Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards
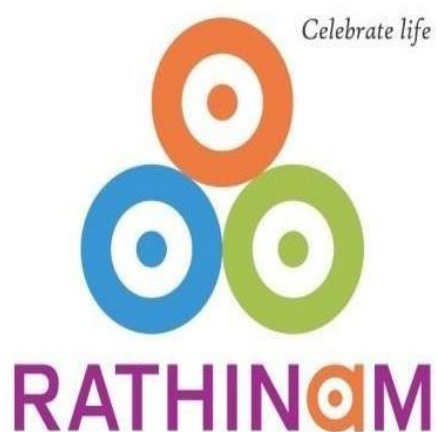
Page 1 of 92
Regulations 2024

DEPARTMENT OF COMPUTER SCIENCE

RATHINAM COLLEGE OF ARTS AND SCIENCE(AUTONOMOUS)

Rathinam TechZone, Pollachi Road, Eachanari, Coimbatore – 641021

Syllabus for B.Sc. Data Science

(I-VI Semester)

2024–2025 Batch onwards

Vision and Mission of the Institution:

VISION

To emerge as a world-renowned Institution that is integrated with industry to impart Knowledge, Skills, Research Culture and Values in youngsters who can accelerate the overall development of India.

MISSION

To provide quality education at affordable cost, build academic and research excellence, maintain eco-friendly and robust infrastructure, and to create a team of well qualified faculty who can build global competency and employ-ability among the youth of India.

MOTTO

 Transform the youth into National Asset.

Vision and Mission of the Department

Vision

To become a globally recognized department which is deeply connected with tech industry, fostering, transfer of knowledge and skills, instilling a research culture and values in aspiring computer scientists, empowering them to drive India's holistic technological advancement.

Mission

To empower students and cultivate academic and research brilliance and provide them to leverage Technology as a tool for innovation and fostering global competitiveness and employ-ability in diverse field

Motto

Industry – Ready Education

Program Educational Objectives (PEO)

Within a few years of graduation, our alumni will:

PEO1	:	Be successful in top graduate schools and in professional positions within academic & research institutions and industries, and in entrepreneurial and consultancy ventures.
PEO2	:	Contribute their information to expertise effectively as members of technological Teams.
PEO3	:	Demonstrate lifelong learning and engagement through continued professional development, and participation and leadership in professional societies and organizations.
PEO4	:	Conduct themselves in a responsible, professional, and ethical manner.
PEO5	:	Emerge as a globally competent and universally employable professional who accelerates the overall development of India.

Mapping of Institute Mission to PEO

Institute Mission	PEO's
To provide quality education at affordable cost, build academic and research excellence maintain eco-friendly and robust infrastructure.	PEO1,PEO2
To create a team of well qualified faculty who can build global competency and employability among the youth of India.	PEO2,PEO5

Mapping of Department Mission to PEO

Department Mission	PEO's
To empower students and cultivate academic and research brilliance	PE01,PE02
Provide them to leverage Technology as a tool for innovation	PEO3
Fostering global competitiveness and employability in diverse field	PE04,PE05

Program Outcomes (PO):

During the completion of the program, the graduate will be able to:

PO1	:	Demonstrate knowledge competency in core discipline
PO2	:	Apply the appropriate knowledge and suitable skills in solving the complex problems
PO3	:	Conduct investigations of complex problems through various scientific approaches
PO4	:	Design solutions for complex and open ended real-life or real-time problems
PO5	:	Use appropriate and advanced tools for wide range of practices with an understanding on its associated limitations
PO6	:	Work effectively and responsibly as a member or a leader in a team
PO7	:	Express complex concepts within the profession and with society at large
PO8	:	Understand the professional roles and responsibilities
PO9	:	Analyze social and environmental aspects of the professional practices
PO10	:	Practice higher moral and ethical standards during the discharge of professional duties
PO11	:	Incorporate finer finance and business practices in all professional engagements
PO12	:	Identify and address their professional development through lifelong learning

Program Specific Outcomes(PSO):

PSO1	:	Ability to apply the acquired practical skills in the field of data science viz data analysts, data engineers, or data scientists.
PSO2	:	Become insightful of machine learning algorithms and techniques, and develop predictive models, classification systems, and recommendation engines for various domains such as finance, healthcare, and marketing.
PSO3	:	Understand the ethical implications of working with data and adhere to best practices for data privacy, security, and responsible data usage in accordance with legal and industry standards

Correlation between the PO/PSO and the PEOs

Program Outcomes		PEO1	PEO2	PEO3	PEO4	PEO5
PO1	:	L	M	M	M	L
PO2	:	M	S	L	S	S
PO3	:	L	S	S	M	M
PO4	:	S	S	L	S	S
PO5	:	M	L	S	S	S
PO6	:	S	S	M	M	S
PO7	:	S	L	S	S	M
PO8	:	M	M	L	M	S
PO9	:	S	S	S	L	M
PSO1	:	S	M	M	M	L
PSO2	:	M	S	M	S	M
PSO3	:	M	M	S	S	M

Components considered for Course Delivery is listed below:

1. Classroom Lecture
2. Laboratory class and demo
3. Assignments
4. Mini Project
5. Project
6. Online Course
7. External Participation
8. Seminar
9. Internship

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 6 of 92
Regulations 2024

Mapping of Pos with Course Delivery:

Program Outcomes	Course Delivery								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
PO1	L	M	S	S	L	M	S	S	M
PO2	M	S	M	M	S	M	L	S	S
PO3	S	S	S	S	S	M	S	M	M
PO4	M	L	S	M	S	M	M	L	M
PO5	S	M	M	L	M	S	S	M	M
PO6	M	S	L	S	M	S	M	S	S
PO7	L	M	S	S	L	S	M	M	S
PO8	S	S	M	S	S	S	S	S	S
PO9	S	S	S	M	S	S	L	S	S
PSO1	S	M	M	S	L	M	M	M	S
PSO2	S	S	M	M	S	L	S	S	M
PSO3	S	M	S	S	M	M	S	L	M

RATHINAM COLLEGE OF ARTS AND SCIENCE(AUTONOMOUS)

Scheme of curriculum for B.Sc. Data Science

for the students admitted in the batch during 2024-2025

Board of Studies-Computer Science (UG)

S.No.	Sem	Part	Sub Type	Course Code	Course Name	Credit	Hours	INT	EXT	Total
1	1	1	L1		Language - I	3	5	50	50	100
2	1	2	L2		English – I	3	5	50	50	100
3	1	3	Core		Programming in C	4	5	50	50	100
4	1	3	Core		C lab	4	4	50	50	100
5	1	3	Allied		Allied-I Mathematics for Computer Science	4	5	50	50	100
6	1	4	SEC		Skill Enhancement Courses – I Database Management System / Practical – Database Management System Lab	4	4	50	50	100
7	1	4	AEC		Ability Enhancement Course I Environmental Studies **or** Universal Human Values & Professional Ethics	2	2	50	0	50
						24	**30**	**350**	**300**	**650**
1	2	1	L1		Language - II	3	5	50	50	100
2	2	2	L2		English – II	3	5	50	50	100
3	2	3	Core		Problem Solving and Python Programming	4	5	50	50	100

4	2	3	Core		Problem Solving and Python Programming Lab	4	4	50	50	100
5	2	3	Electi ve		Elective - I Entreprenuers hip Development	4	4	50	50	100
6	2	3	Allied		Discreate Mathematics	4	5	50	50	100
7	2	4	AEC		Ability Enhancement Course II Design Thinking	2	2	50	0	50
8	2	5	Ext		Extension Activity - I (NASA)	1	0	25	0	25
						25	**30**	**375**	**300**	**675**

1	3	1	L1		Language – III	3	4	50	50	100
2	3	2	L2		English - III	3	4	50	50	100
3	3	3	Core		Data Engineering	4	6	50	50	100
4	3	3	Core		Data Engineering Lab	4	4	50	50	100
5	3	3	Allied		Quantitative Aptitude	4	5	50	50	100
6	3	4	SEC		Applied Data Structures	4	5	50	50	100
7	3	4	AEC		Ability Enhancement Course III Soft Skill-1	2	2	50	0	50
8	3	3	ITR		Internship / Industrial Training (Summer vacation at the end of II semester activity)	2	0	50	0	50
9	3	5	Ext		Extension Activity - II (NASA)	1	0	25	0	25
						27	**30**	**425**	**300**	**725**

1	4	1	L1		Language – IV	3	4	50	50	100
2	4	2	L2		English - IV	3	4	50	50	100
3	4	3	Core		Programming in R Language	4	6	50	50	100
4	4	3	Core		Programming in R Lab	4	4	50	50	100
5	4	3	Allied		Maths for data Science	4	5	50	50	100
8	4	3	Elective		Elective II - Data Mining	4	5	50	50	100
7	4	4	AEC		Ability Enhancement Course IV Soft Skill-2	2	2	50	0	50
8	4	5	Ext		Extension Activity - III (NASA)	1	0	25	0	25
						25	**30**	**375**	**300**	**675**
1	5	3	Core		Data Visualization	4	6	50	50	100
2	5	3	Core		Data Visualization Lab	4	6	50	50	100
3	5	3	Elective		Elective III - Image Analytic	4	6	50	50	100
	5	3	PRJ		Project	0	6	0	0	0
4	5	4	SEC		Machine Learning Techniques	4	6	50	50	100
5	5	3	ITR		Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	0	50	0	50
6	5	5	Ext		Extension Activity - IV (NASA)	1	0	25	0	25
						19	**30**	**275**	**200**	**475**
1	6	3	Core		Natural Language	4	6	50	50	100

					Processing					
2	6	3	Core		Natural Language Processing Lab	4	4	50	50	100
3	6	3	Elective		Elective IV - Deep Learning	4	6	50	50	100
4	6	3	PRJ		Core Project	8	8	100	100	200
5	6	4	SEC		Big Data Acquisition and Analysis	4	6	50	50	100
						24	30	300	300	600
					Total credit	144	180	2100	1700	3800

Additional Credits										
S.No.	Sem	Part	Sub Type	Course Code	Course Name	Credit	Hours	INT	EXT	Total
1	2	6	VAC		VAC - Microsoft CoE Course / NPTEL	2	2	50	0	50
3	4	6	IDC		VAC - Microsoft CoE Course / NPTEL	2	2	50	0	50
4	5	6	VAC		VAC - Microsoft CoE Course / NPTEL	2	2	50	0	50

Certificate on Minor Discipline										
S.No.	Sem	Part	Sub Type	Course Code	Course Name	Credit	Hours	INT	EXT	Total
1	2	6	MD		Course – I	5	2	0	100	100
2	3	6	MD		Course – II	5	2	0	100	100
3	4	6	MD		Course – III	5	2	0	100	100
4	5	6	MD		Course – IV	5	2	0	100	100

Core - Theory

S.No.	Sem	Pre-requesite	Course Code	Course Name	Offering Department	Type Theory / Practical
1	I			Programming in C	**IT**	**Theory**
2	II			Problem Solving and Python Programming	**CS- Industry Training**	**Theory**
3	III			Data Engineering	**IT**	**Theory**
4	IV			Programming in R Language	**IT**	**Theory**
5	V			Data Visualization	**IT**	**Theory**
6	VI			Natural Language Processing	**IT**	**Theory**

Core - Theory / Practical

S.No.	Sem	Pre-requesite	Course Code	Course Name	Offering Department	Type Theory / Practical
1	I			C lab	**IT**	**Theory / Practical**
2	II			Problem Solving and Python Programming Lab	**IT**	**Theory / Practical**
3	III			Data Engineering Lab	**IT**	**Theory / Practical**
4	IV			Programming in R Lab	**IT**	**Theory / Practical**
5	V			Data Visualization Lab	**IT**	**Theory / Practical**
6	VI			Natural Language Processing Lab	**IT**	**Theory / Practical**

Allied

S.No.	Sem	Pre-	Cour	Course	Offering	Type

o.	m	requesite	se Code	Name	Department	Theory / Practical
1	I			Basic Statistic		**Theory**
2	II			Discrete Mathematics		**Theory**
3	III			Quantitative Aptitude		**Theory**
4	IV			Maths for data Science		**Theory**

Skill Enhancement Course

S.No.	Sem	Pre-requesite	Course Code	Course Name	Offering Department	Type Practical / Training
1	I			Fundamentals of Data Science		
2	III			Applied Data Structures		
3	V			Machine Learning Techniques		
4	VI			Big Data Acquisition and Analysis		

Elective

S.No.	Sem	Pre-requesite	Course Code	Course Name	Offering Department	Type Practical / Training
1	IV			Elective II - Data Mining		
2	V			Elective III - Image Analytic		
3	VI			Elective IV - Deep Learning		

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 13 of 92
Regulations 2024

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
11T	Part I Tamil	3	6	1	0	Theory

Introduction:
பகுதி முதல் பாடமாக அமையும், தமிழ்ப்பாடம் கவிதைகள், இலக்கணம், இலக்கியவரலாறு ஆகியவைகள் கொண்டு அமைந்து உள்ளது. ஐந்து அலகுகளாக பகுக்கப்பட்டுள்ளது.

Course Outcome:

CO1	:	பாரதியார், பாரதிதாசன், சிற்பி, சுரதா ஆகிய கவிதைகளின் விளக்கத்தை மாணவர்கள் அறிந்து கொள்ளுவதால், தன்னம்பிக்கையை வெளிக்கொணரும் வகையில் உள்ளது.	
CO2	:	பெண் கவிஞர்களின் படைப்பு கவிதையை அறிவதன் மூலம் வாழ்வியல் செய்திகளையும், யதார்த்த நிலையும் அறிய உதவுகிறது.	
CO3	:	எண்ணங்களே ஏணிப்படிகள் -வாழ்வில் வெற்றி பெற வேண்டுமானால் எண்ணங்களை வளர்ந்துக் கொள்ள வேண்டும். சிந்தனையில் மூழ்கினர்ல் தெளிவு கிடைக்கும் என்ற கருத்துக்களை அறியும் வகையில் அமைந்துள்ளது.	
CO4	:	படைப்புத்திறனை வெளிப்படும் விதமாகவும், இலக்கணத்தை அறிய பயனுள்ளதாக அமைகிறது.	
CO5	:	இலக்கியவரலாறு பற்றியச் செய்திகளைக் கொண்டு அதன் வளர்ச்சி நிலையை அறிவும் வகையில் உள்ளது	

அலகு I :   [12 பாட வகுப்புகள்]

பாரதியார் - பெண் விடுதலை, பாரதிதாசன் - வீரத் தமிழன், சிற்பி – நிலவுப்பூ, சுரதா - நாடு ஆகியவற்றின் விளக்கம் தருதல்

அலகு II :   [12 பாட வகுப்புகள்]

தாமரை - தொலைந்துபோனேன், அ. வெண்ணிலா - நீரிலலையும் முகம் மாலதி மைத்ரி - கன்னியாகுமரி, க்ருஷாங்கினி - புன்னை மரம் ஆகிய பெண் கவிதைகளின் செய்திகளை அறிவதால் வாழ்வியல் சூழலையும், யாதர்த்த நிலையையும் விளக்குதல்.

அலகு III :   [12 பாட வகுப்புகள்]

எண்ணங்களே ஏணிப்படிகள் - தெளிவான இலக்கு - ஆற்றல் நதி பெருகட்டும் - அறிவை விரிவு படுத்துக்கள் - முன்னேற்றப் படிகள் - வெற்றிச் சிகரம்- எப்பொழுதும் வெற்றி ஆகியவைகள் வாழ்வின் முன்னேற்றதுக்கான செய்திகள் அறியப்பயன்படும்.

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 14 of 92
Regulations 2024

அலகு IV :	[12 பாட
வகுப்புகள்]	
பெயர் சொல், வினைச்சொல், இடைச்சொல், உரிச்சொல், எச்சம் - இலக்கணத்திற்கு விளக்கம் அளித்தல் - படைப்பிலக்கியப் பயிற்சி, கவிதை எழுதல் வானொலித் தமிழ், தொலைக்காட்சித் தமிழ், பயன்பாட்டுத்தமிழ், இலக்கண நோக்கில் பயிற்றுவித்தல் எழுதுதல் கவிதை + வானொலி பேச்சுத்திறன் வளர்த்தல். ஆகியவைகள் கொண்டு திறன் வளர்க்க உதவுதல்.	
அலகு V :	[12 பாட
வகுப்புகள்]	
இலக்கியவரலாறு பற்றியச் செய்திகள் மற்றும் புதுக்கவிதைகளின் தோற்றங்கள், வளர்ச்சிகள் அறிவும்	
வகையில் உள்ளது. ஹைக்கூ, குக்கூ, சென்ட்ரியூ, கஜல். ஆகியவற்றுக்கு விளக்கம் தருதல்.	
பாடநூல்கள்: 1. பாரதியார் கவிதைகள், 2. பாரதிதாசன் கவிதைகள், 3. சுரதா கவிதைகள், 4. சிற்பி கவிதைகள் 5. அ. வெண்ணிலா	
பார்வை நூல்கள் : 1 இலக்கியவரலாறு பாக்கியமேரி, 2. இலக்கண நூல், 3. மு.வ. தமிழ் இலக்கிய வரலாறு	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	General English					

Introduction: To encourage students to inculcate and use effective communication skills in their day-to-day lives. To develop the LSRW skills to enhance the culture and thoughts through language

Course Outcome:

CO1	:	Develop and integrate the use of the four language skills i.e. Reading, Listening, Speaking, and Writing
CO2	:	Understand the total content and underlying meaning in the context
CO3	:	Form the habit of reading for pleasure and for information
CO4	:	Comprehend material other than the prescribed text
CO5	:	Develop the linguistic competence that enables them, in the future, to present the culture and civilization of their nation.

12 Hours

Unit I:

1.1 A Patch of Land -Subramania Bharathi. - 1.2 JRD-Harish Bhat - 1.3 The Faltering Pendulum- Bhabani Bhattacharya - 1.4 Listening for General and Specific Information - 1.5 Vocabulary: Synonyms, Antonyms, Word Formation

12 Hours

Unit II:

2.1 The Sparrow-Paul Lawrence Dunbar - 2.2 Us and Them-David Sedaris (From Dress your Family in Corduroy and Denium} - 2.3 How I taught my grandmother to read-Sudha Murthy - 2.4 Appropriate use of /articles and Parts of Speech - 2.5 Listening to Giving Instructions/Directions

12 Hours

Unit III:

3.1 A Nation's Strength- Ralph Waldo Emerson - 3.2 Uncle Podger Hangs a Picture-Jerome K.Jerome

3.3 Self-Introduction, Greeting, Introducing Others. - 3.4 Error Detection

12 Hours

Unit IV:

4.1 Love Cycle - 4.2 The Gold Frame-R.K Laxman - 4.3 Communication and its types - 4.4 Close Reading - 4.5 Paragraph Writing

12 Hours

Unit V:

5.1 Translation -   5.2 Conversation -   5.3 Free Writing -   5.4 Sentence Types

Text books:

1. Steel Hawk and other stories by Bhattacharya, Bhabani, New Delhi Sahitya Akademi 1967
2. How I Taught my Grandmother to Read and Other Stories, Murthy, Sudha, Penguin Books, India, 2004

Reference Books :

1. English in use - A textbook for College Students (English, Paperback, - T.Vijay Kumar, K Durga Bhavani, YL Srinivas
2. Practical English Usage - 4th Edition By Michael Swan
3. The Art of Civilized Conversation: A Guide to Expressing Yourself with Style and Grace –Margaret Shepherd, Penny Carter, (Illustrator), Sharon Hogan, 2005.

CORE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core - I – Problem Solving Using C	**4**	**6**	-	-	**Core Theory**

Introduction:

This subject covers the C Programming Course. Throughout this course, students will learn the fundamental and advanced concepts of C programming, enabling them to write efficient and reliable programs for various applications.

Course Outcome:

CO1	:	Understand basic C programming concepts and create simple programs confidently.
CO2	:	Use decision-making and looping tools to solve different problems in programming.
CO3	:	Use advanced methods to make decisions and organize data effectively in programs.
CO4	:	Manage input/output operations and files smoothly in programs.
CO5	:	Organize code effectively using functions and pointers to make programs run better.

Unit I : Introduction to C Programming and Basic Constructs
[12 periods]
Getting Started with C - The C Character Set - Constants, Variables, and Keywords - Form of a C Program - Compilation and Execution - The First C Program - C Instructions - Types of Instructions - Type Declaration Instruction - Arithmetic Instruction - Control Instructions - Types of Operators.

Unit II: Decision Making and Looping Constructs
[12 periods]
Decision Control Instruction: - The if Statement - The if-else Statement - Nested if-else - Use of Logical Operators - The Conditional Operators - **Loop Control Instruction**:- Loops and the while Loop - The for Loop - The do-while Loop - Break and Continue Statements

Unit III: Advanced Decision Making and Data Structures
[12 periods]
Case Control Instruction - Decisions using switch - Comparison of switch and if-else Ladder - The goto Keyword - Data Types Revisited - The C Pre-processor - Arrays and Multidimensional Arrays - Strings and String Functions - Structures and Array of Structures- Console I/O Functions

Unit IV: Functions, Modular Programming, and Pointers
[12 periods]
Functions - Introduction to Functions - Passing Values between Functions - Scope Rule of Functions - Using Library Functions - Return Type of Function – Pointers - Call by Value and Call by Reference - Introduction to Pointers - Pointer Notation - Pointers and Arrays - Pointers to Functions - Recursion

Unit V: Input / Output Operations and Structures in C
[12 periods]
Data Organization - File Operations: Opening a File - Reading from a File - Closing the File -
Counting Characters – A File-Copy Program - Writing to a File - File Opening Modes - Text Files
and Binary Files - Issues in Input / Output - Operations on Bits

Text books:
1. Yashavant Kanetkar , "Let us C" , Fourteenth Edition, BPB Publication, 2017.
2. E.Balagurusamy, "Programming in ANSI C", Seventh Edition McGraw Hill, 2017

Reference Books :
1. Byron S Gottfried, "Programming with C", Fourth Edition, McGraw-Hill, 2018
2. Herbert Schildt, "C: The Complete Reference", Fourth Edition, McGraw-Hill, 2021

Course Outcomes	Program Outcomes											
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**P10**	**P11**	**P12**
CO1	1	3	1	1	3	1	3	1	1	1	1	3
CO2	1	3	2	1	1	3	3	1	1	1	1	1
CO3	1	3	3	3	1	2	1	3	3	1	3	1
CO4	1	2	3	3	1	1	1	3	2	3	2	1
CO5	1	2	3	3	1	3	1	3	2	3	1	1

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical - I – Programming In C Lab	**4**	**-**	**-**	**6**	**Core Practical**

Introduction:

This subject, C Programming Lab, will equip you with the foundational knowledge to excel in programming with C. Students will learn to effectively utilize basic constructs, implement arrays, manipulate strings, work with pointers, and understand structures and file processing techniques.

Course Outcome:

CO1	:	Understand and apply C programming constructs effectively.	
CO2	:	Develop programs in C using basic constructs proficiently.	
CO3	:	Implement arrays in C programs for various applications.	
CO4	:	Utilize strings, pointers, and functions proficiently in C applications.	
CO5	:	Implement structures and file processing techniques effectively in C applications.	

1. Create a program that calculates the area of a circle given its radius.
2. Implement a program that determines whether a given year is a leap year or not.
3. Display whether the entered number is an Armstrong number or not
4. Create a program that compares three numbers and prints the largest one.
5. Write a program to print the Fibonacci series up to a certain number of terms using a while loop.
6. Write a program that takes an integer input n and prints a triangle pattern with n rows, where each row contains one more asterisk(*) than the previous row.
7. Write a program to find the sum of elements in a one-dimensional array.
8. Implement a program to count the number of vowels in a given string.
9. Create a program to reverse a given string.
10. Write a function that receives marks received by a student in 3 subjects and returns the average and percentage of these marks. Call this function from main( ) and print the results in main( ).
11. Write a program to swap two numbers using pointers.
12. Write a program to calculate the factorial of a number using a recursive function.
13. Write a program to store and display information about students using structures.
14. Write a program to read data from a file and display it on the screen.
15. Write a program to copy contents of one file to another. While doing so replace all lowercase characters to their equivalent uppercase characters.

Text books:

1. Yashavant Kanetkar , "Let us C" , Fourteenth Edition, BPB Publication, 2017.
2. E.Balagurusamy, "Programming in ANSI C", Seventh Edition McGraw Hill, 2017

Reference Books :

1. Herbert Schildt, "C: The Complete Reference", Fourth Edition, McGraw-Hill, 2021
2. Byron S Gottfried, "Programming with C", Fourth Edition, McGraw-Hill, 2018

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 20 of 92
Regulations 2024

Course Outcomes	Program Outcomes											
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**P10**	**P11**	**P12**
CO1	1	3	1	1	1	2	1	1	1	1	1	1
CO2	1	3	1	1	1	3	1	1	1	1	1	1
CO3	1	1	2	3	3	1	1	1	1	1	2	1
CO4	1	1	1	3	3	1	1	3	1	1	2	1
CO5	1	1	1	3	3	1	1	3	1	1	1	1

ALLIED COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Allied- MATHEMATICS FOR COMPUTER SCIENCE	**4**	**4**	-	-	**Core Theory**

Introduction:

This paper focuses on the Mathematical logic, Relations& Functions, Formal languages and Graph Theories To understand the basic concepts of set theory. To understand the various statements in light of mathematical logic. To study various relations and functions. To understand graph theory in the course's context. To understand the deeper concepts of graph theory.

Course Outcome:

CO1	:	To demonstrate a working knowledge of set notation and elementary set theory with its corresponding set operations and also Venn diagram.	
CO2	:	To apply the fundamental concepts of Mathematical Logic and Tautologies.	
CO3	:	To apply and understand the fundamental concepts of Relations and Functions.	
CO4	:	To demonstrate different traversal methods for graphs.	
CO5	:	To demonstrate different methods for trees and its properties.	

Unit I :
[12 periods]
Set theory – Introduction-Basic definition – Types of sets – Operations on sets –Euler-Venn diagrams – Laws of set theory – Power sets and products – Inclusion and exclusion principle.

Unit II:
[12 periods]
Mathematical logic – Introduction to propositional logic – Basic logical operations-Tautologies – Contradiction – Predicates and Quantification

Unit III:
[12 periods]
Relations – Binary Relations – Set operation on relations – Types of Relations – Partial order relation – Equivalence relation – Composition of relations – Functions – Types of functions – Invertible functions – Composition of functions

Unit IV:
[12 periods]
Graph theory – Basic terminology – Paths, cycle and connectivity – sub graphs – Types of graphs – Representation of graphs in computer memory

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 22 of 92
Regulations 2024

Unit V:
[12 periods]
Trees – Properties of Trees – Binary trees – Traversing Binary Trees – Computer Representation of general trees.

Text books:

1. Discrete Mathematics for Computer Science by Gary Haggard, JohnSchlipf and Sue Whitesides
2. Discrete Mathematics by J.K. Sharma second edition – 2005. Macmillan India Ltd.

Reference Books :

1) Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2) William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

Course Outcomes	Program Outcomes											
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**P10**	**P11**	**P12**
CO1	1	3	1	1	1	2	1	1	1	1	1	1
CO2	1	3	1	1	1	3	1	1	1	1	1	1
CO3	1	1	2	3	3	1	1	1	1	1	2	1
CO4	1	1	1	3	3	1	1	3	1	1	2	1
CO5	1	1	1	3	3	1	1	3	1	1	1	1

SKILL ENHANCEMENT COURSE

Course Code	Course Title	Credit	Lecture	Tutorial	Practical	Type
	Database Management System	4	5	-	-	Core Theory

Course Introduction

This course enables the student skills and knowledge to tackle complex database challenges, optimize database performance, and design efficient database solutions using advanced DBMS and SQL techniques.

Course Outcomes	On completion of this course, students will

CO 1:	To provide a basic introduction about DBMS. To Understand the DBMS.
CO 2:	To Provide an overview of ER Diagrams and the Relational model. To Understand key constraints in DBMS.
CO 3:	Understand the various Normalization and implementations.
CO 4:	Explain DB applications, embedded SQL and overview of storage and indexing.
CO 5:	Understand the concept of ACID properties and Physical Database and Tuning.

Unit I:	Overview of Database Systems	[12 Periods]

Introduction - Overview of Database Management - What is Database System - History of DBMS - Managing Structured Data - File Systems vs. DBMS - Basics of DBMS – DBMS Architecture -Overview of Relational Model - Database languages – Queries - Transaction Management - Structure & Design of a DBMS - Object Relational and semi-structured DB - Users & Administrators- Client/Server Architecture - Case Study.

Unit II:	Database Design Models	[12 Periods]

The Relational Model - Relational Calculus - Introduction to Database Design - ER Diagrams – Entities, Attributes and Relationships. Design with ER Model - Conceptual Design for Large Enterprises - UML - Case Study.

Relational Model: The Relational Model Integrity Constraints - Key Constraints – Primary Key Constraints - Foreign Key Constraints - General Constraints - Relational Algebra- Selection and Projection- Set Operation - Relational Calculus - Tuple Relational Calculus- Domain Relational Calculus - Case Study.

Unit III:	Schema Refinement and Normal Forms	[12 Periods]

DB Design - Normal forms and Atomic Domain- Functional Dependencies and Decomposition - Database Design Process
SQL: SQL queries – Union – Intersect - and Except - Nested Queries – Aggregate Queries- Null values- Joins – Views - Stored Procedures - User defined Functions – Triggers – Transactions - Case Study

Unit IV:	DB Application Development	[12 Periods]

DB Access from applications – embedded SQL, Cursors, and Dynamic SQL.
Introduction to JDBC & SQL/J - Stored Procedures.
Overview of Storage and Indexing: Data on external storage - File Organizations and Indexing - Index Data Structures - Comparison of File Organizations - Indexes and Performance Tuning.

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 25 of 92
Regulations 2024

Overview of Query Evaluation: System Catalog - Operator Evaluation - Algorithms for relational operations. Introduction to Query Optimization – Alternative Plans - Case Study.

Unit V:	Transaction Management	[12 Periods]

Introduction to Transaction - ACID Properties Serializability- Transactions and Schedules - Concurrent Execution of Transactions - Lock-based concurrency control - Transaction support in SQL commit - rollback – save point - Introduction to Crash Recovery.

Physical Database Design and Tuning: Introduction to Physical Database design - Index Selection - Clustering. Overview of Database Tuning - Choices in tuning queries and Views - Case Study

Text Books:

1. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke 3rd Edition, McGraw Hill 2003.
2. Database System Concepts, AbrahamSilberschatz, Henry F.Korth and S.Sudarshan, 5th Edition, McGraw Hill 2006.

Reference Books:

1. Fundamentals of Database Systems, Elmasri and Navathe, 5thEdition, Addison- Wesley, 2007.
2. An Introduction to Database Systems, C.J. Date, A. Kannan, S. Swamynatham, 8th Edition, Pearson education, 2006.

Web Resources:

1. https://www.javatpoint.com/dbms-tutorial
2. https://www.appdynamics.com/topics/database-management-systems

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11		PO12
CO1	2	3	3	2	2	1	1	1	2	1	1		1
CO2	3	3	3	1	1	3	2	1	2	1	1		1
CO3	3	3	3	1	2	2	1	3	2	1	3		1
CO4	2	1	3	2	1	3	2	3	1	2	2		2
CO5	3	1	3	1	2	2	2	3	2	2	2		1

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Database Management System Lab	**4**	**0**	**0**	**5**	**Practical**

List of Practical Programs:

1. Practical Based on Data Manipulation.
   • Adding data with Insert, • Modify data with Update, • Deleting records with Delete
2. Practical Based on Implementing the Constraints.
    • NULL and NOT NULL, • Primary Key and Foreign Key Constraint • Unique, Check and Default Constraint
3. Practical for Retrieving Data Using following clauses.
   • Simple select clause, • Accessing specific data with Where, Ordered By, Distinct and Group By
4. Practical Based on Aggregate Functions.
   • AVG, • COUNT, • MAX, • MIN, • SUM, • CUBE
5. Practical Based on implementing all String functions.
6. Practical Based on implementing Date and Time Functions.
7. Practical Based on implementing use of union, intersection, set difference.
8. Implement Nested Queries & JOIN operation.

9. Practical Based on performing different operations on a view.
10. Practical Based on implementing use of triggers, cursors & procedures.

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	2	2	3	1	2	3	2	1	2	1	1	1
CO3	3	3	2	1	1	2	1	3	2	1	2	1
CO4	1	1	3	3	1	2	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

ABILITY ENHANCEMENT COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Environmental Studies	2	2	**0**	**0**	**AEC**

Introduction:

To understand These fundamentals form the basis for more advanced data science applications, such as deep learning, natural language processing, and predictive analytic s, among others. Mastering these foundational concepts is crucial for becoming proficient in data science.

Course Outcome:

CO1	:	Students will grasp the fundamental concepts of data types, structures, and formats used in data science, including structured and unstructured data.Students will understand how to evaluate the performance of machine learning models using appropriate metrics and techniques and select the best model for a given problem.
CO2	:	Students will be able to clean and preprocess raw data, including handling missing values, outliers, and inconsistencies to prepare data for analysis.
CO3	:	Students will gain proficiency in exploring data using statistical methods and visualization techniques to uncover patterns, trends, and relationships within datasets.
CO4	:	Students will learn techniques to transform raw data into meaningful features that enhance the performance of machine learning models.
CO5	:	Students will understand how to evaluate the performance of machine learning models using appropriate metrics and techniques and select the best model for a given problem.

Unit I

A Multidisciplinary Subject – Natural Resources – Forest Resources – Water Resources – Mineral   Resources – Food Resources – Energy Resources – Land Resources.

Unit II

Ecosystem – Concepts of Ecosystem – Characteristics – Food Chains – Food Web – Ecological Pyramids –Energy Flow in an Ecosystem – Nutrient Cycling – Primary Production – Ecosystem Regulation – Ecological Succession – Major Ecosystem Types.

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 29 of 92
Regulations 2024

Unit III

Biodiversity and its Conservation – Diversity – Biogeographically Classification of India – Value of Biodiversity – Global Biodiversity – Biodiversity: National, Regional or Local – Hot Spots of Bio Diversity –Threats to Biodiversity – Loss of Habitat – Poaching – Man-wildlife Conflicts – Endangered Species of India– Endemic Species of India – Conservation of Biodiversity.

Unit IV

Environmental Pollution – Air pollution – Noise Pollution – Water Pollution – Thermal Pollution – MarinePollution – Soil Pollution – Nuclear Hazards – Solid Waste Management – Role of an Individual inPrevention of Pollution – disaster Management.

Unit V

Social Issues and the Environment – From unsustainable to sustainable development – Urban problemsrelated to energy – Water Conservation – Rainwater Harvesting – Watershed Management –Resettlement and Rehabilitation Issues – Environmental Ethics – Climate change – Global Warming – Acid Rain – Ozone Layer Depletion – Environmental Legislation.

Textbook:

1. Perspectives in Environmental Studies – Aubha Kaushik, C. P. Kaushik, New Age International

Publishers, Second Edition, 2004.

References:

"1. Basics of Environmental Science – Michael Allaby, Routledge – London, 2nd Edition, 1996.

2. Principles of Environmental Science and Technology – K. Saravanan, S. Ramachandran and R. Baskar,

New Age International Publishers, 2005.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**
CO1	L	H	H	L	L	L	L	L
CO2	M	H	L	L	L	L	M	L
CO3	L	L	L	L	L	L	L	H
CO4	M	H	M	L	L	L	L	L
CO5	L	H	H	H	L	H	L	M

VALUE ADDED COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Value Added Course - Foundations of Full Stack Web Development	**2**	**3**	**-**	**0**	**Theory & Practical**

Introduction: To become knowledgeable about the most recent web development technologies. Idea for creating two tier and three tier architectural web applications. Design

and Analyse real time web applications. Constructing suitable client and server side applications. To learn core concept of both front end and back end programming.

Course Outcome:

CO1	:	Develop a fully functioning website and deploy on a web server.
CO2	:	Gain Knowledge about the front end and back end Tools.
CO3	:	Find and use code packages based on their documentation to produce working results ina project.
CO4	:	Create web pages that function using external data.
CO5	:	Implementation of web application employing efficient database access.

Unit I: **[5 hours]**

Web Development Basics: Web development Basics - HTML & Web servers Shell - UNIX CLI Version control - Git &Github HTML, CSS.

Unit II :   **[5 hours]**

Frontend Development: Javascript basics OOPS Aspects of JavaScript Memory usage and Functions in JS AJAX for data exchange with server jQuery Framework jQuery events, UI components etc. JSON data format

Unit III: **[5 hours]**

REACT JS: Introduction to React React Router and Single Page Applications React Forms, Flow Architecture and Introduction to Redux More Redux and Client-Server Communication

Unit IV: **[5 hours]**

Java Web Development: JAVA PROGRAMMING BASICS, Model View Controller (MVC) Pattern MVC Architecture using Spring RESTful API using Spring Framework Building an application usingMaven

Unit V: **[5 hours]**

Databases & Deployment: Relational schemas and normalization Structured Query Language (SQL) Data persistence using Spring JDBC Agile development principles and deploying application in Cloud.

Text Book:
1. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett ProfessionalJavaScript for Web Developers Book by Nicholas C. Zakas
2. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-byStep Guide to CreatingDynamic Websites by Robin Nixon
3. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB. Copyright © 2015 BYAZAT MARDAN

Reference Books:
1. Full-Stack JavaScript Development by Eric Bush
2. Mastering Full Stack React Web Development Paperback – April 28, 2017 by TomaszDyl , Kamil Przeorski , Maciej Czarnecki

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
21T	Part I Tamil	**3**	**6**	**1**	**0**	**Theory**

Introduction:
இரண்டாம் பருவப் பாடத்திட்டம் அற இலக்கியம், சிற்றிலக்கியம், சிறுகதைகள், இலக்கணம், இலக்கிய வரலாறு ஆகியவைகள் கொண்டு உருவாகியுள்ளது.

Course Outcome:

CO1	:	ஆறஇலக்கியத்தில் -நீதிநெறி கருத்துக்களை அறிந்து கொள்ளுவதால், வாழ்க்கையில் பண்புகளை பின்பற்றவும், அறறிவோடு வாழவும் கருத்துக்கள் உள்ளடங்கி இருப்பதால் பயனுள்ளதாக அமையும்.
CO2	:	சிற்றிலக்கியத்தின் செய்திகளான அறம், விருந்தோம்பல் போன்றவற்றை மாணவர்கள் தெளிவாக அறிந்துகொள்ளுவது, அன்பின் மேன்மை, பண்பு ஆகியவைகளும் அறிந்து கொள்ள முடிகிறது.
CO3	:	அணி இலக்கணம் அறிவதால் இலக்கணத்தின் சிறப்பையும் முக்கியக்கியத்துவத்தையும் அறியலாம்.
CO4	:	சிறுகதைகளில் உள்ள கதைகளில் உள்ள மையக்கருத்துகளைத் தெரிந்து கொள்ளுவது சமுதாயச் சிந்தனையையும், விழிப்புணர்வும் உருவாக்க உதவுகிறது.
CO5	:	தன்னம்பிக்கை கட்டுரை- தன்னம்பிக்கையே வெற்றி – சிந்தனைகளை தூண்டி செயலாக்கும் நுட்பங்களை அறிந்தல், தானாக வளர்வதற்கான வழிகாட்டி, வெற்றிக்கு வழிகாட்டுவதாக அமைகிறது.

அலகு I :
[12 பாட வகுப்புகள்]

அற இலக்கியம் : திருக்குறள், அன்புடைமை, அறிவுடைமை, நாலடியார், பழமொழி நாநூறு-ஆகியவைகள் நீதியின் கருத்துக்களைக் கொண்டு பாடமாக உள்ளது.

அலகு II :
[12 பாட வகுப்புகள்]

சிற்றிலக்கியம்: நந்திக்கலம்பகம், சிற்றிலக்கிய உறுப்புகள்- குற்றலாக் குறவஞ்சி – மலைவளம், கலிங்கத்துப்பரணி, காடு பாடியது, அழகர் கிள்ளை விடு தூது, கலிங்கத்துப்பரணி– கோயில் பாடியது, கிள்ளை வயடட தூது ஆகிய சிற்றிலக்கியங்களின் கருத்துக்களைத் தெளிவாக எடுத்துரைத்தல்.

அலகு III:
[12 பாட வகுப்புகள்]

ஆணி இலக்ணம் - சிலேடை அணி, பரியாய அணி, விபாவனை அணி, அதிசய அணி, இலக்கணம் - விளக்கத்துடன் கற்பிக்கப்படும்.

அலகு IV:
[12 பாட வகுப்புகள்]

சிறுகதைகள் : தேர்ந்தெடுக்கப்பட்ட 4-சிறுகதைகள் - மாணவர்களின் தனித்திறனை வளர்க்கும் பொருட்டு எடுக்கப்படும். சமுதாய செய்திகள்

மற்றும் சமுதாய நோக்குப் பற்றி விளக்கம் தருதல்.

| அலகு V : |
| [12 பாட வகுப்புகள்] |
| |
| தன்னம்பிக்கை கட்டுரைகள் - தன்னம்பிக்கையே – முன்னேற்றச் சிந்தனைகள்திட்டமிடுதல்- தன்னம்பிக்கை தரும் வெற்றிகள்- வளமூட்டும் வார்த்தைகள்- திறமை தீபம் - ஏற்றுகள்- செயலினில் புதுமை செய்வோம் மாணவர்களுக்கு தன்னம்பிக்கை வளர்க்க உதவும். |

பாடநூல்கள்:

1.பதினென்கீழ்க்கணக்கு நூல்கள், 2.நந்திக்கலம்பகம்,
3.குற்றலாக்குறவஞ்சி, 4. கலிங்கத்துப்பரணி

பார்வை நூல்கள் :

1. ஜெயகாந்தன் சிறுகதை, 2. புதுமைப்பித்தன் சிறுகதை, 3. சூடாமணி – சிறுகதை, 4. எஸ். ராமகிருஷ்ணன்- சிறுகதை , 5. மு.வ. -தமிழ் இலக்கிய வரலாறு , 6. டாக்டர் கே.கே பிள்ளை – தமிழக வரலாறு மக்களும் பண்பாடும், 7. பேரா.முனைவர் பாக்யமேரி - இலக்கணம் இலக்கிய வரலாறு மொழித்திறன்.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
22E	**General English**					

Introduction: To encourage students to inculcate and use effective communication skills in their day-to-day life. To develop the LSRW skills to enhance the culture and thoughts through language

Course Outcome:

CO1	:	Learn to introduce themselves and talk about everyday activities confidently
CO2	:	Be able to write short paragraphs on people, places, and events
CO3	:	Identify the purpose of using various tenses and effectively employ them in speaking and writing
CO4	:	Gain knowledge to write subjective and objective descriptions
CO5	:	Identify and use their skills effectively in formal contexts.

12 Hours

Unit I:

1.1   Very Indian Poem in Indian English -Nissim Ezekiel - 1.2   If you Are Wrong Admit it-Dale Carnegie - 1.3 Reading for General and Specific Information   (Charts, tables schedules, graphs, etc.) - 1.4 Homonyms, Homophones, Homographs

12 Hours

Unit II:
2.1 Still I Rise- Maya Angelou - 2.2   Kindly Adjust Please- Shashi Tharoor - 2.3   Verbs and Tenses

2.4   Subject Verb Agreement

12 Hours

Unit III:

3.1 Alchemist-Paulo Coelho

12 Hours

Unit IV:

4.1 The Flower- Tennyson - 4.2 The Spoon-Fed Age. W.R. Inge - 4.3 Paragraph Writing - 4.4 Error detection

12 Hours

Unit V:
5.1 On Killing a Tree- Gieve Patel - 5.2 Taking and Note Making - 5.3 Reading news and weather reports

5.4 Precis Writing.

Text books:
1. The Alchemist - Paulo Coelho Harper - 2005

Reference Books :
1   Advanced English Grammar. Martin Hewings. Cambridge University Press, 2000

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 36 of 92
Regulations 2024

2. Descriptive English. SP Bakshi, Richa Sharma • 2019, Arihant Publications (India) Ltd.
3. The Reading Book: A Complete Guide to Teaching Reading. Sheena Cameron, Louise Dempsey, S & L. Publishing, 2019.
4. Skimming and Scanning Techniques, Barbara Sherman, Liberty University Press, 2014
5 Brilliant Speed Reading: Whatever you need to read, however ...Phil Chambers

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Python Programming	**4**	**5**	**-**	**0**	**Theory**

Introduction: After learning the Syntax and Semantics and create Functions, Handle Strings and Files, Understand Lists, Dictionaries and Regular expressions, Implement Object Oriented Programming concepts, Build Web Services and introduction to Network and Database Programming students are able to develop rich dynamic websites in Python.

Course Outcome:

CO1	:	Examine Python syntax and semantics and be fluent in the use of Python flow control and functions
CO2	:	Demonstrate proficiency in handling Strings and File Systems
CO3	:	Understand Lists, Dictionaries and Regular expressions in Python
CO4	:	Interpret the concepts of Object-Oriented Programming as used in Python
CO5	:	Implement exemplary applications related to Network Programming, Web Services and Databases in Python

Unit I: **[12 periods]**

Installing Python, Simple program using Python, Expressions and Values, Variables and Computer Memory, error detection, Multiple line statements, Designing and using functions, functions provided by Python, Tracing function calls in memory model, omitting return statement. Working with Text: Creating Strings of Characters, Using Special Characters in Strings, Creating a Multiline String, Printing Information, Getting Information from the Keyboard.

Unit II :   **[12 periods]**

A Boolean Type , Choosing Statements to Execute, Nested If Statements , Remembering the Results of a Boolean Expression Evaluation , A Modular Approach to Program Organization, Importing Modules , Defining Your Own Modules, Testing Code Semi automatically Grouping Functions Using Methods: Modules, Classes, and Methods , Calling Methods the Object-Oriented Way, Exploring String Methods, Underscores.

Unit III: **[12 periods]**

Storing Collections of Data Using Lists: Storing and Accessing Data in Lists, modifying Lists, Operations on Lists, Slicing Lists, Aliasing, List Methods, Working with a List of Lists. Repeating Code Using Loops: Processing Items in a List, Processing Characters in Strings, Looping Over a Range of Numbers, Processing Lists Using Indices, Nesting Loops in Loops, Looping Until a Condition Is Reached, Repetition Based on User Input, Controlling Loops Using Break and Continue Reading and Writing.

Unit IV: **[12 periods]**

Files: Kinds of files, opening a File, Techniques for Reading Files, Files over the Internet, Writing Files, and Writing Algorithms That Use the File-Reading Techniques, Multiline Records. Storing Data Using Other Collection Types: Storing Data Using Sets, Storing Data Using Tuples, Storing Data Using Dictionaries, inverting a Dictionary, Using the In Operator on Tuples, Sets, and Dictionaries, Comparing Collections.

Unit V: **[12 periods]**

Collection of New Information Object-Oriented Programming : Understanding a Problem Domain , Function "Isinstance," Class Object, and Class Book , Writing a Method in Class Book, Plugging into Python Syntax: More Special Methods, Creating Graphical User interface: Building a Basic GUI, Models, Views, and Controllers, Customizing the Visual Style Introducing few more Widgets, Object-Oriented GUIs, Keeping the Concepts from Being a GUI Mess.

Reference Books:
1. L. Halterman, "Fundamentals of Python Programming", Southern Adventist University July 26, 2018, Copyright © 2017 Richard L. Halterman Richard.
2. John V Guttag, ―Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
5. Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
   Charles Dierbach, Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition, 2013

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	1	3		3		2				3	3		3
CO2		2	3		1		3	2	3				
CO3	2	1	2			1				2	1	3	2
CO4	3			1	3	3			1	3		1	3
CO5		3			2		2	3					

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Python Programming Lab	4	0	-	5	Lab

Introduction: Understand the basic operations and creations of various applications using python.
Course Outcome:

CO1 :	Write, test, and debug simple Python programs.
CO2 :	Implement Python programs with conditionals and loops for stack, sorting algorithms.
CO3 :	Read and write data from/to files in Python.
CO4 :	Use Python lists, dictionaries for representing compound data.
CO5 :	Write Script to SQL and Demonstrate Exception in Python.

Lab Experiments:
1. Create a calculator program using Python.
2. Create Python program using different String functions.
3. Implement Selection sort algorithm using Python Program.
4. Implement stack Operation using Python Program.
5. Read and Write into a file using Python Program.
6. Demonstrate use of Dictionaries in Python Program.
7. Create Comma Separate Files (CSV), Load CSV files into internal Data Structure.
8. Write script to work like a SQL SELECT statement for internal Data Structure made in earlier exercise.
9. Write script to work like a SQL Inner Join for an internal Data Structure made in earlier exercise.
10. Demonstrate Exceptions in Python.

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3				3		3		3		3		3
CO2	2	3		2	3	2		3				3	
CO3	3	2	3			3	2		2	1	3		1
CO4			2	3	3					1		2	2
CO5	1	3		1		2	2		3		1		

ELECTIVE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective I - Entrepreneurial Development	**4**	**6**	**-**	**-**	**Core Theory**

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 40 of 92
Regulations 2024

Introduction:
To build the necessary competencies and creativity and prepare them to undertake entrepreneurship as a desirable and feasible career option.

Course Outcome:

CO1	:	To know about the role of the entrepreneur in India and around and the globe, understand the benefits and drawbacks of entrepreneurship and students has to avoid them; entrepreneurial failure.
CO2	:	CO2 : The course aims to develop student's ability to create, lead and coordinate projects within the textile and fashion sector. It also intends to provide tools and methods in order to make use of entrepreneurial thinking to develop a business project.
CO3	:	CO3 : Students will be able to define, identify and/or apply the principles of new venture financing, growth financing, and growth financing for existing businesses.
CO4	:	CO4 : To understand process of women entrepreneur and how faced their problems
CO5	:	CO5 : To understand difference between Micro, small and medium Enterprise

Unit I : **[12periods]**

Entrepreneur – importance- qualities, nature types – difference between entrepreneur and entrepreneurship and economic development – its importance – role of entrepreneurship – entrepreneurial environment.

Unit II: **[12periods]**

Project management: sources of business idea – project classifications – identifications – formulation and design – feasibility analysis – preparation of project report and presentation. Financial analysis – concept and scope project cost estimate – operating revenue estimate – ratio analysis – investment.

Unit III: **[12periods]**

Project finance: sources of finance – institutional finance – role of IFC, IDBI, ICICI, LIC, SFC, SIPCOT, commercial bank – appraisal of bank for loans. Institutional aids for entrepreneurship development

Unit IV: **[12 periods]**

The innovation process – the diagnosis – the consultation of group – selecting a strategy
preparing the organization setting up the investment. Women entrepreneur – problems face by women entrepreneur – economic impact of women entrepreneur

Unit V: **[12 periods]**
Setting small scale industries – step in setting SSI unit – problems of entrepreneur – sickness in small industries – reason and remedies – Incentives and subsidies role of DICS, SIDCO, NSICS, IRCI, NIDC, SIDBI, SISI, SIPCOT.

Text books:
.
. Robert D. Hisrich, Mathew J Manimala, Michael P Peters, Dean A Shepherd,
.
   "Entrepreneurship", McGraw Hill Education, 2014

Reference Books :

.
Bhushan Y.K, "Entrepreneurial Development" Sultan Chand & Sons, Nineteenth Edition -2013.
.

.
L.M. Prasad, "Entrepreneurial Development", 5th Edition, Himalaya publication, Mumbai – 2006.
.

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3	3	1	3	1	1	1	3	3	3	1	3
CO2	3	2	3	1	3	1	2	1	3	3	2	2	2
CO3	3	3	3	1	3	1	2	1	3	3	3	1	3
CO4	3	2	3	1	3	1	2	1	3	3	2	3	2
CO5	3	3	3	1	3	1	2	1	3	3	3	2	3

ALLIED COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	DISCRETE MATHEMATICS			**0**	**0**	**skill**

Introduction:
To understand the various concepts of discrete mathematics

Course Outcome:

CO1	:	To understand the fundamental concepts of discrete mathematics.	
CO2	:	To understand the fundamental concepts of discrete mathematicTo develop the ability to solve problems in combinatorics, propositional and predicate logic, relations and recurrence relations.	
CO3	:	To develop the ability to solve problems in combinatorics, propositional and predicate logic, relations and recurrence relations.	
CO4	:	To understand the fundamental concepts of discrete mathematics.	
CO5	:	To understand the fundamental concepts of discrete mathematicTo develop the ability to solve problems in combinatorics, propositional and predicate logic, relations and recurrence relations.	

UNIT-I: **Propositional Logic**: Definition, Statements & Notation, Truth Values, Connectives, Statement Formulas & Truth Tables, Well- formed Formulas, Tautologies, Equivalence of Formulas, Duality Law,Tautological Implications, Examples

UNIT-II: Predicate Logic: Definition of Predicates; Statement functions, Variables, Quantifiers, Predicate Formulas, Free & Bound Variables; The Universe of Discourse, Examples, Valid Formulas & Equivalences, Examples.

UNIT-III: Lattices & Boolean Algebra: Properties of lattices – Lattice as Algebraic System-Sub lattices- lattice Homomorphism- Special Lattices – Boolean Algebra- sub algebra- Boolean Expression and Boolean functions- expression of a Boolean function in canonical form-logic Gates- Karnaugh Map Method

UNIT – IV: Basics of Counting: The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations andCombinations, Inclusion-Exclusion Principle.

UNIT-V: Formal Language: Introduction- Phrase –Structure Grammar- Types – BNF- Finite state Machine – Input output strings- Finite state Automata

Text book

Discrete mathematics – T. Veerarajan – McGraw Hill Education 2017,
Chapters 1,2,6,8

References:

1. Discrete Mathematical Structures with application to Computer Science, Tremblay and Manohar – (Tata McGrawHill, New Delhi) 1997.

Discrete mathematics, Venkataraman .M.K. and others –2000 The National Publishing Company.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**
CO1	L	H	H	L	L	L	L	L
CO2	M	H	L	L	L	L	M	L
CO3	L	L	L	L	L	L	L	H
CO4	M	H	M	L	L	L	L	L
CO5	L	H	H	H	L	H	L	M

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 44 of 92
Regulations 2024

VALUE ADDED COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Value Added Course - IoT Essentials: A Beginner's Guide	**2**	**3**	**-**	**-**	**Theory & Practical**

Unit I: Introduction to IoT and Development Setup

5 Hours

Introduction to IoT: Overview and applications of IoT. - Setting Up the Development Environment: Installing and configuring Arduino/Raspberry Pi. - Basic programming (C/C++, Python) - Basic Concepts and Practices: Blinking an LED - Reading a button press.

Unit II: Working with Basic Sensors

5 Hours

Humidity and Smoke Sensors: -Interfacing with humidity and smoke sensors - Light and Distance Sensors: Interfacing with light sensors - Interfacing with distance sensors.

Unit III: Display Modules and Additional Sensors

5 Hours

LCD Display - Displaying data on an LCD screen - Vibration and Tilt Sensors: Basics and interfacing. RFID and Touch Sensors - Interfacing with RFID and touch sensors.

Unit 4: Advanced Sensors and Actuators:

5 Hours

Weight and Soil Moisture Sensors - Interfacing with weight sensors - Interfacing with soil moisture sensors -Interfacing Water Pumps: Controlling water pumps.

Unit 5: Data Collection, Cloud Integration, and Security:

5 Hours

Data Logging and Cloud Integration - Storing sensor data locally and remotely. - Introduction to cloud services for IoT - Security in IoT - Basics of IoT security.

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 45 of 92
Regulations 2024

Text books:

1. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach. Vpt, 2014.

Reference Books :

1. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
31T	Part I Tamil	3	6	1	0	Theory

Introduction: மூன்றாம் பருவப் பாடத்திட்டம் சிறுகதை, வானொலி, தொலைக்காட்சி, கணிப்பொறி,
மொழிப்பெயர்ப்பு ஆகியவைகள் கொண்டு உருவாகியுள்ளது.

Course Outcome:

CO1	:	சிறுகதை எழுதுதல்- சிறுகதையின் வடிவம் மையக்கதாபாத்திரம். பயனுள்ளதாக அமையும். சிறுகதை இலக்கணம் அறிதல், தலைப்பு, கதைக்களம் சிறுகதையின் அமைப்பு அறிந்து கொள்ள முடிகிறது.
CO2	:	வானொலியில் இடம் பெறும் நிகழ்ச்சிகள் - தமிழ் சார்ந்த பேச்சு, விவாதம், மாணவர்கள் அறிந்து கொள்ள பயன் உள்ளது.
CO3	:	தொலைக்காட்சியின் இயல்பு-தொலைக்காட்சியின் நன்மைகள், நிகழ்ச்சி தயாரிக்கும் முறை- நிகழ்ச்சி ஒருங்கிணைப்புகள், நிகழ்;ச்சி நடத்துதல்.
CO4	:	கணிப்பொறி வரலாறு- கணிப்பொறி வகைகள்,. கணிப்பொறி பயன்பாடுகள் ஆகியவைகள் மாணவர்களுக்கு பயனுள்ளது.
CO5	:	மொழிப்பெயர்ப்;பு வரலாறு, மொழிபெயர்ப்பு இயல்புகள் மற்றும் முக்கியத்துவம் பற்றித் தெளிவாக புரிந்து கொள்ள முடியும்.

அலகு I :
[12 பாட வகுப்புகள்]

சிறுகதை எழுதுதல் - சிறுகதையின் வடிவம். மையக்கதாபாத்திரம், எதிர் கதாபாத்திரங்கள். சிறுகதை இலக்கணம் அறிதல், தலைப்பு கதைக்களம் சிறுகதையின் அமைப்பு சிறுகதை பயன்பாடு, சிறுகதையின் தொடக்கம் தெளிவுரையுடன் விளக்கம் கொடுத்து கற்பிக்கப்படும்.

அலகு II :
[12 பாட வகுப்புகள்]

வானொலி வரலாறு. வானொலி பயன்பாடு, வானொலியில் இடம் பெறும் நிகழ்ச்சிகள் - தமிழ் சார்ந்த பேச்சு, விவாதம்,பட்டிமன்றம். வானொலியில் கல்வி ஒலிபரப்பு, வேலைவாய்ப்பு, வேளாண்மை நிகழ்ச்சிகள், மருத்துவக் குறிப்புகள் ஆகியவைகள் பற்றி விளக்கம் மற்றும் பேச்சுக்கலைகள் வளர்க்க கற்றுக்கொடுக்கப்படும்.

அலகு III:
[12 பாட வகுப்புகள்]

தொலைக்காட்சியின் வரலாறு-தொலைக்காட்சி தன்மைகள், இயல்பு,

நன்மைகள், நிகழ்ச்சி தயாரிக்கும் முறை-நிகழ்ச்சி ஒருங்கிணைப்புகள், நிகழ்ச்சி நடத்துதல். தொலைக்காட்சி வர்ணனைகள் விருதுகள், நிகழ்ச்சிகள் ஆகியவைகள் பற்றி விளக்கம் தருதல்.

அலகு IV:
[12 பாட வகுப்புகள்]
கணிப்பொறி வரலாறு- கணிப்பொறி வகைகள், கணிப்பொறி பயன்பாடுகள், மாத.

நாட்காட்டி தயாரித்தல் விளம்பரம் உருவாக்கம், மதிப்பெண் பட்டியல் தயாரித்தல், கணினி கலைச்சொல்லாக்கம் விளக்கம் கொடுத்து கற்பிக்கப்படும்.

அலகு V :
[12 பாட வகுப்புகள்]

மொழிப்பெயர்ப்பு வரலாறு, இயல்புகள் பயன் ஆகியவைகள் அறிந்து கொள்ள பயிற்சிகள் கொடுத்து கற்பிக்கப்படும்.

பாடநூல்கள்:
1. எழுதுவது எப்படி- மகரம் வாசகர் வட்டம், 2. தமிழ் இணைய இதழ்கள் - அண்ணா கண்ணன்
3. .மொழிபெயர்ப்புக்கலை : மு.வளர்மதி, 4. மொழிபெயர்ப்பியல் : சு.சண்முக வேலாயுதம்,

5. மொழி பெயர்ப்பும், சொல்லாக்கமும் தென்புலோலியூர், மு.கணபதிப்பிள்ளை

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
32E	**General English**					

Introduction: To encourage students to inculcate and use effective communication skills in their day-to-day lives. To develop the LSRW skills to enhance the culture and thoughts through   language

Course Outcome:

CO1	:	Broaden their outlook and sensibility and be acquainted with cultural diversity and divergence in perspectives.
CO2	:	Be updated with basic informatics skills and attitudes relevant to the emerging knowledge society
CO3	:	Produce grammatically and idiomatically correct language
CO4	:	Gain knowledge in writing techniques to meet academic and professional needs
CO5	:	Be equipped with sufficient practice in Vocabulary, Grammar, Comprehension and Remedial English from the perspective of career-oriented tests.

12 Hours

Unit I:

1.1   The Voice of the Mountains -Mamang Dai - 1.2   Romeo & Juliet- The Balcony Scene - 1.3 Writing Letters and Emails - 1.4 Data Interpretation and Reporting

12 Hours

Unit II:

2.1 Sita- Toru Dutt - 2.2 Macbeth-Banquet Scene - 2.3 Writing and messaging on Social Media Platforms (blogs, Twitter, Instagram,   Facebook)

12 Hours

Unit III:

3.1 A Song of Hope- Oodgeroo Noonuccal - 3.2 Julius Caesar- Murder Scene - 3.3 Tryst with Destiny-Jawaharlal Nehru - 3.4 Learning netiquette, email etiquette

12 Hours

Unit IV:

4.1 In an Artist's Studio- Christina Rossetti - 4.2 Yes, We Can Barack Obama - 4.3 Meeting Etiquettes- Language, dress code, voice modulation. - 4.4 Online Meetings- Terms and expressions used - 4.5 Framing Questions

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 49 of 92
Regulations 2024

12 Hours
Unit V: 5.1 You've Got to Find What You Love- Steve Jobs - 5.2 Group Discussion - 5.3 Conducting and participating in meetings - 5.4.Voices
Text books: 1. Arden Shakespeare Complete works by Shakespeare (Author), William (Author), Bloomsbury, 2011
Reference Books : 1. The Shakespeare Book. Big Ideas Simply Explained, Stanley Wells et al. DK Publishing, 2015 2. Famous Speeches by Mahatma Gandhi, Creatingspace Independent Publishing Platform,2016 3. How to Build a Professional Digital Profile Kindle Edition 4. by Jeanne Kelly Bernish, Bernish Communications Associates, LLC; 1st edition (May 29, 2012) 5. Keys to Teaching Grammar to English Language Learners, Second Ed.: A Practical Handbook by Keith S Folse, Michigan Teacher Training, 2016 6. 5. Role Play-Theory and Practice. Krysia M Yardley-Matwiejczuk, SAGE Publications Ltd, 1997

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Data Engineering	**4**	**4**	**-**	**0**	**Theory**

Introduction: Data Engineering refers to the building of systems to enable the collection and usage of data. This data is usually used to enable subsequent analysis and data science; which often involves machine learning. Making the data usable usually involves substantial compute and storage, as well as data processing and cleaning.

Course Outcome:

CO1	:	To know the Data Engineering basics and Lifecycle.
CO2	:	To understand the Data Architecture Design with various options available.
CO3	:	To learn the Data generation and Storage
CO4	:	To understand Ingestion process and know about Queries, Modeling, and Transformation.
CO5	:	To learn Data Analytics, Machine Learning and to know the importance of Security and Privacy.

Unit I: [12 periods]
Data Engineering Introduction : KDD Process – Kinds of data can be mined – Kind of patterns can be mined – Technologies used – Kinds of Applications targeted – Issues in data mining - Data Objects and Attribute Types - Data preprocessing overview – Data Cleaning – Data Integration – Data Reduction – Data Transformation and Discretization.

Unit II :   [12periods]
Data Warehousing : Data warehouse – Basic Concepts –Modeling - Data cube and OLAP – Data warehouse Design and Usage – Implementation - Data Generalization by Attribute Oriented Induction

UnitIII: [12periods]
Data Modeling : Introduction to data modeling-Relational data models-NoSQL data models-Data Pipelines- Data Quality-Production data Pipelines

UnitIV: [12periods]
Data Processing : ETL basics –Extraction of Data-Extraction Methods-Transportation of data-Transportation mechanisms-ETL Tools-Loading and Transformation. Data Capture-Data warehouse performancebasic query-advanced query-Schema modeling techniques-Analysis and Reporting-OLAP

Unit V: [12periods]
Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings.

Text Book:
1.   Paul Crickard "Data Engineering with Python" work with massive datasets to design datamodels and automate data pipelines Using python,2020

2.   Jiawei Han, MichelineKamber, Jain Pei "Data Mining: Concepts and Techniques", Third edition, Elsevier, Morgan Kaufmann Publishers, 2012.

Reference Books:

1.   Glenn J. Myatt, Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, John Wiley Publishers, 2007.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		2	2	2		1	3		2		3		1
CO2			3		3		1		1	3		2	3
CO3	2	2		3	1	3		3		1			2
CO4	3		1	3		2		1	3		3	3	
CO5	1	3			2			1		2		1	3

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Database Engineering Lab	**4**	**0**	**0**	**4**	**Practical**

Introduction: To be able to learn about the entire pipeline of a typical system involving data, collection, preprocessing, storage, retrieval, processing, analysis, and visualization.

Course Outcome:

CO1	:	Preprocessing techniques for various datasets
CO2	:	Standard database systems concepts like tables, relations, query
CO3	:	Information retrieval techniques such as indexing, scoring, ranking, evaluation
CO4	:	Data processing algorithms and data structures

1. Practicals on RDD (Resilient Distributed Dataset) with Scala Operations and transformations.
   a. Use of next mentioned operations and functions: Parallelize, Read text file, Read CSV, Create RDD, Actions, Pair Functions, Repartition and Coalesce, Shuffle Partitions, Broadcast Variables, Accumulator Variables and Convert RDD to DataFrame
   b. Use of next mentioned operations : Read multiple text files into RDD, Read CSV file into RDD, Create an empty RDD, RDD Pair Functions and Generate DataFrame from RDD

2. Practical on the DataFrame operations
   a. Demonstrate the use of next mentioned operations: Create an empty DataFrame, Create an empty DataSet, use of Rename nested column, Adding or Updating a column on DataFrame, Drop a column on DataFrame, Adding literal constant to DataFrame, Changing column data type, Pivot and Unpivot a DataFrame, Create a DataFrame using StructType & StructField schema
   b. Use of next mentioned operations: Selecting the first row of each group, Sort DataFrame, Union DataFrame, Drop Rows with null values from DataFrame, Split single to multiple columns, Concatenate multiple columns, Replace null values in DataFrame, Remove duplicate rows on DataFrame, Remove distinct on multiple selected columns, Spark UDF

3. Practical on the Spark Array and Map operations
   a. Use of next mentioned operations: Create an Array (ArrayType) column on DataFrame, Create a Map (MapType) column on DataFrame, Convert an Array to columns, Create an Array of struct column, Explode an Array and map columns, Explode an Array of structs, Explode an Array of map columns to rows
   b. Use of next mentioned operations: Create a DataFrame with nested Array, Explode nested Arrays to rows, Flatten nested Array to single Array, Convert array of String to a String column

4. Spark Aggregate : Group rows in DataFrame, Get Count distinct on DataFrame, Add row number to DataFrame, Select the first row of each group

5. Spark SQL Joins, Spark SQL Schema, StructType & SQL Functions
   a. Use of next mentioned operations: Use of Spark SQL Join, Join multiple DataFrames, Inner join two tables/DataFrame, Self join, Join tables on multiple columns, Convert case class to a schema, Create array of struct column, Flatten nested column

b. Use of next mentioned functions : Date and Time Functions, String Functions, Array Functions, Map Functions, Aggregate Functions, Window Functions, Sort Functions, JSON Functions

6.   Spark SQL : Demonstrate the use of next functions : createDataFrame(), where() & filter(), withColumn(), withColumnRenamed(), drop(), distinct(), groupBy(), join(), map() vs mapPartitions(), foreach() vs foreachPartition(), pivot(), union(), collect(), cache() & persist(), udf().

7.   Spark Data Source API
   a. Use of next operations :Process JSON from a Text file, Read & Write CSV file, Read and Write JSON file, Read & Write Parquet file, Read & Write XML file, Read & Write Avro files
   b. Use of next operations : Read & Write HBase using "hbase-spark" Connector, Read & Write from HBase using Hortonworks, Read & Write ORC file, Read Binary File
   c. Use of File conversions operations from each type to other : CSV, Parquet, JSON, Avro, Text file

8.   Practical of Spark Streaming
   a. Use of next operations : OutputModes Append vs Complete vs Update, Read JSON Files From Directory with Scala Example, Read data From TCP Socket with Scala Example, Consuming & Producing Kafka messages in JSON format
   b. Use of next operations :Consuming & Producing Kafka messages in Avro format, from_avro and to_avro functions, Avro data from Kafka topic using from_avro() and to_avro(), Batch Processing using Kafka Data Source

9.   Spark MLlib : Demonstrate use of Estimator, Transformer, and Param

10.   Spark HDFS : Demonstrate the use of next operations :Processing files from Hadoop HDFS (TEXT, CSV, Parquet, Avro, JSON), Processing TEXT files from Amazon S3 bucket, Processing JSON files from Amazon S3 bucket, Processing CSV files from Amazon S3 bucket, Processing Parquet files from Amazon S3 bucket, Processing Avro files from Amazon S3 bucket.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3		2	3			1				3		3
CO2		3		2	1	3		1	1	3			
CO3	2			1		1	3		2	3		2	
CO4	3	2			3					1			1
CO5		3	1		3		2				2	3	

ALLIED COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Allied – QUANTITATIVE APTITUDE	**4**	**4**	**-**	**-**	**Theory**

QUANTITATIVE APTITUDE

Goal: To enhance the problem solving skills, to improve basic mathematical skills and to help students who are preparing for any type of competitive examinations.

Course Outcomes:

CO1	:	Define the concept of OOP as well as the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
CO2	:	Identify the situations of Program Control Statements, Introducing Classes, Objects and Methods of their usages.
CO3	:	Identify String Handling, Arrays, classes, objects, members of a class and the relationships among them needed for a specific problem.
CO4	:	OOP concepts like inheritance, Interface & package in real time situations.
CO5	:	Develop Java application programs using sound OOP practices (e.g., interfaces and APIs) and proper program structuring (e.g., by using access applet, multithreading) K3

Unit I: [12 Periods]
Area-Average-Calendar-Chain Rule-Puzzles

Unit II: [12 Periods]
Partnership-Percentage-Pipes and Cisterns-Problems on ages

Unit III: [12 Periods]
Problems on boat and Stream-Ratio- Simple Interest-Time and work

Unit IV: [12 Periods]
Mental Ability and logical reasoning - Analogy Test- Series Test- Same Class (Odd) Test-
Logical Venn Diagram - Syllogism.

Unit V: [12 Periods]
Analytical Reasoning-Mirror Images-Water Image (Number Letter Figure)-Completion of
Incomplete Pattern-Grouping of Identical figures.

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 55 of 92
Regulations 2024

Text Book:

1.

Dr. R.S.Aggarwal ," Quantitative Aptitude" , S.Chand, company limited

Reference Books:

1.

Dr.R.S.Aggarwal ,"A Modern Approach to Verbal and Non Verbal Reasoning, Revised Edition, S.Chand.

Edgar Thorpe "Mental ability and Quantitative Aptitude", 2 Edition

Hand book on "Mental Ability and Logical Reasoning" by Bharathiar University, Coimbatore.

SKILL ENHANCEMENT COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Applied Data Structure	**4**	**4**	**0**	**0**	**Theory**

Introduction :

Assess how the choice of data structures and algorithm design methods impacts the performance of programs.

Course Outcome:
CO1 : Students develop knowledge of basic data structures for storage and retrieval of ordered or unordered data.
CO2 : Students develop knowledge of linked lists.
CO3 : Students develop knowledge of applications of searching, and sorting of each data structure.
CO4 : Student develop Knowledge of Tree
CO5 : Student develop Knowledge of Graph

Unit I: [12 Periods]
Introduction - Basic Terminology - Data Structures - Abstract Data Types. Stacks – operation of Stack- Array Representation - Arithmetic Expressions - Polish Notation - Application of Stacks - Queue – Operation of Queue- Application of Stacks Queue.

Unit II: [12 Periods]
Linked Lists Introduction - Linked lists- Operation of Linked List - Linked List Implementation of Stack and Queue- Circular Linked list – Doubly Linked List.

Unit III: [12 Periods]
Sorting Introduction- Sorting - Merging - Merge-Sort - Quick Sort - Heap sort.

Unit IV: [12 Periods]
Trees Introduction- Binary Trees - Representing Binary Trees in memory- Traversing Binary Trees - Traversal Algorithm using Stacks - Binary Search Trees - Searching - Inserting and deleting in Binary Search Trees

Unit V: [12 Periods]
Graphs Introduction – Definitions and terminology – graph representations – Depth first search – Breadth first search.

Text Books:
1. M. A. Weiss, "Data Structure and Algorithm Analysis in C", Pearson Education Asia,2002.
2. 2. Gilberg, F Richard & Forouzan, A Behrouz, Data Structures: A Pseudocode approach

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 57 of 92
Regulations 2024

with C, 2nd Edition, Cengage, 2008. 3. Horowitz Sahni Anderson-Freed, Fundamental of Data Structures in C, Universities Press, Reprint 2008.

Reference Books:

1. Richard Johnsonbaugh, Algorithims, Pearson Education, 2nd Edition, 2008.

2.L.Kathirvelkumaran and R. Muralidharan , "Data Structure for Beginners ",Coimbatore Institute of Information Technology ,First Edition 2019.

3. Knuth, Donald E, Art of Computer Programming, Sorting & Searching, Addison-Wesley, 3rd Edition, 2005.

Course Outcomes	Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3		3		3			2		3			3
CO2		2		3	3	3	3		3	3		3	2
CO3	3	3	2	1	2		2			3	3	3	3
CO4	3			2		3		3	1		3	3	
CO5	3	3	1			2	3				2		

VALUE ADDED COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Value Added Course - Understanding Blockchain Technology	**2**	**3**	**-**	**-**	**Theory & Practical**

Introduction:

This course is intended to study the basics of Understanding Blockchain technology. During this course the learner will explore various aspects of Blockchain technology like application in various domains. By implementing, learners will have idea about private and public Blockchain, and smart contract.

Course Outcome:

CO1	:	Understand the history and fundamental concepts of blockchain technology, including digital money, distributed ledgers, and the basic crypto primitives such as hash functions and digital signatures.
CO2	:	Analyze and evaluate various consensus mechanisms used in blockchain, with a focus on proof of work and scalability in both permissioned and permission less blockchains.
CO3	:	Understand and implement the components and chain code in Hyperledger Fabric, including the use of SDK and front-end tools like Hyperledger Composer.
CO4	:	Apply blockchain technology in financial software and systems, including settlements, KYC, capital markets, insurance, and trade/supply chain management.
CO5	:	Explore the use of blockchain in government applications, focusing on digital identity, land records, record-keeping, and public distribution systems, with an emphasis on privacy and security.

Unit I:

[5 periods]

History: Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy-: Block chain Architecture and Design-Basic crypto primitives: Hash, Signature- Hash chain to Block Chain-Basic consensus mechanisms.

Unit II:

[5 periods]

Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Block chain consensus protocols**:** Permissioned Block Chains-Design Goals-Consensus protocols for Permissioned Block chains.

Unit III:

[5 periods]

Decomposing the consensus process-Hyper ledger fabric components-Chain code Design and Implementation: Hyper ledger Fabric II: -Beyond Chain code: fabric SDK and Front End-Hyper ledger composer tool.

Unit IV:

[5 periods]

Block chain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital Markets-Insurance- Block chain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting.

Unit V:

[5 periods]

Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems: Block chain Cryptography: Privacy and Security on Block chain.

Text books:
1. Mark Gates, "*Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money*", Wise Fox Publishing and Mark Gates 2017.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "*Hands-On Block chain with Hyper ledger: Building decentralized applicationswith Hyperledger Fabric and Composer*", 2018.

3. Bahga, Vijay Madisetti, "*Block chain Applications: A Hands-On Approach*", Arshdeep Bahga,Vijay Madisetti publishers 2017.

Reference Books :
1. 1. Andreas Antonopoulos, "*Mastering Bitcoin: Unlocking Digital Crypto currencies*", O'ReillyMedia, Inc. 2014.
2. Melanie Swa, "*Block chain* ",O'Reilly Media 2014.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
41T	Part I Tamil	3	6	1	0	Theory

Introduction: நான்காம் பருவப் பாடத்திட்டம் புதுக்கவிதை. தகவல்தொடர்பு, ஒரங்க நாடகம், இதழியல்பு. நூல் மதிப்புரை ஆகியவைகள் கொண்டு உருவாகியுள்ளது.

Course Outcome:

CO1	:	புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும்..கவிதையின் அமைப்பு முறை, புதுக்கவிதை, மரபுக்கவிதை, புதுக்கவிதை, மரபுக்கவிதை வேறுபாடுகள், கரு. வடிவம், உத்திகள் மாணவர்களுக்கு படைப்புத்திறன் வளர்வதற்கு பயன் உள்ளது.
CO2	:	தகவல் தொடர்பின் அடிப்படைகள்- பண்புகள்- சிறப்புகள், பயன்பாடுகள் ஆகியவைகள் குறித்து மாணவர்களுக்கு விளக்கம் தருதல்.
CO3	:	தொலைக்காட்சியின் இயல்பு-தொலைக்காட்சியின் நன்மைகள், நிகழ்ச்சி தயாரிக்கும் முறை நிகழ்ச்சி ஒருங்கிணைப்புகள், நிகழ்ச்சி நடத்துதல். ஆகியவைகள் மாணவர்கள் தெரிந்து கொள்ளல்.
CO4	:	கணிப்பொறி வரலாறு- கணிப்பொறி வகைகள்.. கணிப்பொறி பயன்பாடுகள் ஆகியவைகள் மாணவர்களுக்கு பயனுள்ளது.
CO5	:	மொழிப்பெயர்ப்பு வரலாறு, மொழிபெயர்ப்பு இயல்புகள் பற்றி தெளிவாக புரிந்து கொள்ள முடியும்.

அலகு I :   [12
பாட வகுப்புகள்]

புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும் - கவிதையின் அமைப்பு முறை, புதுக்கவிதை, மரபுக்கவிதை - புதுக்கவிதை, மரபுக்கவிதை வேறுபாடுகள், கரு, வடிவம், உத்திகள் - கவிதை எழுதுவதின் நோக்கம். எழுதும் முறைகள், வரிகள் வரையறை - கவிதை உருவாக்கம் தலைப்பு தேர்வுசெய்யும் முறைகள்.

அலகு II :   [12
பாட வகுப்புகள்]

தகவல் தொடர்பின் அடிப்படைகள்- பண்புகள்- சிறப்புகள், பயன்பாடுகள் - தகவல் தொடர்பு சாதனங்களின் பணிகள் - தகவல் தொடர்பில் ஏற்படும் தடைகள், தகவலை ஏற்பவரின் தகுதிகள் - பொதுமக்களும் தகவல் தொடர்பு சாதனங்களும்.

அலகு III: [12
பாட வகுப்புகள்]

ஒரங்க நாடகம் வரலாறு, நடகத்தின் தோற்றமும், வளர்ச்சியும். - ஒரங்க நாடகம் எழுதுதல், கதை அமைப்பு, அடிப்படைக்கூறுகள் - வானொலி அல்லது தொலைக்காட்சி மற்றும் திரைப்படத்துக்கு - ஒரங்க நாடகம் எழுதுதல்.

அலகு IV: [12
பாட வகுப்புகள்]

இதழியல் விளக்கம் - பத்திரிக்கை நிர்வாக அமைப்பு மற்றும் ஆசிரியர்கள் - 3.இன்றைய தமிழ் நாளிதழ்கள் பற்றிய செய்கள் (தினமணி, தினமலர், தினத்தந்தி,

தினகரன்).

அலகு V :   [12
பாட வகுப்புகள்]

1. நூல் மதிப்புரை - திறனாய்வு செய்தல் - 2.கடிதம் மற்றும் விண்ணப்பம் எழுதுதல் - கட்டுரை திறனை வளர்த்தல்- கட்டுரை தலைப்பு, கட்டுரை அமைப்பு முறைகள்

பாடநூல்கள்:
1.புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும் வல்லிக்கண்ணன்
மக்கள் தகவல் தொடர்பியல்- முனைவர் கி.இராசா
3..கலைச்சொல்லாக்கம் இராதா செல்லப்பன்

4 இதழியல் கலை டாக்டர் மா.பா.குருசாமி

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
42E	**English for Communication-II**					

Introduction: To encourage students to inculcate and use effective communication skills in their day-to-day lives. To develop the LSRW skills to enhance the culture and thoughts through language and Literature

Course Outcome:

CO1	:	Learn to communicate effectively and appropriately in real-life situation
CO2	:	Use English effectively for study purposes across the curriculum
CO3	:	Develop interest in and appreciation of Literature
CO4	:	Develop and integrate the use of the four language skills
CO5	:	Enhance their language skills, especially in the areas of grammar and pronunciation

12 Hours

Unit I:

1.1 I am Malala -Malala Yousafzai- Chapter1 - 1.2 Nelson Mandela's Interview with Larry King - 1.3   Job Applications: Cover Letters, CV/Resume - 1.4   Refuting, Discussion & Debating

12 Hours

Unit II:

2.1   The Zoo Story- Edward Albee - 2.2   Rakesh Sharma's Interview with Indira Gandhi from Space - 2.3 Making Suggestions& Responding to Suggestions, Asking for and Giving Advice or Help – 2.4   Creating a digital profile-LinkedIn

12 Hours

Unit III:

3.1   My Inventions-Nikola Tesla- Chapter 2 - 3.2   Lionel Messi with Sid Love-(Print) - 3.3   Body Language-Practical Skills for Interviews - 3.4   Interviews (face-to-face, telephone, and video conferencing)

12 Hours

Unit IV:

4.1 The Proposal- Anton Chekhov - 4.2. Filling forms (Online & Manual) creation of account, railway reservation, ATM, Credit/ Debit card - 4.3. Speaking in a Formal situation (welcome address, Vote of the thanks

12 Hours

Unit V:

 5.1 Public Speaking -   5.2 Chicago Address-Swami Vivekananda -   5.3 SWOT Analysis

Text books:
1 Am Malala The Girl Who Stood Up for Education and Was Shot by the Taliban by Malala Yousafzai, Christina Lamb, Little Brown, 2013

2. My Inventions by Nikola Tesla, Ingram Short title, 2011 Edition

Reference Books :

1. Writing Your Life: A guide to writing Autobiographies, Mary Borg Taylor Francis,   2021.
2. One-act Plays for Acting Students: An Anthology of Short Norman A. Bert • 1987
3. The One-Act Play Companion: A Guide to plays, playwrights ... Colin Dolley, Rex Walford • 2015
4. How to Build a Professional Digital Profile Kindle Edition by Jeanne Kelly Bernish,Bernish
    Communications Associates, LLC; 1st edition (May)

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 64 of 92
Regulations 2024

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core-I-R Programming	4	6	-	-	Core Theory

Introduction:

To Provides an introduction to fundamental concepts of R programming language and software environment for statistical analysis, graphics representation and reporting.

Course Outcome:

CO1	:	To understand and explore the basics of R Programming language.
CO2	:	Understand the basics of operators for calculations on arrays, lists, vectors and matrices.
CO3	:	To learn the integrated collection of tools for data analysis.
CO4	:	Understand the working of various applications with lists and arrays.
CO5	:	To familiarize the graphical facilities for data analysis.

Unit I : INTRODUCTION TO R PROGRAMMING [12 periods]

R OVERVIEW and Evolution of R - Features of R and ENVIRONMENT SETUP - Local Environment Setup - R BASIC SYNTAX R Command Prompt - R Script File and Comments in R - R DATA TYPES - R Vectors , Lists - R Matrices - Arrays , Factors - Data Frames - R VARIABLES ,Variable Assignment - Data Type of a Variable ,Finding Variables , Deleting Variables.

Unit II: DECISION MAKING & LOOPING STATEMENTS [12 periods]

R OPERATORS: Types of Operators - Arithmetic Operators , Relational Operators , Logical Operators - Assignment Operators, Miscellaneous Operators - R DECISION MAKING : R If Statement - R If...Else Statement, The if...else if...else Statement - R Switch Statement - R LOOPS: R Repeat Loop - R While Loop ,R For Loop - Loop Control Statements, R Break Statement, R Next Statement.

Unit III: FUNCTIONS [12 periods]

R FUNCTION: Function Definition Function Components - Built in Function , User defined Function , Calling a Function - Lazy Evaluation of Function. R STRINGS: Rules Applied in String Construction - String Manipulation - R VECTORS: Vector Creation Accessing Vector Elements - Vector Manipulation.

Unit IV:LIST & ARRAYS [12 periods]

R LISTS: Creating a List , Naming List Elements - Accessing List Elements - Manipulating List Elements - Merging Lists - Converting List to Vector - R MATRICES: Accessing Elements of a Matrix - Matrix Computations. R ARRAYS: Naming Columns and Rows , Accessing Array Elements - Manipulating Array Elements - Calculations Across Array Elements - R FACTORS: Factors in Data Frame - Changing the Order of Levels - Generating Factor Levels.

Unit V: WORKING WITH FRAMES , FILES , MYSQL [12 periods]

R DATA FRAMES: Extract Data from Data Frame - Expand Data Frame - R PACKAGES: R DATA RESHAPING - Joining Columns and Rows in a Data Frame - Merging Data Frames - Melting and Casting , Melt the Data , Cast the Molten Data. R CSV FILES - R EXCEL FILE - R PIE CHARTS - R HISTOGRAMS - R Regressions - R DATABASES : RMySQL Package - Connecting R to MySql , Inserting Data into the Tables - Creating Tables in MySql - Dropping Tables in MySql.

Text books:

1.1. Tilman M. Davies, "The Book of R – A first Course in Programming and Statistics", 2016.

Reference Books :

1.Roger D Peng, "R Programming for Data Science", 2015.

2.Chambers, "Software for Data Analysis: Programming with R", Springer, 2010.

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3		2	3							3		3
CO2		3		2	3	3		1	3	3			
CO3	2		3	3		1	3		2	3		2	
CO4	3	2			3			3		1			1
CO5		3	1		3		2		3		2	3	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core - I –R Programming Lab	**4**	**6**	**-**	**-**	**Core Practical**

Introduction:
R is a powerful programming language and environment for statistical computing and graphics. It is widely used among statisticians, data analysts, and researchers for data analysis, visualization, and machine learning. This lab introduces students to the fundamental concepts of programming in R, data manipulation, statistical analysis, and graphical representation of data.

Course Outcome:

CO1	:	Show the installation of R Programming Environment
CO2	:	Utilize and R Data types for developing programs
CO3	:	Make use of different R Data Structures
CO4	:	Develop programming logic using R Packages
CO5	:	Analyze the data sets using R programming capabilities

1.   Download and install R-Programming environment andinstall basic packages using install. Packages () command in R.
2.   Learn al the basics of R-Programming (Data types ,Variables , Operators etc.)
3.   Implement R-Loops with different examples.
4.   Learn the basics of functions in R and implement with examples.
5.   Implement data frames in R. Write a program to join columns and rows in a data frame using c bind () and r bind () in R.
6.   Implement different String Manipulation functions in R.
7.   Implement different data structures in R(Vectors ,Lists ,Data Frames)
8.   Write a program to read acsv file and analyze the data in the file in R
9.   Create pie charts and bar charts using R.
10.   Create a data set and do statistical analysis on the data using R.
11.   Write R program to find Correlation and Covariance
12.   Write R program for Regression Modeling
13.   Write R program to build classification model using KNN algorithm
14. Write R program to build clustering model using K-mean algorithm

Text books:
1. JaredP.Lander,RforEveryone:AdvancedAnalyticsandGraphics,2ndEdition,PearsonEducation,2018.

Reference Books :
1.   S.R.ManiSekharandT.V.SureshKumar,ProgrammingwithR,1 st Edition,,CENGAGE,2017.
    .

Course Outcomes	Program Outcomes											
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**P10**	**P11**	**P12**
CO1	1	3	1	1	3	1	3	1	1	1	1	3
CO2	1	3	2	1	1	3	3	1	1	1	1	1
CO3	1	3	3	3	1	2	1	3	3	1	3	1
CO4	1	2	3	3	1	1	1	3	2	3	2	1
CO5	1	2	3	3	1	3	1	3	2	3	1	1

ALLIED COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Allied –	**4**	**4**	**-**	**-**	**Theory**

	MATHEMATICS FOR DATA SCIENCE					

MATHEMATICS FOR DATA SCIENCE

Goal: This paper enables the students to relate mathematics with Data Science and improve their logical thinking.

Course Outcomes:

CO1	:	Understand the concepts of Summation of Series.
CO2	:	Understand the concepts of Cayley Hamilton Theorem and inverse matrices.
CO3	:	Understand the concepts of finite differences.
CO4	:	Understand the knowledge about expansions, hyperbolic and inverse hyperbolic functions.
CO5	:	Understand the concept of Leibnitz theorem and functions of two variables.

UNIT 1: [12 Periods]

Summation of series: Binomial series – Exponential series – Logarithmic series – Simple Problems

UNIT 2: [12 Periods]

Matrices: Symmetric – Skew – Symmetric – Hermitian – Skew-Hermitian – Orthogonal and Unitary matrices – Cayley-Hamilton theorem (without proof) – Verification – Computation of inverse of matrix using Cayley – Hamilton theorem.

UNIT 3: [12 Periods]

Numerical Methods: Newton's method to find a root approximately. Finite Differences: Interpolation: Operators, Δ, ∇, E, E inverse difference tables. Interpolation formulae: Newton's forward and backward interpolation formulae for equal intervals, Lagrange's interpolation formula.

UNIT 4: [12 Periods]

Trigonometry: Expansions of $\sin^n\theta$, $\cos^n\theta$ in a series of powers of $\sin\theta$ and $\cos\theta$ – Expansions of $\sin(n\theta)$ and $\cos(n\theta)$ in a series sines and cosines of multiples of "θ" – Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in a series of powers of "θ" – Hyperbolic and inverse hyperbolic functions.

UNIT 5: [12 Periods]

Differential Calculus: Successive differentiation, n-th derivatives, Leibnitz theorem (without proof) and applications, Jacobians, maxima and minima of functions of two variables – Simple problems

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 68 of 92
Regulations 2024

Text Books:

1.

Allied Mathematics, Volume I and Volume II by P. Duraipandian and S.Udayabaskaran, S. Chand Publications Volume I: Unit I – IV, Volume II – Unit V

Reference Books:

1.

Ancillary Mathematics by S. Narayanan and T.K. Manickavachagom Pillay, S. Viswanathan Pinters, 1986, Chennai

Allied Mathematics by A. Singaravelu

Allied Mathematics by P.R. Vittal

ELECTIVE COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective 1- Data Mining	**4**	**6**	**-**	**-**	**Core Theory**

Introduction:
To provide the knowledge on Data Mining and Warehousing concepts and techniques. To study the basic concepts of cluster analysis To study a set of typical clustering methodologies, algorithms, and applications

Course Outcome:

CO1	:	To understand the basic concepts and the functionality of the various data mining and data warehousing component
CO2	:	To know the concepts of Data mining system architectures
CO3	:	To analyse the principles of association rules
CO4	:	To get analytical idea on Classification and prediction methods.
CO5	:	To Gain knowledge on Cluster analysis and its methods.

Unit I :
  [12periods]

Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Preprocessing: Preprocessing the Data – Data cleaning – Data Integration and Transformation – Data Reduction

Unit II:
 [12 periods]

Data Mining, Primitives, Languages and System Architecture: Data Mining – Primitives – Data Mining Query Language, Architecture of Data mining Systems. Concept Description, Characterization and Comparison: Concept Description, Data Generalization and Summarization, Analytical Characterization, Mining Class Comparison – Statistical Measures

Unit III:
   [12 periods]

Mining Association Rules: Basic Concepts – Single Dimensional Boolean Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases – Multi dimension Association Rules from Relational Database and Data Warehouses

Unit IV:
   [12 periods]

Classification and Prediction: Introduction – Issues – Decision Tree Induction – Bayesian Classification – Classification of Back Propagation. Classification based on Concepts from Association Rule Mining – Other Methods. Prediction – Introduction – Classifier Accuracy

Unit V:
   [12 periods]

Cluster Analysis: Introduction – Types of Data in Cluster Analysis, Petitioning Methods – Hierarchical Methods-Density Based Methods – GRID Based Method – Model based Clustering Method

Text books:
        1. Han and M. Kamber, "Data Mining Concepts and Techniques", 2001, Harcourt India Pvt. Ltd, New Delhi.

Reference Books :

.

K.P. Soman, Shyam Diwakar, V. Ajay "Insight into Data Mining Theory and Practice ",
   Prentice Hall of India Pvt. Ltd, New Delhi

.

.

Parteek Bhatia, 'Data Mining and Data Warehousing: Principles and Practical Techniques',
   Cambridge University Press, 2019

.

Course Outcomes	Program Outcomes											
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**P10**	**P11**	**P12**
CO1	1	3	1	1	3	1	3	1	1	1	1	3
CO2	1	3	2	1	1	3	3	1	1	1	1	1
CO3	1	3	3	3	1	2	1	3	3	1	3	1
CO4	1	2	3	3	1	1	1	3	2	3	2	1
CO5	1	2	3	3	1	3	1	3	2	3	1	1

VALUE ADDED COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Value Added Course: Software Engineering Principles	**2**	**3**	**-**	**-**	**Theory & Practical**
UNIT I: Introduction to Software Engineering: [5 hours] Overview of Software Engineering: Definition and importance of software engineering. Software Development Life Cycle (SDLC): Phases of SDLC, including planning, analysis, design, implementation, testing, deployment, and maintenance. Software Process Models: Waterfall, Agile, Spiral, V-Model, etc.						
UNIT II: Requirements Engineering: [5 hours] Introduction to Requirements Engineering: Importance of requirement gathering. Requirements Elicitation Techniques: Interviews, questionnaires, observation, document analysis. Functional vs. Non-functional Requirements: Definitions and differences. Requirements Specification and Documentation: Creating and maintaining requirements documents. Requirements Validation and Management: Ensuring accuracy and managing changes.						
UNIT III: Software Design: [5 hours] Introduction to Software Design: Design principles and concepts. Architectural Design: Software architecture and design patterns. UML Diagrams: Use case diagrams, class diagrams, sequence diagrams, activity diagrams. Design Patterns: Singleton, Factory, Observer, Strategy, and other design patterns. Design Best Practices: Modularity, cohesion, coupling, and encapsulation.						

UNIT IV: Software Implementation and Coding: **[5 hours]**
Coding Standards and Best Practices: Writing clean, maintainable code. Code Refactoring and Optimization: Improving code quality and performance. Source Code Version Control: Using Git and GitHub for version control. Introduction to Clean Code Principles: Writing code that is easy to understand and maintain. Collaborative Development: Techniques for effective team-based coding.
UNIT V: Software Testing and Maintenance: **[5 hours]**
Types of Software Testing: Unit testing, integration testing, system testing, acceptance testing. Test-Driven Development (TDD): Writing tests before code to ensure functionality. Debugging Techniques: Identifying and fixing bugs. Maintenance and Evolution: Managing changes and updates to software over time. Software Quality Assurance: Ensuring software meets quality standards.
Text books: 1. Sommerville, Ian. Software Engineering (10th Edition). Pearson, 2015.   2. Pressman, Roger S. Software Engineering: A Practitioner's Approach (9th Edition). McGraw-Hill Education, 2019.
Reference Books :   1. Martin, Robert C. Clean Code: A Handbook of Agile Software Craftsmanship. Prentice Hall, 2008.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Data visualization	**4**	**4**	**0**	**0**	**Theory**

Introduction:
To understand the various concepts of Data Visualization is a crucial aspect of data analysis and communication, allowing insights to be conveyed effectively through graphical representations

Course Outcome:

CO1	:	To Identify and recognize visual perception and representation of data.	
CO2	:	To Illustrate about projections of different views of objects	
CO3	:	To Develop and Apply various Interaction and visualization techniques.	
CO4	:	To Analyze various groups for visualization	
CO5	:	To develop and Evaluate visualizations	

Unit I [12 Periods]
INTRODUCTION TO DATA VISUALIZATIONS AND PERCEPTION:

Introduction of visual perception, visual representation of data, Gestalt principles, Information overload.

Unit II [12 Periods]
VISUAL REPRESENTATIONS:

Creating visual representations, visualization reference model, visual mapping, visual analytic,

Design of visualization applications

Unit III [12 Periods]
CLASSIFICATION OF VISUALIZATION SYSTEMS:

 Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

Unit IV   [12 Periods]
VISUALIZATION OF GROUPS:

Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization. Various visualization techniques, data structures used in data visualization.

Unit V   [12 Periods]
VISUALIZATION OF VOLUMETRIC DATA AND EVALUATION OF VISUALIZATIONS:

Visualization of volumetric data, vector fields, processes and

simulations,Visualization of maps, geographic information, GIS systems,

collaborative visualizations, Evaluating visualizations

Textbook:

1. Ward, Grinstein, Keim, *Interactive Data Visualization: Foundations,*

Techniques, and Applications. Natick, 2nd edition,A K Peters, Ltd 2015

References:

1. Tamara Munzner,*Visualization Analysis & Design* ,1st edition,AK Peters

Visualization Series 2014

2. Scott Murray,*Interactive Data Visualization for the Web* ,2nd Edition, 2017

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Data Visualization lab	4	6	0	0	Theory

Course Outcome:

Know the history of data visualization and its connection with computer graphics.

Understand the visualization pipeline with its relationship to other data analysis pipelines.

Know the definition(s) of the visualization and interpretations of the notion.

List of Programs:

1. Write a program to Explore advanced plotting techniques with Matplotlib.
2. Write a program to Utilize Seaborn for statistical data visualization.
3. Write a program to Create interactive plots using Plotly.
4. Write a program to Visualize geospatial data using Folium.
5. Write a program to Visualize time series data.
6. Write a program to Build interactive dashboards using Dash.
7. Write a program to Use Tableau for advanced data visualizations.
8. Write a program to Handling missing data.
9. Write a program to Normalizing and scaling data.
10. Write a program to Visualizing distributions and correlations.

SKILL COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	MACHINE LEARNING TECHNIQUES	**4**	**6**	**0**	**0**	**Theory**

Introduction:

To introduce students to the concepts and techniques of Machine Learning.

Course Outcome:

CO1	:	Understand the basic concepts and techniques of Machine Learning.
CO2	:	Explain the regression methods, classification methods, clustering methods.
CO3	:	Understand the inference and learning algorithms for the hidden Markov model.
CO4	:	Demonstrate Dimensionality reduction Techniques
CO5	:	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

Unit I :

[12 periods]

Introduction – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search- Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

Unit II:

[12 periods]

Linear Models – Multi-Layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-Layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of

Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

Unit III:
   [12 periods]
Tree and Probabilistic Models – Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers - Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

Unit IV:
   [12 periods]
Dimensionality Reduction and Evolutionary Models - Dimensionality Reduction – Linear Discriminant Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic Algorithms – Genetic Offspring – Genetic Operators – Using Genetic Algorithms – Reinforcements Learning – Overview – Getting Lost Example–Markov Decision Process.

Unit V:
   [12 periods]
Graphical Models – Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.

Text books:
.
EthemAlpaydin, - introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014.
.

Reference Books :
1. Jason Bell, - Machine Learning – Hands on for Developers and Technical professionals, First Edition, Wiley, 2014.
2. Peter Flach, - Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.

Course Outcomes	Program Outcomes							
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**
CO1	3	2	3	2	2	2	1	2
CO2	2	1	2	3	3	1	1	3
CO3	1	2	2	2	1	2	3	2
CO4	3	2	3	3	2	1	2	1
CO5	3	3	2	1	2	3	3	1

ELECTIVE COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IMAGE ANALYTICS	**4**	**6**	**0**	**0**	**Theory**

Introduction:
This course is aimed to understand the basics of image processing techniques for computer vision, learn the techniques used for image pre-processing. To discuss the various object detection techniques and understand the various Object recognition mechanisms. To elaborate on the video analytics techniques

Course Outcome:

CO1	:	Understand the basics of image processing techniques for computer vision and video analysis.
CO2	:	Explain the techniques used for image pre-processing
CO3	:	Develop various object detection techniques.
CO4	:	Understand the various face recognition mechanisms.
CO5	:	Elaborate on deep learning-based video analytics.

Unit I :
[12 periods]
Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures

Unit II:
[12 periods]
Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models – Edges in multispectral images - Local pre-processing in the frequency domain - Line detection by local preprocessing

operators - Image restoration.

Unit III:
   [12 periods]
Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures

Unit IV:
   [12 periods]
Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition-DeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNetGesture Recognition.

Unit V:
   [12 periods]
Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem - RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture Improvement in Inception v2-Video analytics-RestNet and Inception v3.

Text books:
.
.
Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013.
.
.

Reference Books :
1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.

	P01	PO2	P03	P04	P05	P06	P07	P08
CO1	2	2	3	2	1	2	2	2
CO2	2	1	2	1	3	1	1	3
CO3	2	2	2	2	1	2	3	2
CO4	3	2	1	3	2	2	2	3
CO5	2	2	2	1	2	3	3	1

VALUE ADDED COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Value Added Course: Fundamentals of Data Science and Machine Learning	**2**	**3**	**-**	**-**	**Theory & Practical**
UNIT I: Introduction to Data Science [5 hours] Overview of Data Science - Data Science Life Cycle - Data Science Tools and Technologies - Data Collection and Data Cleaning - Exploratory Data Analysis						
UNIT II: Introduction to Machine Learning [5 hours] What is Machine Learning - Types of Machine Learning: Supervised, Unsupervised, and Reinforcement Learning - Key Terminologies in Machine Learning - Overview of Machine Learning Algorithms - Model Evaluation and Validation						
UNIT III: Supervised Learning: [5 hours] Regression Analysis: Linear and Logistic Regression - Decision Trees and Random Forests - Support Vector Machines - Neural Networks and Deep Learning Basics - Model Evaluation Techniques: Cross-Validation, Confusion Matrix, ROC Curve						

UNIT IV: Unsupervised Learning [5 hours]
Clustering Techniques: K-means, Hierarchical Clustering - Dimensionality Reduction: PCA, LDA, t-SNE - Association Rule Learning: Apriori, Eclat - Anomaly Detection - Applications of Unsupervised Learning
UNIT V: Practical Applications and Case Studies [5 hours]
Real-world Applications of Data Science and Machine Learning - Case Studies in Healthcare, Finance, and Marketing - Ethics and Bias in Data Science and Machine Learning - Future Trends in Data Science and Machine Learning - Capstone Project: End-to-End Machine Learning Project
Text books: 3. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett
Reference Books :   2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron   3. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core-Natural Language Processing					Theory

Introduction: This course introduces Natural Language Processing (NLP), focusing on computational techniques for analyzing and understanding human language. It equips students with essential skills to process and derive insights from textual data using advanced computational tools.

Course Outcome:

CO1	:	Understand fundamental concepts and applications of NLP.
CO2	:	Apply text processing techniques using NLTK for tasks like tokenization and tagging.
CO3	:	Implement machine learning models for text classification and information extraction.
CO4	:	Analyze syntactic and semantic structures of sentences for linguistic understanding.
CO5	:	Explore advanced NLP topics including named entity recognition and discourse analysis.

12 Hours

Unit I: Foundations of Natural Language Processing : Texts as Lists of Words - Simple Statistics in Language Processing - Accessing Text Corpora - Conditional Frequency Distributions - Lexical Resources: WordNet.

12 Hours

Unit II: Text Processing Techniques - Regular Expressions for Detecting Word Patterns - Processing Raw Text from Web and Disk - Text Processing with Unicode - Regular Expressions for Tokenizing and Segmenting Text

12 Hours

Unit III: Language Understanding and Classification - Categorizing and Tagging Words Using a Tagger - Supervised Classification Techniques: Decision Trees, Naive Bayes, Maximum Entropy - Automatic Tagging Techniques: N-Gram Tagging, Transformation-Based Tagging

12 Hours

Unit IV: Syntactic and Semantic Analysis: Analyzing Sentence Structure: Context-Free

Grammar, Dependency Grammar - Dependency Parsing - Semantic Analysis of Sentences

12 Hours

Unit V: Advanced Topics in NLP : Information Extraction Techniques: Chunking, Named Entity Recognition, Relation Extraction - Discourse Semantics and Pragmatics - Managing Linguistic Data: Corpus Structure and Life Cycle - Acquiring and Preprocessing Data

Text books:

.

Bird, Steven, Ewan Klein, and Edward Loper. Natural language processing with Python: analyzing text with the natural language toolkit. "O'Reilly Media, Inc.", 2011.

.

.

Thanaki, Jalaj. Python natural language processing. Packt Publishing Ltd, 2017.

.

.

Millstein, Frank. Natural language processing with python: natural language processing using NLTK. Frank Millstein, 2020.

.

Reference Book:

.

Sarkar, Dipanjan. Text analytics with Python: a practitioner's guide to natural language processing. Bangalore: Apress, 2019.

.

Course Outcomes	Program Outcomes											
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**P10**	**P11**	**P12**
CO1	1	3	1	1	1	2	3	1	1	1	1	1
CO2	3	3	3	1	1	1	1	1	3	1	1	1
CO3	1	1	1	2	1	1	1	1	3	1	1	1
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1	1	1	1	2

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core-Natural Language Processing LAB					**Theory**

Introduction: This Natural Language Processing (NLP) Lab course provides hands-on experience in applying computational methods to analyze and process human language. Students will explore various techniques and tools to manipulate textual data, gaining practical insights into the field of NLP.

Course Outcome:

CO1	:	CO1: Master fundamental techniques in NLP like tokenization and frequency analysis using Python and NLTK.
CO2	:	CO2: Apply statistical methods and conditional frequency distributions to analyze text corpora efficiently.
CO3	:	CO3: Implement supervised machine learning models for tasks such as sentiment analysis and text classification.
CO4	:	CO4: Analyze sentence structure and extract grammatical relationships using syntactic parsing techniques.
CO5	:	CO5: Develop applications for named entity recognition (NER) and discourse analysis in textual data.

List of Experiments:
1. Write a program to tokenize a given text and compute word frequencies.
2. Implement a program to create and use conditional frequency distributions for text analysis.
3. Write a program to access and process text data from a corpus (e.g., Gutenberg, Brown corpus).
4. Develop regular expressions to identify and extract specific patterns (e.g., dates, emails) from text.
5. Create a program to handle and normalize text data encoded in Unicode.
6. Implement a POS tagging program using NLTK's built-in taggers (e.g., Unigram, Bigram).

7. Build a supervised machine learning model (e.g., Naive Bayes classifier) for sentiment analysis or topic classification of textual data.

8. Develop a program to parse sentences using syntactic parsing techniques (e.g., dependency parsing).

9. Implement a NER system to identify and classify named entities (e.g., persons, organizations) in text.

10. Write a program to extract specific types of information (e.g., relationships between entities) from text using chunking or dependency parsing.

11. Develop a program to analyze discourse structures or co-reference resolution in a given text.

12. Create scripts to manage linguistic data, such as downloading corpora, preprocessing text files, or building custom corpora.

13. Integrate NLP functionalities with external APIs (e.g., Google Natural Language API, Stanford NLP) for advanced analysis tasks.

Text books:

1. Bird, Steven, Ewan Klein, and Edward Loper. Natural language processing with Python: analyzing text with the natural language toolkit. "O'Reilly Media, Inc.", 2011.

2. Thanaki, Jalaj. Python natural language processing. Packt Publishing Ltd, 2017.

Reference Book:

1. Sarkar, Dipanjan. Text analytics with Python: a practitioner's guide to natural language processing. Bangalore: Apress, 2019.

Course Outcomes	Program Outcomes											
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**P10**	**P11**	**P12**
CO1	1	2	2	2	2	1	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	1	2	1	1	2	1	1	1	2
CO4	2	1	1	1	1	1	1	1	1	1	1	1
CO5	1	2	1	2	1	1	2	1	2	1	2	1

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in B.Sc. Data Science the academic year 2024-2025 & Onwards

Page 86 of 92
Regulations 2024

SKILL COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Skill - Big Data Acquisition and Analytics	**4**	**6**	**-**	**-**	**Core Theory**

Introduction:

In this course, students to understand more advanced tools used to wrangle and analyze big data. Through this course the students got guided in basic approaches to querying and exploring data using higher level tools built on the top of a Hadoop platform.

Course Outcome:

CO1	:	To understand the meaning of big data, need of big data and how worth to study by understands their characteristics of big data.
CO2	:	To gain knowledge in evolution of Hadoop, understanding the components of Hadoop.
CO3	:	To understand the value of data analyst and how to implementing a big data in organization.
CO4	:	To analysis the big data in context, getting the knowledge of predictive analytics and big data.
CO5	:	To understanding the concepts of humanizing and consumerization of big data analytics.

Unit   I   :   **[12 periods]**

Big Data- Form the Business perspective: What is big data- Characteristics of big data- Can There be enough? The Volume of the Data- Variety Is the spice of Life- How Fast Is Fast? The Velocity of Data- Data in the Warehouse and Data in Hadoop- Wrapping It Up.

Unit   II: **[12 periods]**

Big data- From the Technology perspective: All about Hadoop- The Histroy of Hadoop- Components of Hadoop- Application Development in Hadoop- Getting your Data into Hadoop.

Unit   III   :   **[12 periods]**

Getting Started with the big data Analytics- Changing Focus with big data- The role of the Data

Analyst- Implementing Big Data Analytics within an Organization Using Alteryx- Blending Data from Multiple Sources- Looking at Alteryx Designer Desktop.

Unit IV: **[12 periods]**

Analysing big data in context: Focus on Context: Focus on Context, Not just Integration- Combining Big Data with Spatial Data- Leveraging External Data provider Resources. Getting Value form predictive Analytics and big data: Why do Predictive Analytics on Big data?- Moving predicative Analytics to the from predictive analysis.

Unit V: **[12 periods]**

Humanizing Big Data Analytics: Putting Big Data in the Hands of Those Who Need it- Humanizing Data Design Principles- Humanizing Big Data Analytics Workflow- Considering Consumerization of Big Data Analytics- Getting an Alteryx Analytics Gallery overview- publishing Data and Analytics to Cloud Service- focusing on Consuming Applications- The Best platform for Strategic Analytics.

Text books:

1.
Understanding Big Data (Analytics for Enterprise Class Hadoop and Streaming Data), Chris Eaton, Drik Deroos, Tom Deutsch, George Lapis, Paul Zikopoulos, 2011(Unit-I, II).
2.
1.
Big Data Analytics for Dummies, Micheal Wessler, OCP & CISSP, 2012(Unit-III, IV, V)
2.

Reference Books :

.
Big Data Analytics Using Splunk, Peter Zadrozny and Rahu Kodali, Apress 2013.
.

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3				1	1	1		3		1	3
CO2	3			1	3	1	2			3	2		
CO3			3	1			2	1	3	3	3	1	3
CO4	3			1	3	1	2	1			2	3	2
CO5	3	3	3	1	3			1	3	3	3	2	3

ELECTIVE COURSE

Course Code	Couse Title	Credit	Lecture	Tutorial	Practical	Type
	Deeplearning	4	5	-	-	**Core Theory**

Course Introduction

Deep Learning aims to provide students with a comprehensive understanding of deep neural networks, enabling them to design, train, and implement advanced models to address complex problems in areas such as image recognition, natural language processing, and predictive analytics

Course Focus on:Skill Development/ Entrepreneurship / Employability / Research

Course Outcomes	On completion of this course, students will
CO 1:	Gain a solid understanding of various deep learning models such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), and transformers, and be capable of implementing these models in practical applications
CO 2:	Develop proficiency in using deep learning frameworks and tools such as Tensor Flow, Py Torch, and Keras to build, train, and validate models efficiently
CO 3:	Apply deep learning techniques creatively to solve complex problems in various domains, including vision, language, and audio, demonstrating an ability to innovate and improve existing solutions
CO 4:	Critically analyze the performance of deep learning models, understand their limitations, and make informed decisions about how to improve their accuracy and efficiency
CO 5:	Understand the ethical and social implications of deploying deep learning technologies, including issues related to bias, privacy, and security

Unit I:	**DEEP LEARNING CONCEPTS**	[12 Periods]

lamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modelling. Early Neural Networks. How is Deep Learning different from Machine Learning. Scalars. Vectors. Matrixes, Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data. Video Data.

.

Unit II:	**NEURAL NETWORKS**	**[12 Periods]**

About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Over fitting and Under fitting. Hyperparameters

Unit III:	**CONVOLUTIONAL NEURAL NETWORK**	**[12 Periods]**

CNN, Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. Backpropagation Through the Convolutional Layer. Filters and Feature Maps. Backpropagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions. Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, and Microsoft ResNet Model. RCNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO

.

Unit IV:	**NATURAL LANGUAGE PROCESSING USING RNN**	**[12 Periods]**

About NLP & its Toolkits. Language Modeling . Vector Space Model (VSM). Continuous Bag of Words (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Cooccurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe. Backpropagation Through Time. Bidirectional RNNs (BRNN) . Long Short Term Memory (LSTM). Bi-directional LSTM. Sequence-to-Sequence Models (Seq2Seq). Gated recurrent unit GRU.

Unit V:	**DEEP REINFORCEMENT & UNSUPERVISED LEARNING**	**[12 Periods]**

ut Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy Gradient Methods. Actor-Critic Algorithm. About Autoencoding. Convolutional Auto Encoding. Variational Tentative Auto Encoding. Generative Adversarial Networks. Autoencoders for Feature Extraction. Auto Encoders for Classification. Denoising Autoencoders. Sparse Autoencoders

.

Text Books:

1. Deep Learning A Practitioner's Approach Josh Patterson and Adam Gibson O'Reilly Media, Inc.2017
2. Learn Keras for Deep Neural Networks, JojoMoolayil, Apress,2018
3. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
4. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017
5. Pro Deep Learning with TensorFlow, SantanuPattanayak, Apress,2017.

Reference Books:

1Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017

 2. Pro Deep Learning with TensorFlow, SantanuPattanayak, Apress,2017.

Web Resources:

.

https://www.tutorialspoint.com/deeplearning

Mapping of Course Outcome with Programme Outcome and Programme Specific Outcome:

Course Outcome	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	1
CO2	3	2	3	1	1	3	2	1	2	1	1	1
CO3	3	3	2	1	2	2	1	3	2	1	2	1
CO4	1	1	3	3	1	3	2	3	1	2	2	2
CO5	3	1	3	1	3	2	2	3	1	2	2	1

VALUE ADDED COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Value Added Course - Problem Solving and Algorithm Development	**2**	**3**	**-**	**-**	**Theory & Practical**

UNIT I: Problem Solving and Algorithmic Thinking
5 Hours

Problem Solving and Algorithmic Thinking Overview – problem definition, logical reasoning; Algorithm – definition, practical examples, properties, representation, algorithms vs programs.

UNIT II: Problem Understanding and Analysis
5 Hours

Algorithmic thinking – Constituents of algorithms – Sequence, Selection and Repetition, input-output; Computation – expressions, logic; Problem Understanding and Analysis – problem definition, input-output, variables

UNIT III: Introduction to Problem Solving programs
5Hours

Introduction to Problem Solving through programs, Steps to develop a program, Representation of Algorithm, Software development life cycle, Programming approaches, Types of programming languages, Introduction to c, Developing a c program, Console input and output functions, Syntax and Semantic errors.

UNIT IV: Operators and Expressions
5Hours

Identifiers and keywords, Data types, Constants, Variables, Declarations, Expressions, Statements, Arithmetic operators, Unary operators, Relational and logical operators, Assignment operators, Conditional operator.

UNIT   V: Algorithm   Implementation 5Hours

Branching, Looping, Arrays, Function implementation algorithm for these concepts.

Text books:

4. Riley DD, Hunt KA. Computational Thinking for the Modern Problem Solver. CRC press; 2014 Mar 27
5. Byron Gottfried, "Schaum's Outline of Programming with C",McGraw Hill Education (India), 4th edition, 2018, ISBN: 978-9353160272

Reference Books :

6. Yashavant Kanetkar, "Let Us C", Bpb Publications, 15th edition, 2016, ISBN:9788183331630