shortest Paths - Bellman–Ford Algorithm - Optimal Binary Search Trees - 0/1 Knapsack - Reliability Design - The Traveling Salesperson Problem.	10	You Tube Videos
V	The General Method – The 8-Queens Problem – Sum of Subsets– Graph Coloring -Hamiltonian Cycles – Branch and Bound: Knapsack Problem – Travelling Salesman Problem.	10	You Tube Videos
	Total	**48**	

Text Book	**1.**	Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, 2009,"Introduction to Algorithms", 3rd Edition, MIT Press
	2.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, 2009,"Fundamentals of Computer Algorithms, 2nd Edition, University Press
Reference Books	**1.**	Robert L. Kruse and Clovis L. Tondo, 2007, "Data Structures and Program design in C", 2nd Edition, Pearson Education
	2.	Michael T. Goodrich, Roberto Tamassia",2001,Algorithm Design, Foundations, Analysis, and Internet Examples", 1st Edition., Wiley
	3.	Mark Allen Weiss,2013, "Introduction to the Design Data Structures and Algorithm Analysis in C++",4th Edition., Addison-Wesley
	4.	Tim Roughgarden. 2017, "Algorithms Illuminated", Kindle Edition Sound like yourself Publishing, New York.

Journal and Magazines	https://dl.acm.org/journal/algr
E-Resources and Website	https://www.youtube.com/watch?v=FtN3BYH2Zes https://www.youtube.com/watch?v=nLmhmB6NzcM

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/Employability

Semester - I
CORE III: ADVANCED JAVA

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24CSP1CB	ADVANCED JAVA	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • Advance Java concepts to develop applications • The Concepts of Java Beans and Swings • Database Connectivity using JDBC and Embedded SQL
Prerequisite	Knowledge on Basic Programming skill

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom'sTaxonomy Knowledge Level
CO1	Understand about Java beans and swing	K2
CO2	Understand the life cycle of Java Servlet	K2
CO3	Develop and apply event in JSP and RMI	K3
CO4	Learn the architecture and design of Enterprise Java Bean	K2
CO5	Design applications implementing Database Connectivity using JDBC and Embedded SQL.	K6

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		
CO5	✓	✓	✓	✓	✓

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Java Beans and Swing Introduction: Advantages – Design patterns for Properties – Events – Methods and Design Patterns - Java Beans API - Swing : Introduction – Swing Is Built on the AWT - Two Key features of Swing – MVC Connections – Components and Containers – The Swing Packages – Simple Swing Applications - Exploring Swing	10	Text Book
II	Java Servlet Introduction: Background - The life cycle of a Servlet – Using Tomcat for Servlet development – A Simple Servlet – The Javax.Servlet Packages – Reading Servlet Parameters – The javax.servlet.http packages – Handling Http request and responses– cookies - Session Tracking.	10	Reference Book
III	Java Server Pages, Remote Method Invocation Java Server Pages- Introduction - Tags: Variable Objects - Request String: Parsing Other Information - User Session - Cookies - Session objects. Java Remote method Invocation: Remote Interface - Passing Objects - RMI Process - Server side - Client side	08	Text Book
IV	Enterprise Java Bean Enterprise Java Beans : The EJB Container – EJB Classes - EJB Interfaces –Deployment Descriptors : Referencing EJB - Sharing Resources - Security Elements -Query Elements - Assembly Elements - Session Java Bean: Stateless and Stateful -Creating a Session Java Bean - Entity Java Bean - Message -Driven Bean	10	NPTEL
V	Database Connectivity JDBC Objects : The Concept of JDBC - JDBC Driver types – JDBC Packages – Database Connection – Statement Objects – ResultSet – Transaction Processing - JDBC and Embedded SQL : Tables and Indexing - Inserting, Selecting and Updating Data	10	You Tube Videos
	Total	**48**	

Text Book	**1.**	Herbert Schildt, 2018, "Java The Complete Reference", 10th Edition, Tata McGraw Hill (Unit I-II)
	2.	Jim Keogh, 2002, "J2EE: The Complete Reference", McGraw Hill Education(Unit III - V)
Reference Books	**1.**	Herbert Schildt, 2018, "Java, A Beginner Guide", 8th Edn., Oracle Press
	2.	Bert Bates, Karthy Sierra, Eric Freeman, Elisabeth Robson, 2009, "Head First Design Patterns", 1st Edition.), O'Reilly
	3.	Robert Pattinson, 2018, "The Ultimate Beginners Guide for Advance Java "First Edition, Amazon Digital Services LLC
	4.	E Ramaraj P Geetha S Muthukumaran, 2018, "Advanced JAVA Programming", 1st Edition, Pearson., Noida.

Journal and Magazines	https://coderanch.com/t/395092/java/Java-Developers-Journal
E-Resources and Website	https://www.geeksforgeeks.org/java/ https://www.geeksforgeeks.org/java/ https://www.javatpoint.com/java-tutorial

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/Employability

24DAP1CP	PYTHON PROGRAMMING	SEMESTER I

Total Credits: 2
Total Instructions Hours: 48 h

S.No	List of Programs
1	Programs to perform aggregation operations
2	Programs to Implement a sequential search
3	Programs to Explore string functions
4	Programs to Read and Write into a file
5	Programs to Demonstrate use of List
6	Programs to Demonstrate use of Dictionaries
7	Programs to Demonstrate use of Tuples
8	Programs to Create Comma Separate Files (CSV), Load CSV files into internal Data
9	Programs using Pandas: Extract items at given positions from a series
10	Programs to implement correlation and covariance
11	Program to plot graphs using Matplotlib and seaborn packages
12	Programs to Perform Analysis for given data set using Pandas

Note: Ten Programs are mandatory

24CSP1CQ	ADVANCED JAVA	SEMESTER I

Total Credits: 2
Total Instructions Hours: 48h

S.No	List of Programs
1	Programs using Java control statements.
2	Programs to implement the Collection with Iterator.
3	Programs to create applet incorporating features such as images, shapes, background, and foreground color
4	Create applications using simple GUI
5	Programs to perform some applications using Java Bean
6	Create applications using Swing
7	Programs to demonstrate AWT Components with Event Handling.
8	Programs to perform Session Tracking.
9	Java servlet programs to implement sendredirect () Method (using Http servlet class).
10	Servlet programs using HTTP Servlet.
11	Create web applications using JSP.
12	Programs with JDBC to interact with database.

Note: Ten Programs are mandatory.

Semester - I

DSE – I : DIGITAL IMAGE PROCESSING

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24DAP1DA	DIGITAL IMAGE PROCESSING	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • Digital image processing fundamentals, color models and image filtering • Image edge detection and image compression concepts and implement them • Image segmentation and morphological concepts and implement them
Prerequisite	Basic Programming skills

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom'sTaxonomy Knowledge Level
CO1	Understand image processing fundamentals, its models and color models	K2
CO2	Discuss images filtering concepts and techniques	K2
CO3	Demonstrate image edge detection techniques and applications	K3
CO4	Apply image compression methods and models for real life problems	K3
CO5	Analyze segmentation and morphological image processing	K4

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

24DAP1DA-DSE:DIGITAL IMAGE PROCESSING

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Fundamentals: Image Sensing and Acquisition - Image Sampling and Quantization- relationship between Pixels - Random noise - Gaussian Markov Random Field - σ-field, Linear and Non-linear Operations - Image processing models: Causal - Semi-causal - non-causal models - Color Models: Color Fundamentals - Color Models -Pseudo-color Image Processing - Full Color Image Processing - Color Transformation- Noise in Color Images.	08	Text Book
II	Spatial Domain: Enhancement in spatial domain: Point processing - Maskprocessing - Smoothing Spatial Filters - Sharpening Spatial Filters - CombiningSpatial Enhancement Methods - Frequency Domain: Image transforms: FFT - DCT -Karhunen-Loeve transform - Hotlling's T square transform - Wavelet transforms andtheir properties - Image filtering in frequency domain.	10	Text/Reference Book
III	Edge Detection: Types of edges - threshold - zero-crossing - Gradient operators:Roberts - Prewitt and Sobel operators - residual analysis-based technique - Cannyedge detection - Edge features and their applications.	10	Text Book
IV	Image Compression: Fundamentals - Image Compression Models - Elements ofInformation Theory - Error Free Compression: Huff-man coding - Arithmetic coding;- Wavelet transform based coding - Lossy Compression: FFT - DCT - KLT - DPCM -MRFM based compression - Wavelet transform based - Image Compressionstandards.	10	You Tube Videos
V	Image Segmentation: Detection and Discontinuities: Edge Linking and BoundaryDeduction - Threshold - Region-Based Segmentation - Segmentation byMorphological watersheds - The use of motion in segmentation - ImageSegmentation based on Color - Case study.	10	You Tube Videos
	Total	**48**	

Text Book	**1.**	Rafael Gonzalez, Richard E. Woods, 2019, "Digital Image Processing",(Fourth Edition), Pearson Education (UNIT I, II,IV,V)
	2.	A. K. Jain, 2015, "Fundamentals of Image Processing", Second Edition,Pearson Education (UNIT III)
Reference Books	**1.**	S Annadurai, R Shanmugalakshmi, 2007, " Fundamentals of Digital ImageProcessing, (First Edition), Pearson Education
	2.	Todd R.Reed,2015, "Digital Image Sequence Processing, Compression andAnalysis", (Sixth Edition), ECRC Press
	3.	Prasad, S.S.Iyengar, 2015 "Wavelet Analysis with Applications to ImageProcessing",(Seventh Edition) CRC Press
	4.	William K. Pratt, 2002, "Digital Image Processing", John Wiley, NewYork,.

Journal and Magazines	https://dl.acm.org/journal/tog
E-Resources and Website	https://www.youtube.com/watch?v=LXGxK2b1mv4 https://www.youtube.com/watch?v=onWJQY5oFhs

Learning Method	Chalk and Talk/Assignment/Seminar/Brainstorming

Focus of the Course	Skill Development/Employability

Semester - I
DSE – I : INFORMATION RETRIEVAL

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24DAP1DB	INFORMATION RETRIEVAL	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • The concepts of information retrieval techniques • The techniques focused on document classification, tolerant retrieval and evaluation • The methods of developing an information retrieval system
Prerequisite	Basic Knowledge on Data structures, Algorithms and Databases

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom'sTaxonomy Knowledge Level
CO1	Understand the concepts of the standard models of Information Retrieval	K2
CO2	Understand the methods for handling wild card queries and spelling correction	K2
CO3	Apply appropriate methods for scoring and evaluating IR systems	K3
CO4	Apply text classification to locate relevant information from large collections of text data	K3
CO5	Design an Information Retrieval System for search tasks involving XML and web data	K6

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

24DAP1DB-DSE:INFORMATION RETRIEVAL

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Introduction to Information Retrieval– Building an inverted Index - Processing Boolean Queries - Boolean Model vs Ranked Retrieval - Term Vocabulary and Postings: Tokenization - Stop words - Normalization-Stemming - Skip pointers -Phrase queries: Biword indexes- Positional indexes	09	Text Book
II	Search Structures for Dictionaries- Wild card queries – General wild card queries-k gram indexes for wild card queries - Spelling correction – Forms- Edit distance -k gram indexes for spelling correction - Phonetic Correction – Index construction-Distributed indexing- Statistical properties of terms : Heaps' Law- Zipf's Law	10	Text Book/ You Tube Videos
III	Term frequency and weighting –Inverse document frequency-TF-IDF weighting -Vector space model for scoring -Efficient scoring and ranking -Evaluation: Information retrieval system evaluation- Evaluation of unranked retrieval sets-Evaluation of ranked retrieval sets- Case study	10	Text Book
IV	Text classification and Naive Bayes- The text classification problem- Naive Bayes text classification – Feature selection – Mutual information- Vector space classification: Document representations and measures of relatedness in vector spaces-k nearest neighbour - Linear versus nonlinear classifiers - Case study	10	Text Book
V	XML Indexing and Search: Basic XML concepts - Challenges in XML retrieval- A vector space model for XML retrieval - Data vs. Text-centric XML- Web search basics-Web characteristics-Web crawling – Features of web crawler-Architecture-Distributing indexes - Machine learning methods in ad hoc information retrieval - Case study	09	Text/ Reference Book
	Total	**48**	

Text Book	**1.**	Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, 2009 ,"Introduction to Information Retrieval", Edition, Cambridge University Press
Reference Books	**1.**	Baeza -Yates Ricardo and Berthier Ribeiro - Neto, 2011, "Modern Information Retrieval",. 2nd edition, Addison-Wesley
	2.	Gerald Kowalski, 2010, "Information Retrieval Architecture and Algorithms ",First Edition, Berlin, Heidelberg: Springer-Verlag
	3.	G.G. Chowdhury, 2010, "Introduction to Modern Information Retrieval", 3rdEdition, Facet Publishing.
	4.	Bruce Croft, Donald Metzler, and Trevor Strohman, , 2009, "Search Engines: Information Retrieval in Practice" Pearson Education

Journal and Magazines	https://dl.acm.org/journal/infre
E-Resources and Website	https://nlp.stanford.edu/IR-book/information-retrieval-book.html https://people.ischool.berkeley.edu/~hearst/irbook/

Learning Method	Chalk and Talk/Assignment/Seminar/Problem Solving

Focus of the Course	Skill Development/Employability

Semester - I
DSE – I : WEB INTELLIGENCE

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24DAP1DC	WEB INTELLIGENCE	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • The concepts of web mining and crawling • The techniques in opinion mining and sentiment analysis • The concepts of social network Analysis
Prerequisite	Knowledge on Web Technologies

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom'sTaxonomy Knowledge Level
CO1	Understand the concepts of web mining	K2
CO2	Analyze social networks and web crawling	K4
CO3	Experiment with opinion mining and sentiment analysis	K5
CO4	Understand Google Analytics	K2
CO5	Design Applications using web intelligence	K5

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Introduction - Web Mining: Information Retrieval and Web Search - Basic Concepts of Information Retrieval - Information Retrieval Models - Relevance Feedback - Evaluation Measures - Text and Web Page Pre-Processing - Web Search – Meta Search: Combining Multiple Rankings - Web Spamming	10	Text Book
II	Social Network Analysis - Co-Citation and Bibliographic Coupling - Page Rank -Semantic web - Web Intelligence: Levels - Goals - Characteristics - Challenges and issues Tools for web crawling - Web Crawling: Basic Crawler Algorithm - Implementation Issues - Universal Crawlers - Focused Crawlers - Topical Crawlers: Topical Locality and Cues - Best-First Variations - Adaptation - Evaluation – Crawler Ethics and Conflicts	10	Reference Book
III	The Problem of Opinion Mining - Document Sentiment Classification – Sentence Subjectivity and Sentiment Classification – Opinion Lexicon Expansion - Aspect-Based Opinion Mining – Mining Comparative Opinions - Opinion Search and Retrieval - Case study	08	Text Book
IV	Google Analytics: Introduction - Cookies - Accounts vs Property - Tracking Code -Tracking Unique Visitors - Demographics - Page Views and Bounce Rate Acquisitions - Custom Reporting - Case study	10	You Tube Videos
V	Applications: Filters - Ecommerce Tracking - Real Time Reports - Customer Data-Alert - Adwords Linking – Adsense Linking - Attribution Modeling - Segmentation -Campaign Tracking - Multi-Channel Attribution - Case Study – Recommendation engines based on users, items and contents	10	You Tube Videos
	Total	**48**	

Text Book	**1.**	Bing Liu ,2011, "Web Data Mining Exploring Hyperlinks, Contents, and Usage Data", 2nd Edition, Springer (Unit I-III)
	2.	Ning Zhong, Jiming Liu and Yiyu Yao, 2010, "Web Intelligence", Springer(Unit IV,V)
Reference Books	**1.**	Ricardo Baeza -Yates and BerthierRibeiro-Neto, 2011, "Information Retrieval: The Concepts and Technology behind Search", 2nd Edition, ACM Press
	2.	Juan D. Velasquez, Lakhmi C. Jain (Eds.),2010,"Advanced Techniques in Web Intelligence - 1", 1st Edition, Springer
	3.	Mark Levene, 2010, "An Introduction to Search Engines and WebNavigation", 2nd Edition, Wiley

	4.	Eric Fettman, Shiraz Asif, FerasAlhlou , 2016 "Google Analytics Breakthrough", Wiley

Journal and Magazines	https://www.emeraldgrouppublishing.com/journal/ijwis
E-Resources and Website	https://www.youtube.com/user/googleanalytics https://www.youtube.com/watch?v=ClSLdoNKZMI

Learning Method	Chalk and Talk/Assignment/Seminar/Brainstorming

Focus of the Course	Skill Development/Employability

24/4/24
BoS Chairman/HoD
Department of Computer Science with Data Analytics
Dr. N. G. P. Arts and Science College
Coimbatore – 641 048

Dr.N.G.P. Arts and Science College
APPROVED

BoS- 10th	AC - 17th	GB -
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Academic Council
CHAIRMAN
Dr.N.G.P. Arts and Science College

Semester - II CORE: ARTIFICIAL INTELLIGENCE							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	24DAP2CA	ARTIFICIAL INTELLIGENCE	CORE	48	12	-	5

Preamble	This course has been designed for students to learn and understand • Principles and concepts of Artificial Intelligence • Various AI approaches towards problem solving, knowledge representation and reasoning • Concepts of Reinforcement learning and Generative AI
Prerequisite	Knowledge on Basic Mathematics

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the fundamental concepts of Artificial Intelligence	K2
CO2	Analyze a suitable search method for real world problem	K4
CO3	Apply Constraint Satisfaction techniques and Adversarial search methods	K3
CO4	Understand knowledge representation and reasoning in AI	K2
CO5	Understand the models and techniques of reinforcement learning, Generative AI and Prompt Engineering.	K2

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓		
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓		✓		
CO5	✓	✓	✓	✓	✓

24DAP2CA	CORE: ARTIFICIAL INTELLIGENCE

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	**Intelligent Agents and Search Strategies** Foundations of Artificial Intelligence - Intelligent Agents: Agents and Environments- Structure of Agents – Problem Solving: Problem Solving Agents- Problem Formulation - Uninformed earch Strategies: Breadth-First Search – Depth-First Search – Depth-Limited Search – Iterative Deepening Depth-First Search – Bidirectional Search - Comparing Uninformed Search Strategies-Case Study on Intelligent Agents	12	Text Book
II	**Heuristic and Classical Search** Greedy Best-First Search – A * Search – Memory-Bounded Heuristic Search – Heuristic Functions – Local Search Algorithms – Hill Climbing Search – Simulated Annealing – Genetic Algorithms – Online Search Agents and Unknown Environments: Online Search Problems - Online Search Agents - Online Local Search –Learning in Online Search- Case Study on Online Search Agents	12	Text Book
III	**Constraint Satisfaction Problems** Introduction: Constraint Satisfaction Problems (CSP): Backtracking search for CSP-Local Search for CSP - Structure of Problems - Adversarial Search: Introduction – Games – Optimal Decision in Games - The Min Max Algorithm – Alpha–Beta Pruning – Games that Include an Element of Chance: Card Games- Case Study on Optimal Decision in Games	12	Text Book
IV	**Knowledge Representation and Reasoning** Knowledge Based Agents – Logic – Propositional Logic: Syntax – Semantics – A simple knowledge base – Inference – Equivalence, Validity and Satisfiability –Reasoning Patterns in Propositional Logic: Resolution – Forward and Backward Chaining - First Order Logic: Syntax and Semantics of First Order Logic – Using First Order Logic – Case Study on Knowledge Based Agents	12	Text Book

V	**Reinforcement Learning, Generative AI** Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Applications -Generative AI: Key Generative AI Models, Use Cases – Prompt Engineering: Need, Types, Applications- Addressing AI Ethics and Bias, Challenges	12	Text Book
	Total	60	

Text Book	1.	Russell, S.J. and Norvig, P.,2015, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education
Reference Books	1.	Lavika Goel,., 2021, " Artificial Intelligence: concepts and Applications", 1st Edition, Wiley
	2.	Patterson, D.W., 2012,"Introduction to Artificial Intelligence and Expert Systems", Prentice Hall of India.
	3.	Nilsson, N.J, 2011,"Artificial Intelligence A New Synthesis", 1st Edition, Elsevier
	4.	Kevin Knight, Elaine Rich, 2017, Artificial Intelligence, 3rd Edition, McGrawHill Publishing
	5.	https://datasciencehorizons.com/pub/Mastering_Generative_AI_Prompt_Engineering_Data_Science_Horizons_v2.pdf

Journal and Magazines	The Open Artificial Intelligence Journal Artificial Intelligence Research
E-Resources and Website	https://onlinelibrary. wiley.com/loi/23719621 https://www.jair.org/index.php/jair
Learning Method	Chalk and Talk/Assignment/Seminar
Focus of the Course	Skill Development

Semester - II CORE: DATA MINING							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	**24DAP2CB**	**DATA MINING**	**CORE**	**48**	**12**	**-**	**4**

Preamble	This course has been designed for students to learn and understand • Be familiar with foundations of data mining and data preprocessing • Understand algorithms in data mining for data classification and clustering • Know Data Mining Trends and Research
Prerequisite	Knowledge on Basic Statistics and Database

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.	K2
CO2	Analyzing interesting patterns from large amounts of data using classification.	K2
CO3	Discover the role played by Clustering in data mining.	K4
CO4	Choose suitable data mining algorithms to build association rules.	K5
CO5	Evaluate the scope of data mining tools and Techniques	K5

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓		✓	✓	✓
CO5	✓	✓	✓	✓	✓

24DAP2CB	CORE: DATA MINING

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	**Introduction** Data Mining -Database Data – Data Mining Technologies - Data Objects and Attribute types - Measuring Data Similarity and Dissimilarity: Proximity Measures for Nominal Attributes - Proximity Measures for Binary Attributes - Minkowski Distance - Data Preprocessing: Data Cleaning - Data Transformation by Normalization - Discretization: Binning - Histogram	12	Text Book
II	**Classification** Introduction - Decision Tree Induction: Tree Pruning - Bayes Classification Methods: Naïve Bayesian Classification - Model Evaluation and Selection: Metrics for Evaluating Classifier performance - Techniques to improve Classification accuracy: Ensemble Methods - Bagging - Boosting -Random Forests	12	Text Book
III	**Cluster Analysis** Introduction - Partitioning Methods - Hierarchical Methods: Agglomerative - Hierarchical - Distance measures in Algorithmic methods -BIRCH - Density Based Methods: DBSCAN -Evaluation of Clustering: Determining the Number of Clusters - Measuring Clustering Quality- Clustering high dimensional data: Problems - Challenges - Methodologies - Clustering graph and network data- Applications and Challenges.	12	Text Book
IV	**Outlier Detection** Outlier and Outlier analysis - statistical approaches- proximity based approaches- Mining Frequent Patterns, Associations and Correlations: Market Basket Analysis - Apriori Algorithm - Association Rules from frequent itemsets - Advanced Pattern Mining: Pattern Mining in Multilevel,Multidimensional Space	12	Text Book
V	Data Mining Trends and Research Mining Complex data types - Other methodologies of data mining - Data Mining Applications:	12	Text Book

	Financial Data Analysis - Retail and Telecommunication Industries - Science and Engineering - Intrusion Detection and Prevention - Data Mining and Recommender Systems - Data Mining and Society.		
	Total	60	

Text Book	**1.**	Jiawei Han & Micheline Kamber, 2020, "Data Mining – Concepts and Techniques,",3rd Edition Elsevier`
Reference Books	**1.**	Ian H. Witten and Eibe Frank,2005, "Data Mining: Practical Machine Learning Tools and Techniques," 2nd Edition, Morgan Kaufmann
	2.	Arun K Pujari,2006, "Data Mining Techniques " 2ndEdition, University Press Publication
	3.	K.P Soman, Shyam Divakar, A.Ajay, 2006,"Insight into Data Mining: Theory and Practice ", 2nd Edition, Prentice Hall of India
	4.	Alex Berson, Stephen J. Smith, 2004, "Data Warehousing, Data Mining, & OLAP ", Tata McGrawHill

Journal and Magazines	https://link.springer.com/journal/10618
E-Resources and Website	Introduction to Data Mining https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013841785773547520398 4_shared/overview

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Employability/ Skill Development

Semester - II CORE: INFORMATION AND NETWORK SECURITY							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	24DAP2CC	INFORMATION AND NETWORK SECURITY	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • The concepts of Information and Network security • The issues regarding Confidentiality, Integrity and Availability of a data • Various protocols for Information and Network security
Prerequisite	Knowledge on network security

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Discuss the concepts of information security, threats, security services, and countermeasures.	K2
CO2	Illustrate the information security blueprints and major components	K3
CO3	Analyze various cryptographic algorithms	K4
CO4	Compare network security services and mechanisms	K4
CO5	Illustrate Internet security protocols for protecting data	K2

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		✓
CO2	✓	✓			✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓			
CO5	✓	✓			✓

24DAP2CC	CORE: INFORMATION AND NETWORK SECURITY

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	**Information Security** Introduction - Concepts – Components of Information Systems – Approaches to Information Security Implementation – System Development Life Cycle – Security Systems Development Life Cycle – Security Professionals and Organization - Needs of Security: Business Needs – Threats –Attacks – Secure Software Development.	8	Text Book
II	**Security Planning and Technology** Information Security Planning and Governance – Information Security Policy, Standards and Practices – Information Security Blueprint - Continuity Strategies - Security Technology: Access Control – Firewalls – Protecting Remote Connections – Intrusion, Detection and Prevention Systems – Honeypots, Honeynets and Padded Cell System - Scanning and Analysis Tools.	10	Text Book
III	**Cryptography** OSI Security Architecture – Security Services – Classical Encryption Techniques: Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines - Steganography –Block Cipher and Data Encryption Standards–Advanced Encryption Standard: AES Structure – AES Transformation Functions- Rivest Shamir Adleman (RSA) algorithm.	10	Text Book
IV	**Network Security** Network Access control – Extensible Authentication Protocol – Cloud Computing – Cloud Security risks and counter measures – Data protection in the cloud – Cloud security as a service - Addressing cloud computing security concerns – Transport Level Security: Web security Considerations - Hyper Text Transfer Protocol Secure (HTTPS)- Secure Shell.	10	Text Book

V	**Internet Security** Introduction - Internet Mail Architecture – Email Threats and comprehensive email security - S/MIME–Pretty Good Privacy –Domain Name System (DNS) Based Authentication of Named Entities – Sender Policy Framework –IP Security: Overview –Policy – Encapsulating security payload – Combining Security Associations – Internet key Exchange- Case Study: Phishing	10	Text Book
	Total	48	

Text Book	**1.**	Michael E. Whitman and Herbert J Mattord, 2011, "Principles of Information security", 4th Edition, Cengage Learning (Unit I,II)
	2.	William Stallings,2017,"Cryptography and Network Security Principles and Practices",7th Edition ,Prentice hall(Unit III-V)
Reference Books	**1.**	Nina Godbole,2017,"Information Systems Security: Security Management, Metrics, Frameworks and Best Practices", 2nd Edition, Wiley
	2.	Micki Krause ,Harold F.Tipton,2008,"Handbook of Information security management", Vol 1-3, CRC press
	3.	Richard E. Smith, 2019, " Elementary Information Security ", 3rd Edition, Jones & Bartlett Learning
	4.	Jason Andress, 2019, "Foundations of Information Security: A Straightforward Introduction", No Starch Press (RHPS)

Journal and Magazines	1. International Journal of Information Security - https://www.springer.com/journal/10207 2. Journal of Information Security 3. IEEE Security & Privacy
E-Resources and Website	1. SANS Institute - https://www.sans.org/ 2. National Institute of Standards and Technology (NIST) - https://www.nist.gov/cybersecurity 3. OWASP (Open Web Application Security Project) - https://owasp.org/

Learning Method	Chalk and Talk/Seminar

Focus of the Course	Skill Development

Semester - II CORE: ADVANCED DATABASE MANAGEMENT SYSTEMS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	24DAP2CD	ADVANCED DATABASE MANAGEMENT SYSTEMS	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • Parallel, Distributed principles and query processing • MongoDB architecture, features, operations • Specialty databases like spatial, temporal, object based and multimedia databases
Prerequisite	Knowledge on Database Management Systems

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand Parallel and Distributed Database system concepts	K2
CO2	Apply the techniques of Parallel and Distributed query processing	K3
CO3	Analyze NoSQL database and MongoDB features	K4
CO4	Implement MongoDB queries for aggregation, indexing, replication and sharding	K3
CO5	Demonstrate various types of specialty databases like spatial, temporal, object based and multimedia databases	K3

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓		
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓		✓		✓
CO5	✓	✓	✓	✓	✓

24DAP2CD	CORE: ADVANCED DATABASE MANAGEMENT SYSTEMS

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	**Parallel and Distributed Systems** Centralized Database Systems - Server system architectures - Parallel systems - Distributed Systems - Transaction Processing in Parallel and Distributed Systems - Cloud-Based Services - Data Partitioning - Dealing with Skew in Partitioning - Replication - Parallel Indexing - Distributed File Systems	8	Text Book
II	**Parallel and Distributed Query Processing** Parallel Sort - Parallel Join - Other Operations - Parallel Evaluation of Query Plans - Query Processing on Shared - Memory Architectures - Query Optimization for Parallel Execution - parallel Processing of Streaming Data - Distributed Query Processing - Distributed Transactions	10	Text Book
III	**MongoDB** Concepts of NoSQL database - Types of NoSQL database - MongoDB: Features, Architecture, difference from other databases, core concepts, collections, documents -Storage engines: Types, In-memory storage engine, Comparison - Locks: Types, Operations - Administering MongoDB - Shell methods: Connection, Database, Collection methods - Data types	10	Text Book
IV	**MongoDB operations** MongoDB CRUD operations- Intermediate concepts: Atomicity, Consistency - Distributed operations and queries – MongoDB Indexes: Benefits, Creation, Types, Properties - Query selectors - Projection operators - Aggregation - MongoDB Compass - Replication: Replica sets,Heartbeats - Sharding: Sharded Clusters, Shard Key	10	Text Book

V	**Specialty Databases** Object based Databases – Complex Data Types-Object Relational Mapping-XML: Structure of XML Data - Querying and Transformation- Application Programming Interface-Storage - XML applications-Spatial and Temporal Data Mobility: Time in databases - Spatial and Geographic Data-Multimedia Databases	10	Reference Book
	Total	48	

Text Book	1.	Abraham Silberschatz, Hendry F. Korth and S. Sudarsan, 2020, "Database system concepts,", 6th Edition, Mc Graw Hill Education
	2.	Manu Sharma , MongoDB complete guide, BPB publications, First edition
Reference Books	1.	Elma Sri Ramez and Navathe Shamkant.B, 2015 ,"Fundamentals of Database System Concepts", 7th Edition, Pearson
	2.	Raghuram Krishnan, Johnanes Gekrke, 2003, "Database Management System," 3rd Edition, Mc Graw Hill

Journal and Magazines	Journal of advanced database management systems
E-Resources and Website	https://db-book.com/ https://learn.mongodb.com/

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development

Semester – II CORE PRACTICAL: R FOR DATA ANALYTICS							
Semester	**Corse Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	24DAP2CP	R FOR DATA ANALYTICS	CORE PRACTICAL	-	-	48	2

Preamble	This course has been designed for students to implement • about working with data frames, vectors, and matrices. • statistical techniques, including hypothesis testing, regression analysis, and correlation analysis. • visualization in R to solve real world problems.
Prerequisite	Knowledge on Data Analytics tool.

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Demonstrate R data objects like Data Frames, Lists, Matrices, Factors and Vectors.	K3
CO2	Perform Importing, exporting and manipulating data using R.	K3
CO3	Develop programs in R to prepare data for analysis.	K3
CO4	Implement Cluster Analysis and Time Series Analysis using R.	K3
CO5	Demonstrate Text Classification using R.	K3

Mapping with Program Outcomes:					
Cos / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1		✓		✓	
CO2		✓	✓	✓	
CO3	✓	✓		✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	

24DAP2CP	CORE PRACTICAL: R FOR DATA ANALYTICS

Syllabus

S.No	List of Programs
1	Program to perform Vectors, Matrix Manipulation.
2	Program to perform operations on Factors, Data Frame.
3	Program for Operations on String and List.
4	Program to Implement Regression.
5	Program for Exploratory Data Analysis.
6	Program to Import data sets and Perform read and write.
7	Program to implement various charts.
8	Program to Implement Cluster analysis.
9	Program to Implement Time Series.
10	Program to create predictive model for a given dataset.
11	Program to Implement Text Classification.
12	Programs to Implement Term frequency and Inverse Document Frequency.

Manuals	1.	Joseph Adler,(2012), "R in a Nutshell", (1st Edn.), O'Reilly Media, Inc.
	2.	Roger D.Peng, (2015), "R Programming for Data Science" (1st Edn.),Lean Publishing..

Learning Method	Demonstration/ Hands on Experiments/ Group Trials

Focus of the Course	Skill Development/ Employability

Semester – II CORE PRACTICAL: ADVANCED DATABASE MANAGEMENT SYSTEMS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	24DAP2CQ	ADVANCED DATABASE MANAGEMENT SYSTEMS	CORE PRACTICAL	-	-	48	2

Preamble	This course has been designed for students to implement: • Parallel data processing and partitioning schemes in large datasets • Advanced querying, filtering and transformation techniques in MongoDB • Specialized data processing including spatial, multimedia and time-series data using MongoDB
Prerequisite	Database Management Systems Concepts

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Apply parallel processing, partitioning techniques to improve query performance for large-scale data operations	K3
CO2	Implement aggregation framework in MongoDB to perform complex data manipulations, transformations and analysis	K3
CO3	Demonstrate processing of spatial queries in MongoDB for location-based data analysis	K3
CO4	Apply appropriate techniques for storing, indexing and querying multimedia files in MongoDB	K3
CO5	Demonstrate time-series data processing and time-based analysis in MongoDB.	K3

Mapping with Program Outcomes:					
Cos / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	✓	✓		✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

24DAP2CQ	CORE PRACTICAL: ADVANCED DATABASE MANAGEMENT SYSTEMS

S.No	List of Programs
1	Demonstrate parallel processing of aggregation, filter, sort, joins
2	Demonstrate vertical, horizontal partitioning of a table
3	Implement CRUD operations in MongoDB
4	Demonstrate indexing and sorting in MongoDB
5	Demonstrate Aggregation pipelines in MongoDB
6	Demonstrate filtering using Query Selectors
7	Demonstrate transformations in MongoDB
8	Demonstrate spatial data processing in MongoDB
9	Demonstrate multimedia data processing in MongoDB
10	Create and query Time series collections in MongoDB

Manuals	1.	https://www.mongodb.com/docs/manual/

Learning Method	Demonstration/ Hands on Experiments

Focus of the Course	Skill Development/ Employability

Semester - II DSE: CUSTOMER ANALYTICS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	24DAP2DA	CUSTOMER ANALYTICS	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • Concepts of Regression, Factor analysis, Demand forecasting and Market Basket Analysis • Methods to increase Customer Lifetime Value and to identify Customer Loyalty • Techniques in Predictive marketing to predict lead scoring and customer recommendations
Prerequisite	Knowledge on Basic Mathematics

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand regression and factor analysis	K2
CO2	Understand the techniques to forecast future demand	K2
CO3	Apply the concepts to increase customer lifetime value	K3
CO4	Analyze the methods in customer segmentation and profiling	K4
CO5	Apply the predictive marketing techniques for real world problems	K3

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓

24DAP2DA	DSE: CUSTOMER ANALYTICS

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	**Regression and Factor Analysis** Introduction to Analytics - Regression – Assumptions – Factor Analysis – Exploratory Vs Confirmatory Factor Analysis – Using Factor Analysis – Introduction to Retail – Retail Analytics- Sources of Retail Data – Big Data Analytics – Understanding and Estimating Demand: Introduction – Regression to Estimate Demand - Properties of Estimators – Time Series Data	9	Text Book
II	**Forecasting Future Demand and Market Basket Analysis** Price Elasticity and Discounts – Introduction to Elasticity – Modelling Elasticity – Forecasting Future Demand: Autocorrelation – Dummy Variables and Seasonality – Product Bundling: Market Basket - Logistic Regression – Predicting the Market Basket – Estimating Time of Purchase: Survival Analysis	10	Text Book
III	**Increasing Customer Lifetime Value and Identifying Loyalty** Increasing Customer Lifetime Value: Descriptive Analysis – Predictive Analysis-Introduction to Tobit Analysis – Modeling Transactions - Simultaneous Equations – Need for Simultaneous Equations - Missing Value Imputation – Customer Loyalty - Spectrum – 3 R- Earn Burn Measures – Identifying Loyal Customers: Structural Equation Modeling	10	Text Book
IV	**Customer Segmentation** Introduction to Segmentation – Strategic Uses of Segmentation – Conceptual Process – Tools for Segmentation – Metrics – Hierarchical Clustering – K Means Clustering – Latent Class Analysis – Creating Targeted Messages – Introduction to Recency, Frequency, Monetary Value (RFM) – Behavioral Segmentation – RFM Vs Behavioral Segmentation	10	Text Book

V	**Predictive Marketing** Customer Profiling: Types of Data to Collect – Preparing Data for Analysis – Cleaning and Validation – Linking and Deduplication – Data Integration - Optimizing Market Spending – Predicting Customer Personas – Predicting the Customer Journey – Predicting the Customer Value – Predicting Likelihood to Buy – Predicting Individual Recommendations	9	Text Book
	Total	48	

Text Book	1.	Mike Grigsby, 2016, "Advanced Customer Analytics - Targeting, Valuing, Segmenting and Loyalty Techniques", Kogan Page Publishing
	2.	Omer Artun, Dominique Levin, 2015, "Predictive Marketing - Easy ways every Marketer can use Customer Analytics and Big Data", John Wiley & Sons
Reference Books	1.	Stephanie Diamond, Mary grace Bateman, 2013, "Customer Analytics for Dummies", John Wiley & Sons
	2.	Mike Grigsby, 2015, "Marketing Analytics", Kogan Page Publishing.

Journal and Magazines	Griva, A., Bardaki, C., Pramatari, K. et al. Factors Affecting Customer Analytics: Evidence from Three Retail Cases. Inf Syst Front 24, 493–516 (2022). https://doi.org/10.1007/s10796-020-10098-1
E-Resources and Website	-
Learning Method	Chalk and Talk/Assignment/Seminar
Focus of the Course	Skill Development

Semester - II DSE: NATURAL LANGUAGE PROCESSING							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	24DAP2DB	NATURAL LANGUAGE PROCESSING	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • Basic concepts of Natural Language processing • Acquire knowledge in Parts of Speech (PoS) tagging • The basics of Phonetics and Summarization
Prerequisite	Python, Machine Learning

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand basics of Speech and Language Processing	K2
CO2	Understand Lexicons and Transducers	K2
CO3	Apply the various models for Parts of speech processing	K3
CO4	Analyze appropriate Phonetics and Speech synthesis	K4
CO5	Interpret Question Answering and Summarization	K3

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1			✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓

24DAP2DB	DSE: NATURAL LANGUAGE PROCESSING

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	**Introduction of Speech and language processing** Knowledge in Speech and Language Processing- Models and Algorithms - Language, Thought and Understanding - Natural Language Processing (NLP) Applications - Challenges of NLP - Regular Expressions and Automata: Regular Expressions - Finite-State Automata (FSA) – Regular Languages and FSAs.	10	Text Book
II	**Words and Transducers** Finite - State Morphological Parsing - Construction of a Finite-State Lexicon - Finite-State Transducers- Sequential Transducers and Determinism - FSTs for Morphological Parsing - Transducers and Orthographic Rules - Word and Sentence Tokenization - Detecting and correcting spelling errors-Minimum edit distance	10	Text Book
III	**Parts of Speech (PoS) Processing** N-Grams - Word Counting in Corpora - Training and Test sets - Evaluating N-Grams - Smoothing- Parts of Speech (PoS) Tagging English word classes -Tag sets - PoS Tagging - Hidden Markov Model (HMM) - PoS tagging Transformation based tagging - Advanced issues in PoS tagging	8	Text Book
IV	**Phonetics** Articulatory phonetics - Phonological categories and Pronunciation Variation - Phonetics resources- Speech Synthesis - Text Normalization - Phonetic Analysis - Prosodic analysis: Structure, ToBI model - Automatic Speech Recognition: Architecture HMM Applied to speech	10	Text Book

V	**Question Answering and Summarization** Information retrieval - Factoid Question answering -Summarization-Single document summarization-Multi document summarization - Focused summarization and question answering - Summarization evaluation - Dialogue and Conversational agents: Properties of human conversations, Speech acts, Grounding, Conversational structure - Basic Dialogue systems	10	Reference Book
	Total	48	

Text Book	**1.**	Daniel Jurafsky, James H Martin, (2009), "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", (2nd Edn.), Pearson Education Inc
Reference Books	**1.**	Tanveer Siddiqui, US. Tiwary, (2008), "Natural Language Processing and Information Retrieval", Oxford University Press
	2.	James Allen, (1994), "Natural language Understanding"(2nd Edn), Pearson Education
	3.	Steven Bird, Ewan Klein and Edward Loper, (2009), "Natural Language Processing with Python", (1st Edn), O'Reilly Media

Journal and Magazines	https://link.springer.com/article/10.1007/s11042-022-13428-4
E-Resources and Website	https://www.ibm.com/topics/natural-language-processing

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development

Semester - II DSE: ADVANCED STATISTICS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	24DAP2DC	ADVANCED STATISTICS	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • The concepts of the Estimation theory • The concept of design and Analysis of experiments • The applications of non-parametric tests
Prerequisite	Knowledge on Basic Mathematics

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Interpret the Estimation theory	K2
CO2	Understand the different ways of testing hypothesis	K2
CO3	Analyze the test of Goodness of fit	K4
CO4	Compare analysis of experiment	K4
CO5	Apply non-parametric tests to practical problems	K3

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓			
CO2	✓	✓		✓	
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓

24DAP2DC	DSE: ADVANCED STATISTICS

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	**Estimation** Point Estimation: Introduction -Unbiased Estimators - Efficiency - Consistency - Sufficiency - Robustness -Method of moments - Method of maximum likelihood - Bayesian estimation. Interval Estimation: Introduction - Estimation of means - Estimation of difference between means – Estimation of proportions - Estimation of difference between proportions –Estimation of variance – Estimation of the ratio of two variances –Theory in practice.	10	Text Book
II	**Hypothesis Testing** Introduction - Testing a statistical hypothesis - Losses and risks - The Neyman-Pearson lemma - Power function of a test - Likelihood ratio test – Theory in practice	9	Text Book
III	**Tests of Hypothesis Involving Means, Variances and Proportions** Introduction - Tests concerning means - Tests concerning difference between means - Tests concerning variances – Tests concerning proportions - Tests concerning differences among k-proportions - Analysis of an r x c table - Goodness of fit – Theory in practice.	9	Text Book
IV	**Design and Analysis of Experiments** Introduction – One-way designs – Randomized-block design - Factorial experiments - Multiple comparisons - Other experimental designs – Theory in practice	10	Text Book
V	**Non-Parametric Tests** Introduction -Sign test -Signed-rank test - Rank-sum tests: The U Test - Rank-sum tests: H test – Tests based on runs - Rank correlation coefficient - Theory in practice	10	Text Book
	Total	48	

Text Book	1.	Irwin Miller and Marylees Miller, John E. Freund's, 2007, "Mathematical Statistics with Applications", Seventh Edition, Prentices-Hall India Pvt Ltd, New Delhi
Reference Books	1.	Hogg and Craig, 2003, "Introduction to Mathematical Statistics", Pearson Education, New Delhi
	2.	J.M. Kapur and H.C. Saxena, 2001, "Mathematical Statistics", S. Chand & Co, New Delhi.
	3.	Kandethody M. Ramachandran, Chris P. Tsokos, 2009, "Mathematical Statistics with Applications", Elsevier, Gurgaon.
	4.	Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers, Keying E. Ye, 2018, "Probability and Statistics", Pearson Education, New Delhi.

Journal and Magazines	https://link.springer.com/journal/10182/volumes-and-issues
E-Resources and Website	-
Learning Method	Chalk and Talk/Assignment/Seminar
Focus of the Course	Skill Development

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