Computer Science and Engineering- Data Science

Department of Computer Science and Engineering

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COMPUTER SCIENCE AND ENGINEERING-DATA SCIENCE (DS)
B.TECH III YEAR I SEM   (5T+3L) +1 MC

S. No	Course code	Category	Subject Name	Hours per week			Credits
				L	T	P	
1	A55024	PCC	Computer Networks	3	0	0	3
2	A55025	PCC	Operating Systems	3	0	0	3
3	A55030	PCC	Machine Learning	3	0	0	3
4	A55027	PCC	Web Technologies	3	0	0	3
5	A55077 A55078 A55079	OEC-1	1.English for Professionals 2. Essential English and Employability Skills 3. Intellectual Property Rights 4. The Power of Data story Telling	3	0	0	3
6	A55288	ESC-Lab	Quantitative Aptitude and Reasoning	0	1	2	1.5
7	A55210	PCC-Lab	Web Technologies Lab	0	0	4	2
8	A55209	PCC-Lab	Operating Systems & Computer Networks Lab	0	0	3	1.5
9	A55091	MC	NSS/NSO	0	0	2	0
			TOTAL				20

COMPUTER SCIENCE AND ENGINEERING-DATA SCIENCE (DS)
B.TECH III YEAR II SEM   [5 T +3L]

S. No	Course code	Category	Subject Name	Hours per week			Credits
				L	T	P	
1	A56052	PCC	Data Visualization	3	0	0	3
2	A56053	PCC	Predictive Analytics using R Programming	3	1	0	4
3	A56054 A56037 A56038 A56039	PEC–I	1. Mobile Application Development 2. Internet of Things 3. Fundamentals of Digital Image Processing 4. Object Oriented Modeling	2	0	0	2
4	A56035 A56055 A56043 A56042	PEC–II	1. Software Engineering 2. Language Processors 3. Information Storage and Retrieval 4. Principles of Distributed System	3	0	0	3
5	A56080	HSS&MC	Entrepreneurship Development	3	0	0	3
6	A56232	ESC	Skill Integrated Lab	0	0	3	1.5
7	A56215	PCC – Lab	Data Visualization Lab	0	0	4	2
8	A56216	PCC-Lab	Predictive Analytics using R Programming Lab	0	0	3	1.5
			TOTAL				20

COMPUTER NETWORKS

B. Tech III Year I Semester				Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week		Credits	Marks		
A55024	PCC	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Pre requisites

C Programming Language and Data Structures.

Course Outcomes:

At the end of this course, students will be able to:

1. Illustrate the functionalities of various network models and Data link Layer.
2. Analyze error and flow control mechanisms in the data link layer
3. Examine various Routing Protocols.
4. Compare various congestion control mechanisms to improve the QoS of networking.
5. Identify the suitable Application layer protocols for specific applications.

UNIT - I:

Network Models: Layered Tasks, OSI model, Layers in the OSI model, TCP/IPprotocol Suite, Addressing.

Data Link Control: Error detection and Correction- Introduction, Hamming Distance,CRC, Checksum.

UNIT - II:

Data Link Layer: Responsibilities of Data Link Layer: Framing, Flow and Error Control, Noiseless Channels - Simplest Protocol, Stop-and-Wait protocol Noisy Channels - Stop- and-Wait Automatic Repeat Request, Go-Back-N Automatic Repeat request, Selective Repeat Automatic Repeat Request, High-Level Data link Control.

Multiple Access: Random Access, ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access - Reservation, Polling, Token Passing, Channelization - FDMA,TDMA,CDMA.

UNIT- III:

Network Layer: Responsibilities of Network Layer, Delivery, Direct Versus Indirect Delivery,Forwarding, Forwarding Techniques, Forwarding process, Types of Routing tables **Unicast**

Routing protocols: Optimization, Intra- and Interdomain routing ,Distance Vector Routing, Link State Routing, Path Vector Routing,IPV4 Addressing, Address space, Classful Addressing, Classless Addressing, Frame format of IPV4,IPV6.

UNIT- IV:

Transport Layer: Responsibilities of Transport Layer, Process-to-Process delivery, User Datagram Protocol, Transmission Control Protocol, Congestion Control - Open-Loop Congestion, Closed-Loop Congestion Control, Quality of Service, Techniques to improve QoS - Scheduling, Traffic Shaping, Resource Reservation, Admission Control.

UNIT-V:

Application Layer: Responsibilities of Application Layer Domain Name Space, Distribution of Name Space, DNS in Internet, Generic Domain, Country Domain, Inverse Domain Resolution, Domain Name Space (DNS) Messages, Electronic mail, File Transfer Protocol.

Text books:

1) Behrouz A Forouzan ,Data Communications and Networking,4th Edition, McGraw-Hill.

Reference Books:

1. Andrew S. Tanenbaum, Computer Networks, Third Edition.
2. William Stallings, Data Communications, Eight Edition. Pearson Publishers. http://highered.mheducation.com/sites/0072967757/student_view0/index.html

OPERATING SYSTEMS

B. Tech III Year I Semester				Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week			Credits	Marks	
A55025	PCC	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Prerequisites :

Computer Organization, Data Structures

Course Objectives:

1. Introduce basic concepts of operating system and process management
2. Discuss various CPU scheduling algorithms and problems of process synchronization.
3. Demonstrate different methods for handling deadlock.
4. Describe about memory management Techniques.
5. Explore the File system, system security and protection mechanisms.

Course Outcomes:

At the end of the course, students will be able to:

1. Summarize operating system and process management concepts.
2. Apply process scheduling and synchronization related issues.
3. Outline Deadlock Prevention, Avoidance, Detection and recovery mechanisms.
4. Analyze effectively memory management concepts.
5. Illustrate various protection and security measures.

UNIT I

Operating Systems Overview
Introduction -What operating system do, Operating system structure (uni-programmedand multi programmed), Operating system operations, Operating system services, System calls, Types of System calls, Operating system structure.

UNIT II

Process Management and Process Scheduling
Process Management- Process concepts, Process scheduling, Operations on processes, Inter process communication. Multithreading models. Process Scheduling –Basic concepts, scheduling criteria, scheduling algorithms.

UNIT III

Process Synchronization and Deadlocks

Process coordination: Synchronization – Background, The critical section problem, Peterson's solution, Synchronization hardware, Semaphore, Classical problems of synchronization, Monitors.

System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Detection and avoidance, Recovery from deadlock.

UNIT IV

Memory Management

Swapping, Contiguous memory allocation, Paging, Segmentation. Virtual memorymanagement - Demand paging, copy-on-write, page-replacement, Thrashing.

UNIT – V

File system, system protection and security

Storage management – File concept, Access methods, Directory and disk structure, File-system mounting. System protection- Goals of protection, principles of protection,Domain of protection, Access matrix. System Security – Security problem, Program threats, System and Network threats.

Text Books

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Concepts,9th edition ,John Wiley, 2016.

Suggested / Reference Books

1. D.M. Dharmdhere, Operating Systems – A Concept based Approach, 2nd Edition.TMH, 2007.
2. Andrew S Tanenbaum, Modern Operating Systems, 3rd Edition, PHI, 2008.
3. Behrouz A. Forouzan, Richard F. Gilberg, Unix and shell programming, cengage Learning 2009.

MACHINE LEARNING

B. Tech III Year I Semester					Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week			Credits	Marks		
		L	T	P	C	CIE	SEE	Total
A55030	PCC	3	0	0	3	40	60	100

Pre-requisites:

Python Programming, Statistics

Course Objectives:

To understand the need for machine learning for various problem solving

To study the various supervised and unsupervised learning algorithms in machine learning

1. To understand the latest trends in machine learning
2. To design appropriate machine learning algorithms for problem solving

Course Outcomes:

Student will be able to:

1. Understand the Concepts of Machine Learning
2. Develop Simple Regression Models .
3. Build various classification algorithms
4. Analyze the need of ensemble learning and dimension reduction
5. Apply the Clustering algorithms for developing applications

UNIT I:
Introduction to Machine Learning

What is Machine Learning,Types of Machine Learning, Applications of Machine learning, Preparing to Model, Modeling and Evaluation .

UNIT II:
Supervised Learning: Regression

Introduction to Regression,Example of Regression,Simple Linear Regression,Multiple Linear Regression,Assumptions in Regression Analysis,Improving the accuracy of the Linear Regression Model, Ridge Regression, Lasso Regression.

UNIT III:
Supervised Learning: Classification

What is Classification,General Approach to Classification, K-Nearest Neighbor Algorithm, Logistic Regression, Decision Trees: Construction, classification and

regression trees, example, Naive Bayesian Classifier, Support Vector Machines:Optimal Separation, Kernels, Algorithm

UNIT IV:
Unsupervised Learning and Dimensionality Reduction

Types of Unsupervised Learning, Challenges in Unsupervised Learning, Clustering Algorithms: K-Means, Agglomerative, DBSCAN, Comparing and Evaluating Clustering Algorithms.Dimensionality Reduction: Linear Discriminant Analysis (LDA),Principal Component Analysis (PCA), Factor Analysis (FA).

UNIT V:
Ensemble Learning and Reinforcement Learning

Ensemble Methods: Bagging, Boosting & Random Forests, Reinforcement Learning: Overview, Example: Getting Lost, Markov Decision Process, Values, difference between SARSA and Q Learning, Uses of Reinforcement Learning

Text Books:

1. Machine Learning, Saikat Dutt, Subramanian Chandramouli and Amit KumarDas, Pearson, 2018.
2. **Machine Learning: An Algorithmic Perspective by Stephen Marsland, CRCPress, 2009**
3. Introduction to Machine Learning with Python by Andreas C. Müller, Sarah Guido, 2016,O'Reilly Media, Inc.

Reference Books:

1. Introduction to Machine Learning (Adaptive Computation and Machine Learning),Ethem Alpaydin, The MIT Press 2004.
2. **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition Aurélien Géron, 2019, O'Reilly Media, Inc.**
3. Machine Learning, McGraw-Hill Education (India) Private Limited,Tom M. Mitchell, 2013.
4. **Pattern Recognition and Machine Learning. First Edition. ,C. M. Bishop. Springer, 2006.**

WEB TECHNOLOGIES

B. Tech III Year I Semester					Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week			Credits	Marks		
A55027	PCC	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Pre-requisites:

Basics of Object Oriented programming, Java

Course Objectives:

1. To provide knowledge on web architecture, web services.
2. Client side scripting technologies to focus on the development of web-based information systems and web services.
3. To provide skills to design interactive and dynamic web sites.
4. To provide knowledge for implementing web applications with database connection

Course Outcomes:

Student will be able to:

1. Design static web pages and provide client side authentication.
2. Prepare Static Web pages With Validations.
3. Develop new tag sets using XML mechanism.
4. Design and develop web applications using JSP and MVC architecture.
5. Understand database connectivity and retrieving data using client/serverdatabase.

UNIT I:

INTRODUCTION TO WEB: Understanding Internet and Web, Web Architecture, Web servers, protocols: HTTP, Introduction HTML: History of HTML, WWW, HTML Basics: Elements, Attributes, Tags, Tables, Forms, Frames.div and span tags.HTML5

UNIT II:
CSS: Introduction to cascading style sheet, Types of style sheets, page layout, selectors, pseudo classes and elements.CSS3
JAVA SCRIPT: Introduction to scripting, control structures, conditional statements, Arrays functions, objects. JS framework(ReactJS)
HTML DOM: Predefined object (Window, Location, History, Navigator). Events, DOM Node methods, Navigation, creating nodes, adding nodes, inserting nodes, removing & Replaces Nodes, Form object and Elements, DHTML with Java Script. front end frameworks(bootstrap),

UNIT III:

XML: Basics of XML, Elements, Attributes, validation, Name space.

XML Scheme Languages: Introduction to DTD, internal and external DTD, Elements of DTD, DTD Limitations, XML Schema, Schema structure, Elements, parsing XML: XML DOM, Document node, element node, Text node, Java and DOM, Navigating DOM Tree.

UNIT IV:

AJAX: Introduction, Environment, Asynchronous communication, process steps, sending and Retrieving Information, Ajax with XML.

Servlets : Introduction, Lifecycle, Generic and HTTP servlet, passing parameters to servlet, HTTP servlet Request & Response interfaces, Deploying web Applications, Session Tracking: Hidden form fields, cookies, URL- Rewriting, session.

UNIT V:

JSP: Introduction, Difference Between servlets & JSP, Anatomy of JSP page, JSP elements: Directives, comments, Expressions, scriptlets, Declaration, Implicit JSP objects, using Action elements.

JDBC: Introduction, JDBC Drivers, Loading Driver, establishing connection, Executing SQL statement in JSP pages, MVC architecture.

Text Book:

    1. Uttam K. Roy, Web Technologies, 8th Impression, Oxford Publication, 2014.

Reference Books:

1. Thomas Powell, "The Complete Reference HTML and CSS", 5th Edition, Tata McGraw Hill, 2010.
2. Thomas Powell, Fritz Schneider, "The Complete Reference JavaScript 2.0",3rd Edition, Tata McGraw Hill, 2012.

ENGLISH FOR PROFESSIONALS

B. Tech III Year I Semester					Dept. of Computer Science and Engineering-Data Science		
Code	Category	Hours / Week			Credits	Marks		
		L	T	P	C	CIE	SEE	Total
A55077	OE-I	3	0	0	3	40	60	100

Introduction:

The course aims at preparing the students with the tools needed for successful communication at the professional front. It is designed to improve students' academic and professional skills which the employers are currently looking for.

Objective:

To prepare the students to use the language effectively in all professional pursuits

Course Outcomes:

The students will be able to:
1. Analyze the language use in communicative process
2. Describe the process and product
3. Interpret the ideas in group activities
4. Apply different approaches to comprehend the written text
5. Write any technical and official correspondence within the framework

UNIT-I
Essentials of Communication:
Essentials of Grammar **-** Rudiments of Communications Skills (Listening, Speaking, Reading, and Writing) - Applied Grammar and Usage - Non-Verbal Communication

UNIT-II
Listening Skills:

Art of Listening - Developing Effective Listening Skills - Process of Listening, Intensive & Extensive Listening Podcasts, Vodcasts (ICT enabled) - Five steps to Active Listening - Effective and Ineffective Listening Skills -Listening & Note-Taking

UNIT-III
Speaking Skills:

Dynamics of Effective Speaking - Group Discussion - Simulated Presentations, Process& Product Descriptions - Proxemics, Paralinguistic Features

UNIT-IV
Reading Skills:

The Art of Effective Reading - Basic steps to Effective Reading - Extensive and Intensive Reading -Approaches to Efficient Reading - Reading Comprehension

UNIT-V
Writing Skills:

Art of Condensation - Descriptive Writing Techniques - Writing & Answering Memos, Circulars - Inter & Intra Official Communication - Writing Minutes of Meeting - Netiquette
- E-mail & Blog Writing - Note-Making

PRESCRIBED TEXTBOOK:

1. Business Communication (Second Edition) by Meenakshi Raman & PrakashSingh. Oxford University Press. 2012.

REFERENCES:

1. Communicating at Work (Seventh edition) by Adlar, Ronarld.B. McGrawHill. 2004.
2. Cambridge English for Engineering Professionals by Mark Ibbotson. Cambridge University. 2008.
3. Professional Communication by Aruna Koneru. McGrawHill. 2017.
4. The Effective Communicator by Adair John. Jaico Publishing House. 1995.
5. Oxford English for Careers by Oxford University Press.

ESSENTIAL ENGLISH AND EMPLOYABILITY SKILLS

B. Tech III Year I Semester					Dept. of Computer Science and Engineering-Data Science		
Code	Category	Hours / Week			Credits	Marks	
		L	T	P	C	CIE	SEE	Total
A55078	OE-I	3	0	0	3	40	60	100

Course Objectives:

1. To enable students to develop their personality, infuse confidence and increase employability skills in   any chosen career.
2. To provide the students hands-on experience to cope with the demands of theworld of recruiters.
3. To help the students acquire the job skills essential for employment.

Course Outcomes:

1. Enhancement of employability skills and professional etiquette.
2. Acquisition of productive knowledge, competent learning and innovativethinking skills.
3. Implementation of verbal and non-verbal communication competencies inwork place.

UNIT-I

"Six Sigma: Dabbawala" from **"English for Employability"** by K Purushotham published by Orient Black Swan, Hyderabad, India.
 "Personality Development: A Must for Leadership and Career Growth" from **"Personality Development and Soft Skills"** by Barun.K.Mitra, published by Oxford Publications -
Introduction, Learning about Personality Development from 3 Cases, Personality Analysis, Freudian analysis of Personality Development, Swami Vivekananda's Concept of Personality Development, Personality Begets Leadership Qualities.

UNIT-II
"Yet I am not defeated!" from **"English for Employability"** by K Purushothampublished by Orient Black Swan, Hyderabad, India.
"Interpersonal skills" from **"Personality Development and Soft Skills"** by Barun.K.Mitra, published by Oxford Publications -
The Personality Attribute of Taking Bold Decisions, Personality Types and LeadershipQualities, Personality Tests

UNIT-III
"Patricia Narayanan: An Entrepreneur by accident", from **"English for Employability"** by K Purushotham published by Orient Black Swan, Hyderabad, India.

"Soft Skills: Demanded by Every Employer" from **"Personality Development and Soft Skills"** by Barun.K.Mitra, published by Oxford Publications
Introduction to Soft Skills, Lessons from the 3 Case Studies, Change in Today's Work place; Soft Skills as a Competitive Weapon, Antiquity of Soft Skills, Classification of SoftSkills

UNIT-IV
"Satya Nadella: CEO of Microsoft" from "English for Employability" by KPurushotham published by Orient Black Swan, Hyderabad, India.
"Interview Skills" from **"Personality Development and Soft Skills"** by Barun.K.Mitra,published by Oxford Publications.

UNIT-V
"Body Language Reveals Your Inner self and Personality" from **"PersonalityDevelopment and Soft Skills"** by Barun.K.Mitra, published by Oxford Publications - Introduction, Emotions Displayed by Body Language , Handshake-The Most CommonBody Language, Eyes-A Powerful Reflection of One's Inner Self, Entry to My Space –Personal Zones May Vary, Body Language Exhibited during Different ProfessionalInteractions.

Textbooks:

 1. "English for Employability" by K Purushotham published by Orient Black Swan, Hyderabad
2."Personality Development and Soft Skills" by Barun K.Mitra, published by Oxford University Press

References:

1. Cottrell,Stella.*Skills for Success*.London:Palgrave Macmillan,2003.
2. *Enhancing English and Employability Skills*, State Board of TechnicalEducation and Training, Hyderabad: Orient Blackswan Private Limited, 2012.
3. Knight,T.Peter and Mantz Yorke.*Assessment, Learning and Employability*.U.K:Mac Graw-Hill House,2003.
4. Rao,M.S. *Soft Skills Enhancing Employability*.New Delhi: I.K.Publishing House,2010.
5. Rao, Nageshwar.Communication *Skills.* New Delhi: Himalaya PublishingHouse Pvt.Ltd, 2008.
6. Sharma,T.K.Enhancing Employability in Education.India:Patridge Publishing House.2015.
7. Sharma,T.K.Enhancing Employability in Education.India:Patridge Publishing House.2015.
8. Sinha, K. K.*Business Communication.NewDelhi*: Galgotia Publishing Company ,2008.
9. Yadav, Shalini. *Communication Techniques,* New Delhi: University Science Press,2010.

INTELLECTUAL PROPERTY RIGHTS

B. Tech III Year I Semester					Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week			Credits	Marks		
		L	T	P	C	CIE	SEE	Total
A55079	OE-I	3	0	0	3	40	60	100

Course Objective:

The course aims to help the student understand the concept of Intellectual Property Rights and helps the student to appreciate the purpose and function of a trademark and the process involved in getting copyright, patent and related issues. The student is introduced to the importance of trade Secret and Geographical Indications.

Course Outcomes:

At the end of the course student will be able to

1. Explain the concepts of intellectual property rights and related agencies.
2. Describe the purpose and functions of a trademark in a competitive environment.
3. Analyze the process of copyright and procedure.
4. Understand the process of patent and patent issues.
5. Explore the trade secret and geographical indications of its protection from unfair practices.

Unit I:
Introduction to IPR:
Concept of intellectual property rights, importance of intellectual property rights. Typesof intellectual property, international agencies, and treaties.

Unit II:
Trademarks:
Concept of trademarks, purpose, and function of trademarks. Acquisition of trademark rights, protectable matter, selecting and evaluating trademark, trademark registration processes.

Unit III:
Law of copyrights:
Concept of copyright right, fundamentals of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration.

Unit IV:

Law of patents:

Introduction to patent, foundation of patent law, patent searching process, ownership rights and transfer.

Unit V:

Trade Secrets & Geographical Indication:

Law pertaining to trade secrets, determination of trade secrets. Trade secret litigation. Unfair competitions. Geographical Indication, concept of geographical indication, importance of geographical indication, new development of intellectual property rights.

Textbooks:

1. Deborah. E. Bouchoux,Intellectual property right, 5/e,2018,cengage learning.
2. Neeraj Pandey, Intellectual property right, PHI, 2019.

Reference Books:

1. Ramakrishna Chintakunta and M. Geethavani, Kindle e 2021

2. Prabuddha Ganguli,Intellectual Property Right:Unleashing the Knowledge Economy, 2/e, 2017 Tata Mc Graw Hill Publishing company Ltd.

The Power of Data Storytelling							
B. Tech III Year I Semester				**Dept. of Computer Science and Engineering-Data Science**			
Code	**Category**	**Hours / Week**		**Credits**	**Marks**		
	OE-I	L	T	P	C	CIE	SEE	Total
		3	0	0	3	40	60	100

Introduction:

This course will cover the fundamentals of effective data-driven storytelling. Storytelling can put a human perspective on the increasingly complex and rapidly changing world of the digital era. Students will learn how to interpret and analyse the data and willlearn to articulate the stories with data sets and communicate data findings in visual, oral, and written contexts.

Course Objectives:

1. Develop the skills necessary to be effective data storytellers.
2. Locate relevant datasets, extract insights from that data and present theirfindings in myriad formats.
3. Learn how to interpret data and to present it in different formatsto different audiences.

Course Outcomes:

1. Identify the stories within datasets and extract insights from that data.
2. Explain the importance of communication skills and competencies for individualswho serve as data storytellers.
3. Act as a data-driven visual storyteller for optimal presentation of trends, patterns,and insights.
4. make effective client presentations of their work using infographic visualizations.
5. learn tools and concepts which can be put to immediate use to transform datainto stories.

Unit I:
Introduction
We are all storytellers- Stories Bring Data to Life- The Essence of Data Storytelling

Unit II:
Dynamics of Data Storytelling
Getting to the Core- Planning is Everything- The Quick Fix- Application of Story elements

Unit III:
Crafting the Data Story
The Psychology of Storytelling- The narrative Techniques - Making Good stories Great!
– Writer to Storyteller

Unit IV:

Data Visualization

Use Visuals to Advantage: Data Presentation Skills- Infographics Visualizations

Unit V:

Anatomy of Data Story

Rudiments of Grammar - Parts of Speech - Concord Rules - Academic and Technical Vocabulary - Data Interpretation - Case Studies

Textbook:

1. **Vora , Sejal (2019).*The Power of Data Storytelling*, Sage Publications India pvt Ltd.**

Reference books:

1. Dykes, Brent (2020). *Effective Data Storytelling*: New Jersey, Wiley.
2. Knaflic, Cole Nussbaumer (2015).*Storytelling with Data: A Data Visualization Guide for Business Professionals,*https://www.amazon.com/Storytelling-Data-Visualization-Business-Professionals/dp/1119002257/
3. Morrow, Jordon (2021), *Be Data Literate- The Data Literacy Skills EveryoneNeeds to Succeed*, UK: Kogan Page Ltd.
4. Taylor, Scott (2021). *Telling your Data Story: Data storytelling for Time Management*, New Jersey: Technics Publications LLC.
5. https://www.amazon.com/Tableau-Your-Data-Analysis-Software/dp/1119001196/

Quantitative Aptitude and Reasoning

B. Tech III Year I Semester					Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week			Credits	Marks		
A55288	ESC	L	T	P	C	CIE	SEE	Total
		0	1	2	1.5	50	50	100

UNIT I

Number System: Speed Math's, Numbers, Factors, Prime and co primes, LCM & HCF,Divisibility rules, Finding the unit digit and applications, remainder theory.

Ratio and Proportion with Ages: Definition of ratio and Proportion, Finding the resultant ratio. Problems based on Ratios and ages.

Percentages: Introduction to percentages, Percentage Increase /Decrease, Results onPopulation, Results on Depreciation, Variations, Applications of Percentage.

Profit and Loss: Classification of Profit and Loss, Profit/ Loss Percentages, Successive Discount.

UNIT II

Time and Distance: Difference between the average, Relative and Effective speed, reaching the destination late and early, stoppage time per hour, problems based on Trains and problems based on Boats.

Time and Work: Calculating Efficiency, alternate days concept, work and wages, Chain rule, problems based on Pipes and cisterns.

Simple and Compound Interest: Simple interest, Principle, Rate, Amount, Applications of Simple interest, Compound interest, compounded annually, Compounded Half yearly, Compounded Quarterly, Difference between simple and compound interest.

UNIT III

Permutations and Combinations: Fundamental rules, Problems on Permutations andCombinations.

Probability: Definition, Notations and Problems based on Probability.

Mean, Median and Mode: Introduction and problems on Mean, Median and Mode.

Partnership: Relation between Partners, Period of Investments and Shares.

Averages: Average of different groups, change in average by adding, deleting andreplacement of objects

Flow Charts: Introduction of symbols and problems on flow charts.

Seating Arrangement: Circular, Row, Column, Square and Double row arrangement

Puzzles: Paragraph puzzles, incomplete puzzles and problems on them.

Number Series: Number, Alphabet and Letter Series.

Analogy: Simple, Double, Word and Number Analogy

Coding and Decoding: Classifications and Problems on Coding and Decoding.

UNIT V

Clocks: Relation between minute and hour hand, angle between hands of a clock, exceptional cases in clocks. Gaining and loosing of time.

Calendars: Classification of years, finding the day of any random calendar date, repetition of calendar years.

Direction Sense Test: Sort of directions in puzzle, distance between two points, Problems on shadows.

Blood Relations: Defining the various relations among the members of a family, solving blood relation puzzles by using symbols and notations. Problems on coded relations.

Text Books

1. R.S Agarwal, Verbal and Non-Verbal Reasoning, New Edition, S. Chand.
2. R.S Agarwal, Quantitative Aptitude, New Edition, S. Chand.

Reference Book

1. Abhijeet Guha, Quantitative Aptitude, New Edition, Mc Graw Hill.

WEB TECHNOLOGIES LAB

B. Tech III Year I Semester					Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week			Credits	Marks		
A55210	PCC	L	T	P	C	CIE	SEE	Total
		0	0	4	2	50	50	100

Course Objectives:

1. Client server architecture and able to develop static web application
2. Client-side data validation using java script
3. To create dynamic web application using server side technologies
4. To create fully functional web application with MVC architecture.

Course Outcomes:

Student will be able to:

1. Design static web pages and provide client side authentication.
2. Develop new tag sets using XML mechanism.
3. Understand database connectivity and retrieving data using client/server database.
4. Design dynamic web pages and develop web applications using MVC architecture.

Week-1:
Design the following static web pages required for an online book store web site.

1) HOME PAGE:

2) LOGIN PAGE:

Week -2:
Design the student REGISTRATION PAGE:

Week- 3:
Apply internal and external CSS (Cascading Style Sheets) for week1&2 pages.

Week -4:
VALIDATION:

 Write JavaScript to validate the following fields of the above registration page.

Week -5:
Design the catalogue page.

Week -6:

Write an XML file which will display the Book information which includes the following:
Write a Document Type Definition (DTD) to validate the above XML file.

Week -7:

Develop week(1-5) using bootstrap

Week -8:

Write a program to display the HELLO WORLD message using servlet.

Week -10:

Write a program to create cookies and retrieval using servlet.

Week -11:

Write a program to display the HELLO WORLD message using JSP

Week -12:

Convert all above static web pages into the JSP pages.

Week -13:

Using registration form. Authenticate the user when he submits the login form using the
user name and password from the database

Week -14

Create tables in the database which contain the details of items (books in our case like
Book name , Price, Quantity, Amount)) of each category. Modify your catalogue page (week
4)in such a way that you should connect to the database and extract data from the tables and
display them in the catalogue page using JDBC.

Week -15

Implement week -10 in MVC architecture.

OPERATING SYSTEM AND COMPUTER NETWORKS LAB

B. Tech III Year I Semester					Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week			Credits	Marks		
A55209	PCC	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

Course Objectives:

1. Analyze system calls that can offer operating system services
2. Demonstrate various operating system concepts
3. Understand and apply concepts of process synchronization
4. Understand the concept of Dead lock and its avoidance
5. Analyzing page replacement algorithms

Course Outcomes:

1. Understand system calls behavior and implement that can offer operatingsystem services
2. Implement CPU scheduling algorithms multithreading
3. Implement the producer and consumer problem
4. Implement the dead lock avoidance using banker's algorithm
5. Implement page replacement algorithms

PART -A

1. Write a programs using the following system calls of UNIX operating system:fork, exec, getpid, exit, wait, close, stat, opendir, readdir
2. Write a program to implement multithreading?
3. Give the list of processes, their CPU burst times and arrival times, display or print the Gantt chart for FCFS and SJF. For each of the scheduling policy compute and print the average waiting time and average turnaround time
4. Give the list of processes, their CPU burst times and arrival times, display or print the Gantt chart for Priority and Round Rabin. For each of the scheduling policy compute and print the average waiting time and average turnaround time.
5. Implement producer consumer problem using semaphore?
6. Write a program to implement Banker's algorithm for deadlock avoidance?
7. Write a program to implement page replacement algorithms (FCFS, Optimal, LRU)

PART - B

Course Objectives :

1. Understand data link layer framing methods.
2. Know about the various error detection methods.
3. Explore the knowledge of various routing algorithms.
4. Understand Traffic Analysis and Statistics in network.

Course Outcomes

1. Implement data link layer farming methods
2. Analyze error detection method
3. Analyze routing and congestion issues in network
4. Apply Traffic Analysis and Statistics in network

Programs:

1. Implement the data link layer framing method Bit stuffing.
2. Implement the data link layer framing method Character Stuffing.
3. Write a program to compute CRC 16.
4. Implement Dijkstra's algorithm to compute the Shortest path thru a graph.
5. Installation of Wireshark
6. Simulate Packet Capture Using Wire shark
7. Implement Viewing Captured Traffic Using Wire shark
8. Simulate Statistics & Filters Using Wire shark

NATIONAL SPORTS ORGANIZATION (NSO) / NATIONAL SERVICE SCHEME (NSS)

B. Tech III Year I Semester					Dept. of Computer Science and Engineering-Data Science		
Code	Category	Hours / Week			Credits	Marks		
		L	T	P	C	CIE	SEE	Total
A55091	MC	0	0	2	0	50		50

UNIT-I

Health and Wellness

Dimensions of Health: Physical, Mental and Social. Objectives of Health Education. Definition and Dimensions of Wellness – Physical, Emotional, Social, Spiritual, Intellectual and Environmental Wellness. Achieving Wellness.

Practical: Basketball, Cricket, Kho-Kho (Any Two) & Badminton (Mandatory)

Layout of Courts / Fields, Skills, Rules & Lead-up Games.

UNIT-II

Fitness and Body Composition

Physical Fitness Components: Body Composition, Muscular Endurance, Strength, Cardiovascular Fitness and Flexibility, Importance of Cardio-Respiratory Endurance. Obesity and Health Risk Factors. Body Composition Indicators and Measurements.

Practical: Football, Kabaddi, Volleyball (Any Two) & Table Tennis (Mandatory)

Layout of Courts / Fields, Skills, Rules & Lead-up Games.

UNIT-III

Introduction and Basic Concepts of NSS: History, Philosophy, Aims & Objectives of NSS. Emblem, Flag, Motto, Song, Badge, Organizational Structure, Roles and Responsibilities of Various NSS functionaries. NSS Programmes and Activities, Volunteerism and Shramdan.

UNIT-IV

Personality Development Through Community Service: Importance and Role of Youth Leadership, Life Competencies, Social Harmony and National Integration, Youth Development Programmes in India, Citizenship, Health, Hygiene and Sanitation, Environment Issues, Disaster Management, Life Skills.

Vocational And Entrepreneurship Skills Development: Definition and meaning of Entrepreneurship, Qualities of good entrepreneur, Steps /ways in operating an Enterprise and role of financial and support service Institutions. Project Cycle Management, Resource Mobilisation and Documentation and Reporting.

Project work/ Practical: Conducting Surveys on Special Theme, Involving in Shramadan, Swachh Bharat, Blood Donation, Tree Plantation, Awareness Programmes, Identify the Community Problems and List out the all Possible Solutions, Educate the Villagers on Health, Hygiene, Sanitation and Environment Protection. Self- Review of the Students on their Improvements by Participating in the Community Service Programmes.

References

1. Rajiv Parti, *The Soul of Wellness: 12 holistic principles for achieving a healthy body,mind, heart and spirit*, Select book incorporation, New York.
2. H. & Walter, H., (1976). *Turners School Health Education*. Saint Louis: The C.Y. Mosby Company.
3. Nemir, A. (n.d.). *The School Health Education*. New York: Harber and Brothers.
4. Edward T Howley, *Health Fitness Instructors Handbook*, Human Kinetics, USA.
5. **About NSS:** National Service Scheme Manual by Government of India Ministry ofYouth Affairs & Sports, New Delhi.
6. Robert N Lussier, *Management Fundamentals - Concepts, Applications, Skill Development*, Cengage Leaning, First Edition, 2012.
7. Mroczex & Little, *Handbook of Personality Development* –(eds).2006.
8. Richard Blundel, *Exploring Entrepreneurship Practices and Perspectives*, Oxford,2011

DATA VISUALIZATION

				Dept. of Computer Science and Engineering-Data Science			
B. Tech III Year II Semester							
Code	**Category**	**Hours / Week**			**Credits**	**Marks**	
		L	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
A56052	PCC	3	0	0	3	40	60	100

Prerequisites:

Programming knowledge

Course Objectives:

1. To provide an overview and best practices of data visualization
2. To introduce the data types, relationships, and visualization formats.
3. To provide the basic principles for data visualization.
4. To introduce the storytelling for effective data presentation.
5. To introduce a trends in market research and data visualization dashboards,

Course Outcomes:

At the conclusion of the course, students should be able to:

1. Identify the skill sets needed for best practices of data visualization.
2. Explain the significance of data types, relationships and visualization formats in data visualization.
3. Identify principles of data visualization.
4. Apply the storytelling for effective data presentation
5. Evaluate a trends in business using data visualization dashboards.

UNIT I:
Introduction: What is data visualization? History, The data visualization process, Why is data visualization so important in reports and statements? Explaining, Exploring,Analyzing.

UNIT II:
Data types: Quantitative, Qualitative, relationships: Ranking, Deviation, Nominal comparisons, Correlation, Partial and total relationships, Series over time, Distribution. Visualization formats: Bar chart, Histograms, Pie charts, Scatter plots, Heat maps, Linecharts, Bubble charts, Radar charts, Waterfall charts, Tree maps, Area charts

UNIT III:
Basic principles for data visualization, Graphics with an objective: seeking your mantra, Layout and design: communicative elements, Prioritize patterns in your visualizations:Gestalt

UNIT IV:

Storytelling for social and market communication, Data storytelling, A basic recipe for storytelling in your presentations and final reports, Trends in market research and data visualization dashboards, Scrollytelling.

UNIT V:

Application of Data Visualization, Visualizing data tools: HTML5 CANVAS: Linear interpolations, A Simple Column Chart, Animations, Google Charts API Basics, D3.js, and Dashboard using Tableau, Future of data visualization.

Text Books:

1. Chun-houh Chen, Wolfgang Härdle, Antony Unwin, "Handbook of Data Visualization", Springer, 2008.
2. Pérez, J. and Vialcanet, G., Visualize It: A Comprehensive Guide to DataVisualization, 2013.

Reference Books:

1. E. Tufte, "The Visual Display of Quantitative Information", Second Edition, Graphics Press, 2007.
2. Ward, Grinstein Keim, "Interactive Data Visualization: Foundations, Techniques,and Applications", Natick: A K Peters, Ltd.
3. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
4. A Julie Steele and Noah Iliinsky, "Designing Data Visualizations: Representing Informational Relationships", O'Relly.
5. Andy Kirk, Data Visualization: A Successful Design Process, PAKT.
6. Scott Murray, "Interactive Data Visualization for Web", O'Relly.
7. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.

Web references:

1. Visualization through Tableau http://www.tableausoftware.com/public
2. Gap Minder and Google Motion Charts (www.gapminder.org).

PREDICTIVE ANALYTICS USING R PROGRAMMING

B. Tech III Year I Semester				Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week		Credits	Marks		
		L	T	P	C	CIE	SEE	Total
A56053	PCC	3	1	0	4	40	60	100

Course Objectives:

1. Use R for statistical programming, computation, and graphics.
2. Write User defined functions and use R in an efficient way,
3. Fit some basic types of statistical models
4. Use R in their own research,

Course Outcomes:

At the end of this course students will be able to:

1. Understand the basics in R programming in terms of vector, matrix and List (L1)
2. Apply various operations on data frames. (L4)
3. Use the apply family of functions to iterate functions across data for real world problems. (L6)
4. Import, Explore data-sets to create testable hypotheses and identify appropriate statistical tests (L6)
5. Able to apply R programming for predictive analysis Formulate linear andmultiple regression models using R
6. Understand the fundamentals of Predictive Analytics in R.

UNIT I:
Basics of R: Introduction, R-Environment Setup, Programming with R, Basic Data Types, Vectors**:** Creating and Naming Vectors, Vector Arithmetic, Vector Sub setting, Roperators
Matrices: Creating and Naming Matrices, Matrix Sub setting, Arrays,
Lists: Introduction, Creating a List: Creating a Named List, Accessing List Elements,Manipulating List Elements, Merging Lists, Converting Lists to Vectors,

UNIT II:
Factors and Data Frames : Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered Factors, Comparing Ordered Factors, Introduction to Data Frame,Subsetting of Data Frames, Extending Data Frames, Sorting Data Frames, **Conditionals and Control Flow**: Conditional Statements.
Iterative Programming in R: Introduction, While Loop, For Loop, Looping Over List.

UNIT III:
Functions in R: Introduction, Writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R, Input andOutput Operations.

Apply Family in R : Introduction, Using Apply in R, Using Lapply in R, Using Sapply,Using Tapply in R: Split Function, Using Mapply in R.

Charts and Graphs : Introduction, Pie Chart: Chart Legend, 3D Pie Chart, Bar Chart,Box Plot, Histogram, Line Graph: Multiple Lines in Line Graph, Scatter Plot.
Data Interfaces: Introduction, CSV Files: Syntax, Importing a CSV File, Excel Files:Syntax, Importing an Excel file, Binary Files: Syntax, XML Files, Web Data, Databases.

Introduction to Predictive modeling and Predictive modeling Techniques: What is predictive modeling, importance of predictive modeling, applications of Predictive Modeling, Hypothesis Testing, Analysis of Variance (One way ANOVA, Two way ANOVA),T-Test, Linear regression in R, Logistic Regression in R ,Clustering with R.

Text Books:

1. K G Srinivas ,G M Siddesh "Statistical programming in R", Oxford Publications.

Reference Books:

1. K Beginning R: The Statistical Programming Language,Mark Gardener, Wrox.
2. Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", NoStarch Press, 2011.
3. Y. Anchang Zhao ,R and Data Mining: Examples and Case Studies . Elsevier in December 2012.
4. Avril Coghlan ,A Little Book of R For Time Series, Release 0.2.

MOBILE APPLICATION DEVELOPMENT

B. Tech III Year II Semester				Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week		Credits	Marks		
		L	T	P	C	CIE	SEE	Total
A56054	PEC-I	L	T	P	C	CIE	SEE	Total
		2	0	0	2	40	60	100

Course Objectives:

1. Outline the usage of Android development framework.
2. Understand the main components of an Android application and its entire life Cycle.
3. Develop database programming using SQLite.
4. Identify the use of location-based service in android applications.
5. Build SMS and MMS applications using Intents.

Course Outcomes:

At the end of this Mobile Application Development course, students will be able to:
1. Analyze the architecture of android and current trends in mobile operating systems.
2. Apply suitable software tools and APIs for the design of User Interfaces to a particularmobile application.
3. Design applications for mobile devices using SQLite Database.
4. Apply the location-based services in android applications.
5. Summarize the Monitoring changes to the phone, network, data connectivity and SIMstates.

UNIT I:
Introduction to Android, Features of Android, The development framework**:**
Understanding the Android Software Stack, Android Application Architecture; the Dalvik Virtual Machine, Creating First Android Application, Types of Android Applications, Android Development Tools: The Android Virtual Device Manager, Android Emulator, The Dalvik Debug Monitor Service.

UNIT II:
Creating applications and Activities: Introduction to the application Manifest File,
Using the Manifest Editor, Externalizing Resources: Creating Resources - Simple Values, Drawables, Layouts, Menus, Animations.The Android Activity Life cycle. **Building User Interfaces:** Fundamental Android UI design, Introducing Layouts: Defining Layouts, Using Layouts to Create Device Independent User Interfaces, Optimizing Layouts.

UNIT III:

Databases and Content Providers: Introduction to Android Databases, Introducing SQLite, Content Values and Cursors, working with SQLite Databases - Introducing the SQLiteOpenHelper, querying a Database, Extracting Values from a Cursor, Adding, Updating, and Removing Rows, Creating Content Providers, Using Content Providers - Introducing the Content Resolver, Querying Content Providers, Adding, Deleting, and Updating Content

UNIT IV:

Maps and Location based services: Using the location-based services, selecting a Location Provider, selecting a Location provider, finding current location; **Creating Map- Based Activities**: Introducing Map View and Map Activity, Creating a Map-Based Activity, Maps and Fragments

UNIT V:

Telephony and SMS: Using telephony - Initiating Phone Calls, Accessing Telephony Properties and Phone State, Monitoring Changes in Phone State Using the Phone StateListener, Introducing SMS and MMS - Using SMS and MMS in Your Application, Sending SMS and MMS from Your Application Using Intents, Sending SMS Messages Using the SMS Manager.

Text Book:

1. Reto Meier, Professional Android 4 Application Development, 1stEdition, WroxPress, Wiley Publishing, 2014.

Reference Books:

1. Pradeep Kothari, Android Application Development (with Kitkat Support), BlackBook, 2014, Dreamtech Press publisher, Kogent Learning Inc., 2014
2. Erik Hellman, Android Programming: Pushing the Limits, 1st Edition, Wiley Publications, 2014.
3. Mike Wolfson, Android Developer Tools Essentials, O'Reilly Edition, 1st Edition,2013.

B. Tech III Year I Semester					Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week			Credits	Marks		
		L	T	P	C	CIE	SEE	Total
A56037	PEC-I	2	0	0	2	40	60	100

Pre-requisites:

Computer Networks, Python Programming

Course Objectives:

1. Differentiate Physical and Logical Design of IoT
2. Categorize pin configuration of Arduino Uno Board
3. Demonstrate Code in Node-RED
4. Identify communication between M2M
5. Develop an IoT Applications using Raspberry Pi board

Course Outcomes:

At the end of the course student will be able to:

1. Identify physical and logical design of IoT
2. Understand Arduino Uno Board
3. Implement code in Node-RED
4. Develop an IoT Application using Arduino Uno board
5. Develop an IoT Applications using Raspberry Pi board

UNIT - I

Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logicaldesign of IoT, Functional blocks of IoT, Communication models & APIs. (T1, Chapter 1)

Domain specific applications of IoT: Home automation, Cities, Environment, Energy,Retail, Logistics, Agriculture, Industry, Health and lifestyle. (T1, Chapter 2)

UNIT – II

Arduino Basics: Hardware Requirements, Software Requirements, Arduino Programming Lanugage References. (T2, Chapter 1)

Internet Connectivity: Arduino Uno Wired Connectivity(Ethrnet), Arduino Uno Wireless Connectivity(Wifi) (T2, Chapter 2)

UNIT - III
Communication Protocols: HTTP, MQTT (T2, Chapter 3)

Complex Flows: Node-RED: Hardware and Software Required, Circuit, Node-RED Flow, code (Arduino) (T2, Chapter 4)

UNIT - IV
Prototypes

IoT Patterns: Real-time Clients, Remote Control, On-Demand Clients, Web Apps, Location Aware, Machine to Human, Machine to Machine. (T2, Chapter 5-11)

UNIT - V
Using IOT for RFID and MQTT and the Raspberry Pi: Introduction to Raspberry Pi, RFID Technology, IoTRFID Hardware and Software, Building an MQTT Server on a Raspberry Pi, the Software on the Raspberry Pi, Building the IOTRFID Project (T3, Chapter 6)

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press, 2015
2. Adeel Javed, Building Arduino Projects for the Internet of Things Experiments with Real-World Applications, Apress, 2016
3. John C. Shovic , Raspberry Pi IoT Projects, Prototyping Experiments for Makers, Apress, 2016

REFERENCE BOOKS:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press)
2. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014
3. R.K.Mittal and I J Nagrath, Robotics and Control, TMH, 2003

FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

B. Tech III Year II Semester				Dept. of Computer Science and Engineering-Data Science		
Category	Hours / Week		Credits	Marks		
PEC-I	L	T	P	C	CIE	SEE	Total
	2	0	0	2	40	60	100

Pre requisite:

Basic Mathematics

Course Objectives:

1. Comprehend fundamental aspects of digital image processing
2. Understand the image noise models and enhancement methods
3. Evaluate the image segmentation methodologies
4. Understand the colour image processing techniques
5. Understand image morphological operations

Course Outcomes

At the end of the course the students will be able to:

1. Understand the fundamental concepts of digital image processing system
2. Analyze the image noise models and enhancement techniques
3. Comprehend the different image segmentation and restoration methodologies.
4. Analyze the concepts of colour image processing.
5. Apply morphological operations on binary images.

UNIT-I

Introduction: Definition, Pixel, Digital image representation, Types of images, Fundamental steps in image processing, image processing applications. Digital image processing operations – Basic relationships and distance metrics, Classification of image processing operations- Arithmetic operations, Logical operations.

UNIT – II

Image Enhancement and Restoration – Image quality and Need for image enhancement, image enhancement point operations, Histogram based techniques.

Categories of Image Degradations- Image Restoration in the presence of noise only-Mean filters, order statistics filters.

UNIT-III

Image Segmentation: Introduction, classification of image segmentation algorithms, detection of discontinuities, edge detection- stages in edge detection, types of edge detectors, First-order edge detection operators, second-order derivatives filters, edge operator performance, edge linking algorithms, principle of thresholding.

UNIT –IV

Colour image processing: introduction, devices of colour imaging, colour image storage and processing, colour models-RGB Colour Model, HSI Colour Models, HSV Colour Model, Colour Quantization, Image filters for colour images.

UNIT –V

Image Morphology: Need for morphological processing Morphological operators: Erosion, Dilation, Opening & Closing, Hit-or-Miss transform, Basic morphological algorithms, Gray-scale morphology

Text Books

1. S. Sridhar, Digital Image Processing, Oxford University Press, 2nd edition 2016.
2. D. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Prentice Hall, 2nd Edition, 2015.
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011.
4. Gonzalez R.C., Woods R.E, Digital image processing, Pearson, Prentice-Hall of India Pvt.Ltd. New Delhi, 3rd Edition, 2018
5. Jan Erik Solem, Programming Computer Vision with Python, O'Reilly ,1st Edition, 2012

References

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision, 4th Edition, Cengage Learning, 2013
2. Fundamentals of Digital Image Processing, by Anil K. Jain, Prentice- Hall of India Pvt. Ltd,NewDelhi,2002
3. Prince, Simon JD. Computer Vision: Models, Learning and Inference, Cambridge UniversityPress,1stEdition,2012.

OBJECT ORIENTED MODELING

B. Tech III Year II Semester					Dept. of Computer Science and Engineering-Data Science			
Code	Category	Hours / Week			Credits	Marks		
A56039	PEC-I	L	T	P	C	CIE	SEE	Total
		2	0	0	2	40	60	100

Prerequisites:

Any Programming Language

Course Objectives:

1. Introduce the basic concepts of UML.
2. Understand modelling of a real-word application by UML class diagram.
3. Describe the process of Interaction Diagrams.
4. Identify the importance of events, signal and state machines.
5. Demonstrate the component and deployment diagrams.

Course Outcomes:

Students will be able to:
1. Understand the concepts and principles of object-oriented programming in UML.
2. Compare the purposes, major components and key mechanisms of Class andObject Diagram.
3. Design the sequence and Collaboration Diagram for applications.
4. Construct the Start chart diagram for real world applications
5. Analyze the techniques for Component and Deployment Diagrams.

UNIT – I:

Introduction to UML: Importance of modeling, principles of modeling, object oriented Modeling, conceptual model of the UML, Architecture, Software Development Life Cycle.
Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams.

UNIT – II:

Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, Common modelling techniques.
Class & Object Diagrams: Terms, concepts, modeling techniques for Class & ObjectDiagrams, Common modelling techniques.

UNIT – III:
Basic Behavioral Modeling-I: Interactions, Interaction diagrams

Basic Behavioral Modeling-II: Use cases, Use case Diagrams, Activity Diagrams

UNIT – IV:
Advanced Behavioral Modeling: Events and signals, state machines, processes andThreads, time and space, state chart diagrams

UNIT-V
Architectural Modeling: Components, Deployment, Component diagrams and Deployment diagrams

Text Book:

1. Grady Booch, James Rumbaugh, Ivar Jacobson, *The Unified Modeling LanguageUser Guide*, 7th Impression, Pearson Education, 2008.

Reference Books:

1. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, *UML2 Toolkit,* 2nd Edition, WILEY-Dreamtech India Pvt. Ltd., 2012.
2. Meilir Page-Jones, *Fundamentals of Object Oriented Design in UML,* Illustrated Edition, Pearson Education, 2000.
3. Pascal Roques, *Modeling Software Systems Using UML2*, 1st edition, WILEY-Dreamtech India Pvt. Ltd., 2011.
4. Atul Kahate, *Object Oriented Analysis & Design,* 1st Edition, The McGraw-Hill Companies, 2007.
5. Mark Priestley, *Practical Object-Oriented Design with UML,* 2nd Edition, TATA McGrawHill, 2005.

SOFTWARE ENGINEERING

B. Tech III Year II Semester				Dept. of Computer Science and Engineering-Data Science		
Category	Hours / Week		Credits	Marks		
PEC-II	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Prerequisites:

Any programming language

Course objectives

1. Understand the framework activities for a given project.
2. Choose a process model for given project requirements.
3. Design various system models for a given scenario.
4. Design various testing techniques.
5. Understand metrics for Products.

Course Outcomes:

1. Outline the framework activities for a given project.
2. Apply Right process model for a given project.
3. Design various system models for a given Context.
4. Apply various testing techniques for a given project.
5. Identify various risks in project development.

UNIT -I:

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths. A Generic view of process: Software engineering- A layeredtechnology, a process framework, The Capability Maturity Model Integration (CMMI),

Process models: The waterfall model, Incremental process models, Evolutionaryprocess model.

[TB-1,Ch-1,2,3]

UNIT -II:

Agile process Model: Agile principles, Extreme programming, Dynamic System Development Methods, Feature Driven Development, Scrum framework, Sprint, Scrum master, Roles of Scrum Master, Implementing Scrum - A case study. [TB-1,Ch-4]

Software Requirements: Functional and non-functional requirements, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. [TB-2,Ch-6,7]

UNIT -III:

System models: Context Models, Behavioral models, Data models, Object models, structured methods. [TB-2,Ch-8]

Design Engineering: Design process and Design quality, Design concepts, the design model.Modeling component level design: design class based components, conducting component level design. Performing User interface design: Golden rules. [TB-1,Ch-9,11]

UNIT -IV:

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing.
Product metrics : Software Quality, Metrics for Analysis Model- function based metrics, Metrics for Design Model-object oriented metrics, class oriented metrics, component design metrics, Metrics for source code, Metrics for maintenance. [TB-1,Ch-13,14,15]

UNIT -V:

Risk management: Reactive vs. Proactive Risk strategies, software risks, Riskidentification, Risk projection, Risk refinement, RMMM, RMMM Plan.
Quality Management: Quality concepts, Metrics for Software Quality, Software Reviews,Formal Technical Reviews, Software Reliability, The ISO 9000 quality standards.
[TB-1,Ch-25,26]

Text Books:

1. Roger S. Pressman, Software Engineering - A practitioner's Approach, 6th edition. McGraw Hill International Edition, 2005.
2. Somerville, Software Engineering, 7th edition, Pearson education, 2009.

Reference Books:

1. K.K. Agarwal & Yogesh Singh, Software Engineering, New Age International Publishers,3rd edition, 2008
2. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa PublishingHouse, 3rd edition 2005.
3. James F. Peters, Witold Pedrycz, Software Engineering - an Engineering approach, JohnWiely, 2007.
4. Waman S Jawadekar, Software Engineering Principles and Practice, The McGraw-Hill Companies, 2013.
5. https://nptel.ac.in/courses/106/105/106105182/
6. https://ff.tu-sofia.bg/~bogi/knigi/SE/Mcgraw%20Hill%20-%20Software%20Engineering%20-%20A%20Practitioner%27s%20Approach%20-%20Pressman%20(5Th%20Ed,2001,Bookmarked,Cover).pdf

LANGUAGE PROCESSORS

B. Tech III Year II Semester				Dept. of Computer Science and Engineering-Data Science			
Category	Hours / Week			Credits	Marks		
PEC-II	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Pre-requisites:

Formal Languages and Automata Theory, Computer Organization

Course Objectives :

1. Describe the fundamental principles in compiler design.
2. Discuss CFG's and parsing techniques.
3. Predict the performance of different parsers.
4. Summarize the role of runtime environments and memory organization for implementation of typical programming languages.
5. Predict various techniques for code optimization and code generation.

Course Outcomes:

Student will be able to:

1. Analyze the phases of a typical compiler, including the front- and backend.(L3)
2. Apply the role of a parser in a compiler and relate the yield of a parse tree to a grammar derivation.(L3)
3. Design and implement a parser using a typical parser generator.(L6)
4. Implement an intermediate code generator based on given code patterns.(L3)
5. Apply the optimization techniques to have a better code for code generation.(L3)

UNIT I:

Introduction to Compilers: Structure of Compiler-Phases of Compiler, Symbol Table Management, Grouping of Phases into Passes, Compiler Vs Interpreter.
Lexical Analysis: Role and need of Lexical Analyzer, Input Buffering, Regular expressions for identifiers, Signed numbers etc.., A Language for specifying Lexical Analyzer, Lexical phase errors.

UNIT II:
Syntactic Specification: Context Free Grammars, Derivations and Parse Trees, Capabilities of Context Free Grammars, Syntactic Phase errors, Semantic errors.

Basic Parsing Techniques: Parsers, Shift-Reduce Parsing, Operator-Precedenceparsing, Top-Down parsing, Predictive parsers.

UNIT III:

Construction of efficient Parsers: LR Parsers, Canonical collection of LR(0) items, Constructing SLR parsing tables, Constructing LR parsing tables, Constructing LALR parsing tables, using Ambiguous grammar, Comparison of SLR,LALR and CALR parsers, Comparison of Top down and Bottom up parsers.

UNIT IV:

Syntax Directed Translation: Syntax Directed Translation schemes, Intermediate codes, Postfix notation, Three Address code, Quadruples and triples.

Symbol table: Contents of Symbol table, Data Structures for symbol tables, representing scope information.
Run-Time Environments: Storage Organization, Stack allocation of space, Access to non data.

UNIT V:

Code Optimization: Principal sources of optimization, Loop optimization, CopyPropagation, Dead code elimination, Redundant sub expression elimination.
Code Generation: Object programs, problems in Code generation, A Machine Model, ASimple Code generator, Register allocation and assignment, Peephole optimization.

Text Book:

1. Alfred V Aho, Jeffrey D Ullman, Principles of Compiler Design, PearsonEducation, 2001.

Reference Books:

1. J P Trembly and P G Sorenson, The Theory and practice of Compiler Writing, McGraw Hill, 2005.
2. Alfred V Aho, Ravi sethi ,Jeffrey D Ullman, Compilers-Principles , Techniquesand Tools , Pearson Education, second edition.
3. Dick Grone, Henri E Bal, Ceriel J H Jacobs, Modern Compiler Design, Wiley Dreamtech, 2006.

INFORMATION STORAGE AND RETRIEVAL

B. Tech III Year II Semester				Dept. of Computer Science and Engineering-Data Science		
Category	**Hours / Week**		**Credits**	**Marks**		
PEC-II	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Prerequisites:

Database management system

Course Objectives:

1. This course studies the basic principles and practical algorithms used for information retrieval and text mining
2. To understand the functions of Information retrieval
3. To provide exploration of information retrieval systems' evaluation tools
4. To provide hands-on experience in evaluating search engines to solve computational search problems.
5. To understand the complexity of Information Retrieval Systems.

Course Outcomes:

Student will be able to:

1. Acquire the knowledge of information retrieval system and its capabilities
2. Comprehend the knowledge of indexing and Data structure that can usedfor storing the data
3. Know the concept of indexing and clustering of the information
4. Understand the searching techniques and visualization
5. Have a handle on algorithms for text searching and multimedia retrieval

UNIT -1
Introduction to Information Retrieval Systems: Definition, Objectives, functional overview, Relation to Database Management system.
IRS capabilities: Search capabilities, Browse Capabilities, Miscellaneous Capabilities

UNIT –II
Cataloging and Indexing: History of objectives of Indexing, indexing process, automatic indexing
Data Structure: Introduction to Data structure, Stemming Algorithms, Invert file system,N-Gram Data structure, PAT data structure, Hypertext and XML data structure

UNIT- III
Automatic Indexing: Classes of Automatic indexing, Statistical indexing, Natural language, concept Indexing, Hypertext Linkage.

Document and Term Clustering: Introduction to clustering, Thesaurus Generation,Manual clustering, Automatic term clustering

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UNIT –IV
</div>

User Search Techniques: Searching statement and binding, Similarity Measurement and Ranking, Relevance Feedback, Selective dissemination of information search, weighted searches of Boolean system.
Information Visualization: introduction to information visualization, Cognition and perception

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UNIT –V
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Text Search Algorithms: Introduction to Text search techniques, Software text searchalgorithms, hardware text search system
Multimedia information retrieval: Spoken language audio retrieval, Non- speechaudio retrieval, Graph Retrieval, Imagery retrieval, video retrieval

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Text Book:
</div>

1. Gerald J.Kowalski, Mark T. Maybury,Information storage and retrieval systems,theory and implementation, 2nd Edition, Springer publications.

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Reference Books:
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1. Christopher D. Manning and Prabhakar, Raghavan, Introduction to information Retrieval, Cambridge University Press, 2008.

2. Ricardo baeza-Yates, Modern information retrieval, Pearson Education, 2007.

3. Robert Korthage, Information storage and Retrieval, John wiley& sons.

PRINCIPLES OF DISTRIBUTED SYSTEM

B. Tech III Year II Semester				Dept. of Computer Science and Engineering-Data Science		
Category	Hours / Week		Credits	Marks		
PEC-II	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Pre-Requisite:

Operating Systems, Computer Networks

Course Objectives:

1. Outline various models for processing and communication in distributedsystems
2. Examine the file characteristics and Naming services
3. Explores the concept of clocks and distributed algorithms
4. Describes about transactions and their properties in distributed systems
5. To design and implement sample distributed systems.

Course Outcomes:

After completion of the course the students will be able to:

1. Identify the models for distributed processing and communication
2. Apply the knowledge in naming synchronization, consistency and replication
3. Predict the advantages and challenges in designing distributed Algorithms
4. Analyse distributed transactions and transaction recovery
5. Design Distributed Systems

UNIT I:

Characterization of Distributed Systems: Introduction, Examples of Distributed systems, Resource sharing and web, challenges, Architectural model: Client Server model, Proxy Servers and Caches, Peer process model ,Fundamental model
:Interaction model, Security model ,Failure model.

UNIT II:

Distributed file system: Characteristics of file systems, Distributed file system requirements, File service architecture. **Name Services:** Name space ,Name resolution , Domain Name System ,DNS name servers ,Directory services, discovery services inJini

UNIT III:

Time and Global States: Clocks, events and Process states, Synchronizing physical clocks , logical clocks, distributed debugging. Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections, Multicast communication.

UNIT IV:

Transactions and Concurrency control: Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering. **Distributed Transactions**: Flat and Nested Distributed

Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

UNIT V:

Replication : System model , group communication ,Fault tolerant services ,Passive(primary-backup) replication,Active replication,Transactions with replicated data.**Designing Distributed Systems:Google Case Study** :Introducing the case study Google, physical model ,overall architecture and design philosophy ,Data storage and coordination services , Google file system, Chubby, BigTable ,Distributed computation services.

Text Books:

1. G Coulouris, J Dollimore, T Kindberg, Distributed Systems Concepts and Design,fifth Edition, Pearson Education.

Reference Books:

1. S.Mahajan and S.Shah, Distributed Computing, Oxford University Press.
2. PradeepK.Sinha, Distributed Operating Systems Concepts and Design, PHI.
3. M Singhal, N G Shivarathri, Advanced Concepts in Operating Systems, Tata McGraw-Hill Edition.
4. K.P.Birman, Reliable Distributed Systems, Springer.
5. A.S. Tanenbaum and M.V. Steen, Distributed Systems: Principles and Paradigms,Pearson Education.
6. R.Chow, T.Johnson, Distributed Operating Systems and Algorithm Analysis, Pearson.
7. A.S.Tanenbaum, Distributed Operating Systems, Pearson Education.

Web Resources:

https://www.cs.usfca.edu/~srollins/courses/cs682-s08/web/notes/models.html

ENTREPRENEURSHIP DEVELOPMENT

B. Tech III Year II Semester				Dept. of Computer Science and Engineering-Data Science		
Category	Hours / Week		Credits	Marks		
HSS&MC	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Course Objectives:

The objective of this course is to familiarize the student with entrepreneurship, the issues involved in it, the potential of entrepreneurship and intrapreneurship, the legal environment and statutory issues and explore various funding opportunities.

Course Outcomes

1. Interpret the concepts of Entrepreneurship and Intrapreneurship.
2. Apply the opportunity identification techniques
3. Differentiate needs of different segments
4. Develop business model and MVP
5. Recognize organizational forms, IPR concerns and funding opportunities for startups.
.

Unit – I:
Introduction to Entrepreneurship: Entrepreneurship and Intrapreneurship, Business Incubators, Rural entrepreneurship, Social Entrepreneurship, women entrepreneurs, Role of entrepreneurs in economic development, Types of entrepreneurs. Entrepreneurial mind set and stress, Causes of failure.

Unit – II:
Opportunity identification: Myths and realities of entrepreneurship, Opportunity identification, Problem worth solving, idea generation techniques, Design thinking.

Unit – III:
Customer analysis: Market segmentation, consumer persona, Product market fit, Unique Value proposition.

Unit – IV:
Business model and MVP: Business model canvas, MVP, Risks and assumptions, Importance of financial planning.

Unit – V:
Organizational forms Funding Opportunities: Organizational forms - Partnership, Sole proprietorship, Corporation. Intellectual Property Rights- Copyrights, Trademarks, Patents. Law Vs. Ethics, Informal capital- Friends and Family, Angels, Venture Capitalists, Idea/ Patent, Growth strategies

Text Books:

1. Vasant Desai, YayatiNayak, Entrerpreneurship, Himalaya Publishing House,2018
2. D.F.Kuratko and T.V.Rao Entrepreneurship- Cengage Learning,2012

References:

1. Dhruv Nath, Sushanto Mitra, Funding Your Startup: And Other Nightmares, 2020
2. Rajeev Roy, Entrepreneurship, Oxford University Press, 2/e, 2012
3. V Srinivasa Rao, Lean Digital Thinking: Digitalizing Businesses in a New WorldOrder, Bloomsbury India, 2021
4. S.K.Mohanty, Fundamentals of Entrepreneurship, PHI, 1/e,2005
5. MOOCS by Wadhwani Foundation

SKILL INTEGRATED LAB

B. Tech III Year II Semester				Dept. of Computer Science and Engineering-Data Science			
Code	**Category**	**Hours / Week**		**Credits**	**Marks**		
	ESC LAB	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

Learning Objectives

1. To improve the students' fluency in English, through a well-developed vocabulary
2. To enable them to respond them appropriate socio-cultural and professional contexts.
3. They will be able to communicate their ideas relevantly and coherently in writing.

Course Outcomes

The students will be able to

1. make oral presentations effectively
2. participate in group discussions
3. develop vocabulary
4. write project/Business reports
5. take part in social and professional communication

Exercise I
Presentation Skills:

Oral presentations (individual and group) / JAM sessions/Seminar - Power pointpresentations - Body Language-kinesics - Haptics

Exercise II
Group Discussion:

Dynamics of Group Discussion - Dos and Don'ts – Intervention - Summarizing -Modulation of Voice - Relevance - Fluency and Coherence

Exercise III
Vocabulary Building:

synonyms and antonyms - Word Roots - One-Word Substitutes, - Prefixes and Suffixes - study of Word Origin- -Analogy -Idioms and Phrases

Exercise IV

Writing Skills:

Structure and presentation of different types of writing - Resume Writing /E-Correspondence/Statement of Purpose - Report Writing - Business Report Writing - Research Abilities/Data Collection/Organizing Data/Tools/Analysis

Exercise V

Interview Skills:

Concept and Process - Pre-Interview Planning - Opening Strategies - Answering Strategies - Interview through Telephone and Videoconferencing.

A mini project should be given for the students to work in teams and theAssessment is done.

References:

1. Dr. Rao, A. Ramakrishna., Dr. G. Natanam and Prof SA Sankaranarayana.*English Language Communication: A Reader cum Lab Manual. Chennai*: Anuradha Publications, 2008.
2. *English Vocabulary in Use series*. Cambridge University Press, 2008.
3. Nicholls, Anne. *Master Public Speaking.* JAICO Publishing House, 2006.
4. Sen, Leena. *Communication Skills.* New Delhi: PHI Learning Pvt Ltd, 2009.

DATA VISUALIZATION LAB

B. Tech II Year I Semester					Dept. of Computer Science and Engineering-Data Science			
Code	**Category**	**Hours / Week**			**Credits**	**Marks**		
A56215	PCC LAB	L	T	P	C	CIE	SEE	Total
		0	0	4	2	50	50	100

Prerequisites:

Some exposure to programming.

Course Objectives:

- To acquire in-depth understanding of the data visualization techniques.
- To empower students with tools and techniques for handling and analyzing data.
- To empower students with tableau tool for managing and interpreting data.
- To strengthen the analytical and problem solving skill through developing realtime applications.

Course outcomes

At the conclusion of the course, students should be able to:

- Understand data visualization concepts related to different applications.
- Apply different techniques for accessing data sources.
- Create different charts, stories using Tableau.
- Create powerful business dashboards using Tableau.

Programming Languages/Tools:

- Tableau Desktop. Tablea
- u's data visualization software is provided through the Tableau for Teaching program at http://www.tableau.com/data-visualizationsoftware

List of Experiments:

Week 1:
Introduction to Tableau interface / Installation of Tableau.

Week 2 – Week 3:
Apply accessing, importing data/connecting to external Sources using Tableau. Graphs and Layouts, Colors, Size, Text and Typography, Shape, Lines.

Week 4 – Week 6:
Charting in Tableau: Colors, Shapes, and Sizes, Dual Line Charts, Tableau Tooltip. Bar Charts, Line Graphs, Pie Charts, Maps, Scatter Plots, Gantt Charts, Bubble Charts,

Histograms, Bullet Charts, Heat Maps and Highlight Tables, Tree maps and Box-and-Whisker Plots.

Week 7:

 Multivariate visualization on given dataset using Tableau.

Week 8:

Maps and Geographic Data Analysis using Tableau.

Week 9 - Week 12:

Creating dashboards and stories: Hierarchies, Actions, Filters, and Parameters using Tableau. Connecting/publishing data using Tableau Public Server.

Week 13 – Week 16:

Study projects on selected applications using data visualization. Submission of abstract, introduction, related work, and progress, Final report, final presentations and videos.

References:

1. Nandeshwar, A. (2015), Tableau Data Visualization Cookbook, Mumbai: PACKT / Shroff Publishers.
2. https://public.tableau.com/en-us/s/resources

PREDICTIVE ANALYTICS USING R PROGRAMMING LAB

B. Tech II Year I Semester					Dept. of Computer Science and Engineering-Data Science			
Code	**Category**	**Hours / Week**			**Credits**	**Marks**		
A56216	PCC LAB	L	T	P	C	CIE	SEE	Total
		0	0	3	1.5	50	50	100

Prerequisites:

Basics of Statistics, Machine Learning and Basic knowledge in any Programminglanguage.

Course Objectives:

The course should enable the students to:
1. To acquire in-depth understanding of the predictive analytics.
2. To empower students with tools and techniques for handling, managing, analyzing and interpreting data.
3. To acquire in-depth understanding of charts and graphs.
4. Practice R operations required for predictive analytics.
5. Understand linear regression model.

Course outcomes:

1. Demonstrate and set up of R studio.
2. Apply EDA tools for managing, analyzing and interpreting data.
3. Summarize data insights using charts and graphs.
4. Develop R scripts for predictive analytics.
5. Analyse data with linear regression model.

Week-1:
Installation and Environment set up R and R studio.

Week-2:
Experiments on Vector Arithmetic operations.

Week-3:
Experiments on Matrices operations.

Week-4:
Experiments on Arrays functions.

Week-5:
 Experiments on Factors.

Week-6:

Experiments on Data Frames.

Week-7:

Experiments on List operations.

Week-8:

Write R scripts which demonstrate logical operations and Conditional Statements.

Week-9:

Write R scripts which demonstrate Looping over List.

Week-10:

Write   R scripts which demonstrate Nested Functions and Function Scoping.

Week-11:

Experiments on Mathematical Functions, Lapply, Sapply and Apply functions in R.

Week13:

Generate different Charts and Graphs using R.

Week-14:

Perform ANOVA Test, Regression, and Clustering on data using R.

Week 15 – Week 16:

Study projects on selected applications on predictive analytics. Submission of abstract, introduction, related work, and progress, Final report, final presentations and videos.