

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Rathinam Tech Zone, Eachanari, Coimbatore – 641021.

DEPARTMENT OF COMPUTER SCIENCE



Syllabus for

B.Sc. Data Science and Analytics

(I and II 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 employability 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.

To establish a department with global recognition deeply intertwined with the technology sector, facilitating the exchange of knowledge and skills, cultivating a culture of research, and imbuing aspiring computer scientists with values, thereby empowering them to spearhead India's comprehensive technological progress.

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 employability in diverse field

To empower students, nurturing academic and research excellence, while equipping them to utilize technology as a catalyst for innovation, enhancing global competitiveness and employability across diverse fields.

Motto

Industry – Ready Education

Program Educational Objectives (PEO)

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 Data Science and Analytics 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's Mission to PEO

Institute's Mission	PEO's
To provide quality education at affordable cost, build academic and research excellence maintain eco-friendly and robust infrastructure, and	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	PEO1, PEO2
Provide them to leverage Technology as a tool for innovation	PEO3
Fostering global competitiveness and employability in diverse field	PEO4, PEO5
To empower students and cultivate academic and research brilliance	PEO1, PEO2

Program Outcomes (PO):

PO1 (Disciplinary Knowledge)	:	Demonstrate knowledge competency in required disciplines in University level courses appropriate to the study program.
PO2 (Problem Analysis)	:	Apply appropriate knowledge and adopt suitable skills to identify, formulate, analyze and solve complex problems in real life situations and reach substantiated conclusions.
PO3 (Investigation)	:	Conduct investigation of complex problems by following scientific approach to knowledge development that include appropriate experiments, analysis, evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; interpretation of data, formulation of coherent arguments and synthesis of information (assumptions, hypothesis or implications) in order to reach valid conclusions.
PO4 (Design of Solutions)	:	Design solutions for complex, open-ended real-life problems and to design systems, components or processes that meet specific needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

P05 (Modern Tool Usage)	:	Create, select, apply, adapt, and extend appropriate techniques, resources, and modern tools to a range of activities, from simple to complex, with an understanding of the associated limitations.
P06 (Individual and Team Work)	:	Work effectively and respectfully as a member and leader in teams, facilitate cooperative or coordinated effort, act together as a group or a team in the interests of a common cause and work efficiently, preferably in a multi-disciplinary setting. Possess knowledge of the values and beliefs of multiple cultures and a global perspective. Task mapping, setting direction, building a team, formulating an inspiring vision, motivating and inspiring team members who can help achieve the vision, and guide people to the right destination.
P07 (Communication)	:	Express complex concepts within the profession and with society at large. Such ability includes listening, speaking, reading and writing, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
P08 (Professionalism)	:	Understand the professional roles and responsibilities in society, especially the primary role of protection of the public and the public interest.
P09 (Environment and Sustainability)	:	Analyze social and environmental aspects of the activities. Such ability includes an understanding of the interactions that has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.
P010 (Moral and Ethical Awareness)	:	Embrace moral/ ethical values; formulate a position/ argument about an ethical issue from multiple perspectives and apply professional ethics, accountability and equity.
P011 (Economics and Project Management)	:	Appropriately incorporate economics and business practices including project, risk, and change management into the practice of the system and to understand their limitations.
P012 (Life- long Learning)	:	Identify and address their own educational needs in a changing World in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

Program Specific Outcomes (PSO):

PSO1	:	Ability to develop, evaluate, and effectively communicate data-driven policy recommendations and its impact with the aid of predictive modeling and address societal challenges thereby improving public services
PSO2	:	Ability to understand AI practices and develop data governance frameworks with ethical guidelines ensuring the ethical use of data in public service delivery, regulatory compliance, and citizen engagement.
PSO3	:	Frame strategies in partnerships with public safety agencies, healthcare institutions, and disaster response teams to develop early warning systems, streamline resource distribution, and lessen the repercussions of disasters and crises on communities

Correlation between the PO/PSO and the PEOs

Program Outcomes		PEO 1	PEO 2	PEO 3	PEO 4	PEO 5
PO 1	:	1	2	2	2	1
PO 2	:	2	3	1	3	3
PO 3	:	1	3	3	2	2
PO 4	:	3	3	1	3	3
PO 5	:	2	1	3	3	3
PO 6	:	3	3	2	2	3
PO 7	:	3	1	3	3	2
PO 8	:	2	2	1	2	3
PO 9	:	3	3	3	1	2
PO 10	:	1	3	1	3	3
PO 11	:	3	2	2	2	1
PO 12	:	3	1	2	2	3
PSO 1	:	2	3	1	1	2
PSO 2	:	3	2	2	3	1
PSO 3	:	2	3	3	3	3

3 – Strong correlation; 2-moderate correlation; 1-Less correlation; Blank-no correlation

Components considered for Course Delivery is listed below:

- a. Class room Lecture
- b. Laboratory class and demo
- c. Assignments
- d. Mini Project
- e. Project
- f. Online Course
- g. External Participation
- h. Seminar
- i. Internship

Mapping of POs with Course Delivery:

Program Outcome	Course Delivery								
	a	b	c	d	e	f	g	h	i
P01	2	3	1	1	2	1	3	3	1
P02	3	2	2	3	3	3	1	2	3
P03	3	3	1	3	1	1	1	2	2
P04	2	3	2	3	3	1	1	3	1
P05	3	2	1	2	1	3	3	3	3
P06	2	3	3	2	3	1	2	3	3
P07	2	3	1	3	1	1	2	3	2
P08	2	2	1	2	3	3	2	3	2
P09	1	1	2	3	3	3	2	3	3
P010	2	3	2	3	2	2	2	2	2
P011	1	1	2	2	2	3	3	2	3
P012	1	2	3	2	2	2	3	2	3
PSO1	2	3	1	3	2	3	1	3	3
PSO2	3	2	2	3	3	2	2	3	2
PSO3	2	3	3	2	2	3	3	2	3

3 – Strong correlation; 2-moderate correlation; 1-Less correlation; Blank-no correlation

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)**B. Sc. (Data Science and Analytics) Curriculum Structure - Regulation – 2024****(For students admitted from 2024-2025 and onwards)**

S.No.	Sem	Part	Sub Type	Sub Code	Subject	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		Core Course – I Theory Programming in C	4	5	50	50	100
4	1	3	Core		Core Course – II Practical Programming in C	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		Core Course – III Theory Python	4	5	50	50	100

					Programming					
4	2	3	Core		Core Course – IV Practical Python Programming Lab	4	4	50	50	100
5	2	3	Elective		Elective - I Entrepreneurs Development	4	4	50	50	100
6	2	3	Allied		Allied-II Discrete 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		Core Course – V Theory Programming Concept Using Java	4	6	50	50	100
4	3	3	Core		Core Course – VI Practical Programming Concept Using Java Lab	4	4	50	50	100
5	3	3	Allied		Allied-III Quantitative Aptitude	4	5	50	50	100
6	3	4	SEC		Skill Enhancement Courses – II Practical / Training Fundamentals of Data Science	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	2	0	50	0	50

					Training (Summer vacation at the end of II semester activity)					
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		Core Course - VII Theory Programming in R Language	4	6	50	50	100
4	4	3	Core		Core Course - VIII Practical Programming in R Lab	4	4	50	50	100
5	4	3	Allied		Allied-IV 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		Core Course - IX Theory Big Data Technology	4	6	50	50	100
2	5	3	Core		Core Course - X Practical Big Data Technology Lab	4	6	50	50	100
3	5	3	Elective		Elective - III- Natural Language Processing	4	6	50	50	100
	5	3	PRJ		Project	0	6	0	0	0
4	5	4	SEC		Skill Enhancement	4	6	50	50	100

					Courses – III Practical / Training Machine Learning Foundations					
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		Core Course – XI Theory Cloud Computing	4	6	50	50	100
2	6	3	Core		Core Course – XII Practical Cloud Computing Lab	4	4	50	50	100
3	6	3	Elective		Elective – IV Image Analytics	4	6	50	50	100
4	6	3	PRJ		Core Project	8	8	100	100	200
5	6	4	SEC		Skill Enhancement Courses – IV Practical / Training Algorithms in Data Science	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

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3			12
Part II	3	3	3	3			12
Part III	12	16	15	16	15	20	94
Part IV	6	2	6	2	4	4	24
Part V		1	1	1	1		4
Total	24	25	28	25	20	24	146

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
22BGE11T	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:

C01	:	பாரதியார், பாரதிதாசன், சிற்பி, சுரதா ஆகிய கவிதைகளின் விளக்கத்தை மாணவர்கள் அறிந்து கொள்ளுவதால், தன்னம்பிக்கையை வெளிக்கொணரும் வகையில் உள்ளது.
C02	:	பெண் கவிஞர்களின் படைப்பு கவிதையை அறிவதன் மூலம் வாழ்வியல் செய்திகளையும், யதார்த்த நிலையும் அறிய உதவுகிறது.
C03	:	எண்ணங்களே ஏணிப்படிகள் -வாழ்வில் வெற்றி பெற வேண்டுமானால் எண்ணங்களை வளர்ந்துக் கொள்ள வேண்டும். சிந்தனையில் மூழ்கினால் தெளிவு கிடைக்கும் என்ற கருத்துக்களை அறியும் வகையில் அமைந்துள்ளது.
C04	:	படைப்புத்திறனை வெளிப்படும் விதமாகவும், இலக்கணத்தை அறிய பயனுள்ளதாக அமைகிறது.
C05	:	இலக்கியவரலாறு பற்றியச் செய்திகளைக் கொண்டு அதன் வளர்ச்சி நிலையை அறிவும் வகையில் உள்ளது

Unit I :**[12 periods]**

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

Unit II:**[12 periods]**

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

Unit III:**[12 periods]**

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

Unit IV:**[12 periods]**

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.

Unit V:**[12 periods]**

இலக்கியவரலாறு பற்றியச் செய்திகள் மற்றும் புதுக்கவிதைகளின் தோற்றங்கள், வளர்ச்சிகள் அறிவும் வகையில் உள்ளது. ஹைக்கூ, குக்கூ, சென்ட்ரியூ, கஜல். ஆகியவற்றுக்கு விளக்கம் தருதல்.

Text books:

1. பாரதியார் கவிதைகள், 2. பாரதிதாசன் கவிதைகள், 3. சுரதா கவிதைகள், 4. சிற்பி கவிதைகள்
5. அ. வெண்ணிலா

Reference Books :

- 1 இலக்கியவரலாறு பாக்கியமேரி, 2. இலக்கண நூல், 3. மு.வ. தமிழ் இலக்கிய

வரலாறு

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
23BGE12E	English for Communication-1	4	0	0	4	Theory

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	:	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.

Unit I :**[12 periods]**

A Patch of Land –Subramania Bharathi, JRD-Harish Bhat, The Faltering Pendulum- BhabaniBhattacharya
Listening for General and Specific Information, Vocabulary: Synonyms, Antonyms, Word Formation

Unit II:**[12 periods]**

The Sparrow-Paul Lawrence Dunbar, Us and Them-David Sedaris (From Dress your Family in Corduroy and Denim), How I taught my grandmother to read-Sudha Murthy, Appropriate use of /articles and Parts of Speech, Listening to Giving Instructions/Directions

Unit III:**[12 periods]**

A Nation's Strength- Ralph Waldo Emerson, Uncle Podger Hangs a Picture-Jerome K.Jerome
Self-Introduction, Greeting, Introducing Others, Error Detection

Unit IV:**[12 periods]**

Love Cycle , The Gold Frame-R.K Laxman, Communication and its types, Close Reading

Unit V:**[12 periods]**

Translation, Dialogue Writing, Free Writing, 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.

Course Outcomes	Program Outcomes											
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	3	3	3	3	3	3	3	2	3	2	3	2
C02	2	3	3	3	2	3	3	2	2	2	3	2
C03	3	3	3	2	3	3	3	2	3	2	3	2
C04	3	3	3	3	3	3	3	2	2	2	3	2
C05	3	2	3	3	3	3	3	2	2	3	3	2

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core - I - Problem Solving	4	6	-	-	Core

	Using C					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:																					
<table border="1"> <tbody> <tr> <td>CO1</td> <td>:</td> <td>Understand basic C programming concepts and create simple programs confidently.</td> </tr> <tr> <td>CO2</td> <td>:</td> <td>Use decision-making and looping tools to solve different problems in programming.</td> </tr> <tr> <td>CO3</td> <td>:</td> <td>Use advanced methods to make decisions and organize data effectively in programs.</td> </tr> <tr> <td>CO4</td> <td>:</td> <td>Manage input/output operations and files smoothly in programs.</td> </tr> <tr> <td>CO5</td> <td>:</td> <td>Organize code effectively using functions and pointers to make programs run better.</td> </tr> </tbody> </table>							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.
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:																					
<ol style="list-style-type: none"> 1. E.Balagurusamy, “Programming in ANSI C”, Seventh Edition McGraw Hill, 2017 2. YashavantKanetkar, “Let us C” , Fourteenth Edition, BPB Publication, 2017. 																					
Reference Books :																					
<ol style="list-style-type: none"> 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	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	1	3	1	1	3	1	3	1	1	1	1	3
C02	1	3	2	1	1	3	3	1	1	1	1	1
C03	1	3	3	3	1	2	1	3	3	1	3	1
C04	1	2	3	3	1	1	1	3	2	3	2	1
C05	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:

C01	:	Understand and apply C programming constructs effectively.
C02	:	Develop programs in C using basic constructs proficiently.
C03	:	Implement arrays in C programs for various applications.
C04	:	Utilize strings, pointers, and functions proficiently in C applications.
C05	:	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.

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
3. E.Balagurusamy, "Programming in ANSI C", Seventh Edition McGraw Hill, 2017

Course Outcomes	Program Outcomes											
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	1	3	1	1	1	2	1	1	1	1	1	1
C02	1	3	1	1	1	3	1	1	1	1	1	1
C03	1	1	2	3	3	1	1	1	1	1	2	1
C04	1	1	1	3	3	1	1	3	1	1	2	1
C05	1	1	1	3	3	1	1	3	1	1	1	1

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:

C01	:	To demonstrate a working knowledge of set notation and elementary set theory with its corresponding set operations and also Venn diagram.
C02	:	To apply the fundamental concepts of Mathematical Logic and Tautologies.
C03	:	To apply and understand the fundamental concepts of Relations and Functions.
C04	:	To demonstrate different traversal methods for graphs.
C05	:	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	
Unit V:	[12 periods]
Trees – Properties of Trees – Binary trees – Traversing Binary Trees – Computer Representation of general trees.	
Text books:	
<ol style="list-style-type: none"> 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 :	
<ol style="list-style-type: none"> 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	P02	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

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]										
<p>DB Access from applications – embedded SQL, Cursors, and Dynamic SQL. Introduction to JDBC & SQL/J - Stored Procedures.</p> <p>Overview of Storage and Indexing: Data on external storage - File Organizations and Indexing - Index Data Structures - Comparison of File Organizations - Indexes and Performance Tuning.</p> <p>Overview of Query Evaluation: System Catalog - Operator Evaluation - Algorithms for relational operations. Introduction to Query Optimization – Alternative Plans - Case Study.</p>												
Unit V:	Transaction Management	[12 Periods]										
<p>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.</p> <p>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</p>												
Text Books:												
<ol style="list-style-type: none"> 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:												
<ol style="list-style-type: none"> 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:												
<ol style="list-style-type: none"> 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
C01	3	3	3	2	2	1	1	1	2	1	1	1
C02	2	2	3	1	2	3	2	1	2	1	1	1
C03	3	3	2	1	1	2	1	3	2	1	2	1
C04	1	1	3	3	1	2	2	3	1	2	2	2
C05	3	1	3	1	3	2	2	3	1	2	2	1

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 in a project.
CO4	: Create web pages that function using external data.
CO5	: Implementation of web application employing efficient database access.

Unit I: [5hours]

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

Unit II : [5hours]

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: [5hours]

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: [5hours]

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

Unit V: [5hours]

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
Professional JavaScript for Web Developers Book by Nicholas C. Zakas
2. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic 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 Tomasz Dyl , Kamil

Przeorski , Maciej Czarnecki

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

Introduction:

□□எ□□.

Course Outcome:

C01	:	□□.
C02	:	□□ற□□.
C03	:	□□.
C04	:	□□ற□□.
C05	:	□□ற□□.

□□க□□]

□□ □□ட□□க உ□□எ□□.

□□க□□]

□□□

□□

□□

□□

□□

□□

□□.

□□க□□]

□□ □□எ□□க□□ த□□த□□.

□□க□□]

□□.

□□க□□:

□□பர□□

□□க□□ :

□.

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:

C01	:	Learn to introduce themselves and talk about everyday activities confidently
C02	:	Be able to write short paragraphs on people, places, and events
C03	:	Identify the purpose of using various tenses and effectively employ them in speaking and writing
C04	:	Gain knowledge to write subjective and objective descriptions
C05	:	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- ShashiTharoor - 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
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:

C01	:	Examine Python syntax and semantics and be fluent in the use of Python flow control and functions
C02	:	Demonstrate proficiency in handling Strings and File Systems
C03	:	Understand Lists, Dictionaries and Regular expressions in Python
C04	:	Interpret the concepts of Object-Oriented Programming as used in Python
C05	:	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
C01	1	3		3		2				3	3		3
C02		2	3		1		3	2	3				
C03	2	1	2			1				2	1	3	2
C04	3			1	3	3			1	3		1	3
C05		3			2		2	3					

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

	Programming Lab					
--	------------------------	--	--	--	--	--

Course Outcome:

C01	:	Write, test, and debug simple Python programs.
C02	:	Implement Python programs with conditionals and loops for stack, sorting algorithms.
C03	:	Read and write data from/to files in Python.
C04	:	Use Python lists, dictionaries for representing compound data.
C05	:	Write Script to SQL and Demonstrate Exception in Python.

Introduction: Understand the basic operations and creations of various applications using 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

C01	3				3		3		3		3		3
C02	2	3		2	3	2		3				3	
C03	3	2	3			3	2		2	1	3		1
C04			2	3	3					1		2	2
C05	1	3		1		2	2		3		1		

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

Development					Theory
Introduction:					
To build the necessary competencies and creativity and prepare them to undertake entrepreneurship as a desirable and feasible career option.					
Course Outcome:					
C01	:	To know about the role of the entrepreneur in India and around the globe, understand the benefits and drawbacks of entrepreneurship and students have to avoid them; entrepreneurial failure.			
C02	:	C02 : 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.			
C03	:	C03 : Students will be able to define, identify and/or apply the principles of new venture financing, growth financing, and growth financing for existing businesses.			
C04	:	C04 : To understand process of women entrepreneur and how they face their problems			
C05	:	C05 : To understand difference between Micro, small and medium Enterprise			
Unit I:					[12 periods]
Entrepreneur – importance- qualities, nature types – difference between entrepreneur and entrepreneurship and economic development – its importance – role of entrepreneurship – entrepreneurial environment.					
Unit II:					[12 periods]
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:					[12 periods]
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 DIC, SIDCO, NSIC, IRCI, NIDC, SIDBI, SISI, SIPCOT.					
Text books:					
1. . Robert D. Hisrich, Mathew J Manimala, Michael P Peters, Dean A Shepherd,					

“Entrepreneurship”, McGraw Hill Education, 2014

Reference Books :

2. Bhushan Y.K, “Entrepreneurial Development” Sultan Chand & Sons, Nineteenth Edition -2013.
3. 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
C01	3	3	3	1	3	1	1	1	3	3	3	1	3
C02	3	2	3	1	3	1	2	1	3	3	2	2	2
C03	3	3	3	1	3	1	2	1	3	3	3	1	3
C04	3	2	3	1	3	1	2	1	3	3	2	3	2
C05	3	3	3	1	3	1	2	1	3	3	3	2	3

Subject	Subject Title	Credit	Lecture	Tutorial	Practical	Type
---------	---------------	--------	---------	----------	-----------	------

Code						
	Allied –DISCRETE MATHEMATICS	4	4	-	-	Theory

Introduction:

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

Course Outcome:

C01	:	Students will gain an understanding of the Basic definition of Logics with examples.
C02	:	Students will gain knowledge of Predicate Logic.
C03	:	Students will be able to implement and evaluate types of Lattices and Boolean Algebra
C04	:	Students will learn about Pigeon Hole principle and Permutation and Combination
C05	:	Students will be able to gather information about Formal Languages.

UNIT 1:**[12 Periods]**

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 2:**[12 Periods]**

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:**[12 periods]**

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:**[12 periods]**

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

Unit V:**[12 periods]**

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

Text books:

1. Discrete mathematics – T. Veerarajan – McGraw Hill Education 2017
2. Ralph P. Grimaldi, “Discrete and Combinatorial Mathematics – An applied introduction”, Third Edition, Addison Wesley Publishing Company, 1994.

Reference Books :

1. Discrete Mathematical Structures with application to Computer Science, Tremblay and Manohar – (Tata McGraw Hill, New Delhi) 1997.
2. Discrete mathematics, Venkataraman .M.K. and others –2000 The National Publishing Company.

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.						
Text books:						
1. Bahga, Arshdeep, and Vijay Madiseti. 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
21T	Part I Tamil	3	6	1	0	Theory

Introduction:

□□எ□□.

Course Outcome:

C01	:	□□.
C02	:	□□ற□□.
C03	:	□□.
C04	:	□□ற□□.
C05	:	□□ற□□.

□□க□□]
□□ □□ட□□க உ□□எ□□.

□□க□□]
□□□
□□
□□
□□
□□
□

□]
□□.

□□க□□]
□□ □□எ□□க□□ த□□த□□.

□□க□□]
□□.

□□க□□]:
□□பர□□

□□க□□ :
1

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
32E	General English					
<p>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</p> <p>Course Outcome:</p>						
C01	: Broaden their outlook and sensibility and be acquainted with cultural diversity and divergence in perspectives.					
C02	: Be updated with basic informatics skills and attitudes relevant to the emerging knowledge society					
C03	: Produce grammatically and idiomatically correct language					
C04	: Gain knowledge in writing techniques to meet academic and professional needs					
C05	: 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

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
	Core - I - Programming Concept Using Java	4	6	-	-	Core Theory

Introduction:

This course presents a conceptual and practical introduction to imperative and object oriented programming, exemplified by Java.

Course Outcome:

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	:	OOPS 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 : INTRODUCTION TO Java Programming Fundamentals**[12 periods]**

Java Programming Fundamentals: The Java Language, the Key Attributes of Object-Oriented Programming, the Java Development Kit, a First Simple Program, Handling Syntax Errors, the Java Keywords, Identifies in Java, the Java Class Libraries Introducing. Data Types and Operators: Java's Primitive Types, Literals, A Closer Look at Variables, The Scope and Lifetime of Variables, operators, Shorthand Assignments, Type conversion in Assignments, Using Cast, Operator Precedence, Expressions.

Unit II: STATEMENTS:**[12 periods]**

Program Control Statements: Input characters from the Keyword, if statement, Nested ifs, if-else-if Ladder, Switch Statement, Nested switch statements, for Loop, Enhanced for Loop, While Loop, do-while Loop, Use break, Use continue, Nested Loops. Introducing Classes, Objects and Methods: Class Fundamentals -Objects - Reference Variables and Assignment, Methods, Returning from a Method, Returning Value, Using Parameters, Constructors, constructor types, The new operator Revisited, Garbage Collection and Finalizers, The this Keyword.

Unit III: Operators & constructors**[12 periods]**

More Data Types and Operators: Arrays, Multidimensional Arrays, Alternative Array Declaration Syntax, Assigning Array References, Using the Length Member, The Bitwise operators. String Handling: String Fundamentals, The String Constructors, Three String-Related Language Features, String Buffer and String Builder. A Closer Look at Methods and Classes: Controlling Access to Class Members, Pass Objects to

Methods, How Arguments are passed, Returning Objects, Method Overloading, Overloading Constructors, Recursion, Understanding Static, Introducing Nested and Inner Classes, Var args: Variable-Length

Unit IV: [12 periods]

Inheritance: Inheritance Basics, Member Access and Inheritance, Constructors and Inheritance, Method Overriding, Overridden Methods support polymorphism, Why Overridden Methods, Using Abstract Classes, Using final keyword. Interfaces: Fundamentals, Creating, Implementing, References, Implementing Multiple Interfaces, Constants, Interface extended, Nested Interfaces. Packages: Fundamentals, Packages and Member Access, Importing Packages, Static Import. Exception Handling: Hierarchy, Fundamentals, Uncaught Exception, Multiple catch clauses, tryblocks, throwing an Exception, finally, throws, Java's Built-in Exceptions

Unit V: [12 periods]

Multithreaded Programming: fundamentals, thread creation types, Multiple Threads, Thread Priorities, Synchronization, using Synchronization Methods. Enumerations, Auto boxing and Annotations: Enumerations, Java Enumeration are class types, Auto boxing, Annotations (metadata) Generics: Generics Fundamentals Bounded Types, Methods, Constructors, Some Generic Restrictions. Applets: basics - Skeleton, life cycle of applet - applet methods - Passing parameters to Applets.

Text books:

1. Herbert Schildt, Java The Complete Reference, 11th Edition, Copyright © 2019 by McGraw-Hill Education (Publisher).

Reference Books :

1. Mahesh Bhavde and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2008, ISBN:9788131720806.
2. Rajkumar Buyya, S Thamarasi selvi, Xingchen Chu, Object oriented Programming with Java, Tata McGraw Hill Education Private Limited.
3. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill Companies.
4. Anita Seth and B L Juneja, JAVA One step Ahead, Oxford University Press, 2017.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core-I- Programming Concept Using Java Lab	4	6	-	-	Core Practical

Introduction:

This course presents a conceptual and practical introduction to imperative and object oriented programming, exemplified by Java.

Course Outcome:

CO1	:	Execute JAVA programs based on simple constructs like arrays, loops , decision statements, functions etc
CO2	:	Incorporate object oriented concepts like classes, objects, inheritance, polymorphism resembling real time situation.
CO3	:	Demonstrate the use of packages and interfaces
CO4	:	Develop OOP programs containing User created Exception handling & Threading.
CO5	:	Familiarize with Java development Environment such as Eclipse, NetBeans etc. Suggestive list of programs.

1. To find the sum of any number of integers entered as command line arguments
2. To learn use of single dimensional array by defining the array dynamically.
3. To check if a number is prime or not, by taking the number as input from the keyboard
4. To find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument
5. Write a program that show working of different functions of String and StringBufferclasses like setCharAt(), setLength(), append(), insert(), concat()and equals().
6. Write a program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions(from lower to higher data type)
7. Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passed by reference and to learn use of final keyword
8. Write a program to demonstrate the concept of boxing and un-boxing.
9. Create a multi-file program where in one file a string message is taken as input from the user
10. Write a program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate Fibonacci series is given in a different file belonging to the same package.

11. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages
12. Write a program DivideByZero that takes two numbers a and b as input, computes a/b, and invokes Arithmetic Exception to generate a message when the denominator is zero.
13. Write a program to demonstrate priorities among multiple threads.
14. Write a program to generate a window without an applet window using main() function.

Course Outcomes	Program Outcomes											
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	1	3	1	1	3	1	3	1	1	1	1	3
C02	1	3	2	1	1	3	3	1	1	1	1	1
C03	1	3	3	3	1	2	1	3	3	1	3	1
C04	1	2	3	3	1	1	1	3	2	3	2	1
C05	1	2	3	3	1	3	1	3	2	3	1	1

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

Introduction:

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 Outcome:

C01	:	Define the concept of OOP as well as the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
C02	:	Identify the situations of Program Control Statements, Introducing Classes, Objects and Methods of their usages.
C03	:	Identify String Handling, Arrays, classes, objects, members of a class and the relationships among them needed for a specific problem.
C04	:	OOP concepts like inheritance, Interface & package in real time situations.
C05	:	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.

Text books:

1. Dr.R.S.Aggarwal,"QuantitativeAptitude", S.Chand, companylimited

Reference Books :

1. Dr.R.S.Aggarwal,"AModernApproachtoVerbalandNonVerbalReasoning, RevisedEdition, S.Chand.
2. EdgarThorpe"Mentalabilityand QuantitativeAptitude",2Edition

3. Handbook on "Mental Ability and Logical Reasoning" by Bharathiar University, Coimbatore.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
---------------------	----------------------	---------------	----------------	-----------------	------------------	-------------

	Value Added Course - Understanding BlockchainTechnology	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 Blockchain consensus protocols: Permissioned Block Chains-Design Goals-Consensus protocols for Permissioned Blockchains.

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, invoicemanagement/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 Blockchain.

Text books:

1. Mark Gates, "*Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money*", WiseFoxPublishingandMarkGates2017.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "*Hands-On Block chain with Hyper ledger: Building decentralized applications with Hyper ledger Fabric and Composer*", 2018.
3. Bahga, Vijay Madiseti, "*Blockchain Applications: A Hands On Approach*", Arshdeep Bahga, Vijay Madisetti publishers 2017.

Reference Books :

1. 1. Andreas Antonopoulos, "*Mastering Bitcoin: Unlocking Digital Cryptocurrencies*", O'Reilly Media, Inc. 2014.
2. Melanie Swa, "*Blockchain*", O'Reilly Media 2014.

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

Introduction:

□□எ□□.

Course Outcome:

C01	:	□□.
C02	:	□□ற□□.
C03	:	□□.
C04	:	□□ற□□.
C05	:	□□ற□□.

□□க□□]
□□ □□ட□□க உ□□எ□□.

□□க□□]
□□□
□□
□□
□□
□□
□

□□க□□]
□□.

□□க□□]
□□ □□எ□□க□□ த□□த□□.

□□க□□]
□□.

□□க□□]:
□□பர□□

□□க□□ :
1

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:

C01	: Learn to communicate effectively and appropriately in real-life situation
C02	: Use English effectively for study purposes across the curriculum
C03	: Develop interest in and appreciation of Literature
C04	: Develop and integrate the use of the four language skills
C05	: Enhance their language skills, especially in the areas of grammar and pronunciation

12 Hours
Unit I: 1.1 I am Malala -MalalaYousafzai- 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 MalalaYousafzai, 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)

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

Reference Books :

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

2. 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
C01	3		2	3							3		3
C02		3		2	3	3		1	3	3			
C03	2		3	3		1	3		2	3		2	
C04	3	2			3			3		1			1
C05		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:

C01	:	Show the installation of R Programming Environment
C02	:	Utilize and R Data types for developing programs
C03	:	Make use of different R Data Structures
C04	:	Develop programming logic using R Packages
C05	:	Analyze the data sets using R programming capabilities

1. Download and install R-Programming environment and install basic packages using install. Packages () command in R.
2. Learn all 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 csv 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. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, 2nd Edition, Pearson Education, 2018.

Reference Books :

1. S.R. Mani Sekhar and T.V. Suresh Kumar, Programming with R, 1st Edition, CENGAGE, 2017.

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

Introduction:

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 Outcome:

C01	:	Define the concept of OOP as well as the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
C02	:	Identify the situations of Program Control Statements, Introducing Classes, Objects and Methods of their usages.
C03	:	Identify String Handling, Arrays, classes, objects, members of a class and the relationships among them needed for a specific problem.
C04	:	OOP concepts like inheritance, Interface & package in real time situations.
C05	:	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.

Text books:

2. Dr.R.S.Aggarwal,"QuantitativeAptitude", S.Chand, companylimited

Reference Books :

4. Dr.R.S.Aggarwal,"AModernApproachtoVerbalandNonVerbalReasoning, RevisedEdition, S.Chand.

5. EdgarThorpe"Mentalabilityand QuantitativeAptitude",2Edition

6. Handbook on "Mental Ability and Logical Reasoning" by Bharathiar University, Coimbatore.

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:						
C01	:	To understand the basic concepts and the functionality of the various data mining and data warehousing component				
C02	:	To know the concepts of Data mining system architectures				
C03	:	To analyse the principles of association rules				
C04	:	To get analytical idea on Classification and prediction methods.				
C05	:	To Gain knowledge on Cluster analysis and its methods.				
Unit I :						[12 periods]
Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Pre-processing: Pre-processing 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, Partitioning 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 :

1. K.P. Soman, Shyam Diwakar, V. Ajay “Insight into Data Mining Theory and Practice “, Prentice Hall of India Pvt. Ltd, New Delhi
2. Parteek Bhatia, ‘Data Mining and Data Warehousing: Principles and Practical Techniques’, Cambridge University Press, 2019

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
	Core - I - Big Data Technology	4	6	-	-	Core Theory

Introduction:

Big Data Technology is an advanced field of study focusing on the storage, processing, and analysis of large volumes of data generated from various sources. The course provides insights into the fundamental concepts of big data, Hadoop ecosystem, data analytics techniques, and tools used to handle and analyze big data. Students will gain practical skills in using big data technologies to solve real-world problems and make data-driven decisions.

Course Outcome:

CO1	:	Learn the characteristics and challenges of big data, and explore the importance of big data in the modern business environment.
CO2	:	Acquire knowledge of Hadoop components, architecture, and tools used for storing, processing, and managing big data.
CO3	:	Apply various data analytics techniques to extract meaningful insights from big data using tools like Hadoop and Spark.
CO4	:	Understand different data storage and processing technologies and their applications in big data management.
CO5	:	Develop practical skills to implement big data solutions for real-world applications using industry-standard tools and platforms.

Unit I : Introduction to Big Data**[12 periods]**

Overview of Big Data: Definition, characteristics (Volume, Velocity, Variety, Veracity, Value).- Big Data Challenges and Opportunities. - Big Data Architecture: Data Sources, Data Storage, Data Processing, Data Analysis.- Introduction to Hadoop: History, Components, and Ecosystem.- Hadoop Distributed File System (HDFS): Architecture, Features, and Benefits.

Unit II: Hadoop Ecosystem and MapReduce:**[12 periods]**

Introduction to MapReduce: Concept, Architecture, and Workflow. - Writing MapReduce Programs: Mapper, Reducer, and Combiner Functions. - Hadoop Ecosystem Components: HDFS, YARN, Hive, Pig, HBase, and ZooKeeper. - Data Ingestion with Sqoop and Flume. - Introduction to Apache Spark: Architecture, RDDs, and DataFrames.

Unit III: Data Storage and Management**[12 periods]**

Data Storage Options: HDFS, HBase, Cassandra, and Amazon S3 - NoSQL Databases: Introduction, Types, and Use

Cases. - Data Warehousing with Hive: Architecture, Query Language, and Integration with HDFS. - Data Modeling and Schema Design. - Data Security and Privacy in Big Data.

Unit IV: Data Analytics Techniques

[12 periods]

Introduction to Data Analytics: Descriptive, Predictive, and Prescriptive Analytics. - Data Preprocessing Techniques: Cleaning, Transformation, and Integration. - Machine Learning with Spark MLlib: Classification, Regression, Clustering, and Collaborative Filtering - Real-Time Data Processing with Apache Kafka and Storm. - Data Visualization Tools and Techniques.

Unit V: Big Data Applications and Case Studies

[12 periods]

Big Data Applications in Various Domains: Healthcare, Finance, Retail, and Social Media. - Case Studies on Big Data Implementation: Success Stories and Lessons Learned. - Big Data and IoT: Integration and Applications. - Future Trends in Big Data Technology: AI and Big Data, Edge Computing, and Cloud-based Big Data Solutions. - Project Work: Developing a Big Data Solution for a Real-world Problem.

Text books:

1. "Hadoop: The Definitive Guide" by Tom White

Reference Books :

1. "Big Data: Principles and Best Practices of Scalable Real-Time Data Systems" by Nathan Marz and James Warren
2. "Spark: The Definitive Guide" by Bill Chambers and Matei Zaharia

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
C01	3	3			2		2			3	3		
C02			3		3		3		3		3	2	1
C03	3	2		1		3	3	3					3
C04		3		3		1					2		
C05			2		3			2	1	2		3	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core-I- Big Data Technology Lab	4	6	-	-	Core Practical

Introduction:

The Big Data Technology Lab course is designed to provide hands-on experience with the tools and techniques used to manage and analyze large datasets. The lab exercises will focus on practical implementation of big data concepts, including data storage, processing, and analysis using Hadoop and its ecosystem, as well as Apache Spark. Students will gain the skills necessary to handle real-world big data challenges and develop solutions that drive business insights and innovation.

Course Outcome:

CO1	:	Understand and apply different data storage technologies such as HDFS and NoSQL databases for big data management.
CO2	:	Write and execute MapReduce programs to process large datasets efficiently using the Hadoop framework..
CO3	:	Use various Hadoop ecosystem tools like Hive, Pig, and HBase for data ingestion, storage, and querying.
CO4	:	Implement data analytics and machine learning algorithms using Apache Spark and its libraries.
CO5	:	Develop solutions for real-time data processing and streaming using tools like Apache Kafka and Storm.

1. Install Apache Hadoop
2. Develop a MapReduce program to calculate the frequency of a given word in a given file.
3. Develop a MapReduce program to find the maximum temperature in each year.
4. Develop a MapReduce program to find the grades of student's.
5. Develop a MapReduce program to implement Matrix Multiplication.
6. Develop a MapReduce to find the maximum electrical consumption in each year given
7. electrical consumption for each month in each year.

8. Develop a MapReduce to analyze weather data set and print whether the day is shinny or cool day.
9. Develop a MapReduce program to find the tags associated with each movie by analyzing
10. Movie lens data.
11. Develop a program to calculate the maximum recorded temperature by yearwise for the
12. weather dataset in Pig Latin
13. Write queries to sort and aggregate the data in a table using HiveQL.

Text books:

1. Tom White, "Hadoop: The Definitive Guide" Fourth Edition, O'reilly Media, 2015.

Reference Books :

1. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, Uderstanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data, McGrawHill Publishing,2012.
2. AnandRajaraman and Jeffrey David Uilman, Mining of Massive Datasets Cambridge

University Press, 2012.

Course Outcomes	Program Outcomes											
	P01	P02	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
	Elective-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.

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	12 Hours

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

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	P02	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	Subject Title	Credit	Lecture	Tutorial	Practical	Type
---------	---------------	--------	---------	----------	-----------	------

Code						
	Skill – Machine Learning Foundations	4	6	-	-	Skill Theory

Introduction:

Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to create automated systems that can sift through large volumes of data at high speed to make predictions or decisions without human intervention. Machine learning as a field is now incredibly pervasive, with applications spanning from business intelligence to homeland security, from analysing biochemical interactions to structural monitoring of aging bridges, and from emissions to astrophysics.

Course Outcome:

CO1	:	Understand the difference between continuous class label and discrete class label classification methods.
CO2	:	Predict the continuous class variable using linear regression analysis.
CO3	:	Predict the binary class variable using decision tree and random forest
CO4	:	Understand the importance of Logistic regression and its application in business.
CO5	:	Apply the assessment method to find the better number of PCA and Clusters for the given data

Unit I : Introduction to Machine Learning Algorithms**[12 periods]**

Introduction to Machine learning – Statistical Learning – types of Machine Learning – learning models: geometric, probabilistic and logistic models, introduction to supervised, unsupervised and reinforcement learning – model evaluation – model implementation – model accuracy indicators.

Unit II: Supervised Learning –Regression Analysis**[12 periods]**

Introduction to parametric machine learning method- assumptions of parametric machine learning methods- linear model and its assumptions- simple linear regression- parameter estimation- properties of regression parameters- testing the significance of regression parameters- estimation of σ^2 , Interval Estimation of the Mean Response- prediction of new observations-Confidence interval for β_0 , β_1 and σ^2 -Multiple linear Regression analysis-parameter estimation, and significance of coefficients, assumptions of multiple linear regression parameters

Unit III: Classification Techniques – Decision Tree:**[12 periods]**

Introduction to decision tree algorithms- classification tree- characteristics of classification tree – size and hierarchical nature of tree- training and testing data set- induction algorithms- probability estimation in decision tree – Laplace correction and no match method- stopping criteria for tree development- pruning techniques and pruned tree-evaluation of decision tree classifiers

Unit IV:**[12 periods]**

Classification Techniques–Logistic Regression Introduction to logistic regression- assumptions involved in logistic regression- concepts on odds and odds ratio- maximum likelihood estimation- binomial logistic regression- parameter estimation- properties of logistic regression coefficients- logistic regression for correlated data- model accuracy testing- confusion matrix-Receiver Operating Characteristic Curve-area under curve- likelihood ratio test- concepts and interpretation of Pseudo R square tests- Hosmer-Lemeshow Test- Wald Test, prediction using better fit model and interpretation

Unit V: Unsupervised Learning:[12 periods]

Introduction to data dimension reduction techniques, linearity of variables- assumptions of linearity among variables- general purpose and description of principle component analysis- extraction of principle components- extraction techniques- orthogonal and oblique rotation of linear combination of variables- factor analysis and its relevance with business application- introduction to cluster analysis and its validations.

Text books:

1. Introduction to Linear Regression Analysis, Fifth Edition - DOUGLAS C. MONTGOMERY, ELIZABETH A. PECK, G. GEOFFREY VINING, A JOHN WILEY & SONS, INC., PUBLICATION
2. Introduction to Machine Learning – Ethem Alpaydm, The MIT Press

Reference Books :

1. Applied Regression Analysis, Third Edition – Norman R Draper, Harry Smith, John Wiley & Sons.

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
C01	3	3	3	1	3	1	1	1	3	3	3	1	3
C02	3	2	3	1	3	1	2	1	3	3	2	2	2
C03	3	3	3	1	3	1	2	1	3	3	3	1	3
C04	3	2	3	1	3	1	2	1	3	3	2	3	2
C05	3	3	3	1	3	1	2	1	3	3	3	2	3

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:						
1. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett						
Reference Books :						
1. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron						
2. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney						

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Cloud Computing	4	6			Core-Theory

Introduction:

Cloud Computing is a paradigm shift in computing that has revolutionized the way businesses and individuals consume IT resources. It offers on-demand access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications) that can be rapidly provisioned and released with minimal management effort.

Course Outcome:

CO1 :	Understand fundamental Cloud Computing concepts and principles.
CO2 :	Compare Cloud Computing with traditional computing models.
CO3 :	Analyze IaaS, PaaS, and SaaS models and their applications.
CO4 :	Evaluate security concerns and governance frameworks in Cloud Computing.
CO5 :	Identify emerging trends like mobile cloud computing and IoT in Cloud Computing.

Unit I:**[12 periods]**

INTRODUCTION Cloud Computing Introduction, From, Collaboration to cloud, working of cloud computing, pros and cons, benefits, developing cloud computing services, Cloud service development, discovering cloud services.

Unit II:**[12 periods]**

Evolution and Enabling Technologies : Historical Development of Cloud Computing - Integration of Cluster, Grid, and Cloud Computing - Technological Advancements Enabling Cloud Adoption

Unit III:**[12 periods]**

Cloud Computing Models and Services: Cloud Computing Model Overview - Service Delivery Models (IaaS, PaaS, SaaS) - Case Studies: Salesforce.com, Force.com Benefits, Challenges, and Ethical Issues

Unit IV:**[12 periods]**

Security and Management in Cloud Computing: Security Concerns in Cloud Computing - Cloud Security Reference Model - Resource Virtualization and Management - Standards, Compliance, and Governance

Unit V:**[12 periods]**

Emerging Trends and Future Directions: Future Trends in Cloud Computing - Mobile Cloud Computing and IoT - Impact of Edge Computing and Serverless Architectures - Case Studies of Popular Cloud Service Providers: Amazon AWS, Microsoft Windows Azure, Google App Engine, OpenStack, Jelastic, iCloud, Live Mesh.

Text books:

1. Bhowmik, Sandeep. "Cloud computing". Cambridge University Press, 2017.
2. Ian Foster and Dennis B Gannon, "Cloud Computing for Science and Engineering", MIT Press, Massachusetts, 2017.
3. RajkumarBuyya, James Broberg and AndrzejGoscinski, "Cloud Computing: Principles and Paradigms", Wiley India Pvt Ltd, New Delhi, 2017.

Reference Books :

1. Mathew Portnoy, "Virtualization Essentials", Wiley India Pvt Ltd, New Delhi, 2017.
2. Thomas Erl, ZaighamMahmood and Ricardo Puttini, "Cloud Computing: Concepts, Technology and Architecture", Pearson Education, Chennai, 2017.
3. Anthony T Velte, Toby J Velte and Robert Elsenpeter, "Cloud Computing – A Practical Approach", McGraw Hill Education (I) P Ltd, Chennai, 2017.
4. Kris Jamsa , "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security, and More", Jones and Bartlett, New Delhi, 2014.

Program Outcomes											
P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
1	3	1	1	3	1	3	1	1	1	1	3
1	3	2	1	1	3	3	1	1	1	1	1
1	3	3	3	1	2	1	3	3	1	3	1
1	2	3	3	1	1	1	3	2	3	2	1
1	2	3	3	1	3	1	3	2	3	1	1

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Course – XI Cloud Computing Lab	4				Core Practical

Introduction:

This lab course aims to provide hands-on experience with Google Apps, simulating cloud environments using virtualization, creating and provisioning virtual machines, and simulating data centers. The course covers various cloud platforms and resource management within the cloud.

Course Outcome:

CO1	:	To inculcate the concepts of distributed computing.
CO2	:	To familiarize students with the concepts of cloud computing and its services.
CO3	:	To explain different cloud platforms and types of cloud services.
CO4	:	To demonstrate resource management in cloud environments.
CO5	:	To inculcate the concepts of distributed computing.

LIST OF EXPERIMENTS**1. Collaborative Learning Environment using Google Apps**

- Create a collaborative learning environment for a specific learning topic.
- Use Google Drive for hosting e-books.
- Use Google Docs for important articles.
- Use Google Slides for presentations.

2. Virtual Box Installation and Virtual Image Creation

- Install VirtualBox.
- Create a Windows/Linux virtual image.
- Analyze the virtual configuration.

3. Amazon AWS Instance Creation

- Register with Amazon AWS.
- Create a Windows/Linux instance.
- Connect using RDP.
- Create and manage S3 buckets.

4. Case Study on Amazon Elastic Cloud Services

- Study and report on Amazon Elastic Cloud Services (EC2).
- Explore instance types, AMIs, and pricing models.

5. Case Study on Microsoft Azure

- Study and report on Microsoft Azure cloud services.
- Explore Azure virtual machines, storage, and other services.

6. Installation and Configuration of Just Cloud

- Install Just Cloud software.
- Configure cloud storage and understand its features.

7. Working in Cloud9

- Demonstrate programming in different languages using Cloud9 IDE.
- Explore collaborative coding features in Cloud9.

8. Installation and Configuration of Hadoop/Eucalyptus

- Install Hadoop/Eucalyptus.
- Configure the environment for distributed computing.

9. Running Hadoop MapReduce

- Implement a simple MapReduce program.
- Analyze the output and performance.

Text books:

1. Bhowmik, Sandeep. "Cloud computing". Cambridge University Press, 2017.
2. Ian Foster and Dennis B Gannon, "Cloud Computing for Science and Engineering", MIT Press, Massachusetts, 2017.
3. RajkumarBuyya, James Broberg and AndrzejGoscinski, "Cloud Computing: Principles and Paradigms", Wiley India Pvt Ltd, New Delhi, 2017.

Reference Books :

1. Mathew Portnoy, "Virtualization Essentials", Wiley India Pvt Ltd, New Delhi, 2017.
2. Thomas Erl, ZaighamMahmood and Ricardo Puttini, "Cloud Computing: Concepts, Technology and Architecture", Pearson Education, Chennai, 2017.
3. Anthony T Velte, Toby J Velte and Robert Elsenpeter, "Cloud Computing – A Practical Approach", McGraw Hill Education (I) P Ltd, Chennai, 2017.
4. Kris Jamsa , "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security, and More", Jones and Bartlett, New Delhi, 2014.

Program Outcomes											
P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
1	3	1	1	3	1	3	1	1	1	1	3
1	3	2	1	1	3	3	1	1	1	1	1
1	3	3	3	1	2	1	3	3	1	3	1
1	2	3	3	1	1	1	3	2	3	2	1
1	2	3	3	1	3	1	3	2	3	1	1

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:

C01	:	Understand the basics of image processing techniques for computer vision and video analysis.
C02	:	Explain the techniques used for image pre-processing
C03	:	Develop various object detection techniques.
C04	:	Understand the various face recognition mechanisms.
C05	:	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:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and MachineVision", 4nd edition, Thomson Learning, 2013.

Reference Books :

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

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Algorithms in Data Science	3	6	0	0	Theory

Introduction:

This course In the realm of data science, algorithms play a crucial role in processing and analyzing large volumes of data to uncover patterns, make predictions, and derive actionable insights. An algorithm is essentially a step-by-step procedure or formula for solving a problem or performing a task. In data science, these algorithms are employed to build models that can learn from data, identify relationships, and make informed decisions.

Course Outcome:

CO1	:	Understand Fundamental Algorithmic Concepts
CO2	:	Apply Supervised and Unsupervised Learning Algorithms
CO3	:	Design and Optimize Predictive Models
CO4	:	Analyze and Interpret Data Using Advanced Algorithms
CO5	:	Address Ethical and Practical Considerations in Algorithm Design

Unit 1: Introduction to Algorithms and Data Structures**[5 Hours]**

Introduction to Algorithms, Definition and characteristics, Importance in data science, Algorithmic complexity (Big O notation), Data Structures Overview, Arrays, Linked Lists, Stacks and Queues, Searching and Sorting Algorithms, Linear and Binary Search, Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Heap Sort, Algorithm Analysis, Time Complexity, Space Complexity.

Unit 2: Advanced Data Structures**[5 Hours]**

Trees, Binary Trees, Binary Search Trees (BST), AVL Trees, B-Trees, Graphs, Definition and Terminology, Representation of Graphs (Adjacency Matrix, List), Graph Traversal (BFS, DFS), Hashing, Hash Functions, Collision Resolution Techniques (Chaining, Open Addressing), Applications of Hashing, Heaps, Binary Heaps, Heap Operations, Priority Queues

Unit 3: Algorithms for Data Processing and Analysis**[5 Hours]**

Divide and Conquer, Concept and Examples, Applications in Data Science, Dynamic Programming, Principles and Examples, Applications in Data Science, Greedy Algorithms, Concept and Examples, Applications in Data Science, Backtracking and Branch and Bound, Basic Concepts, Examples and Applications.

Unit 4: Machine Learning Algorithms**[5 Hours]**

Supervised Learning Algorithms, Linear Regression, Logistic Regression, Decision Trees, Support Vector Machines (SVM), k-Nearest Neighbors (k-NN), Unsupervised Learning Algorithms, k-Means Clustering, Hierarchical Clustering, Principal Component Analysis (PCA), Anomaly Detection, Ensemble Methods, Bagging and Boosting, Random Forest, Gradient Boosting Machines (GBM)

Unit 5: Algorithms for Big Data**[5 Hours]**

Introduction to Big Data, Characteristics of Big Data (Volume, Variety, Velocity, Veracity), Challenges in Big Data Processing, MapReduce Paradigm, Concept and Architecture, Examples and Applications, Big Data Tools and Frameworks, Hadoop, Spark

Text books:

1. Leskovec, J., Rajaraman, A., & Ullman, J. D. (2014). *Mining of Massive Datasets*. Cambridge University Press.
2. Zikopoulos, P. C., & Eaton, C. (2011). *Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*. McGraw-Hill

Reference Books :

1. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). *Introduction to Algorithms*. MIT Press.
2. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. MIT Press.
3. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning*. Springer.

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: <ol style="list-style-type: none"> Riley DD, Hunt KA. Computational Thinking for the Modern Problem Solver. CRC press; 2014 Mar 27 Byron Gottfried, "Schaum's Outline of Programming with C", McGraw Hill Education (India), 4th edition, 2018, ISBN: 978-9353160272 						
Reference Books : <ol style="list-style-type: none"> Yashavant Kanetkar, "Let Us C", Bpb Publications, 15th edition, 2016, ISBN:9788183331630 						