LOYOLA ACADEMY

DEGREE & PG COLLEGE

OLD ALWAL, SECUNDERABAD - 500 010, TELANGANA, INDIA

(An Autonomous Institution Affiliated to Osmania University)

Re-accredited with 'A' Grade (III Cycle) by NAAC

A Catholic Christian Minority Institution (Co-Education)

A "College with Potential for Excellence" by UGC

www.loyolaacademy.edu.in **email:** info@loyolaacademy.edu.in **Ph:** 040-27862363/27860077

SYLLABUS

of

B.Sc. Computer Data Science and Data Analytics Engineering

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For the Academic Year 2025-2026

SYLLABUS

of

B.Sc. COMPUTER DATA SCIENCE AND DATA ANALYTICS ENGINEERING

Principal **Dean** **Chairman, Board of Studies**

For the Academic Year 2025-2026 for the Batch 2025-2026

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SCHOOL OF SCIENCE

PROGRAMME OUTCOMES

PO1: Scientific Knowledge. Apply the knowledge of Science, Mathematics, Engineering & Technology fundamentals to solve the complex problems**.**

PO2: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental Considerations.

PO3: Problem analysis: Identify, formulate, research literature, and analyze complex scientific problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO4: Modern tool usage: Create, select and apply appropriate techniques, resources, and modern technology and IT tools to complex science and technological activities.

PO5: Environment and sustainability: Understand the impact of professional science and technological solutions in societal and environmental contexts and for sustainable Development.

PO6: Individual and team work: Function objectively as an individual and as a member in diverse teams.

PO7: Communication: Communicate effectively on complex science & technology activities with society at large and able to write effective reports and documentation.

PO8. Life-long learning: Recognize the need and ability to engage in independent and lifelong Learning in the context of technological change

DEPARTMENT OF B.Sc. Computer Data Science and Data Analytics Engineering

PROGRAMME SPECIFIC OUTCOMES

Students will be able to:

PSO1: Apply computer science languages and algorithms, as well as mathematical and statistical models for developing solutions to the real world problems.

PSO2: Understand the fundamentals of Computer Organization, Operating Systems and networking related concepts and apply the knowledge of computer systems in designing and building software solutions.

PSO3: Demonstrate, identify, formulate and analyse diverse big data problems helping in business decision making. Apply supervised and unsupervised machine learning methodologies.

PSO4: Apply appropriate Data Mining and Text Mining techniques for cleaning, processing and transforming the data. Analyze and interpret the data using an ethically responsible approach

Consolidated Scheme(New)

	SEM	Course-1	Course-2	Course-3	Course-4	Course-5	Course-6		Hours	Credits	
I	Sem I	**(AECC-1)** General English-I (3)	**(AECC-2)** Value Education and Personal Development(2)	**(DSC-1)** Fundamentals of Data Science(4+1)	**(DSC-2)** Differential Equations Numerical Analysis (5)	**(DSC-3)** Operating System (4+1)	**(DSC-4)** Problem Solving and Python Programming (4+1)		30	25	AECC=2 DSCC=4
	Sem II	**(AECC-3)** General English-II (3)	**(AECC-4)** Indian Heritage and Culture (2)	**(DSC-5)** Discrete Mathematics (4)	**(DSC-6)** Descriptive Statistics and Probability	**(DSC-7)** Database Management system	**(DSC-8)** Data Structures and algorithms using Python	**PLANET (NON-CGPA)**	30	25	AECC=2 DSC=4
II	Sem III	**(GE)** (2+1)	**(AECC-5)** Environmental Studies&Gender Sensitization (3)	**(SEC-1)** Web Technology (2)	**DSC-9)** PY Spark (4)	**(DSC-10)** Data Engineering with Python (4+1)	**(DSC-11)** Statistical methods and Inference (4+1)	**Summer Internship(2) (SEC-2)**	30	24	AECC=1 GE=1 SEC=1 DSC=3
III	Sem IV	**(DSC-12)** Applied Statistics (4)	**(SEC-3)** Information Technology(2)	**(DSE-13)** R Programming (4+1)	**(DSC-14)** Machine Learning	**(DSC-15)** Artificial Intelligence(4)	**(DSC-16)** Programming in Java (4+1)		30	25	DSC=5 SEC=1
	Sem V	**(DSC-17)** Data Visualization Tools (3+1)	**(DSC-18)** Natural Language Processing (4+1)	**(DSC-19)** Big Data Analytics (4+1)	**(DSE-1)** Software Engineering /Text Data Analytics (4)	**(DSE-2)** Data Analytics and Decision Making / Data Security (4)	**(DSC-20)** Optimization methods for Analytics (4)		30	26	DSE=2 DSC=4
	Sem IV	**(DSC-21)** Deep Learning (4+1)	**(DSE-3)** Software Testing\Marketing Data Analytics(4)	**(DSE-4)** Cloud Computing\ Human Computer Interaction(4)	**(DSE-5)** PROJECT REPORT (6)				30	19	DSE=2 DSC=1
Legend: 1. Ability Enhancement Compulsory Course (AECC) : 05 2. Generic Elective (GE) 01 3.Skill Enhancement Course (SEC) 03 4.Discipline-Specific Core(DSC) 21 5.Discipline-Specific Elective (DSE) 05							**Total**		**180**	**144**	

Consolidated Scheme(EXISTING)

	Sem	Course-1	Course-2	Course-3	Course-4	Course-5	Course-6	Hours	Credits	
I	I	General English-I (3) **(AECC-1)**	Value Education and Personality Development (2) **(AECC-2)**	Fundamentals of Information Technology (4+1) **(SEC-1)**	Differential Equations Numerical Analysis (4) **(Core-1)**	Descriptive Statistics and Probability (4+1) **(Core-2)**	Problem Solving and Programming through C (4+1) **(Core-3)**	29	24	AECC=2 SEC=1 CORE=3
	II	General English-II (3) **(AECC-3)**	Indian Heritage and Culture(2) **(AECC-4)**	Abstract Algebra (4) **(Core-4)**	Operating Systems (4) **(Core-5)**	Probability Distributions(4+1) **(Core-6)**	Data Structures through C (4+1) **(Core-7)**	29	23	AECC=2 CORE=4
II	III	Environmental Studies and Gender Sensitization (3)**(AECC-5)**	Generic Elective (2+1) **(GE-1) (IDE)**	Python Programming (4+1) **(SEC-2)**	Computer Organization (4) **(Core-8)**	Statistical Methods (4+1) **(Core-9)**	Database Management Systems (4+1) **(Core-10)**	30	25	AECC=1 GE=1 SEC=1 CORE=3
	IV	Accounting and Financial Management(3) **(GE-2)**	R Programming(4+1) **(SEC-3)**	Data Warehousing and Data Mining(4) **(Core-11)**	Computer Networks(4) **(Core-12)**	Statistical Inference(4+1) **(Core-13)**	Java Programming (4+1) **(Core-14)**	29	26	GE=1 SEC=1 CORE=4
	IV	Accounting and Financial Management**(3)** **(GE-2)**	R Programming (4+1) **(SEC-3)**	Data Warehousing and Data Mining (4) **(Core-11)**	Computer Networks (4) **(Core-12)**	Statistical Inference (4+1) **(Core-13)**	Java Programming (4+1) **(Core-14)**	29	26	GE=1 SEC=1 CORE=4
III	V	Operations Research (4) **(GE-3)**	Data Visualization Tools (3+1) **(SEC-4)**	Software Engineering/ Text Data Analytics (4) **(DSE-1)**	Machine Learning Techniques (4+1) **(Core-15)**	Artificial Intelligence (4) **(Core-16)**	Applied Statistics (4) **(Core-17)**	29	25	GE=1 DSE=1 SEC=1 CORE=3
	VI	Data Security/ Cloud Computing (4) **(DSE-2)**	Software Testing & Quality / Marketing Data Analytics (4) **(DSE-3)**	Big Data Analytics (4+1) **(Core-18)**	MAJOR PROJECT(6)			29	19	DSE=2 CORE=1 PROJECT =1

Legend: 1. Ability Enhancement Compulsory Course (AECC) : 05 2.Generic Elective (GE) 03 3.Skill Enhancement Course (SEC) 04 4.Core 18 5.Discipline-Specific Elective (DSE) 03		**Total**	**175**	**142**	

Year-wise and Semester-Wise Distribution of Courses
Department of B.Sc. Computer Data Science and Data Analytics Engineering
First Year First Semester
Academic Year2025-26 of 2025-2028 Batch (CBCS)

Sl. No.	Part	Course Code	Title of the Course	Hours /Week	Duration of Exam(hrs.)	Marks			Credits
						Internal	External	Total	
1	I	EN23101	General English-I (AECC-1)	3	3	40	60	100	3
2	I	VE18101	Value Education and Personal Development (AECC-2)	2	3	40	60	100	2
3	II	DS25101	Fundamentals of Data Science (DSC-1)	5	3	40	60	100	4
4	II	DS25102	Differential Equations and Numerical Analysis (DSC-2)	5	3	40	60	100	4
5	II	BS22101	Operating Systems (DSC-3)	4	3	40	60	100	4
6	II	DS25103	Problem Solving and Python Programming (DSC-4)	5	3	40	60	100	4
PRACTICALS									
7	II	DS25104	Fundamentals of Data Science	2	3	40	60	100	1
8	II	DS25105	Unix Shell Programming lab	2	3	40	60	100	1
9	II	DS25106	Problem Solving and Python Programming	2	3	40	60	100	1
Total				30	-	**360**	**540**	**900**	**24**

*Ability Enhancement Compulsory Course(AECC) * Discipline Specific Core(DSC)

COURSE NAME
GENERAL ENGLISH-I

Credits: 3 **Semester:I**
Course Code:EN23101 **No of Lecture Hours: 45**

Course Objective:

- Through an exposure to contemporary passages, the students would be able to have a grasp on the language of today, with specific emphasis on the Listening, Speaking, Reading and Writing skills
- Through the components of a passage, vocabulary and grammar section, speaking component and writing segments, there is a holistic development for language proficiency and fluency.

Course Outcome:

CO1: To distinguish between words which are either spelt or pronounced alike, yet render distinct meanings; imparting a sound clarity on everyday usage of language, and for developing the art of parallel listening and writing.

CO2: To construct vocabulary and to gain understanding on the tense component, a pivotal constituent for language structuring and vocabulary building.

CO3: To identify with economical word constructions, paying specific attention in constructing sound writing skills.

CO4: To interpret functional grammar, the basic part involved in sentence constructing to improve linguistic skills

CO5: To develop communication skills to provide a platform for language efficiency for effective language deliver

Course Content	Hours Allotted	Pedagogy
Module I: Title: Fundamentals of Communication-I **Short Story - The Mystery Story (source – teacherluke.co.uk)** • Present Tense • Past Tense • Future Tense • Paragraph Writing	**(9)** 3 2 2 2	PowerPoint presentations / Lectures
Module II: Title: Language Proficiency for Effective Writing and Speaking Skills-I **Poem- Goodbye Party for Miss Pushpa T.S. by Nissim Ezekiel** • Subject- Verb Agreement • Punctuations • Review Writing	**(9)** 3 3 3	Case Studies / Review of research articles
Module III: Title: Wit and Humour From the text A tea Party by Ruth Prawer Jhabvala • Explanation of the text	**(9)** 2 2	Assignments

• Grammar -------Nouns, Articles • Vocabulary --- Homonyms, Homophones, Homographs • Writing Skill ------Note- Making	2 3	
Module IV: Title: Human Values From the text "India's Contribution to World Unity" • Explanation of the text • Grammar----adverbs • Vocabulary----Adjective and Adverb Suffixes • Writing Skill------Formal Letters and Curriculum Vitae	**(9)** 2 2 2 3	Lectures
Module V: Title: From the text "Sachin Tendulkar" • Explanation of the text • Grammar----- Adjectives, Comparison of Adjective • Vocabulary-----Common Errors, Commonly Misspelt words, Commonly Confused Words • Writing Skill-----References and Bibliographies	**(9)** 2 2 2 3	Assignments / Lectures

Learning Resources	
1.	Textbook: Epitome of Wisdom, Maruthi Publications
2.	Reference books: Krishna Mohan and Meera Banerjee. Developing Communication Skills. 1990. New Delhi. Macmillan India Ltd. 2. Krishnaswamy. N. and Sriraman, T. Current English for Colleges. 1995. Madras Macmillan India Ltd. 3. Narayanaswamy, V.R. Strengthen Your Writing. 1979. New Delhi. Orient Longman. 4. Sharma, R.C. and Krishna Mohan. Business Correspondence. 1978. New Delhi. Tata McGraw-Hill Publishing Co

COURSE NAME
VALUE EDUCATION AND PERSONAL DEVELOPMENT

Credits: 2 **Semester:I**
Course Code:VE18101 **No of Lecture Hours: 30**

Course Objective:

- To produce intellectually competent, morally upright, socially committed, spiritually inspired citizens in the service of the nation and the world.

Course Outcome:

CO1: Students will be able to **Differentiate** Accepted norms and Counter values and be able to identify the various Dimensions of Human Development.

CO2: Students will be able to **Demonstrate** Love and Experience of God and identify the Basic Issues of Life and Happiness as a life goal.

CO3: They will able to Understand the importance of Concern for others and critique the various problems that deter the growth of the society.

CO4: The students will be able to **Recognize** the traits of a good personality and practice Self-exploration

CO5: Students will be able to **Interpret** the Purpose of Life and Goal Setting and demonstrate Self-management.

Course Content	Hours Allotted	Pedagogy
Module I: Title: INTRODUCTION TO ETHICS	**(6)**	PowerPoint presentations / Lectures
• Why Value Education?	2	
• Reasons to have Ethics for Life		
• Accepted Norms and Counter Values	2	
• Dimensions of Human Development: Physical, Intellectual, Emotional, Moral, Spiritual and Social	2	
Module II: Title:APPROACH TO LIFE	**(6)**	Case Studies / Review of research articles
• Conscience and Pseudo-Conscience	1	
• Happiness as Life-goal	1	
• Values revealed and lived in Religions	1	
• Experience of God	1	
• Love: The three components of Love	1	
• Some of the basic stages and issues of Life: Family, Love, Sex, Marriage	1	
Module III: Title: CONCERN FOR OTHERS	**(6)**	Assignments
• Self and Another	3	

• Human Context • Moral Problems of a Society / True Society: Social Desire, Social Fear, Social Silence, Social Indifference	3 3	
Module IV: Title:TRANSFORMATION OF SELF • Definitions of personality • Characteristics of personality • Elements of personality • Traits of good personality • Self-Identity, self-concept • Self-Discovery, self-acceptance • Self-Esteem WORK SHEET (1): Self Estimation	**(6)** 2 1 1 2	Lectures
Module V: Title:LIFE ENRICHMENT SKILLS • Purpose of life - Goal setting • Characteristics of Goals • Building Relationships • Time Management • Stress Management • Emotional Management • Conflict Management • Team Management (Group Dynamics) WORK SHEETS (1) & (2): 1)Anger Management 2) Team Management	**(6)** 1 1 1 1 2	Assignments / Lectures

Learning Resources	
1.	Reference books: *Human Values - Development Program- AIACHE* *In Harmony*

COURSE NAME
FUNDAMENTALS OF DATA SCIENCE

Credits: 4 **Semester:I**
Course Code:DS25101 **No of Lecture Hours: 75**

Course Objective:Students will develop skills in data analysis, data cleaning, visualization, business intelligence, and analytics using Excel and Power Query to drive decision-making and business optimization.

Course Outcome: The students would be able to

CO1: Define and categorize data types and their importance for organizations.

CO2: Apply data cleaning and preparation techniques using **Excel and Power Query**

CO3: Evaluate and create visualizations to represent data effectively.

CO4: Implement business intelligence concepts for strategic decision-making**.**

CO5: Apply data-driven methodologies through case studies and real-world applications.

Course Content	Hours Allotted	Pedagogy
Module I: Title:Introduction to Data and Its Importance	**(15)**	
• What is Data? (Definition, types, structure)	2	
• Introduction to data science(definition, scope, workflow, applications)	3	
• Role of data science in organisations(decision-making, automation, optimization)	1	Powerpoint presentations / Lectures
• Understanding data types &structures(numerical, categorial, time-series, text, images)	3	
• Data handling in excel(tables, named ranges, importing data)	3	
• Gathering & storing data in excel(data sources, cloud storage, CSV, excel databases)	3	
Module II: Title:Data Cleaning & Transformation using excel & power query	**(15)**	

• Introduction to data cleaning in excel handling missing values, duplicates, outliers, data validation, text functions, conditional formatting • Power query basics for data cleaning connecting & loading data from various sources removing errors, duplicates ,and blank values • Data transformation using power query a.splitting and merging columns b.creating conditional columns and custom formulas • Advanced data preparation in power query a.filtering and grouping data b.unpivoting and reshaping datasets • Connecting power query to pivot tables in excel	3 3 3 3 3	Case Studies / Review of research articles
Module III: Title:Introduction to Data Visualization • Principles of Data Visualization (clarity, accuracy, simplicity) • Basic Charts & Graphs in Excel (Bar, Line, Pie, Scatter Plot) • Advanced visualization with pivot charts • Creating interactive dashboards in excel • Using power query for dynamic reports & visualization(3 principles of data visualization (clarity,accuracy,simplicity)	**(15)** 3 3 3 3 3	Assignments
Module IV: Title : Introduction to data analytics using Excel • What is data analytics?(descriptive,diagnostic,predictive,prescriptive) • Analytics tools in excel o a.Lookup functions(VLOOKUP,XLOOKUP,INDEX-MATCH) o b.Statistical functions(SUMIF,AVERAGEIF,COUNTIF) • Advanced analytics in excel	**(15)** 3 3 3	Lectures

○ a.using pivot tables for deep analysis ○ b.creating calculated fields and measures • Power query for data aggregation & insights • Excel solver & forecasting techniques	3 3	
Module V: Title: business intelligence & decision-making using data science • Introduction to business intelligence & decision-making a.understanding business intelligence(BI) b.role of data in strategic decision-making c.difference between reporting & analytics • Data-driven decision-making process a.importance of data-driven culture in organizations b.framework for data-driven decision-making c.challanges in implementing data science for business • Case study1:sales performance analysis using excel &power query ○ Problem statement :analyzing regional sales performance ○ Techniques used: a.importing & cleaning sales data b.creating pivot tables& power query transformations c.generating dashboards for insights	**(15)** 5 5 5	Assignments / Lectures

Learning Resources
ESSENTIAL READING: **1.**Microsoft excel data analysis and business modeling-wayne Winston,2019,Microsoft press

COURSE NAME
DIFFERENTIAL EQUATIONS AND NUMERICAL ANALYSIS

Credits: 4 **Semester: I**
Course Code:DS25102 **No of Lecture Hours: 75**

Course Objective:

- To impart basics and solving differential equations applications of differential equations.

Course Outcome:

CO1: Classify the differential equations with respect to their order and linearity. Solve differential equations of first order using numerical and analytical methods such as Integrating Factors.
CO2: Analyze and Solve basic application problems described by first order differential equations. such as orthogonal trajectories.
CO3:Solve second order Homogeneous Equations with Constant Coefficients. Obtain exact and Numerical solutions using differential equations technology.
CO4: Analyse and evaluate the accuracy of common numerical methods.
CO5: Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations.

Course Content	Hours Allotted	Pedagogy
Module I: Title:Exact differential equations • Solving Exact differential Equations • Equations reducible to Exact differential Equations • Integrating factor **Applications of first order Differential Equations** • Orthogonal trajectories - Cartesian • coordinates- Polar coordinates.	**(15)** 3 3 3 3 3	Powerpoint presentations / Lectures
Module II: Title:Linear Differential Equations with constant coefficients • Auxiliary equation, Rules for finding the Complementary function • Rules for finding the Particular integral • Working rule for finding P.I. when X=eax, Sinax, Cosbx, xm, eaxv, xm.v	**(15)** 5 5 5	Case Studies / Review of research articles

Module III: Title:The calculus of finite differences • Definition, Forward Difference, Backward Difference, and shift operator • Difference formulae – The difference table. • To express any value of the function in terms of leading terms and the leading difference of a difference table • Simple Problems on ∇, Δ and E • Newton- Gregory Forward and backward Interpolation formulae	**(15)** 3 3 3 3 3	Assignments
Module IV: Title:Interpolation with equal intervals • Interpolation with unequal intervals -divided differences (Only Definition.) Newton's divided difference Interpolation formula (Newton's formulae for unequal intervals) • Lagrange's Interpolation formula for unequal intervals • Central difference Interpolation formulae • Gauss Interpolation formula • Stirling's Interpolation formula • Bessel's Interpolation formula	**(15)** 3 3 3 3 2 **1**	Lectures
Module V: Title:Numerical differentiation and Integration • Determination of First second and third order derivatives of the tabulated function • Using Newton forward and backward Interpolation formulae • Differentiation using Central difference Interpolation formula • Numerical Integration using Trapezoidal rule, Simpson's 1/3 – rule, 3/8 Simpson's 3/8 rule – Simple problems there on.	**(15)** 5 4 3 3	Assignments / Lectures

Learning Resources

ESSENTIAL READING:

Ahsan, Zafar. 2006 **Differential Equations and their Applications.** 2ndEdition. New Delhi: Prentice hall of India Ltd. (For Units I, II, & III) Dr. Gupta, PP.Malik, G.S.2004. **Calculus of Finite Differences and Numerical Analysis.** Meerut: Krishna Prakashan Media (P) Ltd. Dr .Goel, B.S. Dr.Mittal, S.K. 2007.**Numerical Analysis.** 3rd Edition. Meerut:Krishna Prakashan Media (P) Ltd.

SUGGESTED READING:

1.Venkateswara Rao,V.Krishna Murthy, N. SharmaB.V.S.S. AnjaneyaSastry, S.2016.B.Sc.**Mathematics Volume-I**. New Delhi:S.Chand and Company.
Raisinghania, M. D. 2015. **Ordinary Differential Equations.** New Delhi: S.Chand and Company.

COURSE NAME
OPERATING SYSTEMS

Credits: 4 **Semester:I**
Course Code:BS22101 **No of Lecture Hours: 60**

Course Objective: To learn the core ideas in operating systems, process management, memory protection, CPU scheduling, concurrent programming, deadlocks and File systems.

Course Outcome:
CO1: **Explain** functions, types and structures of operating system

CO2: **Analyze** various process management concepts including scheduling and synchronization

CO3: **Illustrate** the concepts of memory management and I/O system.

CO4: **Solve** issues related to file system interface.

CO5: **Choose** an appropriate Page replacement algorithm.

Course Content	Hours Allotted	Pedagogy
Module I: • Introduction -Define Operating System, mainframe system, desktop systems • Multiprocessor systems, distributed systems, clustered systems • Real time systems ,hand held systems • Operating system structures-system components • Operating system services, system calls • Systems programs, system structure and virtual Machine	**(12)** 2 2 2 2 2 2	Powerpoint presentations / Lectures
Module II: • Process concept-process concept,process scheduling • Operation on processes, cooperating processes • Inter process communication • Process scheduling-basic concepts, scheduling criteria, scheduling algorithms .	**(12)** 3 3 3 3	Case Studies / Review of research articles
Module III: • Process synchronization-critical section problem • Semaphores, monitors • Deadlocks-deadlock characterization, methods for handling deadlocks	**(12)** 3 3 3 3	Assignments

• Deadlock prevention, Deadlock avoidance, Deadlock detection		
Module IV: • File system-file concept, access methods • Directory structure, file system mounting, file system sharing. • File system implementation-file system structure, file system implementation. • Directory implementation, allocation methods, free space management.	**(12)** 3 3 3 3	Lectures
Module V: • Memory management-swapping, contiguous memory allocation • Fragmentation-internal and external fragmentation • Paging, segmentation, segmentation with paging. • Virtual memory management-demand paging • Page replacement algorithms, Thrashing and working set model.	**(12)** 2 2 3 2 3	Assignments / Lectures

Learning Resources

ESSENTIAL READING:

1 **Operating Systems: Evolutionary Concepts and Modern Design Principles** by Pranabananda Chakraborty, 2024, 1st Edition, Published by Chapman & Hall.

2 **Modern Operating Systems, 5th Edition** by Andrew S. Tanenbaum and Herbert Bos, 2022, 5th Edition, Published by Pearson.

SUGGESTED READING:

1. Tanenbaum Andrew, S. 2001. **Modern Operating Systems.** New Delhi: Pearson Education.

COURSE NAME
PROBLEM SOLVING AND PYTHON PROGRAMMING

Credits: 4 **Semester:I**
Course Code:DS25103 **No of Lecture Hours: 75**

Course Objective: The main objective is to teach computational thinking using python

Course Outcome:

CO1: Implement the computing and problem solving in python programming.

CO2: Express how to write loops and decision statements in Python.

CO3:Implement how to use appropriate data structures.

CO4: Explain how to write classes and objects, create arrays.

CO5:Classify different types of inheritance.

Course Content	Hours Allotted	Pedagogy
Module I: • **Introduction to Computing and Problem Solving:** Fundamentals of Computing-Computing Devices-Identification of Computational Problems – Pseudo Code and Flowcharts-Instructions-Algorithms-Building Blocks of Algorithms. • **Introduction to Python Programming-** Python Interpreter and PVM, Variables and Identifiers. • **Data types in python**: built in datatypes-None type, numeric, sequences, sets, mappings • **Operators**: Arithmetic, Assignment, unary, relational, logical, Boolean, bitwise, membership, Identity operators.	(15) 5 5 3 2	Powerpoint presentations / Lectures
Module II: • **Control Flow Statements**: The if, the if...else, the if... elif ...else, while, for, loop, continue, break, pass, assert, return Statements. • **Functions**: Built-In Functions, Function Definition and Calling the Function, formal and actual arguments (positional, keyword, default, variable length arguments.	**(15)** 5 5	Case Studies / Review of research articles

• **Strings**: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number. String Slicing and Joining, String Methods, Formatting Strings.	5	
Module III: • **Lists**: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, sorting list elements. • **Tuples:** Creating Tuples, Accessing the Tuple Elements, Basic Operations on Tuples, Functions to Process Tuples, Nested Tuples, Inserting Elements in a Tuple, Modifying Elements of a Tuple, Deleting Elements from a Tuple. • **Dictionaries:** Operations on Dictionaries, Dictionary Methods, Using for Loop with Dictionaries, , Converting Lists into Dictionary, Converting Strings into Dictionary	**(15)** 5 5 5	Assignments
Module IV: • **Arrays:** Arrays in Python, Advantages of Arrays, Creating an Array, Importing the Array Module, Processing the Arrays, Types of Arrays, Working with Arrays using numpy, Creating Arrays using array(), linespace, logspace, arrange(),zeros()andones() Functions. • **<u>Introduction to Object oriented programming:</u> features of oops**: Class and objects, encapsulation, abstraction, inheritance, polymorphism • **Classes and Objects:** Creating a Class, The Self Variable, Constructor, Types of Variables, Namespaces, Types of Methods, Instance Methods, Class Methods, Static Methods	**(15)** 5 5 5	Lectures
Module V: Title: • **Inheritance**:overriding super class constructors and methods,types of inheritance(single and multiple) • **Exceptions-** Errors in a Python Program, Compile-Time Errors, Runtime Errors, Exceptions, Exception Handling, Types of Exceptions, The except Block, The assert Statement • **Files in Python:** Files, Types of Files in Python, opening a file, Closing a file	**(15)** 5 5 5	Assignments / Lectures

Learning Resources

ESSENTIAL READING:

1. **Python Programming** by S. Sridhar, J. Indumathi, 2023, 1st Edition, Published by Pearson Education.
2. **Learn Python Programming, 3rd Edition** by Fabrizio Romano, 2024, 3rd Edition, Published by Packt Publishing.
3. **Python Programming** by R. Nageswara Rao, 2023, 1st Edition, Published by Wiley India.

SUGGESTED READING:

Chun, Wesley **J**. **Core Python Programming**. 2nd Edition. USA: Pearson Education

COURSE NAME
FUNDAMENTALS OF DATA SCIENCE PRACTICAL

Credits: 1 **Semester:I**
Course Code:DS25104 **No of Lecture Hours: 30**

Objective:

To prepare students for data handling, analysis, visualization in Excel, and POWER QUERYS for efficient data manipulation and insights.

Outcomes:

Students will develop practical skills in data handling, analysis, and visualization using Excel, along with proficiency in POWER QUERY FOR organizing, and summarizing data, preparing them for real-world data science tasks.

LIST OF PRACTICALS

1. Introduction to Excel and Data Handling

1. Import **Student**, **Employee**, and **Customer** data into Excel.
2. Basic data navigation: Rows, columns, sheets.
3. Use Excel functions for data entry and basic calculations.

2. Sorting and Filtering Data

1. Sort **Student** data by Grade (A to C).
2. Sort**Employee** data by Salary in descending order.
3. Filter **Customer** data to only show customers from specific cities.

3. VLOOKUP and HLOOKUP Functions

1. Use **VLOOKUP** to find salary information for an employee from the **Employee** table.
2. Use **HLOOKUP** to fetch purchase amounts for customers based on customer names.

4. Data Visualization Using Excel

1. Create a **Bar Chart** to compare **Employee Salary** across different departments.
2. Create a **Pie Chart** to show the distribution of **Student Grades**.
3. Create a **Scatter Plot** to visualize Purchase Amount against City for **Customer** data.

5. Conditional Formatting and PivotTables

1. Apply **Conditional Formatting** to highlight employees earning more than $70,000.
2. Create a **PivotTable** summarizing the total purchase amount by **City** for **Customer** data.
3. Use PivotTable to summarize average salary by department.

6. Import Data from an Excel File

1. Open Excel and go to **Data > Get Data > From File > From Workbook**.
2. Import a dataset (Sales_Data.xlsx).
3. Load the data into Power Query Editor.

7. Import Data from a CSV File

1. Go to **Data > Get Data > From File > From Text/CSV**.
2. Load a CSV file (Employee_Data.csv) into Power Query.
3. View the data and clean any formatting issues, such as unwanted columns.

8. Remove Unnecessary Columns During Import

- Import a dataset (Sales_Data.csv) into Power Query.
- Remove columns that aren't needed (e.g., "Customer Address", "Order ID") before loading the data into Excel.
- After cleaning, load the data into an Excel worksheet.

9. Apply Data Transformation (Filter & Sort)

- Load a dataset (Orders.xlsx) into Power Query.
- Apply the following transformations:
  1. **Filter** the "Sales" column to show only sales greater than 1000.
  2. **Sort** the data by "Order Date" in **ascending order**.
- Load the cleaned data into an Excel worksheet.

10. Load Data from Multiple Sources

- Import two datasets:
  1. Products.xlsx
  2. Sales_Data.xlsx
- Merge the two datasets by matching the "Product ID" column from both files using a **Left Join**.
- After merging, remove any redundant columns and load the final table into Excel.

COURSE NAME

UNIX SHELL PROGRAMMING LAB

Credits: 1 **Semester:I**
Course Code:DS25105 **No of Lecture Hours: 30**
Objectives:

- To understand various commands and programming constructs of shell programming.
- To implement various algorithms of CPU scheduling and memory management algorithms.

Course Outcome:

- Students will be able to identify UNIX/Linux utilities and implement shell scripts to perform tasks that are more complex.

LIST OF PRACTICALS

1. Introduction to Vi Editor, File and Directory related Commands.

2. Miscellaneous Commands

3. Arithmetic in Shell Scripts

4. Sample programs using Shell Script

5. Decision making in Shell Script

6. Loop control structures in Shell Script.

7. Implementation of UNIX System calls

8. Implementation of CPU Scheduling algorithms

9. Implementations of memory management algorithms

COURSE NAME

PROBLEM SOLVING AND PYTHON PROGRAMMING PRACTICAL

Credit:1 **Semester: I**

Course Code: DS25106 **No of Practical Hours: 30**

Objective: To develop applications using object oriented concepts of Python.

Outcome: Students will be able to demonstrate object oriented concepts of Python.

List of Practical's

1. Fibonacci series up to a limit.
2. Sum and product of all the items in the list.
3. Multiplication table of a number.
4. Print largest and smallest of items in the list.
5. Remove duplicates from a list.
6. Print a specified list after removing elements.
7. Add, subtract and multiply two matrices.
8. Transpose a matrix.
9. Find second smallest and largest number in a list.
10. Count the number of elements in a list within a range.
11. Get the frequency of the elements in a list.
12. Illustrate functions.
13. Check whether a string is palindrome or not.
14. Print a pattern.
15. Program that takes a list of words and returns the longest one.
16. Print date and time and current month calendar.
17. Demonstrate pass by reference and pass by value.
18. Demonstrate types of formal arguments.
19. Demonstrate on functional programming.

20. Demonstrate on scope of variables.

21. Demonstrate on file attributes.

22. Read and write to a file.

23. Program to work with directories.

24. Demonstrate on modules.

25. Program on exception.

26. Display Invalid Mark exception if mark is greater than 100.

27. Program on class and object (Take Student or Employee)

28. Program for inheritance.

29. Display odd and even numbers using threads in a range.

30. Program on threads.

31. Program for accessing attributes in class.

32. Program for illustrating method overriding.

33. Program for illustrating method overloading.

34. Program for performing DML operations on table.

35. Display Hello World after clicking a button.

36. GUI program to display the message after selecting a radio button.

37. GUI program to display a (i) Slider (ii) list box (iii) Scroll bar (iv) Check button

38. GUI program to display the message after entering a text into entry box.

Year-wise and Semester-Wise Distribution of Courses
Department of B.Sc. Computer Data Science and Data Analytics Engineering
First Year Second Semester
Academic Year 2025-26 of 2025-28 Batch (CBCS)

Sl. No.	Part	Course Code	Title of the Course	Hours /Week	Duration of Exam(hrs.)	Marks			Credits
						Internal	External	Total	
1	I	EN23201	General English-II (AECC-3)	3	3	40	60	100	3
2	I	IC23201	Indian Heritage & Culture (AECC-4)	2	3	40	60	100	2
3	II	DS25201	Discrete Mathematics (DSC-5)	4	3	40	60	100	4
4	II	DS25202	Descriptive Statistics and Probability Distributions (DSC-6)	5	3	40	60	100	4
5	II	DS25203	Database Management System (DSC-7)	5	3	40	60	100	4
6	II	DS25204	Data Structures and algorithms using Python (DSC-8)	5	3	40	60	100	4
PRACTICALS									
7	II	DS25205	Descriptive Statistics and Probability Distributions	2	3	40	60	100	1
8	II	DS25206	Data Structures and algorithms using Python	2	3	40	60	100	1
9	II	DS25207	Database Management System	2	3	40	60	100	1
10	II	PL18001	PLANET*	-	-	-	-	-	1
Total				**30**		**320**	**480**	**800**	**25**

*Ability Enhancement Compulsory Course(AECC) * Discipline Specific Core(DSC)

COURSE NAME
GENERALENGLISH-II

Credits: 3 **Semester:II**
Course Code:EN23201 **No of Lecture Hours: 45**

Course Objective:

- To enhance the learners' communication skills by giving adequate exposure in reading, writing, listening and speaking skills and the related sub-skills.
- To develop oral and written communicative skills among the students so that their employability enhances and English becomes the medium of their livelihood and personality

Course Outcome:

CO1: To identify a sound understanding on the formation of words and to demonstrate the functional grammatical component in the sentence.
CO2: To paraphrase ideas and thoughts in a coherent, neat and organized manner in order to utilize the writing skills for sound writing propagandas.
CO3:To create an understanding on Indian Literature, alongside to develop and chisel their communication skills.
CO4: To recognize the moral element which underlies in the short story; an exposure to informal language.
CO5. To develop listening and speaking skills through effective sentence constructions and efficient delivery.

Course Content	Hours Allotted	Pedagogy
Module I: Title:Fundamentals of effective communication- II **Flash Fiction- The Mice by Lydia Davies** • Simple, Complex and Compound Sentences • Conversion of sentences • Information Transfer	**(9)** 1 3 3 2	PowerPoint presentations / Lectures
Module II: Title:Language Proficiency for Effective speaking and Writing Skills-II **Short Story- The Face on the Wall by E V Lucas** • Active and Passive Voice • Conjunctions • Essay Writing	**(9)** 2 3 2 2	Case Studies / Review of research articles
Module III: Title:Health From the text "Three Days to See" • Explanation of the text • Grammar -------Usage of Modal Auxiliary Verbs • Vocabulary --- Collective Nouns, Technical Vocabulary • Writing Skill ------News Paper Report	**(9)** 3 2 2 2	Assignments

Module IV: Title:Short Story From the text "Leela's Friend" by R.K.Narayan • Explanation of the text • Grammar----Phrasal Verbs, Wh- Question • Vocabulary----Noun and Verb Suffixes • Writing Skill------Writing a Narrative	**(9)** 3 2 2 2	Lectures
Module V: Title:Inspiration From the text "The Last Leaf" by O. Henry • Explanation of the text • Grammar----- Prepositions • Vocabulary-----Idioms • Writing Skill----- Précis Writing	**(9)** 2 2 2 2	Assignments / Lectures

Learning Resources

ESSENTIAL READING:

Epitome of Wisdom, Maruthi Publications.

SUGGESTED READING:

1. Krishna Mohan and Meera Banerjee. Developing Communication Skills. 1990. New Delhi. Macmillan India Ltd.
2. Krishnaswamy. N. and Sriraman, T. Current English for Colleges. 1995. Madras Macmillan India Ltd.
3. Narayanaswamy, V.R. Strengthen Your Writing. 1979. New Delhi. Orient Longman.
4. Sharma, R.C. and Krishna Mohan. Business Correspondence. 1978. New Delhi. Tata McGraw-Hill Publishing Co

COURSE NAME
INDIAN HERITAGE AND CULTURE

Credits: 2 **Semester: II**
Course Code:IC23201 **No of Lecture Hours: 30**

Course Objective:

- To apprise the students with a sound background of Indian Culture.
- To equip the students with social & community problems of India.
- To prepare the student for civil service exams where Indian Heritage & Culture paper is compulsory for all the streams.

Course Outcome:

CO1: Student will have knowledge about Indian Customs and Traditions.

CO2: Student can make use of the subject knowledge to attempt all kinds of competitive especially civil services.

CO3: The Subject helps the student community to have knowledge of historical and contemporary social, religious and political issues of the nation.

CO4:

CO5:

Course Content	Hours Allotted	Pedagogy
Module I: Title: INTRODUCTION-ANCIENT INDIAN HERITAGE AND CULTURE • Meaning of culture-Characteristics of Indian Culture • Indus Valley Civilization and Vedic/Aryan Culture • Mauryas and Guptas • Ashoka the great and Harshavardana • South Indian Kingdoms-Satavahanas, Pallavas, Cholas • Development of the art and architecture - contributions of Buddhism and Jainism	**(6)** 2 1 1 1 1	PowerPoint presentations / Lectures
Module II: Title: MEDIEVAL INDIA-INFLUENCE OF ISLAM ON INDIAN CULTURE • Cultural Development under the Delhi Sultanate and Mughals • Sufi and Bakti Movement in Medieval period • Cultural Achievements of Kakatiys and Qutubshahis • Development of Art and Architecture during medieval India	**(6)** 2 2 1 1	Case Studies / Review of research articles

Module III: Title: IMPACT OF WEST AND REFORM MOVEMENTS • Influence of western culture on Indian Society • 19th century Socio Religious Reform Movement-Raja Ram Mohan Roy, Ishwara Chandra Vidyasagar and Veerasalingam • Subaltern Movements in India – Jyothirao Phule-Savitribai Phule, E.V Ramaswamy Naikar-Narayana Guru- Dr.B.R. Ambedkar • Indian National movement- Moderate, Extremist and Gandhian phases	**(6)** 2 2 1 1	Assignments
Module IV: Title: RELIGIOUS AND CONSTITUTIONAL INSTITUTIONS • Perceptions of all Major Religions- A critical Analysis • Rise of communalism in Indian Society • Democratic system in India and its functions- Evolution of the constitution and organs of democrazy.	**(6)** 2 2 2	Lectures
Module V: Title: Social Groups and Rights • Fundamental rights women, chilldren and LGBTQ • Tribal culture and their issues	**(6)** 3 3	Assignments / Lectures

Learning Resources

1. Jha, Dr K.N. 2006. Studies in ancient & Medieval India, COSMOS Book hive Ltd: Gurgaon.
2. Mahajan, V.D. 2008. Ancient India. S.Chand, New Delhi.
3. Manasseh, Dr P. 2010. An Overview of Indian Culture. Gamaleil Publishers, Hyderabad.
4. Malpani, Madanlal & Malpani, Shamsunder. 2014, Indian Heritage and Culture. Kalyani Publishers, Ludhiana.
5. Mhaske, Dr R.H. 2012. Human Rights, Social Justice and Political Challenges. Chandralok Prakashau, Kanpur.
6. Singh, Gurdip & Ahuja, V.K. 2012. Human Rights in 21" Century. Universal Law Publisher, New Delhi.

COURSE NAME
DISCRETE MATHEMATICS

Credits: 4 **Semester:II**
Course Code:DS25201 **No of Lecture Hours: 60**

Course Objective: The objective of the course is to introduce students with an introduction to lattices, Boolean algebras and fundamental concepts in graph Theory, with some of their modern applications.

Course Outcome:

CO1: Develop understanding of Logic Sets and Functions

CO2: Understand Boolean algebra and basic properties of Boolean algebra; able to simplify simple Boolean functions by using the basic Boolean properties

CO3: Develop an understanding of how graph and tree concepts are used to solve problems arising in the computer science

CO4: Evaluate and apply the fundamental concepts in graph theory.

CO5: Apply graph theory based tools in solving practical problems.

Course Content	Hours Allotted	Pedagogy
Module I: Title: • Relations and ordering- Types of relations- Equivalence relation • Partial order relations - Partially ordered sets • Maximal and Minimal Elements of Possets - Hasse diagrams	**(12)** 4 4 4	PowerPoint presentations / Lectures
Module II: Title: **Lattices:** • Lattices - Properties of lattices • Types of Lattices – Bounded Lattice, Distributive lattice – Complemented Lattice and their Properties	**(12)** 6 6	Case Studies / Review of research articles
Module III: Title: • **Boolean algebra:** Boolean algebra and its Applications • Boolean polynomials, Disjunctive normal form, Conjunctive normal form • Minimization of Boolean functions using K-Map technique	**(12)** 4 4 4	Assignments
Module IV: Title: • **Graph theory – I**: • Definition of a graph, Degree of vertex • First theorem of graph theory Paths and connection • Isomorphism of graphs • some special simple graphs • Trees and their properties	**(12)** 4 2 2 2 2	Lectures

Module V: Title: **Graph theory-II**: • Planar graphs, Euler's formula • Euler graphs • Hamiltonian graphs • Chromatic numbers (Only Problems)	**(12)** 3 3 3 3	Assignments / Lectures

Learning Resources

ESSENTIAL READING:

1. Venkateswara Rao, V.Krishna Murthy, N.Sharma B.V.S.S., Anjaneya Sastry, S.2016.B.Sc. **Mathematics Volume-I.**New Delhi: S. Chand and Company.
2. Vasistha, AR. Matrices. Meerut: Krishna Prakashan Mandir.

SUGGESTED READING:

1. I.N. Herstein.2012.Topics in Algebra.2ndEdition. New Delhi: Wiley Publications.
2. Gillian Joseph, A.2006.**ContemporaryAbstractAlgebra.2ndEdition**.New Delhi: Narosa Publishing House.

COURSE NAME
DESCRIPTIVE STATISTICS AND PROBABILITY DISTRIBUTION

Credits: 4 **Semester: II**
Course Code: DS25202 **No of Lecture Hours:75**

Course Objective:

- To prepare students for lifelong learning and successful careers using their statistical skills.

Course Outcome:Students will be able to compute descriptive statistics and probabilities from data, using the application of correct statistical notation and language.
CO1: Analyze statistical data using measures of central tendency and dispersion.
CO2: Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.
CO3: Develop the probability mass and density function of random variables
CO4: Use discrete and continuous probability distributions, including requirements, mean and variance, and making decisions.
CO5: Apply the Normal probability distribution including standard normal curve calculations of appropriate areas.

Course Content	Hours Allotted	Pedagogy
Module I: Title:Descriptive Statistics • Measures of central tendency (Arithmetic Mean, Median, Mode)with simple applications • Absolute and relative measures of dispersion (Range, Quartile deviation, mean deviation and standard deviation) with simple applications. • Skewness and Kurtosis - Their measures including those based on quartiles with real life examples. .	**(15)** 5 5 5	PowerPoint presentations / Lectures
Module II: Title: Probability: • Basic concepts in Probability – Deterministic and random experiments – Trail, outcome, sample space, event and operation of events- Mutually exclusive and exhaustive events –Equally likely and favorable outcomes with examples.	**(15)** 3	Case Studies / Review of research articles

• Mathematical, Statistical and axiomatic definitions of probability with merits and demerits. Properties of probability based on axiomatic Definition conditional probability and independence of events. • Addition and multiplication theorems for 'n' events • Baye's Theorem and problems	5 2 **5**	
Module III: Title:Random Variables and Mathematical Expectations • Definition of Random Variables, Discrete and Continious random variables • Functions of random variables, Probability mass function and probability density function with illustrations (Mean and Variance Only) • Distribution function and its properties • Mathematical Expectation: Mathematical expectation of random variable • Addition and multiplication theorems of expectation	**(15)** 3 3 3 3 3	Assignments
Module IV: Title:Discrete Distributions: • Uniform and Bernoulli Distributions • Binomial Distribution (Mean and variance using Expectations and simple problems only) • Poisson Distribution (Mean and variance using Expectations and simple problems only) • Fitting of Binomial and Poisson Distributions by Direct and Recurrence Method	**(15)** 5 3 5 2	Lectures
Module V: Title: Continuous Distributions • Rectangular Distribution (Mean and variance using Expectations and simple problems only) • Exponential distribution(Mean and variance using expectations and simple problems only) • Normal distribution (Mean and variance using expectations and simple problems only) • Fitting of exponential distribution by direct method • Fitting of normal distribution by Ordinates and Area's method	**(15)** 3 3 3 3 3	Assignments / Lectures

Learning Resources

ESSENTIAL READING

1. V.K. Kapoor and S.C. Gupta 2007. Fundamentals of Mathematical Statistics. New Delhi: Sultan Chand& Sons.

SUGGESTED READING

1. Goon AM, Gupta MK, Das Gupta B.2007 Fundamentals of StatisticsVol-I. Kolkata: The world press Pvt. Ltd.
2. M. Jagan Mohan Rao and Papa Rao, 2010 A Text book of Statistics Paper-I. Tenali: Deepti Publications

Willam Feller. 1990 Introduction to Probability theory and its applications. Volume –I, New Delhi: Wiley Publications

COURSE NAME
DATABASE MANAGEMENT SYSTEM

Credits: 4 **Semester:II**
Course Code: DS25203 **No of Lecture Hours: 75**

Course Objective:

- To design a database and enforce integrity constraints to keep the database consistent, normalize tables to eliminate redundancies, query relational data using Structured Query Language, understand storage strategies for easy retrieval of data through indexing, and understand PL/SQL and transaction management.

Course Outcome:

CO1: Represent logical database using Entity Relationship and Enhanced ER model.
CO2: **Formulate** database using relational algebra and organize using normalization.
CO3: **Develop** programs using PL/SQL and the need for Transactions
CO4: **Explain** the need for NOSQL and its characteristics
CO5: **Implement** document databases such as MongoDB

Course Content	Hours Allotted	Pedagogy
Module I: Title: Fundamentals of DBMS • **Introduction to DBMS** Definition and Purpose of DBMS Comparison with File Systems Types of DBMS (Hierarchical, Network, Relational, Object-Oriented, NoSQL) Importance and Applications in Data Science • **Database System Architecture** DBMS Architecture (1-Tier, 2-Tier, 3-Tier) Database Users and Administrators Data Independence (Logical and Physical) Data Models (Relational, ER, Document, etc.) Components of DBMS • **Relational Model** Schema, Instances, Attributes, Tuples Keys (Primary, Candidate, Foreign, Composite, Super Key) Integrity Constraints (Domain, Entity, Referential)	**(15)** 5 5 5	PowerPoint presentations / Lectures
Module II: Title: SQL and Database Design • **Structured Query Language (SQL):** Basics (DDL, DML, DCL, TCL) Querying Data (SELECT, WHERE, ORDER BY, GROUP BY,HAVING) Joins (INNER, LEFT, RIGHT, FULL, CROSS) Subqueries, Nested Queries, Views and Indexes SQL Functions (Aggregate and Scalar Functions) • **Database Design:** ER Model to Relational Model Mapping	**(15)** 8 7	Case Studies / Review of research articles

Normalization (1NF,2NF,3NF, BCNF, 4NF, 5NF) Functional Dependencies Decomposition and Lossless Join		
Module III: Title: Transactions, Storage, and Query Processing • **Transactions and Concurrency Control:** Concept of Transactions (ACID Properties) Transaction States Concurrency Problems (Dirty Read, Lost Update, etc.) Locking Mechanisms (Shared and Exclusive Locks) Deadlock Detection and Prevention • **Storage and File Structures:** Storage Media (Primary, Secondary, Tertiary Storage) Data Storage Techniques (Heap, Sequential, Indexed, Hashed Files) RAID (Redundant Array of Independent Disks) • **Query Processing and Optimization:** Steps in Query Processing Query Parsing and Translation	**(15)** 5 5 5	Assignments
Module IV: Title: Distributed Databases • Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols. • History, Introduction and need of NoSQL NoSQL Databases SQL versus NoSQL,ACID vs HBASE CAP theorem • Key value pair, ocument, Column family and Graph databases New Features of Oracle23ai	**(15)** 5 5 5	Lectures
Module V: Title: Mongodb Schema less databases, Materialized views, Distribution Models: Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication **MongoDB** Introduction, Terms used in MongoDB and RDBMS CRUD operations- create, drop database, data types, Arrays, aggregate function, map reduce framework, cursors Indexes, MongoImport, MongoExport, Automatic generation of unique Numbers for the _id field	**(15)** 5 10	Assignments / Lectures

Learning Resources:

1. Database System Concepts, Henry F. Korth, Avi Silberschatz, S. Sudarshan, 2021, McGraw-Hill Education, 7th Edition.
2. NoSQL Distilled, Pramod J. Sadalage, Martin Fowler, 2013, Addison-Wesley.
3.MongoDB: The Definitive Guide, Kristina Chodorow, 2013, O'Reilly Media, 2nd Edition**.**
4. Oracle Database 23ai Documentation, Oracle Corporation, 2023, Oracle.
5.Release Update 23.5 Features oracle

COURSE NAME
DATA STRUCTURES AND ALGORITHMS USING PYTHON

Credits: 4 **Semester:II**
Course Code:DS25204 **No of Lecture Hours: 75**

Course Objective:

- To focus on different methods of sorting, searching, storing data and understanding time and storage efficiency.

Course Outcome:

CO1: Choose appropriate data structures to represent data items in real world problems
CO2: Illustrate non-linear data structures like linked list
CO3: Construct data with nonlinear data structure using trees.
CO4: Explain the concept of graphs and b trees
CO5: Explain the concept of Searching and sorting.

Course Content	Hours Allotted	Pedagogy
Module I: Title: • Fundamental Concepts: Introduction to Data Structures, Types of Data Structures, Introduction to Algorithm, Pseudo-code, Flow Chart, Analysis of Algorithms • . Linear Data Structure Using Arrays: 1-D Arrays, 2-D Arrays, N-D Arrays, Memory Representation and Address Calculation of 1-D, 2-D, N-D Arrays, Concept of Ordered List, String Manipulation, Pros and Cons of Arrays • Stacks: Concept, Primitive Operations, Abstract Data Type, Representation Stacks Using Arrays, Prefix, Infix, Postfix Notations for Arithmetic Expression, Applications of Stacks– Converting Infix Expression to Postfix Expression, Evaluating the Postfix Expression, Checking Well-formed (Nested) Parenthesis, Processing of Function Calls, Reversing a String.	**(15)** 5 5 5	PowerPoint presentations / Lectures
Module II: • Recursion: Introduction, Recurrence, Use of Stack in Recursion, Variants of Recursion, Execution of Recursive Calls, Recursive Functions, Iteration versus Recursion. • Queues: Concept, Primitive Operations, Abstract Data Type, Representation Queues Using Arrays, Circular Queue, Double-Ended Queue, Applications of Queues • Linked Lists: Introduction, Concept, Terminology, Primitive Operations-creating, inserting, deleting, traversing, Representation of Linked Lists, Linked List Abstract Data Type	**(15)** 5 5 5	Case Studies / Review of research articles

Module III: • Linked List Variants - Singly Linked List, Doubly Linked List, Linear and Circular Linked List, Representation Stacks and Queues Using Linked Singly Lists, Application of Linked List–Garbage Collection. • Trees: Introduction, Representation of a General Tree, Binary Tree Introduction, Binary Tree Abstract Data Type, Implementation of Binary Trees • Binary Tree Traversals – Preorder, Inorder, Postorder Traversals, Applications of Binary Trees Briefly.	**(15)** 5 5 5	Assignments
Module IV: Title: • Graphs: Introduction, Graph Abstract Data Type, Representation of Graphs, Graph Traversal – Depth-First Search, Breadth First Search • Spanning Tree – Prim's Algorithm, Kruskal's Algorithm. • Hashing: Introduction, Hash Functions, Collision Resolution Strategies	**(15)** 5 5 5	Lectures
Module V: Title: • Searching and Sorting: Sequential (Linear) Search, Binary Search, Bubble Sort, Insertion Sort • Selection Sort, Quick Sort, Merge Sort, and Comparison of Sorting Techniques. • Heaps: Concept, Implementation, Abstract Data Type, Heap Sort.	**(15)** 5 5 5	Assignments / Lectures

Learning Resources:

ESSENTIAL READING:
1. Data Structures and Algorithms Using Python by Subrata Saha, 2023, 1st Edition, Published by Cambridge University Press.
2. Data Structures and Program Design Using Python by Robert L. Kruse, C.L. Tondo, and Bruce P. Leung, 2024, 1st Edition, Published by Pearson Education.
3. Algorithms and Data Structures with Python by John B. Schneider, 2024, 1st Edition**,** Published by Packt Publishing
SUGGESTED READING:
1. "Computer Algorithms" - 2009 Ellis Horowitz, Sartaj Sahni and S. Rajasekaran
2. "Data Structure and Algorithmic Thinking with Python" -2011 Narasimha Karumanchi
3. "Data Structures and Algorithms in Python"-2016 Roberto Tamassia, M. H. Goldwasser, M.T. Goodrich. 4. "Problem Solving in Data Structures & Algorithms Using Python" - 2016 Hemant Jain

DESCRIPTIVE STATISTICS AND PROBABILITY PRACTICALS

Credit:1 **Semester: II**
Course Code: DS25205 **No of Practical Hours: 30**

Objective: **:** To prepare students for lifelong learning and successful careers using their statistical skills. Statistical information covers different subject areas (economic, demographic, social etc.). It provides basic information for decision making, evaluations and assessments at different levels.
Outcome: Students will be able to compute descriptive statistics and probabilities from data, using the application of correct statistical notation and language using Office automation. Students will be able to apply different distributions in a variety of decision making situations.

LIST OF PRACTICALS

1. Computation of measures of Central tendency (mean, median, mode).

2.Computation of measures of dispersion (Mean deviation, Quartile deviation, standard deviation), coefficient of variation

3. Computation of coefficients of Skewness and Kurtosis – Karl Pearson's and Bowley's for grouped data

4. Computation of measures of Central tendency (mean, median, mode) using Office automation.

5.Computation of measures of dispersion (Mean deviation, Quartile deviation, standard deviation), coefficient of variation using Office automation

6. Computation of Skewness, Kurtosis using Office automation.

7. Fitting of Binomial distribution – Direct method.

8. Fitting of Binomial distribution – Direct method using Office Automation

9. Fitting of Binomial distribution – Recurrence relation method

10. Fitting of Poisson distribution – Direct method

11. Fitting of Poisson distribution – Direct method using Office Automation.

12. Fitting of Poisson distribution –Recurrence relation method.

13. Fitting of Normal distribution – Areas method.

14. Fitting of Normal distribution – Ordinates method

15. Fitting of Exponential distribution.

16. Fitting of Exponential distribution using Office Automation.

DATA STRUCTURES THROUGH PYTHON PRACTICAL

Credits:1 **Semester: II**

Subject Code: DS25206 **No of Practical Hours: 30**

OBJECTIVE: Implement algorithms for data structures, sorting, and graph traversal operations. Demonstrate efficient implementation and understanding of data structures and algorithms.

LIST OF PRACTICALS

1. Write programs to implement the following using an array: a) Stack ADT b) Queue ADT
2. Write a program to convert the given infix expression to postfix expression using stack.
3. Write a program to evaluate a postfix expression using stack
4. . Write a program to ensure the parentheses are nested correctly in an arithmetic expression.
5. Write a program to find following using Recursion a) Factorial of +ve Integer b) nth term of the Fibonacci Sequence (c) GCD of two positive integers
6. Write a program to create a single linked list and write functions to implement the following operations. a) Insert an element at a specified position b) Delete a specified element in the list c) Search for an element and find its position in the list d) Sort the elements in the list ascending order
7. Write a program to create a double linked list and write functions to implement the following operations. a) Insert an element at a specified position b) Delete a specified element in the list c) Search for an element and find its position in the list d) Sort the elements in the list ascending order
8. Write a program to create singular circular linked lists and function to implement the following operations. a) Insert an element at a specified position b) Delete a specified element in the list c) Search for an element and find its position in the list
9. Write programs to implement the following using a single linked list: a) Stack ADT b) Queue ADT. 10 Write a program to implement Binary search technique using Iterative method and Recursive methods.
10. Write a program for sorting the given list numbers in ascending order using the following technique: Bubble sort and Selection sort
11. Write a program for sorting the given list numbers in ascending order using the following technique: Insertion sort and Quicksort
12. Write a program for sorting the given list numbers in ascending order using the following technique: Merge sort and Heapsort
13. Write a program to traverse a binary tree in following way. a) Pre-order b) In-order c)Post order 15 Write a program to the implementation graph traversals – BFS and DFS
14. . Write a program to find the minimum spanning tree for a weighted graph using a) Prim’s Algorithm b) Kruskal’s Algorithm.

Database Management System-PRACTICALS

Credit:1 **Semester: II**
Course Code: DS25207 **No of Practical Hours: 30**

Objective: To develop relational and non-relational databases using SQL and NoSQL

List of Practical's:

1.Create a Supplier table as shown below :

Sup_No (Primary Key)	Sup_Name	Item_Supplied	Item_Price	City
S1	Suresh	Keyboard	400	Hyderabad
S2	Kiran	Processor	8000	Delhi
S3	Mohan	Mouse	350	Delhi
S4	Ramesh	Processor	9000	Bangalore
S5	Manish	Printer	6000	Mumbai
S6	Srikanth	Processor	8500	Chennai

2. Write sql query to display Supplier numbers and Supplier names whose name starts with 'R'
3. Write sql query to display the name of suppliers who supply Processors and whose city is Delhi.
4. Write sql query to display the names of suppliers who supply the same items as supplied by Ramesh.
5. Write sql query to increase the price of Keyboard by 200.
6. Write sql query to display supplier numbers, Supplier names and item price for suppliers in delhi in the ascending order of item price.
7. Write sql query to add a new column called CONTACTNO.
8. Write sql query to delete the record whose item price is the lowest of all the items supplied.
9. Create a view on the table which displays only supplier numbers and supplier names.
10. Write sql query to display the records in the descending order of item price for each item supplied.
11. Write sql query to display the records of suppliers who supply items other than Processor or Keyboard.

2.Below are the details of Employees working for a software Company. Create the table called EmpDetails with the below mentioned details.

Eid (Primary Key)	Ename	DOB	Designation	Salary	DOJ
E101	Suma	29-Dec-89	Designer	20000	01-Apr-10
E102	Amit	10-Jan-95	Programmer	25000	18-Feb-18
E103	Payal	15-Aug-85	Tester	35000	13-Jun-11
E104	Kiran	20-Apr-90	Programmer	40000	7-Mar-14
E105	Meenal	29-May-83	DBA	50000	9-Dec-11
E106	Sheila	1-May-70	Analyst	60000	25-Sep-18
E107	Swamy	13-Jan-85	Programmer	45000	14-Feb-16
E108	Sushma	22-Dec-76	DBA	45000	31-Jan-12

a. Write sql query to display all the employees whose designation is Programmer.
b. Write sql query to display employees who have joined after 2014.
c. Write sql query to display all the employees whose name ends with ‘a’.
d. Write sql query to display the total salary of all the employees whose designation is programmer.
e. Write sql query to display all the employee names in upper case.
f. Write sql query to display the details of the employee with highest experience.
g. Write sql query to display the details of the employees whose name contains‘ee’.
h. Write sql query to increase the salaries of employees by 5000 whose designation is DBA.
i. Write sql query to display the employees whose salary is more than the average salary of all the employees.
j. Write sql query to display the record in the following format:
xxxxxxxxx is working as xxxxxxxxxxxxxx with a Salary of Rs.xxxxxxxx
eg: Suma is working as Designer with a Salary of Rs. 20000

3.Create the two tables as shown below with the given constraints:

Table name: **Employee**

Constraints: Eid is Primary key and DeptId is foreign key

Salary should not be less than 10000

Eid (Primary Key)	Ename	DeptId (Foreign Key)	Designation	Salary (> 10000)	DOJ
101	Sudha	D2	Clerk	20000	01-Apr-10
102	David	D1	Manager	50000	18-Feb-18
103	Preethi	D3	Clerk	35000	13-Jun-11
104	Kiran	D1	Salesman	20000	7-Mar-14
105	Meenal	D2	Clerk	50000	9-Dec-11
106	Sunitha	D3	Manager	60000	25-Sep-18
107	Akhil	D3	Clerk	25000	14-Feb-16
108	Sushma	D2	Manager	45000	31-Jan-12

Tablename: **Department**

Constraints:DeptId Primary key and Dname is NOT NULL

DeptId (Primary Key)	Dname
D1	Sales
D2	Marketing
D3	Finance

a. Write sql query to display all the employees who earn more than average salary of all the employees in the company.
b. Write sql query to display the fields Eid, Ename and Dname.
c. Write sql query to sort the employee table in the descending order of salaries.
d. Write sql query to list all the job designations in the employee table without repetitions.
e. Write sql query to display all the employee details Department wise and in the ascending order of their salaries.
f. Write sql query to display all the clerks in DeptId D2.
g. Write sql query to display all the employees who joined in the year 2011.
h. Write sql query to display all the employees who joined in the month of February.
i. Write sql query to display all the employees whose salary is between 30000 and 45000.
j. Write sql query to display all the employee details along with their work experience in the company till current date.

4.Below are the details of Students enrolled in various course of B.Com. Create the table called Student with the below mentioned details.

Sid (Primary Key)	Sname	DOB	State	Gender	Category	Course
1001	Neha	29-Dec-02	Telangana	F	Gen	Comp
1002	Arun	10-Jan-02	Telangana	M	OBC	Honors
1003	Payal	15-Aug-01	Maharashtra	F	Gen	Appl
1004	Amrita	20-Apr-02	Karnataka	F	OBC	Honors
1005	Pavan	29-May-03	AndhraPradesh	M	ExServicemen	Comp
1006	Anchal	1-May-03	Gujarat	F	OBC	Comp
1007	Ramya	13-Jan-02	Telangana	F	Gen	Appl
1008	Rakesh	22-Dec-01	AndhraPradesh	M	Sports	Comp

a. Write sql query to display the students who are not from Telangana or Andhra Pradesh.
b. Create a view to display the columns Sid, Sname for students belonging to Telangana.
c. Write sql query to create an index on column Sname.
d. Write sql query to display all the female students enrolled under Comp course and who belong to OBC.
e. Write sql query to display the student ids, names, and their present age.
f. Write sql query to display the students in the ascending order of their names for each course.
g. Write sql query to delete all the students records who have enrolled for Comp course and who are born after 2002.
h. Write sql query to add two new columns Contact no and Email to the existing fields.
i. Write sql query to display all the Student names prefixed with Mr./Ms. Based on Gender column.
j. Write sql query to display all the Student names where the length of the name is 5 characters.

5.Create a Table for Library Information

Table name: Library

Constraints: BookId is primary key and BookName is NOT NULL

BookId (Primary Key)	BookName	Author	DatePurchased	Publisher	Price
B101	Cost Accounting	Jain Narang	11-Feb-13	Kalyani	800
B102	Business Statistics	OP Aggarwal	22-Dec-11	Himalaya	750
B103	Rdbms	C J Date	2-Mar-15	TMH	900
B104	Mgmt Accounting	RK Sharma	19-Apr-16	Kalyani	450
B105	Operating Systems	Galvin	25-Nov-13	PHI	750
B106	Advanced Accounting	SC Gupta	16-Apr-18	Himalaya	600

a. Write sql query to display the list of authors from Himalaya publications.

b. Write sql query to display the total cost of books purchased Publisher wise.
c. Write sql query to count the total number of books under Kalyani publications.
d. Write sql query to rename the column Publisher as Publications.
e. Write a sql query to display the books in the ascending order of Date Purchased.
f. Write sql query to create an index on the fields Book Name and Author.
g. Write sql query to display the books whose price is between 500 and 700
h. Write sql query to increase the price of all the books by 200 for publishers other than Himalaya or Kalyani.
i. Write sql query to display the book details where author name contains the name Sharma.
j. Create a view to display the fields BookId and Book Name where the Publisher is Himalaya

1. Queries on EMP and DEPT tables
a. Simple query
b. Aggregate, numeric and string functions
c. Group by, order by clause
d. Joins
e. Set operators

6.Design a distributed database system using both homogeneous and heterogeneous databases and implement data storage strategies.

7.Create a schema-less database in MongoDB and perform CRUD operations on it.

8.Implement a master-slave replication setup and test data consistency across replicas.

9.Use MongoDB's aggregation framework to perform data analysis and visualize results.

10Design a sharding strategy in MongoDB to manage large datasets efficiently.

Year-wise and Semester-Wise Distribution of Courses
Department of B.Sc. Computer Data Science and Data Analytics Engineering
Second Year First Semester
Academic Year 2025-26 of 2024-2027 Batch (CBCS)

Sl. No.	Part	Course Code	Title of the Course	Hours /Week	Duration of Exam(hrs.)	Marks			Credits
						Internal	External	Total	
1	I	ES23301	Environmental Studies and Gender Sensitization (AECC-5)	3	3	40	60	100	3
2	II	G23DS1T	Generic Elective(GE-1) Python programming(IDE)	2	3	4 0	60	100	2
3	II	DS20301	Python Programming (SEC-2)	4	3	40	60	100	4
4	II	DS18302	Computer Organization (Core –8)	5	3	40	60	100	4
5	II	BS23308	Statistical Methods (Core –9)	4	3	40	60	100	4
6	II	BS23301	Database Management Systems (Core-10)	4	3	40	60	100	4
PRACTICALS									
7	II	G23DS1P	Generic Elective (GE-1) (IDE)	2	3	40	60	100	1
8	II	DS20304	Python Programming (SEC-2)	2	3	40	60	100	1
9	II	BS20039	Statistical Methods (Core –9)	2	3	40	60	100	1
10	II	DS23305	Database Management Systems (Core-10)	2	3	40	60	100	1
Total				**30**	-	400	600	1000	**25**

*Ability Enhancement Compulsory Course(AECC) * Discipline Specific Core(DSC)
*Skill Enhancement Certificate Course(SECC) *General Elective(GE)

GENERIC ELECTIVE

INTER-DEPARTMENTAL/INTER-DISCIPLINARY

UG COURSES FOR AY 2025-26

LIST OF GE COURSES OFFERED IN 2025-26

S.No	Department	Course
1	B.Sc. Chemical Technology	Solar Process Technologies
2	B.Sc. Agricultural Science and Rural development	Principles of Organic Farming
3	B.Sc. Computer Science and Engineering	PC Operating Systems
4	B.Com Honors	Taxation
5	B.Sc. Computer Science and IT	PC Hardware and Software Installation
6	B.Com Marketing	Principles of Marketing
7	B.Sc. Biotechnology, Genetics and Chemistry	Medical Lab Technology
8	B.Com Business Studies	Banking
9	B.A Mass Communication	Photography
		Film Appreciation
10	B.Sc. Food Technology and Management	Principles of Food Processing
11	B.A Psychology, English Literature and Journalism	Communication Skills
		Career Skills
		Psychology for Living
12	B.Sc. Mathematics, Statistics and Computer Science	Quantitative Aptitude
		Data Analysis
13	B.Sc. Multimedia and Animation	Creative Arts
14	B.Com Computers	Accounting
15	Bachelor of Business Administration	Principles of Management
16	B.Com International Finance	Project Management
17	B.Sc. Computer Data Science and Data Analytics Engineering	Python Programming
18	B.Com Business Process Management	Financial Markets
19	B.Sc. Food Science, Nutrition and Dietetics	Nutrition and Dietetics
20	B.Sc. Computer Science and Cognitive Systems	Introduction to Worksheet

21	B.Com Business Analytics	Principles of Insurance
22	B.Sc. Computer Science and Artificial Intelligence	Introduction to AI
23	B.Sc. Computer Science and Cyber Security	Principles of Information Security
24	B.A Economics, Public Administration and Computer App.	Human Rights
25	B.Com Information Systems	Human Resource Management
26	BBA Entrepreneurship Development	Startup Management
27	B.Sc. Computer Science & Cloud Computing	Web Programming
28	B.Sc. Computer Science & Internet of things	Introduction to IOT using Arduino
29	BBA Retail Operations Management	Consumer Behavior
30	BBA Tourism	Tourism Management
31	B.Sc. Computer Science & Machine Learning	Machine Learning for everyone
32	B.Com Fintech	Right to information Act
33	B.Com Strategic Finance	GST

COURSE NAME
ENVIRONMENTAL STUDIES AND GENDER SENTIZATION

Credits: 3 **Semester:III**
Course Code:ES23301 **No of Lecture Hours:45**

Course Objective:

- To understand the importance of ecological balance for Sustainable Development
- To understand the impacts of developmental activities and mitigation measures
- To understand the environmental policies and regulations.
- To develop students' sensibility with regard to issues of gender in contemporary India
- To provide a perspective on the socialization of men and women
- To expose the students to debate on the politics and economic works and on gender violence.

Outcome:

- Students will gain knowledge on environmental aspects and involve themselves in acquiring a sustainable environment.
- Students will be sensitized towards gender issues in the society and the laws enforced for their protection.

Course Outcome:

COl: Understand the importance of Environmental education, conservation of natural resources & understand the importance of ecosystems and biodiversity.

CO2: Understand the pollution problems and apply the environmental science knowledge on solid waste management, disaster management.

C03: Apply the environmental science knowledge to improve the resources Evaluate and understand the sustainable environmental conditions and control methods.

C04: Identify the interactions and inter sections of identities (e.g., gender, race, ethnicity class, sexuality, and so on) and assess the ways in which they contribute to instances of privilege and power dynamics across cultures, space, and time. And their problems

CO5: Understand the gender problems and ways of addressing them, including interactions across local to global scales in communities and overcome inequalities with legislation .

Course Content	Hours Allotted	Pedagogy
Module I: Title:NATURAL RESOURCES, ECOSYSTEMS & BIODIVERSITY	**(9)**	
• Definition, Scope and importance of environmental studies. Need for public awareness.	2	
• Renewable & Non-Renewable resources, Brief account on Forests, Water, Minerals and Energy (Solar, Wind, and Geo-thermal &Bio-energy).	2	PowerPoint presentations / Lectures
• Definition of Ecosystem, Structure and functions-food chains, food webs, ecological pyramids, producers, consumers and decomposers. Energy flow and example ecosystems--F orest, Desert, Aquatic ecosystem	2	
• Definition of Biodiversity, types (Genetic, Species, Ecosystem), India-mega diversity Nation.	2	

• Hotspots, Threats to biodiversity, Conservation of biodiversity (In-Situ and Ex-Situ)	1	
Module II: Title:ENVIRONMENTAL POLLUTION • Brief account on causes, effects, prevention and control measures of a)Air pollution b)Water Pollution c)Soil pollution d)Noise pollution Manne Pollution • Solid Waste Management: Causes, Effects & Control measures of urban • Disaster Management: floods, Earthquakes, and Cyclones.	**(9)** 3 3 3	Case Studies / Review of research articles
Module III: Title:Social Issues and Environment • Rain-Water Harvesting, Water-shed Management, and From Unsustainable to Sustainable Development. • Global Warming, Ozone depletion, and Acid rains • Environmental Legislation: Air Act, Water Act, Environmental Protection Act, Forest Act, Wildlife Act. • Environmental & Human Health HIV/AIDS • Welfare Programs Family, Women & Child Welfare, Population Explosion • Role of Information Technology in Environmental Studies.	**(9)** 2 2 2 1 1 1	Assignments
Module IV: Title:Gender Studies • Why should we study gender issues? • Socialization- Making women and making men • Being together as equals-Through the lens of gender • Missing women: Gender selection and its consequences • Health issues of Women	**(9)** 2 2 2 2 1	Lectures
Module V: Title:Gender & Labour -Gender Violence & Law • House work: The invisible labour- my mother doesn't work "share the load" • Sexual harassment – say no eve teasing – the caste based violence –Nirbhaya Act • Domestic violence - Is home a safe place? - Blaming the victim-Domestic violence Act • Forums of justice-Hindu Inheritance Act(2005)	**(9)** 3 3 2 1	Assignments / Lectures

Learning Resources
1.Textbook: **Towards a World of Equals** **A Bilingual Text on Gender**. A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu. Hyderabad: Telugu Academy.
2.Environmental Studies-from Crisis to Cure. Rajagopalan R, 2015, Third Edition.
3.**A Textbook of Environmental Studies,** Dr D K Asthana and Dr Meera Asthana. 2014. Revised Edition. New Delhi: S. Chand & Company.

COURSE NAME

GENERIC ELECTIVE-PYTHON PROGRAMMING

Credits: 2 **Semester:III**
Course Code:G23DS1T **No of Lecture Hours:30**

Course Objective:

- To offer an easy syntax compared to Perl and the Unix/Linux "Shell Languages" and it is easier to learn and maintain.

Course Outcome:

CO1: **Implement** the structure and components of a Python program.
CO2: **Express** how to write loops and decision statements in Python.
CO3: **Interpret** how to write functions and pass arguments in Python.
CO4:**Explain** how to build Python packages module for reusability
CO5: **Create** files and GUI programs

Course Content	Hours Allotted	Pedagogy
Module I: • **Introduction to Python:** Python, Features of Python, Execution of a Python Program, Memory Management in Python, Comparisons between C and Python, Comparisons between Java and Python. • **Writing Our First Python Program:** Writing Our First Python Program, Executing a Python Program - Using Python's Command, Line Window, and Using Python's IDLE Graphics Window • **Data types in Python, Operators in python**	**(6)** 2 1 3	PowerPoint presentations / Lectures
Module II: Title: • **Control Statements:** The if Statement, A Word on Indentation, The if … else Statement, The if … elif … else Statement, The while Loop, The for Loop, Infinite Loops, Nested Loops, The else Suite, The break Statement, The continue Statement, The pass Statement, The assert Statement, The return Statement. • **Lists and Tuples:** List, Creating Lists using range() Function, Updating the Elements of a List, Concatenation of Two Lists, Repetition of Lists, Membership in Lists, Aliasing and Cloning Lists, Methods to Process Lists, Finding Biggest and Smallest Elements in a List, Sorting the List Elements, Number of Occurrences of an Element in the List.	**(6)** 2 4	Case Studies / Review of research articles

Tuples: Creating Tuples, Accessing the Tuple Elements, Basic Operations on Tuples, Functions to Process Tuples, Nested Tuples, Inserting Elements in a Tuple, Modifying Elements of a Tuple, Deleting Elements from a Tuple. **Dictionaries:** Operations on Dictionaries, Dictionary Methods, Using for Loop with Dictionaries, Converting Lists into Dictionary, Converting Strings into Dictionary		
Module III: • **Arrays:** Arrays in Python, Advantages of Arrays, Creating an Array, Importing the Array Module, Processing the Arrays, Types of Arrays, Working with Arrays using NumPy, Creating Arrays using array(), linespace, logspace,arrange(),zeros()and ones() Functions. • **Strings -** Sequences, Strings, Strings and Operators, String-Only Operators, Built-in F functions, String Built-in Methods, Special Features of Strings	**(6)** 3 3	Assignments
Module IV: • **Functions-** Introduction, Calling Functions, Creating Functions, Passing Functions, Formal Arguments, Variable Length Arguments, Functional Programming, Variable Scope, Recursion, Generators • **Classes and Objects:** Creating a Class, The Self Variable, Constructor, Types of Variables, Namespaces, Types of Methods, Instance Methods, Class Methods, Static Methods • **Exceptions-** Errors in a Python Program, Compile-Time Errors, Runtime Errors, Exceptions, Exception Handling, Types of Exceptions, The except Block, The assert Statement	**(6)** 2 2 2	Lectures
Module V: • **Files in Python:** Files, Types of Files in Python, opening a file, Closing a file 3 • **Graphical User Interface:** GUI in python, using tkinter, sample programs using Tkinter	**(6)** 3 3	Assignments / Lectures

Learning Resources	
1.	Textbook: Rao, Dr. R. Nageswara. Core Python Programming. 2nd Edition. Dream tech Press
2.	Reference books: Chun, Wesley **J**. **Core Python Programming**. 2nd Edition. USA: Pearson Education

COURSE NAME
PYTHON PROGRAMMING

Credits:4 **Semester:III**
Course Code:DS20301 **No of Lecture Hours:60**

Course Objective: To offer an easy syntax compared to Perl and the Unix/Linux "shell languages" and it is easier to learn and maintain.

Course Outcome: Students will be able to
CO1: Implement the structure and components of a Python program.

CO2: Choose appropriate data structures.

CO3: Interpret how to write classes and create objects.

CO4: Explain how to use Inheritance and Threads.

CO5: Create basic GUI programs and Database Connectivity

Course Content	Hours Allotted	Pedagogy
Module I: • **Introduction to Python:**Python, Features of Python, Execution of a Python Program Viewing the Byte Code, Flavors of Python, Python Virtual Machine, Frozen Binaries, Memory Management in Python, Garbage Collection in Python, Comparisons between C and Python, Comparisons between Java and Python. • **Writing Our First Python Program:**Writing Our First Python Program, Executing a Python Program - Using Python's Command Line Window Using Python's IDLE Graphics Window Running from System Prompt, Getting Help in Python, Getting Python Documentation Help. • **Data types in Python:** Comments in Python, Doc Strings, How Python Sees Variables, Data types in Python Built-in Data Types, Bool Data type.Sequences in Python, Sets, Literals in Python, Determining the Data type of a Variable What about Characters, User-defined Data types,Constants in Python, Identifiers and Reserved words, Naming Conventions in Python. • **Operators in Python:** Arithmetic Operators, Assignment Operators,Unary Minus Operator, Relational Operators, Logical Operators, Boolean Operators, Bitwise Operators, Membership Operators, Identity Operators.	**(12)** 3 3 3 3	PowerPoint presentations / Lectures

Operator Precedence and Associativity, Mathematical Functions Using IDLE Window, Using Command Line Window. **Input and Output:** Output statements, Input Statements,Command Line Argument		
Module II: • **Control Statements:** The if Statement, A Word on Indentation, The if … else Statement, The if ..elif .. else Statement, The while Loop, The for Loop, Infinite Loops, Nested Loops, The else Suite, The break Statement, The continue Statement, The pass Statement, The assert Statement,The return Statement • **Arrays in Python:** Array, Advantages of Arrays, Creating an Array, Importing the Array Module,Indexing and Slicing on Arrays, Processing the Arrays, Types of Arrays. Working with Arrays using Numpy.Creating arrays with array(),linspace(), logspace(),arange(),zeros() and ones() functions • **Strings and Characters:** Creating Strings, Length of a String, Indexing in Strings, Slicing the Strings, Repeating the Strings, Concatenation of Strings, Checking Membership, Comparing Strings, Removing Spaces from a String, Finding Sub Strings, Counting Substrings in a String, Strings are Immutable, Replacing a String with another String, Splitting and Joining Strings, Changing Case of a String, Checking Starting and Ending of a String, String Testing Methods, Formatting the Strings, Working with Characters, Sorting Strings, Searching in the Strings, Finding Number of Characters and Words, Inserting Sub String into a String, Regular Expressions, Sequence Characters, Quantifiers and Special Characters in Regular Expressions. • **Functions:** Difference between a Function and a Method, Defining a Function, Calling a Function, Returning Results from a Function, Returning Multiple Values from a Function, Functions are First Class Objects, Pass by Object Reference, Formal and Actual Arguments, Positional Arguments, Keyword Arguments, Default Arguments, Variable Length Arguments, Local and Global Variables, The Global Keyword, Passing a Group of Elements to a Function, Recursive Functions, Anonymous Functions or Lambdas Function Decorators, Generators, Structured Programming.	(12) 3 3 3 3	Case Studies / Review of research articles

Creating our Own Modules in Python, The Special Variable name.		
Module III: • **Lists and Tuples:** List, Creating Lists using range() Function, Updating the Elements of a List, Concatenation of Two Lists, Repetition of Lists, Membership in Lists, Aliasing and Cloning Lists, Methods to Process Lists Finding Biggest and Smallest Elements in a List, Sorting the List Elements, Number of Occurrences of an Element in the List, Finding Common Elements in Two Lists, Storing Different Types of Data in a List, Nested Lists, Nested Lists as Matrices, List Comprehensions. Tuples: Creating Tuples, Accessing the Tuple Elements, Basic Operations on Tuples, Functions to Process Tuples, Nested Tuples, Inserting Elements in a Tuple, Modifying Elements of a Tuple, Deleting Elements from a Tuple. • **Dictionaries:** Operations on Dictionaries, Dictionary Methods, Using for Loop with Dictionaries, Sorting the Elements of a Dictionary using Lambdas, Converting Lists into Dictionary, Converting Strings into Dictionary, Passing Dictionaries to Functions, Ordered Dictionaries • **Introduction to OOPs**: Problem in Procedure Oriented Approach, Specialty of Python Language, Features of Object Oriented Programming System (OOPs)- Classes and Objects, Encapsulation, Abstraction, Inheritance, Polymorphism. • **Classes and Objects:** Creating a Class, the Self Variable, Constructor, Types of Variables, Namespaces, Types of Methods- Instance Methods, Class Methods, Static Methods, Passing Members of one Class to another Class, Inner Classes	**(12)** 3 3 3 3	Assignments
Module IV: Title: • **Inheritance and Polymorphism:** Constructors in Inheritance, Overriding Super Class Constructors and Methods, The super() Method, Types of Inheritance, Single Inheritance, Multiple Inheritance, Method Resolution Order(), Polymorphism, Duck Typing Philosophy of Python, Operator Overloading, Method Overloading, Method Overriding. • **Exceptions:**	**(12)** 3 3	Lectures

Exceptions in Python Program, Exceptions, Exception Handling, Types of Exceptions, The Except Block, The assert Statement, User-Defined Exceptions, Logging the Exceptions • **Threads:** Single Tasking, Multitasking, Difference between a Process and a Thread, Concurrent Programming and GIL, Uses of Threads Creating Threads in Python- Creating a Thread without using a class, Creating a Thread by Creating a Sub Class to Thread Class, Creating a Thread without Creating a Sub Class to Thread Class, Thread Class Methods – Single Tasking using a Thread, Multitasking using Multiple Threads, Thread Synchronization, -Locks, Semaphores, Deadlock of Threads, Avoiding Deadlocks in a Programs, Communication between Threads using notify(), wait() methods and using Queue, Daemo Threads	3 3	
Module V: Title: • **Files in Python:** Files, Types of Files in Python, Opening a File, Closing a File, Working with Text Files Containing Strings, knowing whether a File Exists or Not, Working with Binary Files, The with Statement, Pickle in Python, The seek() and tell() Methods, Working with Directories. • **Graphical User Interface:** GUI in Python, The Root Window, Fonts and Colors, Working with Containers, Canvas, Frame, Widgets, Button Widget, Arranging Widgets in the Frame, Label Widget, Message Widget, Text Widget, Scrollbar Widget, Check button Widget, Radio button Widget, Entry Widget, Spin box Widget, List box Widget, Menu Widget, Creating Tables • **Python's Database Connectivity:** DBMS, Advantages of DBMS over Files, Types of Databases used in Python, Working with MySQL Database, Using MySQL from Python, Retrieving All Rows from a Table, Inserting Rows into a Table, Deleting Row from a Table, Updating Rows in a Table, Creating Database Tables through Python	**(12)** 3 3 6	Assignments / Lectures

Learning Resources	
1.	Textbook: Rao, Dr. R. Nageswara. Core Python Programming. 2nd Edition. Dream tech Press.
2.	Reference books: Chun, Wesley J. Core Python Programming. 2nd Edition. USA: Pearson Education

COURSE NAME
COMPUTER ORGANIZATION

Credits:4 **Semester:III**
Course Code:DS18302 **No of Lecture Hours:75**

Course Objective:

- To have a thorough understanding of the basic structure and operation of a digital computer. To discuss in detail the operation of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point addition, subtraction, multiplication & division.
- To study the different ways of communicating with I/O devices and to study the hierarchical memory system including cache memories and virtual memory

Course Outcome: Students will be able to
CO1: Understand basic Circuit designing and number systems

CO2: Explain about how data transferred from one register to another register

CO3: Construct designing of control unit and Central Processing Unit

CO4: Classify different types of computer arithmetic operations

CO5: Categorize all peripheral devices and memory

Course Content	Hours Allotted	Pedagogy
Module I: Title: • **Digital Logic Circuits:** Digital Computers & Logic Gates • Boolean Algebra & Map Simplification • Combinational Circuits • Flip-Flops and Sequential Circuits • **Digital Components:** Integrated Circuits & Decode • Multiplexers • Registers and Shift Registers • Binary Counters & Memory Unit • **Data Representation:** Data Types & Complements • Fixed- and Floating-Point Representation • Other Binary Codes and Error Detection Codes	**(15)** 1 1 1 2 1 1 1 1 2 2 2	Powerpoint presentations / Lectures
Module II: Title: • **Register Transfer and Microoperations:** Register Transfer language & Register Transfer • Bus and Memory Transfer • Arithmetic Microoperations • Logic Microoperations • Shift Microoperations & Arithmetic Logic Shift Uni	**(15)** 2 1 2 2 2	Case Studies / Review of research articles

• **Basic Computer Organization and Design:** Instruction Codes • Computer Registers • Computer Instructions and Timing and Control • Instruction Cycle • Memory Reference Instructions • Input-Output and Interrupt	1 1 1 1 1 1	
Module III: • **Microprogrammed Control:** Control Memory & Address Sequencing • Microprogram Example • Design of Control Unit • **Central Processing Unit:** Introduction, General Register Organization • Stack Organization • Instruction Formats & Addressing Modes • Data Transfer and Manipulation & Program Control	**(15)** 2 2 2 2 3 2 2	Assignments
Module IV: • **Pipeline and Vector Processing**: Parallel Processing, Pipelining • Arithmetic Pipeline, Instruction Pipeline • **Computer Arithmetic:** Addition and Subtraction • Multiplication Algorithms • Division Algorithms • Floating-Point Arithmetic Operations	**(15)** 1 2 3 3 3 3	Lectures
Module V: • **Input-Output Organization:** Peripheral Devices & I/O Interface • Asynchronous Data Transfer • Modes of Transfer • Direct Memory Access • Input-Output Processor-CPU IOP Communication and Serial Communication • **Memory Organization:** Memory Hierarchy • Main Memory, Auxiliary Memory, • Associative Memory, Cache Memory	**(15)** 2 2 2 1 2 2 2 2	Assignments / Lectures

Learning Resources	
1.	Textbook: Mano Morris,M. 1993. **Computer System Architecture**. 3rd Edition. Asia: Pearson Education
2.	Reference books: Stallings, William. 2003. **Computer Organization and Architecture**. 6th Edition. New Jersey: Pearson Education

COURSE NAME
STATISTICAL METHODS

Credits: 4 **Semester:III**
Course Code:BS23308 **No of Lecture Hours: 60**

Course Objective:

- To acquaint students with various statistical methods and their applications in different fields.
- To cultivate statistical thinking among students
- To develop skills in handling complex problems in data analysis and research design.

Course Outcome:: Students will be able to choose and apply an appropriate statistical analysis or modelling methods to solve problems arising in different research fields

CO1: Calculate and interpret the correlation between two variables

CO2: Produces simple linear regression equations.

CO3: Analyse the categorical data and to study the association among them.

CO4: Understand problem of point estimation.

CO5: Obtain estimators using estimation methods like MLE and method of moments.

Course Content	Hours Allotted	Pedagogy
Module I: Title: • Bivariate data, scattered diagram • Principle of least squares, fitting of a straight line, quadratic and power curves • Concept of correlation, computation of Karl Pearson's correlation coefficient for grouped data and ungrouped data and its properties • Correlation ratio, Spearman's rank Correlation coefficient, its properties.	**(12)** 2 3 4 3	Powerpoint presentations / Lectures
Module II: Title: • simple linear regression, correlation verses regression • properties of regression coefficients • Concepts of partial and multiple correlation coefficients (only for three variables)	**(12)** 4 4 4	Case Studies / Review of research articles
Module III: Title: • Analysis of categorical data, independence and association and partial association of attributes	**(12)** 4	Assignments

• Various measures of association (Yule's) for two way data and coefficient of contingency (Pearson and Tcheprow) • Coefficient of colligation	4 4	
Module IV: Title: • Concepts of population, parameter, random sample, statistic, Sampling distribution and Standard error of sample mean(s) and sample proportion(s). • Independence of sample mean and variance in Random sampling from normal distributions Point estimation of a parameter, concept of bias and mean square error of an estimate • Criteria of good estimator – consistency, unbiasedness, efficiency and sufficiency with examples	**(12)** 4 4 4	Lectures
Module V: Title: • Statement of Neyman's Factorization theorem • Derivations of sufficient statistics in case of Binomial, Poisson, Normal and Exponential (one parameter only) distributions Estimation by method of moments • Maximum likelihood (ML), statements of asymptotic properties of MLE • Concept of interval estimation. Confidence intervals of the parameters of normal population by Pivot method	**(12)** 3 3 3 3	Assignments / Lectures

Learning Resources	
1.	Textbook: Kapoor V.K. and Gupta S.C. 2007. Fundamentals of Mathematical Statistics. New Delhi: S. Chand& Co.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
DATABASE MANAGEMENT SYSTEMS

Credits:4 **Semester:III**
Course Code:BS23301 **No of Lecture Hours:60**

Course Objective:

- To form the basis for bulk management of data. This marks the beginning and maintenance of the databases. It offers the power to logically present the databases to individual usage as well. Provides facilities for data access, enforcing data integrity, managing concurrency and restoring the data from backups

Course Outcome:

- **CO1**: To **describe** Entity Relationship and Enhanced ER model.
- **CO2**: To **understand** the relational model, reduction to relation schema, relational algebra and normalization.
- **CO3**: To **use** SQL- the standard language of relational databases and PL/SQL programming.
- **CO4**: To **understand** the storage and file structure, storage access, indexing and hashing techniques of the database.
- **CO5**: To **understand** the need for NoSQL databases and their characteristics, the concepts of NoSQL databases.

Course Content	Hours Allotted	Pedagogy
Module I: Title: • Database-System Applications, Purpose of Database Systems • View of Data, Database Languages, DDL, DML • Relational Databases, Object-Based and Semi structured Databases • Data Storage and Querying, Transaction Management • Database Architecture, Database Users and Administrators • Enhanced entity relationship model : Generalization, Specialization, Aggregation, Design Considerations. • **E-R Model**: Entity Relationship Model, Constraints • Entity Relationship Diagrams, Design Issues • Weak Entity Sets, Extended E-R Features	**(12)** 1 1 2 1 2 2 1 1 1	PowerPoint presentations / Lectures
Module II: Title: • Relational Model: Structure of Relational Databases • Fundamental Relational-Algebra Operations • Additional Relational Algebra Operations • Extended Relational- Algebra Operations • Null Values, Modification of the Database • Normalization: First, second • Third Normal forms and BCNF	**(12)** 2 2 1 2 1 2 **2**	Case Studies / Review of research articles

Module III: Title: • **SQL**: Data Definition, Basic Structure of SQL queries • Set operations, Aggregate functions. • Null Values, Nested Sub queries • Joins, Modifications of the database, Views • Integrity Constraints • **PL/SQL** : Functions, Procedures • Triggers, Cursors, Exception Handling, Packages • Authorization in SQL, Granting, Revoking of privileges, Roles • Authorization on Views, Functions and Procedures ,Audit Trail • Application Security	**(12)** 1 2 1 1 1 1 2 1 1 1	Assignments
Module IV: Title: • **Storage and File Structure**: Overview of Physical Storage Media • Magnetic Disks, Physical Characteristics of Disks • Performance Measures of Disks, Optimization of Disk-Block Access • **Storage Access:** Buffer Manager, Buffer Replacement Policies • File Organization, Organization of Records in Files • **Indexing and Hashing**: Basic Concepts, Ordered Indices • B+ Tree Index Files-Structure of a B+ Tree, Queries on B+ Trees • Updates on B+ Trees, B+ Tree File Organization • Static Hashing, Dynamic Hashing • Comparison Ordered Indexing and Hashing	**(12)** 1 1 1 1 1 1 2 2 1 1	Lectures
Module V: Title: • **Why NO SQL:** The Value of relational Databases, Impedance Mismatch, Application & Integration Databases, Attack of the clusters, The Emergence of NoSQL • **Aggregate Data Models:** Aggregates, Column-Family Stores, Summarizing Aggregate-Oriented Databases • **More Details on Data Models:** Relationships, Graph Databases, Schemeless Databases, Materialized Views, Modeling for Data Access • **Distribution Models:** Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication	**(12)** 3 3 2 2	Assignments / Lectures

• 5.**Consistency:** Update Consistency, Read Consistency, Relaxing Consistency, Relaxing Durability, Quorums.	2	

Learning Resources	
1.	Textbook: Silberschatz, Abraham. Korth, H.F. Sudharshan, S.Database System Concepts. 5th Edition.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

PYTHON PROGRAMMING LAB

(GE Inter-Disciplinary)

Credits: 1 **Semester: III**

Subject Code: G23DS1P **No. of Practical Hours:30**

Objective: To develop applications using object oriented concepts of Python.

Outcome: Students will be able to demonstrate object oriented concepts of Python.

LIST OF PRACTICALS:

1. Temperature conversion.
2. Display Fibonacci series up to a limit.
3. Find factorial of a number.
4. Sum and product of all the items in the list.
5. Print the multiplication table of a number.
6. Print largest and smallest of items in the list.
7. Remove duplicates from a list.
8. Add, subtract and multiply two matrices.
9. Transpose a matrix.
10. Second smallest and largest number in a list.
11. Count the number of elements in a list within a range.
12. Get the frequency of the elements in a list.
13. Illustrate functions.
14. Check whether a string is palindrome or not.
15. Demonstrate pass by reference and pass by value.
16. Demonstrate on functional programming.
17. Demonstrate on scope of variables.
18. Demonstrate on module
19. Read and write to a file.
20. Python program on exception.
21. Display Invalid Mark exception if mark is greater than 100.
22. Append data to a file.
23. Program on recursion.
24. Program to print roots of a quadratic equation.
25. Program on break and continue.

PYTHON PROGRAMMING LAB

Credit: 1 **Semester: III**
Subject Code: DS20304 **No. of Practical Hours: 30**
Objective: To develop applications using object oriented concepts of Python. Outcome: Students will be able to demonstrate object oriented concepts of Python.

LIST OF PRACTICALS:

1. Fibonacci series up to a limit.
2. Sum and product of all the items in the list
3. Multiplication table of a number
4. Print largest and smallest of items in the list
5. Remove duplicates from a list
6. Print a specified list after removing elements
7. Add, subtract and multiply two matrices
8. Transpose a matrix
9. Find second smallest and largest number in a list.
10. Count the number of elements in a list within a range
11. Get the frequency of the elements in a list.
12. Illustrate functions.
13. Check whether a string is palindrome or not
14. Print a pattern.
15. Program that takes a list of words and returns the longest one
16. Print date and time and current month calendar.
17. Demonstrate pass by reference and pass by value.
18. Demonstrate types of formal arguments.
19. Demonstrate on functional programming.
20. Demonstrate on scope of variables.
21. Demonstrate on file attributes.
22. Read and write to a file.
23. Program to work with directories.
24. Demonstrate on modules.
25. Program on exception.
26. Display Invalid Mark exception if mark is greater than 100.
27. Program on class and object (Take Student or Employee)
28. Program for inheritance.
29. Display odd and even numbers using threads in a range.
30. Program on threads.
31. Program for accessing attributes in class.
32. Program for illustrating method overriding.
33. Program for illustrating method overloading.
34. Program for performing DML operations on table.
35. Display Hello World after clicking a button.
36. GUI program to display the message after selecting a radio button.
37. GUI program to display a (i) Slider (ii) list box (iii) Scroll bar (iv) Check button
38. GUI program to display the message after entering a text into entry box.

STATISTICAL METHODS LAB

Credit: 1 **Semester: III**

Subject Code: BS20039 **No. of Practical Hours: 30**

Objectives:

- To acquaint students with various statistical methods and their applications in different fields.
- To cultivate statistical thinking among students.
- To develop skills in handling complex problems in data analysis and research design.

Outcome: Students will be able to choose and apply an appropriate statistical analysis or Modeling methods to solve problems arising in different research fields using Office Automation.

LIST OF PRACTICALS:

1. Generation of random samples from Uniform (0, 1), Uniform (a, b) and exponential distributions
2. Generation of random samples from Normal and Poisson distributions.
3. Fitting of straight line and parabola by the method of least squares.
4. Fitting of power curves of the type y =a xb, y = a bx y = aebx by the method of least squares.
5. Computation of Yule's coefficient of association.
6. Computation of Pearson's, Tcherprows coefficient of contingency
7. Computation of correlation coefficient, forming regression lines for ungrouped data.
8. Computation of correlation coefficient, forming regression lines for grouped data.
9. Computation of multiple and partial correlation coefficients.
10. Computation of correlation ratio.
11. Simulation of random samples from Uniform (0, 1), Uniform (a, b), Exponential, Normal and Poisson distributions using Office Automation.
12. Fitting of straight line and parabola by the method of least squares using Office Automation.
13. Fitting of power curves of the type y =axb, y = a bx, y = aebx by the method of least squares using Office Automation.
14. Computation of correlation coefficient, forming regression lines using Office Automation.
15. Computation of multiple and partial correlation coefficients using office Automation.

DATA BASE MANAGEMENT SYSTEMS LAB

Credit: 1 **Semester: III**

Course Code: DS23305 **No. of Practical Hour:30**

Objective:

- To present the concepts and techniques relating to query processing by SQL

Course Outcome:

- Students will be able to use commercial relational database system (Oracle) by writing Queries using SQL and implement PL/SQL

LIST OF PRACTICALS:

1. Creation, Altering and Dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXIST, NOTEXISTS, UNION, INTERSECT, Constraints.

   Example: - Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate Functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and Dropping of Views.
4. Queries using Conversion Functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), datefunctions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc,round, to_char, to_date)
5. i)Creation of simple PL/SQL program which includes Declaration section, Executable section and Exception–Handling sections (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)

   ii)Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features IF, IF-ELSE, NESTED IF, CASE.
7. Program development using WHILE LOOPS, FOR LOOPS, Nested Loops. Using ERROR Handling, BUILT –IN Exceptions, User defined Exceptions.
8. Program development using creation of procedures, passing parameters IN and OUT of Procedures.
9. Program development using creation of stored Functions, invoke functions in SQL Statements and write complex functions.
10. Develop programs using parameters in a CURSOR, FOR UPDATE CURSOR, WHERECURRENT of clause and CURSOR variables.

11. Develop programs using BEFORE and AFTER Triggers, Row and Statement Triggers.
12. Installation of NoSQL Databases: Redis, MongoDB, Cassandra, Neo4j on Windows & Linux

13.Practice CRUD (*Create*, *Read*, *Update*, and *Delete)* operations on the four databases: Redis, MongoDB, Cassandra, Neo4j.

Year-wise and Semester-Wise Distribution of Courses
Department of B.Sc. Computer Data Science and Data Analytics Engineering
Second Year Second Semester
Academic Year2025-26 of 2024-2027 Batch (CBCS)

Sl. No.	Part	Course Code	Title of the Course	Hours /Week	Duration of Exam(hrs.)	Marks			Credits
						Internal	External	Total	
1	II	DS23401	Accounting and Financial Management (GE-2)(DS)	3	3	40	60	100	3
2	II	DS18402	R Programming (SEC-3)	4	3	40	60	100	4
3	II	DS20403	Data Warehousing and Data Mining (Core-11)	4	3	40	60	100	4
4	II	BS20409	Computer Networks (Core-12)	4	3	40	60	100	4
5	II	BS20040	Statistical Inference (Core-13)	4	3	40	60	100	4
6	II	BS18436	Java Programming (Core-14)	4	3	40	60	100	4
PRACTICALS									
7	II	DS18405	R Programming (SEC-3)	2	3	40	60	100	1
8	II	BS20041	Statistical Inference (Core-13)	2	3	40	60	100	1
9	II	BS18437	Java Programming (Core-14)	2	3	40	60	100	1
Total				**29**	**-**	360	540	900	**26**

* Generic Elective (GE) *Discipline Specific DS) *Skill Enhancement Course (SEC)

COURSE NAME
ACCOUNTING AND FINANCIAL MANAGEMENT

Credits: 3 **Semester: IV**
Course Code: DS23401 **No of Lecture Hours: 45**

Course Objective:

- To equip the students with knowledge of accounting process and preparation of final accounts.
- To acquaint the students with various techniques of understanding financial statements.

Course Outcome: Students will be able to
CO1: To describe the need for and importance of accounting and infer the various principles of accounting

CO2: To Explain about Preparation of financial statements

CO3: To Analyze the relationship between cost, volume, and profit

CO4: To interpret the various sources of finance and their impact

CO5: To Create budgets for key factors of organization

Course Content	Hours Allotted	Pedagogy
Module I: Title: Introduction • Principles of Double entry bookkeeping, accounting equation • Accounting concepts and conventions • Importance and scope of financial accounting • Journal, ledger and trial balance (Including simple problems)	**(9)** 2 1 2 4	PowerPoint presentations / Lectures
Module II: Title: Cash Book & Final Accounts • Cash book • Preparation of final accounts without adjustment • Preparation of final accounts with adjustments for reporting the income and financial position	**(9)** 3 2 4	Case Studies / Review of research articles
Module III: Title: Differential Cost and CVP Analysis • Differential Cost – meaning – characteristics of differential costs – differential costing Vs marginal costing • Marginal Cost Contribution – key factor – profit planning – CVP analysis – break even analysis – break even chart – advantages and limitations of marginal cost – applications of marginal costing technique	**(9)** 1 4	Assignments

• Decisions involving alternative choices (including problems)	4	
Module IV: Title: Capital Budgeting • Capital Budgeting process – analysis of capital budgeting decisions – nature of investment decisions • Investment Evaluation criteria – Net Present Value – profitability index – internal rate of return – pay back – accounting rate of return	**(9)** 2 7	Lectures
Module V: Title: Budgeting and Budgetary control • Meaning of budget, budgeting and budgetary control • Types of budget and key factors • Cash budget • Flexible budget	**(9)** 2 2 3 2	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Gupta, G.I. RadhaswamyM.Advances Accountancy. New Delhi: Sultan Chand &Sons. 2. Jain &e Narang. Advances Accountancy, New Delhi: Kalyani Publications. 3. Grewal, T.S. Introduction to Book Keeping& Double Entry Book Keeping. India: Sultan Chand & Sons.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
R PROGRAMMING

Credits: 4 **Semester: IV**
Course Code: DS18402 **No of Lecture Hours: 60**

Course Objective:

- To learn the statistical programming language R and to use it to manipulate data
- To reshape data to support different analysis and to explore data from a variety of sources by building inferential models, generating charts, graphs and other data representations.

Course Outcome:

CO1: Understand basic concept of R**.**

CO2: Demonstrate programming concepts and data structures in R.

CO3: Analyze a large problem by sub dividing it into smaller components using functions

CO4: Choose an appropriate graphic for analysis and analyze data using summary statistics.

CO5: Choose the type of regression based on data set.

Course Content	Hours Allotted	Pedagogy
Module I: Title: • **Introduction to Data Science's** in Various Fields, Impact of DS • Major Activities, Toolkit, Data Scientist, Data Science Team • **Introduction to R:** What is R, Features of R, Simple Math, R as a Calculator • **Reading and Getting Data into R:** Reading Data, Reading a File of Data from a Disk, Reading Bigger Data Files • The read.csv() Command, Alternative Commands for Reading Data in R • Saving Data Files to Disk and Reading Data from the Disk	**(12)** 1 2 2 3 2 2	Powerpoint presentations / Lectures
Module II: Title: • **Series and Control Statements:** Assignment, Modes, Operators, Basic Functions, Generating Data sets, Control Structures • **Vectors:** Definition, Declaration, Generating, Indexing, Naming, Adding, And Removing Elements • **Operations on Vectors:** Recycling, Special Operators, Functions for Vectors Missing Values, Null Values, Filtering and Sub setting	**(12)** 2 5 5	Case Studies / Review of research articles

Module III: Title: • **Data Structures in R-Arrays:** Creating Arrays, Dimensions and Naming, Indexing and Naming, Functions on Arrays • **Matrices:** Creating Matrices, Adding Rows/Columns, Removing Rows/Columns Reshaping Operations, Special Functions • **Lists:** Creating, Naming, Accessing Elements, Adding, Removing, Special Functions, Recursive Lists • **Data Frames:** Creating, Naming, Accessing, Adding, Removing, Special Functions, Merging Exercises • **Functions:** Creating, Functions on Function Object, Scope of Variable, Accessing Global Environment, Closures, Recursion, Creating New Binary Operator	**(12)** 2 2 2 2 4	Assignments
Module IV: Title: • **Descriptive Statistics:** Introduction, Descriptive Statistics, Central Tendency Variability, Mean, Median, Range, Variance, Summary, Exercises • **Graphics:** Introduction, Types, Packages, Basic Graph, Histograms, Stem Leaf Graph, Box Plots, Bar Plots	**(12)** 6 6	Lectures
Module V: Title: • **Linear Regression:** Inferential Statistics, Types of Learning, Linear Regression, Simple Linear Regression, Coefficients, Confidence Interval, RSE, R2 Implementation in R, lm, Functions on 1m, Predict, Plotting, Fitting Regression Line Exercises • **Multiple Linear Regression:** Introduction, Comparison with Simple Linear Regression, Correlation Matrix, F Statistic, Response Vs Predictors, Deciding Important Variables, Model Fit, Predictions, Generating a Model Interactive terms, Non Linear Transformations, ANOVA, lm with Polynomial Exercises	**(12)** 6 6	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Dr. Gardener, Mark.2012. Beginning R The Statistical Programming Language. Indiana: John Wiley & Sons 2. Cotton, Richard. 2013. Learning R. USA: O'Reilly
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
DATAWARE HOUSING AND DATA MINING

Credits: 4 **Semester: IV**
Course Code: DS20403 **No of Lecture Hours: 60**

Course Objective:

- To establish what Data Warehousing is and why Data Warehousing concepts and techniques are proving crucial for firms faced with growing banks of structured and unstructured data.
- To introduce the basic concepts and techniques of Data Mining.

Course Outcome:

CO1: To understand the concepts of Data Warehousing and its importance

CO2: Analyze different Data Mining methods using algorithms

CO3: Explain the classification of data

CO4: Express clustering methods using algorithms.

CO5: Identify importance of Text Mining and related algorithms.

Course Content	Hours Allotted	Pedagogy
Module I: Title: • Introduction to Data Warehousing • Fundamentals and Data Characteristics • Data Warehouse Components. Building Data Marts and Data Warehouse • ETL • Logical Data Modelling Schemes and Designs for Dimensional Modelling • OLAP	**(12)** 1 1 2 2 2 2	PowerPoint presentations / Lectures
Module II: Title: • Introduction: Motivation, Data Warehousing and Data Mining • Technologies • Data Models • Data Warehousing and OLAP: User's Perspective • Data Mining: User's Perspective, Related Disciplines • Other Issues, Future Trends. • Frequent Pattern Matching: Introduction, Basic Problem Definition • Mining Association Rules, Applications • Variations, Interestingness, FIM algorithms • Incremental Mining, Conciseness of Results, Sequential Rules	**(12)** 1 1 1 1 1 1 1 2 2	Case Studies / Review of research articles
Module III: Title: • Classification: Introduction, Basic Problem Definition, Applications	**(12)** 3 2	Assignments

• Evaluation of Classifiers, Other Issues • Classification Techniques • Optimal Classification Algorithms • Regression	2 3 2	
Module IV: Title: • Clustering: Introduction, Basic Problem Definition, Applications • Measurement of Similarity • Evaluation and Classification of Clustering Algorithm • Partitioning Methods, Hierarchical Methods • Density-Based Methods, Grid-Based Methods, Outlier Detection	**(12)** 3 2 2 2 3	Lectures
Module V: Title: • Introduction to Text Data Mining • General and Functional Architecture • Overview of Text Mining • Core Mining Operations • Pre Processing Techniques • Document Collection, Tokenization, Lemmatization, Morphological Analysis • Delimiters, Stop Words, Key Word Search	**(12)** 1 1 2 2 2 2 2	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Pudi, Vikram P, Krishna, Radha. 2009. Data Mining. 1st Edition. New Delhi: Oxford University Press. 2. The raja, Reema. 2009. Data Warehousing. Oxford: Oxford University Press. 3. Weiss, Sholom. Indurkhya, Nitin. Zhang, Tong. Damerau, Fred. 2010. The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data. Springer 4. Feldman, Ronen. Sanger, James. 2006. The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data. Cambridge University Press.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
COMPUTER NETWORKS

Credits: 4 **Semester: IV**
Course Code:BS20409 **No of Lecture Hours: 60**

Course Objective:
- To familiarize with fundamental concepts of computer network.
- To gain expertise in various layers of the TCP/IP model.

Course Outcome:
CO1: Understand and identify basic computer network topologies and protocols and explain Data Communication System components.

CO2: Describe the functions of each layer in OSI model and its protocols.

CO3: Classify different error detecting techniques.

CO4: Build skills of sub-netting and routing mechanisms.

CO5: Classify the routing protocols and analyze how to assign the IP addresses for the given network.

Course Content	Hours Allotted	Pedagogy
Module I: Title:Introduction • Data Communications, Networks, Protocols and Standards • OSI Model, Layers in OSI Model, TCP/IP Protocol Suit • Analog and Digital, Transmission Impairments • Transmission Media-Guided media, Connecting Devices(Hubs, Repeaters, Bridges, Routers-Only Definitions) • Digital Transmission-Digital-to-Digital Conversion • Multiplexing: Frequency-Division, Wavelength and Time Division	**(12)** 2 2 2 2 2 2	PowerPoint presentations / Lectures
Module II: Title: Data Link Layer • Error Detection and Correction-Parity, Check Sum, CRC, Hamming Code • Data Link Control: Framing, Flow and Error Control • Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Piggybacking • HDLC, Random Access- ALOHA, CSMA, CSMA/CD, CSMA/CA • Wired LANs- Ethernet	**(12)** 3 2 2 2 3	Case Studies / Review of research articles
Module III: Title: Network Layer • IP address Space-Introduction • Classful and Classless addressing, Sub netting and Super netting • IPv4- datagram, Fragmentation, checksum, options	**(12)** 2 2 2	Assignments

• Internet Control Protocols- ICMP, IGMP, ARP and RARP • Delivery, Forwarding, Routing protocols -Distance Vector Routing	3 3	
Module IV: Title: Transport Layer • Process-to-Process Delivery, UDP-Well Known Ports, User Datagram, Checksum • UDP Operation, use of UDP • TCP- process to process communication, Numbering bytes, TCP services • Flow control- silly window syndrome, Error Control • TCP connection, State transition diagram, Congestion control, Timers, Options	**(12)** 3 2 2 2 3	Lectures
Module V: Title: Application Layer • DNS- Namespace, Domain Name Space, Distribution of Name Space • DNS in Internet, Resolution, DNS Messages, Types of Records • TELNET, E-mail Architecture, Message Transfer Agent: SMTP • Message Access Agent: POP, FTP • WWW and HTTP- architecture, web documents, HTTP	**(12)** 3 3 2 1 3	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Forouzan, Beharouz A. 2011. Data Communications and Networking. 3rdEdition. New Delhi: Tata Mc Graw Hill. (UNIT- I and II) 2. Forouzan, Beharouz A. 2010. TCP/IP Protocol Suite. 3rdEdition. New Delhi: Tata Mc Graw Hill. (UNIT-III,IV, V)
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
STATISTICAL INFERENCE

Credits:4 **Semester: IV**
Course Code: BS20040 **No of Lecture Hours: 60**

Course Objective:

- To acquaint students with various statistical methods and their applications in different fields.
- To cultivate statistical thinking among students
- To develop skills in handling complex problems in data analysis and research design.

Course Outcome:

CO1: Develop the distributional results needed for statistical inference.
CO2: Analyze hypotheses tests of means, proportions and variances using both one-and two-sample data sets.
CO3: Explain Chi-Squared test for independence of attributes and goodness of fit.
CO4: Differentiate between the tests statistics to be used for dependent and independent samples.
CO5: Design the test statistic to be used when the nature of the distribution is unknown.

Course Content	Hours Allotted	Pedagogy
Module I: Title: • Concepts of Statistical Hypotheses, Null and Alternative Hypothesis, Critical Region, Two types of Errors, Level of Significance and Power of a Test • One and Two Tailed Tests, Test Function (non-randomized and randomized) • Neyman-Pearson's Fundamental Lemma for Randomized tests. • Examples in case of Binomial • Poisson, Exponential • Normal Distributions and their Powers of Test Functions	**(12)** 2 2 2 2 2 2	PowerPoint presentations / Lectures
Module II: Title: • Use of Central Limit Theorem in Testing • Large Sample Tests and Confidence Intervals for Mean(s) • Proportion(s) • Standard Deviation (s)	**(12)** 4 4 4	Case Studies / Review of research articles
Module III: Title: • Fisher's Z – Transformation for Population Correlation Coefficient(s) and Testing the same in case of One Sample and Two Samples. • Definition of Order Statistics and Statement of their Distributions • Tests of Significance based on $\chi 2$ - $\chi 2$ test for Specified Variance	**(12)** 2 2 2	Assignments

• Goodness of Fit • Test for Independence of Attributes (r , s, 2 ,k and 2, 2 • contingency tables)	2 2 2	
Module IV: Title: • Tests of significance based on student's t – t – test for single sample specified mean • Difference of means for independent and related samples • Sample Correlation Coefficient • F – Test for equality of Population Variances	**(12)** 3 3 3 3	Lectures
Module V: Title: • Non-Parametric tests-their advantages and disadvantages • Comparison with parametric tests • Measurement scale-nominal, ordinal, interval and ratio • One sample runs test, sign test • Wilcoxon-signed rank tests (single and paired samples) • Two independent sample tests: Median test • Wilcoxon – Mann-Whitney U test • Wald Wolfowitz's runs test.	**(12)** 1 2 1 2 1 1 1 2	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Kapoo, V.K. and Gupta, S.C. 2007. Fundamentals of Mathematical Statistics. New Delhi: Sultan Chand& Company Pvt Ltd.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
JAVA PROGRAMMING

Credits: 4 **Semester:IV**
Course Code: BS18436 **No of Lecture Hours: 60**

Course Objective:

- To help the students understand the fundamentals of object-oriented programming. Emphasis is on learning important principles of software development and intends to provide practice in developing small-scale programs.

Course Outcome:

CO1: Write java programs and **differentiate** between object-oriented programming and Procedure-oriented programming.

CO2: Apply object-oriented programming features for solving a given problem.

CO3: Incorporate exception handling mechanism.

CO4: Implement Use of java standard API library to handle file operations.

CO5: Develop interactive programs using applet and swing

Course Content	Hours Allotted	Pedagogy
Module I: Title:	**(12)**	PowerPoint presentations / Lectures
• **Object Oriented Programming:** Introduction, Object Oriented Paradigm	1	
• Basic concepts	1	
• Benefits of OOP, Applications of OOP	1	
• Introduction to Java, Features of Java,	1	
• Simple Java Program, Java Program Structure	1	
• Java Tokens, Java Statements, JVM	1	
• Variables, Data types, Operators and Control statements	1	
• Java Program structure, Simple Java program	1	
• **Classes, Objects and Methods:** Defining Class, Adding Variables, Methods	2	
• Creating Objects, Accessing Class Members	1	
• Constructors, Finalizer Methods	1	
Module II: Title:	**(12)**	Case Studies / Review of research articles
• Method Overloading, Static Members, Nesting of Method	1	
• Inheritance, Overriding Methods, Final Variables and Methods, Final Classes	2	
• Abstract Methods and Classes ,Visibility Control	2	
• Arrays, Strings and Vectors, Wrapper classes	1	
• **Interfaces:** Defining Interfaces , Extending and Implementing Interfaces	1	
• Accessing Interface variables	1	
• Packages: Java API Packages, Using system Packages	1	

• Naming Conventions, Creating Packages • Accessing a Package ,Using a Package, Adding a Class to a Package	1 1 1	
Module III: Title: • **Exception Handling:** Types of Errors, Exceptions • Uncaught Exceptions, Using try and catch • Multiple Catch Statements, Nested try statements , throw, throws and finally • Java's Built in Exceptions, User Defined Exceptions • **Multithreaded Programming:** Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread, • Life Cycle of a Thread • Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization	**(12)** 1 2 2 2 2 2 1	Assignments
Module IV: Title: • **Input/Output Files**: Introduction, Concept of Streams, Stream Classes, Byte Stream Classes • Character Stream Classes, Using the File Class, Input-Output Exception • Creation of Files, Bytes, Handling Primitive Data Types • Random Access Files, Simple Input/Output • **Applets**: Applet Class, Basics, Applet vs Application ,Life Cycle • Applet Tag, Passing Parameters, A Simple Banner Applet	**(12)** 2 2 2 2 2 2	Lectures
Module V: Title: • **Event and Event Handling:** Sources of Events • **Event Classes:** Action Event, Mouse Event, Window Event, Item Event, Key Event • Event Listeners,-Action listener, Mouse Listener, Mouse Motion Window Listener, Key Listener, Handling Events. • **Swing Controls:** JLabel and Image Icon, JButton,JRadioButton, JCheckbox, Table, JList, JToggleButton, • JTree, JCombobox, JTextField, JOptionPane	**(12)** 4 2 2 2 2	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Schildt, Herbert. The Complete Reference Java2. India: Tata McGraw Hill.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

R PROGRAMMING LAB

Credit: 1 **Semester: IV**

Subject Code: DS18405 **No. of Practical Hours: 30**

Objectives:

- To learn data structure used in R and to import/export data in R
- To perform various statistical operations on datasets
- To perform data visualization using various data visualization techniques available in R

Course Outcome: Students would be able to master the R programming, perform analytics on large volume of data, and visualize data using the various graphics available in R

1. Assume that we have registered the height and weight for four people: Heights in cm are 180, 165, 160, 193; weights in kg are 87, 58, 65, 100. Make two vectors, height and weight, with the data. The Body Mass Index (BMI) is defined as: weight in kg /(height in m)
   Make a vector with the BMI values for the four people, and a vector with the natural logarithm to the BMI values. Finally make a vector with the weights for those people who have a BMI larger than 25.

2. Assume that we have the following three observations of temperature: 23◦C, 27◦C, 19◦C. Make a vector with these values. Recall the relation between the Celsius and Fahrenheit temperature scale:
   degrees in Fahrenheit = degrees in Celsius x (9/5) +32

   Make a new vector with the temperatures in Fahrenheit.

3. Sort the Following data in increasing order and also in decreasing order

a.

136	112	103	123	143	134	115	106	122	142	133	120
108	121	145	126	120	104	120	144	124	136	105	130
144	117	134	132	120	110	110	133	128	130	115	110
141	126	140	120	120	148	124	142	130	135	152	108
138	150										

b.

147	138	171	157	150	167	164	165	162	141	171	168
155	150	171	150	144	180	153	155	151	164	159	156
140	160	167	140	145	145	150	135	138	145	150	148
158	155	169	149	148	157	123	155	174	158	172	154
152	135										

4. You have the results of a simple experiment to look at the visitation of various bee species to different plants. The number of bees observed was as follows:
   Buff tail: 10 1 37 5 12

   Garden bee: 8 3 19 6 4

   Red tail: 18 9 1 2 4

   Honeybee: 12 13 16 9 10

   Carder bee: 8 27 6 32 23

Make five simple numeric vectors of these data. Now join the bee vectors together to make a data frame. Each row of the resulting frame relates to a specific plant so you could assign names to the rows.

The plant names are Thistle, Vipers bugloss, Golden rain, Yellow alfalfa, and Blackberry. Use these names to create row labels for the data.

5. Try the following commands in order to make a vector with the values and compute various sample statistics:
d <- c(77, 93, 92, 68, 88, 75, 100)

d, sum(d), length(d), mean(d), sum(d)/length(d), sort(d), median(d), sd(d) var(d), sum((d-mean(d))^2) / (length(d)-1), min(d), max(d), summary(d)

6. For the following data sets Compute the Central Tendencies: (i) Mean (ii) Median (iii) Mode (iv) H.M. (v) G.M. Compute Dispersions: (i) Range (Minimum & Maximum) (ii) Quartile Deviation (iii) Mean Deviation (iv) Standard Deviation (v) Variance (vi) Coefficient of variation.

i.	136	112	103	123	143	134	115	106	122	142	133	120
	108	121	145	126	120	104	120	144	124	136	105	130
	144	117	134	132	120	110	110	133	128	130	115	110
	141	126	140	120	120	148	124	142	130	135	152	108
	138	150										
ii.	25	50	40	50	45	25	30	28	25	30	45	55
	41	46	35	25	34	38	36	27	24	29	23	36
	40	15	25	36	38	24	35	30	48	35	41	28
	22	35	26	37	50	39	22	24	20			
iii.	45	50	30	50	45	35	40	48	45	50	65	85
	70	76	35	75	84	48	36	37	54	69	83	86
	90	65	55	46	38	84	95	90	28	65	71	68
	32	55	36	47	50	39	62	54	60	45	50	30
	50	45	35	40	48	45	50	65	85	70	76	35
	75	84	48	36	37	54	69	83	86	90	65	55
	46	38	84	95	90	28	65	71	68	32	55	36
	47	50	39	62	54	60						

7. Create a for loop that, given a numeric vector, prints out one number per line, with its square and cube alongside.

8. The Data presented below is the numbers of students belongs to different faculty in a university, during the period 2007- 2013 (over a period of five years).

Year	Number of students				
	Arts	Commerce	Science	Law	Total
2007-2008	1783	590	391	400	3164
2008-2009	2057	650	478	552	3737
2009-2010	2096	723	438	640	3897
2010-2011	2252	848	394	689	4183
2011-2012	2267	900	554	926	4447
2012-2013	2350	943	576	991	4860

Construct

(i) Simple Bar Diagrams for number of students in Different years.
(ii) Multiple Bars diagram for number of students in different years.

9. The expenditure incurred by a family for different items is presented below. Draw a suitable diagram (Bar and Pie diagrams)

Item number	Item Details	Expenditure in Rs.
1	Food	240
2	Clothing	160
3	Recreation	80
4	Education	120
5	Rent	40
6	Fuel and Lighting	40
7.	Miscellaneous	80

10. The trees data come as part of R. The data is composed of three columns: the Girthof black cherry trees (in inches), the Height (in feet), and the Volume of wood (in cubic feet). Make a scatter plot of girth versus volume and display a line of best-fit? Modify the axes so that the intercept is shown clearly. Use an appropriate plotting symbol and colors to help make the chart more "interesting."

11. Examine the orchis2 data object. Here you see a two-column data frame with a response variable (flower) and a predictor variable (site). Produce a histogram for the sprayed site. Now overlay a density plot.

12. Look at the mtcars data that are built into R. Use the mpg variable as the response and build a regression model.

13. The following table gives the number of aircraft accidents that occurred during the seven days of the week. Test whether the accidents are uniformly distributed over the week.

Days:	Mon	Tue	Wed	Thurs	Fri	Sat
Number of accidents:	14	18	12	11	15	14

14. A company conducted a survey in order to examine if the frequency of usage of company's service depends on the size of the city where it's clients live. The summary of survey is given in the following table:

Frequency of service usage

City size	Always	Sometime	Never
Small	151	252	603
Medium	802	603	405
Large	753	55	408

Does the frequency of usage of company's service depend on the size of the city?

STATISTICAL INFERENCE LAB

Credit: 1 **Semester: IV**

Subject Code: BS20041 **No. of Practical Hours: 30**

Objective:

- To acquaint students with various statistical methods and their applications in different fields
- To cultivate statistical thinking among students
- To develop skills in handling complex problems in data analysis and research design.

Course Outcome: Students will be able to draw inferences about the population from the analysis of the sample data using office automation

LIST OF PRACTICALS

1. Large samples tests for means (s), proportion (s), Standard deviation (s) and correlation coefficient---
2. Small sample tests for single mean and difference of means (independent and dependent samples) and correlation coefficient.
3. Small sample test for single and difference of variances.
4. $\chi 2$ – test for goodness of fit and independence of attributes.
5. Nonparametric tests for single and related samples (sign test and Wilcoxon signed rank test) and one sample runs test
6. Nonparametric tests for two independent samples (Median test and Wilcoxon Mann Whitney – U test, Wald – Wolfowitz's runs test)
7. Small sample tests for mean(s), paired t-test and correlation coefficient using Office Automation.
8. Small sample test for single and difference of variances using Office automation
9. $\chi 2$ – test for goodness of fit and independence of attributes using Office automation

JAVA PROGRAMMING LAB

Credit: 1 **Semester: IV**

Subject Code: BS18437 **No. of Practical Hours: 30**

Objective: To learn Java Programming with object-oriented concepts. Outcome: Students will be able to create applications using object oriented concepts.

1. Program to print student details by class concept.
2. Program to add two numbers using method overloading.
3. Program to demonstrate application of constructors.
4. Program to implement single inheritance.
5. Program to implement method overriding
6. Program demonstrate abstract class.
7. Program to implement packages.
8. Program to implement interfaces.
9. Program to illustrate interface extending another interface
10. Program to implement try and catch statements
11. Program to illustrate multiple catch blocks
12. Program to implement nesting of try block
13. Program to implement finally statement.
14. Program to implement throw in exception handling.
15. Program to implement throw using user defined exception.
16. Program to implement a simple multithreading program.
17. Program to implement runnable interface.
18. Program to implement thread priority.
19. Program to read and write characters.
20. Program to count no.of characters, words and lines in a file
21. Program to read and write primitive data.
22. Program to implement Random Access files.
23. Program for animation in applet.
24. Program for reading parameter through applet.
25. Program for graphics class.
26. Develop an Applet to compute factorial value when the button “Compute” is clicked.
27. Develop an Applet to compute Arithmetic operations when the button is clicked.
28. Program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).
29. Applet program on (i) JCombobox, (ii) JToggleButton (iii) JList (iv) JTabbedpane (v) JTree (vi) JTable
30. Applet program for validating user credentials.

Year-wise and Semester-Wise Distribution of Courses
Department of B.Sc. Computer Data Science and Data Analytics Engineering
Third Year First Semester
Academic Year 2025-26 of 2023-2026 Batch (CBCS)

Sl. No.	Part	Course Code	Title of the Course	Hours /Week	Duration of Exam(hrs.)	Marks			Credits
						Internal	External	Total	
1	I	BS21048	Operations Research(GE-3)	4	3	40	60	100	4
2	II	DS21501	Data Visualization Tools Tools (SEC-4)	3	3	40	60	100	3
3	II	DS21502A	Software Engineering (DSE-1)	4	3	4 0	60	100	4
		DS21502B	Text Data Analytics (DSE-1)						
4	II	DS24503	Machine Learning Techniques (Core –15)	5	3	40	60	100	4
5	II	DS21504	Artificial Intelligence (Core-16)	4	3	40	60	100	4
6	II	DS24507	Applied Statistics (Core-17)	5	3	40	60	100	4
PRACTICALS									
7	II	DS21506	Data Visualization Tools(SEC-4)	2	3	40	60	100	1
8	II	DS24505	Machine Learning Techniques (Core-15)	2	3	40	60	100	1
Total				**29**	**-**	320	480	800	**25**

COURSE NAME
OPERATIONS RESEARCH

Credits: 4 **Semester: V**
Course Code:BS21048 **No of Lecture Hours: 60**

Course Objective:
- To arrive at optimal solutions to complex problems using methods such as Mathematical modelling & algorithms.

Course Outcome:
CO1: Identify the various techniques of operations research and to translate a real–world problems, given words, into a mathematical formulation.
CO2: Construct the simplex table and to plan the optimum results.
CO3: Use the program for optimizing the cost involved in transportation problems
CO4: Develop and solve transformation models and assignment models
CO5: Design the sequence of jobs and to make up the total process time

Course Content	Hours Allotted	Pedagogy
Module I: Title: Operations research • Meaning and scope of operations research • Convex sets and their properties, Definition of general LPP • Solution of linear programming problem by graphical method • Statements of fundamental theorem of LPP and other related theorems. • Formulation of Linear Programming Problem • Optimum solution of linear programming problem by simplex Method.	**(12)** 1 1 1 2 3 4	PowerPoint presentations / Lectures
Module II: Title: Concept of artificial variables. • Big M/Penalty method and two-phase simplex method • Concepts of duality of LPP. • Dual primal relationship, statement of fundamental theorem of duality.	**(12)** 6 1 5	Case Studies / Review of research articles
Module III: Title: • Definition of transportation problem • TPP as a special case of LPP, • Initial basic feasible solution by North West corner rule, Matrix Minima and VAM Methods • Optimal Solution through MODI and stepping stone method for balanced and unbalanced transportation problem • Degeneracy in Transportation problem and resolving it. • Concept of transhipment problem.	**(12)** 1 1 3 4 2 1	Assignments
Module IV: Title: • Formulation and description of Assignment problem and its variations. • Assignment problem a s a special case of T.P and L.P.P	**(12)** 1 1 1	Lectures

• Unbalanced Assignment problem, • Optimal solution using Hungarian Method And travelling salesman problem and its solution.	6 3	
Module V: Title: • Problem of Sequencing • Optimal sequence of N jobs on two machines and three machines without passing under appropriate conditions.	**(12)** 2 5 5	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Sharma S.D. 2007.Operations Research New Delhi: S.Chand& Co.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
DATA VISUALIZATION TOOLS

Credits: 3 **Semester: V**
Course Code:DS21501 **No of Lecture Hours: 45**

Course Objective:

- To familiarize the students with fundamental concepts of Data Visualization.
- Students will learn and understand the basic tools used for visualizing data.

Course Outcome:

CO1: Understand the way of representing visual data and its applications.
CO2: Demonstrate data visualization using combination of various charts.
CO3: Apply visualizing techniques using matplotlib package.
CO4: Design effective graphical analysis in R
CO5: Construct data visualizations with Tableau to create customized dashboards and reports

Course Content	Hours Allotted	Pedagogy
Module I: Title: Data Visulization 1:	**(9)**	PowerPoint presentations / Lectures
• Ways of Representing Visual Data	1	
• Techniques Used for Visual Data Representation	1	
• Types of Data Visualization	1	
• Applications of Data Visualization, Visualizing Big Data	2	
• Tools Used in Data Visualization	2	
• Tableau Products	2	
Module II: Title: Data Visualization Using Excel:	**(9)**	Case Studies / Review of research articles
• Creating Combination of Charts, Creating a Combo Chart with Secondary Axis	1	
• Discriminating Series and Category Axis	1	
• Chart Elements and Chart Types, Data Labels, Quick Layout, Using Pictures in Column Charts	1	
• Band Charts, Thermometer Chart	2	
• Gantt Charts, Waterfall Chart Sparklines, Pivot Charts, Pivot Charts with Pivot Tables, Pivot Charts without pivot Table	2	
	2	
Module III: Title: Plotting and Visualization	**(9)**	Assignments
• A Brief Matplotlib API Primer	1	
• Plotting with Pandas and Seaborn	1	
• Python Visualization Tools	1	
Basic Visualization using R:	1	
• Pie Chart, Bar Chart, Histogram, Line Chart, Kernal Density Plot	1	
• QQ Plot, Box & Whisker Plot, Violin Plot, Dot Chart, Bubble plot	2	
Advanced Visualization Using R:	2	

• Scatter Plot, Corrgrams, Heat Maps, Tree Maps • Using ggplot2 for advanced Graphics		
Module IV: Title: Creating Your First Visualizations and Dashboards • Connecting to Data, Foundations for Building Visualization • Visualizing Data, Creating Bar Charts, Line Charts, Geographic Visualizations • Using Show Me, Bringing Everything Together • Working with Data in Tableau: The Tableau Paradigm, Connecting to Data Managing Data Source Metadata, Working with Extracts instead of Live Connection • Tableau File Types, Joins and Blends, Filtering Data	**(9)** 2 1 2 2 2	Lectures
Module V: Title: Moving from Foundational to More Advanced Visualizations • Comparing Values Across Different Dimensions, Visualizing Dates and Times • Relating Parts of the Data to the Whole, Visualizing Distributions • Data Analytics in Tableau Public, Visualizing Multiple Axes to Compare Different Measures **Using Row-Level, Aggregate, and Level of Detail Calculations:** • Creating and Editing Calculations. Overview of the three Main Types of Calculations, Level of Detail Calculation • Parameters, Practical Examples, Ad hoc Calculation **Table Calculations:** • Overview of Table Calculations, Quick Table Calculations, Relative versus Fixed, Scope and Direction • Addressing and Partitioning, Custom Table Calculations, Practical Examples Data Densification	**(9)** 1 1 1 1 1 2 2	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. DT Editorial Services. 2016. Big Data Black Book. Dream tech Press. 2. Wes, McKinny. 2018. Python For Data Analysis. 2nd Edition. O'Reilly Media 3. Motwani, Dr. Bharati. 2019. Data Analytics with R. Wiley India Pvt. Limited 4. Milligan, Joshua N. 2016. Learning Tableau. 2nd Edition. Packt Publishing Ltd.p
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
SOFTWARE ENGINEERING

Credits: 4 **Semester: V**
Course Code:DS21502A **No of Lecture Hours: 60**

Course Objective:
- To enable students learn software engineering principles and to lay emphasis towards the theoretical foundation.

Course Outcome:
CO1: Explain engineering through various process models.
CO2: Identify analyze Requirements, Object Oriented and various modeling's.
CO3: Categorize design and architecture
CO4: Classify Components, golden rules and design evaluation.
CO5: To understand testing techniques to evaluate quality metrics

Course Content	Hours Allotted	Pedagogy
Module I: Title: • The evolving role of software, software, changing nature of software • Legacy Software, Software Myths • Software engineering-layered technology, Process Framework • CMMI, Process patterns, Personal and Team Process model • Process technology, Product and Process • Process Models	**(12)** 2 2 2 2 1 3	PowerPoint presentations / Lectures
Module II: Title: • System Engineering- Computer Based Systems, Hierarchy • Business Process Engineering, Product Engineering • System Modelling • Requirements Engineering tasks, Initiating Requirements Engineering Process • Eliciting Requirements, Developing Use Cases, Building Analysis Model • Negotiating and Validating Requirements • Requirements Analysis, Analysis Modelling Approaches, Data Modelling Concepts • Object Oriented Analysis, Scenario Based Modelling, Flow Oriented Modelling • Class Based Modelling, Creating Behavioral Model	**(12)** 2 1 1 2 1 2 1 1	Case Studies / Review of research articles
Module III: Title: • Design Process and Quality • Design Concepts and Design Model • Pattern Based Software Design • Software architecture, Data design Architectural styles and Patterns	**(12)** 2 2 2 2	Assignments

• Architectural design, Assessing alternative architectural design • Managing Data flow into Software architecture	2 2	
Module IV: Title: • Introduction to Component, Designing Class Based Components • Conducting Component Level Design, Object Constraint Language • Design Conventional Components • Golden Rules, User Interface Analysis and Design • Interface Analysis, Interface Design Steps • Design Evaluation	**(12)** 2 2 2 2 2 2	Lectures
Module V: Title: • A Single Approach to Software Testing • Strategic Issues, Test Strategies for Conventional Software • Validation Testing, System Testing • Testing Fundamentals, Black Box and White Box Testing • Basis Path Testing, Control Structure Testing • Software Quality • Metrics for Analysis Model • Metrics for Design Model, Metrics for Source Code • Metrics for Testing, Metrics for Maintenance	**(12)** 1 1 1 2 2 1 2 1 1	Assignments / Lectures

2

Learning Resources	
1.	Textbook: 1. Pressman, Rogers S. 2015, Software Engineering, A practitioner's Approach. 6th Edition. Me Graw HII Education
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
TEXT DATA ANALYTICS

Credits:4 **Semester:V**
Course Code:DS21502B **No of Lecture Hours: 60**

Course Objective:

- Students will be able to understand the basic issues and types of text analytics.
- To understand the role played by text mining in Information Retrieval and Extraction.
- To appreciate the current trends in text analytics

Course Outcome:

Students will be able to identify the different features that can be mined from text and web documents and can use available open source classification and clustering tools on some standard text data sets.

Course Content	Hours Allotted	Pedagogy
Module I: Title: Text Categorization • Definition, Document Representation, Feature Selection • Decision Tree Classifiers, Rule-Based Classifiers • Probabilistic and Naive Bayes Classifiers, Linear Classifiers • Classification of Linked and Web Data, Meta-Algorithms	**(12)** 4 3 3 2	PowerPoint presentations / Lectures
Module II: Title: Text Clustering • Clustering, Definition, Vector Space Models, Distance-Based Algorithms • Word and Phrase-Based Clustering • Semi-Supervised Clustering, Transfer Learning	**(12)** 5 4 3	Case Studies / Review of research articles
Module III: Title: Information Retrieval • Information Retrieval and Text Mining, Keyword Search • Nearest Neighbour Methods, Similarity. • Web Based Document Search, Matching, Inverted Lists, Evaluation	**(12)** 4 4 4	Assignments
Module IV: Title: Information Extraction • Information Extraction, Architecture • Co-reference, Named Entity and Relation Extraction • Template Filling and Database Construction, Application • Inductive, Unsupervised Algorithms for Information Extraction • Text Summarization Techniques, Topic Representation, Influence of Context - Indicator Representations.	**(12)** 4 4 2 2	Lectures
Module V: Title: Recent Trends • Visualization Approaches, Architectural Considerations • Visualization Techniques in Link Analysis • Mining Text Streams - Text Mining in Multimedia	**(12)** 2 2 2 2	Assignments / Lectures

• Text Analytics in Social Media, Opinion Mining and Sentiment Analysis • Document Sentiment Classification, Opinion Lexicon Expansion • Aspect-Based Sentiment Analysis, Opinion Spam Detection, Text Mining Application	2 2	

Learning Resources	
1.	Textbook: 1.Weiss, Sholom. Indurkhya, Nitin. Zhang, Tong. Damerau, Fred. 2010. The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data. Springer. 2.Feldman, Ronen. Sanger, James. 2006. The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data. Cambridge University Press.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
MACHINE LEARNING TECHNIQUES

Credits: 4 **Semester:V**
Course Code:DS24503 **No of Lecture Hours: 75**

Course Objective:

- To understand the concepts of machine learning.
- To understand supervised and unsupervised learning and their applications.
- To learn aspects of computational learning theory.

Course Outcome: Student will be able to
CO1: Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
CO2: Classify the learning algorithms and apply to the given data set.
CO3: Identify the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
CO4: Evaluate and interpret the results of the algorithms.
CO5: Design and implement machine learning solutions to classification, regression and clustering problems

Course Content	Hours Allotted	Pedagogy
Module I: Title:Introduction to Machine Learning • Overview of Machine Learning -Definition, scope, and applications -Types of learning:Supervised,unsupervised,Reinforcement. • Basics concepts and python basics for ML -Understanding datasets,features and labels -Introduction to python -Libraries:Numpy,Pandas,Matplotlib.	**(15)** 3 3 3 2 4	PowerPoint presentations / Lectures
Module II: Title: Supervised Learning • Linear Regression -Basic and Mathematical Representation -Implementation in python using scikit-learn • Classification Algorithms -Logistic Regression,K-NN,Decision Trees, SVM -Evaluation metrics:accuracy,precision,recall	**(15)** 4 4 4 3	Case Studies / Review of research articles
Module III: Title: Unsupervised Learning • Clustering -K-Means,Hierarchical • Dimensionality Reduction -PCA • Association Rule Learning -Apriori Algorithm.	**(15)** 5 5 5	Assignments
Module IV: Title:Introduction to Neural Networks • Basics of Neural Networks -Neurons,layers,activation functions. -Feedforward and backpropogation	**(15)** 4 5 6	Lectures

• Types of neural Networks -MLPs,CNNs,RNNs		
Module V: Title: Advanced Topics in Machine Learning • Natural Language Processing(NLP) -Basics and applications in text processing. • Transfer learning -Understanding transfer learning. -Application of pre-trained models. • Artificial Intelligence Integration -Exploring intersections between AI and ML -Applications and synergies. • Reinforcement Learning Fundamentals -Basics,algorithms and key concepts.	**(15)** 4 4 4 3	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. "An Introduction to Machine Learning" by Alpaydin, Ethem (Edition: 4th, Year: 2020) 2nd, Year: 2019) 3. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Geron, Aurélien (Edition:
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
ARTIFICIAL INTELLIGENCE

Credits: 4 **Semester: V**
Course Code:DS21504 **No of Lecture Hours: 60**

Course Objective:
- To introduce basic aspects of Artificial intelligence, utilizing and analyze AI techniques for identifying optimal solutions to search strategies.

Course Outcome:
CO1:Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO2: Understand predicate logic and transform the real life information in different representation.
CO3: Understand formal methods of knowledge representation
CO4: Analyse the underlying mathematical relationships and build expert system
CO5: Demonstrate Knowledge representation techniques

Course Content	Hours Allotted	Pedagogy
Module I: Title:Introduction • Introduction to AI • applications of AI • History of AI • Types of AI, Intelligent agents • Types of agents • Agent environment • Turing test in AI	**(12)** 1 2 2 2 2 2 1	PowerPoint presentations / Lectures
Module II: Title: Search Algorithms - Types of Search Algorithms • Uninformed Search –Breadth First Search, Uniform Cost Search • Depth First Search, and Depth Limited Search • Iterative Deepening Depth First Search, Bidirectional Search • Informed search -Best first search, A* search	**(12)** 3 3 3 3	Case Studies / Review of research articles
Module III: Title: Adversarial search – Types of Games in AI • MIN –MAX Algorithm and its Working • Alpha Beta Pruning and its Working	**(12)** 6 6	Assignments
Module IV: Title: Knowledge Representation • Knowledge Base Agents • Knowledge Representation Techniques • The Wumpus World • Propositional Logic	**(12)** 2 2 2 2 2	Lectures

• First Order Logic • Forward Chaining and Backward Chaining	2	
Module V: Title: Subset of AI • Expert systems • Machine learning and NLP • Future of A	**(12)** 3 3 3	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Kaushik, Saroj. 2011. Artificial Intelligence. First Edition. Cengage Learning India.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
APPLIED STSTISTICS

Credits: 4 **Semester: V**
Course Code:DS24507 **No of Lecture Hours: 75**

Course Objective:
- students will be able to use their statistical skills for decision making and evaluation and assessment at different levels

Course Outcome:
CO1: Describe different components of time series data and **compare** various methods in estimating trend.
CO2: Demonstrate different growth curves and **compute** seasonal variations using various methods.
CO3: Describe multivariate data analytical tools and **model** best fit multiple linear regression for multivariate data.
CO4: Outline different discriminant analysis used for multivariate data analysis.
CO5: Use principal component analysis and factor analysis for dimensional reduction in multivariate data analysis.

Course Content	Hours Allotted	Pedagogy
Module I: Title: **Introduction to Time Series Analysis:** • Definition of time series analysis, Uses of time series analysis, • Components of time series data. Decomposition of time series data. • Graphical representation of time series data. **Measurement of Trend:** • Graphical method, Semi – averages method, Moving averages method. • Principle of least squares method – linear, 2nd degree parabola. • kth degree polynomial, exponential and power curves	**(15)** 2 3 3 2 2 3	PowerPoint presentations / Lectures
Module II: **Growth Curves:** • Definition, advantages of growth curves, measurement of growth curves. • Modified exponential curve, Gompertz curve, Logistic curve. **Seasonal Variations:** • Definition of seasonal variations and types. • Measurement of seasonal variations using: Simple averages method. • Ratio to moving averages method, ratio to trend method, Link relative method	**(15)** 2 5 1 2 5	Case Studies / Review of research articles
Module III: Title: **Introduction to Multivariate Data:** • Definition of multivariate data.	**(15)**	Assignments

• Diagrammatic representation of multivariate data using: • Box plots, histograms, kernel densities, scatter plots. **Multiple Linear Regression:** • Definition of multiple linear regression, prediction of multiple linear regression. • Step wise regression analysis – forward and backward • **Performance testing:** coefficient of determination, • Adjusted coefficient of determination, residual mean square, residual analysis	2 2 2 3 2 2 2	
Module IV: Title: (No Derivations – Only theory and problems) • **Discriminant Analysis:** Definition of discriminant analysis. • types of discriminant analysis, assumptions, and applications. • **Logistic Regression:** Regression with binary dependent variable. • estimating the logistic model, assessing the goodness of fit for the estimated model. • Testing the significance of coefficients and interpreting the coefficients. • Applications of logistic regression.	**(15)** 3 2 2 3 3 2	Lectures
Module V: Title: (No Derivations – Only theory and problems) • **Principal Component Analysis:** Definition of Principal Component Analysis. • Formulation of PCA, Uses and application of PCA. • Graphical representation of PCA, biplots. • **Factor Analysis:** Dimensional reduction, importance of dimensional reduction. • calculation of factor scores and interpretation of factor analysis.	**(15)** 3 3 3 3 3	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Gupta S.C. Kapoor. V. K.(2015): Fundamentals of Applied Statistics, New Delhi, Sultan Chand & Sons (unit I and Il) 2. Anderson, T.W. (2003): An introduction to Multivariate Statistical Analysis, 3"Edition, John Wiley. (units - III and IV and V)
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

DATA VISUALIZATION TOOLS LAB

Credits: 1 **Semester: V**

Subject Code: DS21506 **No. of Lecture Hours: 30**

S.No. Program

1. Create Band chart, Thermometer chart, Gantt chart, Waterfall chart and Pivot chart in Excel.
2. Create Bar charts, Histograms, Pie charts, Logarithmic Plots, Polar Plots in Python.
3. Create Group Bar chart, Stacked Bar chart, Box plot, Histogram, Line Graphs and Scatter Plots in R.
4. Perform String calculations, Data calculations and Table calculations in Tableau

MACHINE LEARNING TECHNIQUES LAB

Credits: 1 **Semester: V**

Subject Code: DS24505 **No. of Lecture Hours: 30**

PROGRAMS

1. Linear Regression
2. Logistic Regression
3. K Nearest Neighbour (KNN)
4. Decision Tree algorithm
5. Support Vector Machine (SVM)
6. K Means algorithm
7. Apriori algorithm
8. Artificial Neural Networks (ANN)

CASE STUDIES:

Case Study 1: Movie Recommendation System

- Scenario: An online streaming platform wants to enhance user experience by recommending movies based on user preferences.
- Objective: Develop a basic recommendation system using user ratings and movie metadata.
- Tasks:
  - Explore and preprocess movie ratings data.
  - Implement a simple collaborative filtering algorithm.
  - Evaluate the recommendation system's effectiveness.

Supervised Learning

Case Study 2: Predicting Housing Prices

- Scenario: A real estate agency wants to predict housing prices based on various features like square footage, number of bedrooms, and location.
- Objective: Build a regression model to predict house prices.
- Tasks:
  - Collect and preprocess housing data.
  - Train a linear regression model using scikit-learn.
  - Evaluate the model's performance and interpret coefficients.

Unsupervised Learning

Case Study 3: Customer Segmentation for an E-commerce Platform

- Scenario: An online retailer wants to understand its customer base and tailor marketing strategies.
- Objective: Apply clustering algorithms to segment customers based on their purchasing behaviour.
- Tasks:
  - Analyse and preprocess customer transaction data.
  - Apply K-Means clustering to identify customer segments.
  - Visualize and interpret the customer segments.

Neural Networks

Case Study 4: Image Classification of Animals

- Scenario: A zoo wants to automate the classification of animals in images captured by security cameras.
- Objective: Build a neural network model to classify images into different animal categories.
- Tasks:
  - Collect and preprocess a dataset of animal images.
  - Implement a simple neural network using a deep learning framework.
  - Train the model and assess its accuracy.

Year-wise and Semester-Wise Distribution of Courses
Department of B.Sc. Computer Data Science and Data Analytics Engineering
Third Year Second Semester
Academic Year2025-26 of 2023-2026 Batch (CBCS)

Sl. No.	Part	Course Code	Title of the Course	Hours /Week	Duration of Exam(hrs.)	Marks			Credits
						Internal	External	Total	
1	II	DS18601A	Data Security (DSE-2)	4	3	40	60	100	4
		DS18601B	Cloud Computing(DSE-2)						
2	II	DS21602A	Software Testing &Quality(DSE-3)	4	3	40	60	100	4
		DS21602B	Marketing Data Analytics (DSE-3)						
3	II	DS21603	Big Data Analytics (Core-17)	4	3	40	60	100	4
PRACTICALS									
4	II	DS21604	Big Data Analytics Lab (Core-17)	2	3	40	60	100	1
5	II	DS18605	Major Project	15	3	40	60	100	6
Total				**29**	**-**	200	300	500	**19**

*Discipline Specific Elective (DSE)

COURSE NAME
DATA SECURITY

Credits: 4 **Semester: VI**
Course Code:DS18601A **No of Lecture Hours: 60**
Course Objective:

- Understanding the significance of privacy, ethics in data environment.
- Analyzing the steps to secure data.

Course Outcome: Students will be able to
CO1: Identify some of the factors driving the need for data security
CO2: Examine and classify particular examples of attacks
CO3: Classify the terms vulnerability, threat and attack
CO4: Analyze physical points of vulnerability in simple networks
CO5: Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems

Course Content	Hours Allotted	Pedagogy
Module I: Title: Attacks on Computers and Computer Security	**(12)**	
• Introduction, The Need for Security, Security Approaches, Principles of Security, Types of Security Attacks	2	
• Security Services, Plain Text and Cipher Text, Stream Ciphers, Block Ciphers	2	
• Security Mechanisms, A Model for Network Security	2	
Cryptography:		PowerPoint presentations / Lectures
• Encryption and Decryption, Substitution Ciphers, Ceaser Cipher, Mono-Alphabetic Cipher, Play-Fair Cipher, Hill Cipher, Poly-Alphabetic Cipher, Transposition Techniques, One-Time Pads	2	
• Introduction to Symmetric and Asymmetric Key Cryptography and	1	
• Its Applications	1	
• Cryptanalysis, Types of Keys, Key Range and Key Size, Possible	1	
• Types of Attacks	1	
Module II: Title: Symmetric Key Cryptography	**(12)**	
• Block Cipher Principles, Symmetric Encryption Principles & Algorithms	2	
• DES Algorithm, Strength of DES, Triple DES	2	
• AES Algorithm, Overview of AES, Iterations in AES	2	Case Studies / Review of research articles
• Stream ciphers, RC4 Algorithm	2	
• Block cipher modes of operation, Electronic Code Book Mode (ECB), Cipher Block Chaining Mode (CBC), Cipher Feedback Mode (CFB), Counters Mode (CTR) **Asymmetric key Cryptography**:	2	
• Principles of Public Key Cryptography, RSA Algorithm	2	

Module III: Title: Intruders, Virus and Firewalls • Introduction to Intruders, Intrusion Detection Systems • Password Management, Password Protection, Password Selection Strategies • Viruses, Threats, Worms, Nature of Viruses, Types of Viruses, Malicious Program • Virus Counter Measures, Anti-Virus Approaches, Generic Decryption, Digital Immune System, Behavior-Blocking Software • Firewall Design Principles, Firewall Characteristics, Types of Firewalls, Firewall Configurations. • Trusted Systems, Data Access Control, Concept of Trusted Systems Trojan Horse Defense	**(12)** 2 2 2 2 2 2	Assignments
Module IV: Title: Information Hiding • Introduction to Information Hiding, Steganography, and Watermarking • Importance of Digital Watermarking, Importance of Steganography • Applications of Watermarking, Applications of Steganography • Properties of Watermarking Systems, Evaluating Watermarking Systems • Properties of Steganography and Steganalysis Systems. Evaluating and Testing Steganographic Systems • Robust Watermarking, Approaches, Robustness to Volumetric Distortions	**(12)** 2 3 2 3 2 2	Lectures
Module V: Title: Case Studies on Cryptography and Security • Secure Inter-branch Payment Transactions • Cross site Scripting Vulnerability • Virtual Elections • Common Criteria for Information Technology Security Evaluation Biometrics: • Components, Enrollment, Authentication, Techniques, Accuracy, Applications • Internet Standards, Internet Society, Internet Organizations, Internet Standard Categories, RFCs	**(12)** 2 2 2 2 2 2	Assignments / Lectures

Learning Resources	
1.	Textbook: 1 Stallings, William. Cryptography and Network Security. Ath Edition. New Delhi: Pearson Education. 2.Forouzan, Behrouz A. Cryptography and Network Security. Mc.Graw Hill Edition. 3.Cox, Ingemar. Miller, Matthew. Bloom, Jeffrey and Fridrich, Jessica. Digital Watermarking and Steganography.2ndEdition. India: TMH.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
CLOUD COMPUTNG

Credits: 4 **Semester: VI**
Course Code:DS18601B **No of Lecture Hours: 60**

Course Objective:

- To know what a distributed system is and to understand properties of distributed system.
- To implement basics, techniques and tools for Cloud Computing.
- To understand any kind of heterogeneous resources over a network using open standards.

Course Outcome: Students will be able to
CO1: Understand distributed systems for cloud computing

CO2: Identify cloud servers, types and components

CO3: Analyse cloud architectural information in the present generation of market

CO4: Compare types of clients in the cloud and virtualization

CO5: Examine virtual machines the market and usage

Course Content	Hours Allotted	Pedagogy
Module I: Title: Introduction to Distributed Systems • Characterization of distributed systems: Introduction, Examples of Distributed Systems • Resource sharing and Web – WWW • Challenges • System Models: Architectural Models • Network and Internetworking: Types of Networks • Networking Principles, Internet Protocols	**(12)** 2 1 1 2 3 3	PowerPoint presentations / Lectures
Module II: Title: Introduction to Cloud Computing • Cloud Computing Overview - Introduction to Cloud Computing, Cloud Components, Infrastructure Services • Benefits – Scalability, Simplicity, Knowledgeable Vendors, More Internal Resources, Security • Limitations - Your Sensitive Information, Applications Not Ready, Developing Your Own Applications, Features of Cloud Platform • System Models for Advanced Computing –Clusters of Cooperative Computing, Grid Computing and Cloud Computing. • Software Systems for Advanced Computing-Service Oriented Software, Parallel and Distributed Programming Models with Introductory Details	**(12)** 2 2 3 2 3	Case Studies / Review of research articles
Module III: Title: Cloud Computing Architecture • Introduction	**(12)**	Assignments

• The Cloud Reference Model: Architecture, Infrastructure and Hardware-as-a-service, Platform as a Service, Software as Service • Types of clouds: Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds • Economics of the Cloud • Open Challenges: Cloud Definition, Cloud Interoperability and Standards, Scalability and Fault Tolerance, Security, Trust and Privacy, Organizational Aspects	1 3 3 2 3	
Module IV: Title: Cloud Computing Technology • Hardware and Infrastructure: Clients, Mobile, Thin, Thick • Local Clouds and Thin Clients: Virtualization in Your Organization: Why Virtualize? How to Virtualize, Concerns, Security • Server Solutions: Microsoft Hyper-V, VMware, VMware Infrastructure • Thin Clients: Sun, Hewlett Packard, Dell • Cloud Storage: Overview: The Basics, Storage as a Service, Providers, Security, Reliability, Advantages, Cautions	**(12)** 2 3 2 3 2	Lectures
Module V: Title: Virtualization • Introduction and Characteristics of Virtualized Environments: Increased Security, Managed Execution, Portability • Taxonomy of Virtualization Techniques: Execution Virtualization, Other Types of • Virtualization • Virtualization and Cloud Computing • Pros and Cons of Virtualization • Technology Examples: Xen: Paravirtualization, VMware: Full virtualization, Microsoft Hyper-V	**(12)** 3 3 2 1 1 2	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Coulouris G, DollimoreJ and Kindberg T. Distributed Systems Concepts and Design. 4th Edition. Pearson Education. 2. Geoffrey C Fox, Kaittwang and Dongrra Elsevier, Jack J. 2012. Distributed and Cloud Computing. 3. Buya, Christian Vechiola and S. Tanurai Selvi: 2012. Mastering Cloud Computing Odis TANH,
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
SOFTWARE TESTING & QUALITY

Credits: 4 **Semester: V**
Course Code: DS21602A **No of Lecture Hours: 60x**

Course Objective:
- To help the students understand the importance and need of testing through testing cycles.
- To learn various testing techniques which are required for any software product.
- To introduce Quality assurance concepts and activities.

Course Outcome:
CO1: Analyze importance of testing in software development process, apply glass-box testing, black- box testing, and how to report and analyze bugs
CO2: Identify problem tracking system, different types of testing and test case design.
CO3: To understand how to build testing strategy, establishing software testing methodology and software testing techniques.
CO4: Explain the definition of quality, metrics for software quality and inspection techniques.
CO5: Classify software configuration management, software reengineering and software restructuring techniques.

Course Content	Hours Allotted	Pedagogy
Module I: Title:	**(12)**	Powerpoint presentations / Lectures
• Example Test Series – First Cycle	1	
• Second Cycle, Subsequent Cycles	1	
• Objectives and Limits of Testing	1	
• Testing in Software Development Process- Planning Process – Planning Stage	1	
• Design Stage Testing	1	
• Glass Box Code Testing	1	
• Black Box Testing	1	
• Software Errors	1	
• Reporting and Analyzing Bugs – Problem Report, Contents Characteristics	1	
• Analysis of Reproducible Bug	1	
• Tactics for Analyzing a Reproducible Bug Making a Bug Reproducible	2	
Module II: Title:	**(12)**	Case Studies / Review of research articles
• Problem Tracking Systems – Objectives, Tasks.	2	
• Overview, Users.	2	
• Mechanics, Further Thoughts on Problem Reporting	2	
• Test Case Design – Characteristics of Good Test	1	
• Equivalence Classes and Boundary Values	1	
• Visible State Transitions, Race Conditions, Load Testing, Error Guessing	1	
	2	

• Function Equivalence Testing • Regression Testing, Executing the Tests		
Module III: Title: • Building a Software Testing Strategy • Establishing a Software Testing Methodology • Determining a Software Testing Techniques • Eleven Steps for Software Testing Process – Overview • Assess Project Management	**(12)** 3 2 3 2 2	Assignments
Module IV: Title: • Product Metrics - Software Quality, Framework for Product Metrics • Metrics for Process and Products - Software Measurement • Metrics for Software Quality. • Quality Management – Quality Concepts, Software Quality Assurance • Software Reviews, Formal Technical Reviews, Software Reliability	**(12)** 2 3 2 2 3	Lectures
Module V: Title: • Change Management - Software Configuration Management • SCM Repository, SCM Process • Reengineering – Software Reengineering • Reverse Engineering, Restructuring	**(12)** 3 3 3 3	Assignments / Lectures

Learning Resources	
1.	Textbook: 1.CemKaner, Jack Falk, Hung Quocguyen. 1998. Testing Computer Software. Comdex. 2. William Perry.2000. Effective Methods for Software Testing. Wiley. 3. Pressman Roger, S. Software Engineering - A Practioner's Approach. 6th Edition. McGraw Hill International Edition.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
MARKETING DATA ANALYTICS

Credits: 4 **Semester: VI**
Course Code:DS21602B **No of Lecture Hours: 60**

Course Objective:

- Great marketing decisions are typically based on sophisticated analysis of time, in-depth consumer, competitor and environmental information.
- This course aims to cover topics in marketing analytics.
- The objective of the course is to give students a general understanding of this vital area in marketing while demonstrating critical application areas.

Course Outcome: Students will be able to
CO1: Understand market research methods

CO2: Analyze consumer behavior and marketing strategy

CO3: Identify market basket analysis

CO4: Examine survival analysis

CO5: Classify customer segmentation

Course Content	Hours Allotted	Pedagogy
Module I: Title: Market Research • Definition, Classification of Research design • Types of Research: Exploratory, Descriptive, and Causal • Overview, Survey Methods, Mode of Administering Survey: Personal, Telephone, Mail, Electronic methods • Observational Methods: Structured Vs Unstructured • Observational Methods Based on Mode of Administration • Comparison between Survey and Observation • How is survey data different from database data?	**(12)** 1 2 3 2 2 1 1	Powerpoint presentations / Lectures
Module II: Title: Consumer Behavior and Marketing Strategy • Introduction, Overview of Consumer Behavior • Overview of Marketing Strategy • Who is most likely to buy and how do I target? • What are the things that drive Demand? • Modeling Elasticity: Business Case	**(12)** 2 2 2 2 2 2	Case Studies / Review of research articles
Module III: Title: Market Basket Analysis • Conceptual Overview of Market Basket Analysis. What is market Basket? • How to estimate/ predict market Basket? • Logistics Regression: Business Case	**(12)** 4 4 4 4	Assignments

Module IV: Title: Survival Analysis • When are my customers likely to buy? • Conceptual overview of survival Analysis • Business Case: Model output and Interpretation	**(12)** 4 4 4	Lectures
Module V: Title: Customer Segmentation • Introduction to Segmentation • What is segmentation? What is a segment? • Why segment? Strategic uses of Segmentation • The 4p's of strategic marketing • Segmentation: Tool and Techniques • General Analytical Techniques: Business Case	**(12)** 2 2 2 2 2 2	Assignments / Lectures

Learning Resources	
1.	Textbook: 1. Hardoon, David R. Shmueli, Galit. 2013. Getting Started With Business Analytics-Insightful Decision Making. Taylor & Francis Group
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

COURSE NAME
BIG DATA ANALYTICS

Credits: 4 **Semester: VI**
Course Code:DS21603 **No of Lecture Hours: 60**

Course Objective:

- To understand and learn about Big Data.
- To learn the analytics of Big Data.
- To understand MapReduce fundamentals

Course Outcome:

CO1: Explain the motivation for big data systems and identify the main sources of Big Data in the real world.

CO2: Develop technical skills in predicative and prescriptive modelling to support business decision-making.

CO3: Implement several Data Intensive tasks using the Map Reduce Paradigm.

CO4: Understand Hadoop ecosystem such as YARN and HIVE-QL for structured databases.

CO5: Demonstrate an ability map-reduce programming using PIG and NoSQL databases for storing purpose and process for Big Data Analytics

Course Content	Hours Allotted	Pedagogy
Module I: **Getting an Overview of Big Data:** • What is Big Data? History of Data Management-Evolution of Big Data • Structuring Big Data, Elements of Big Data Big Data Analytics, Careers and Future of Big Data **Exploring the Use of Big Data in Business Context:** • Use of Big Data in Social Networking Preventing Fraudulent Activities • Introducing Technologies for Handling Big Data: • Distributed and Parallel Computing for Big Data • Introducing Hadoop, Cloud Computing and Big Data **Understanding Big Data Technology Foundations:** • Exploring the Big Data Stack, Virtualization and Big Data • Virtualization Approaches	**(12)** 1 1 1 1 1 2 2 2 1	PowerPoint presentations / Lectures
Module II: Title: **Understanding Hadoop Ecosystem** • Hadoop Ecosystem • Hadoop Distributed File System • HBase -Architecture, Regions	**(12)** 2 4 2	Case Studies / Review of research articles

Understanding MapReduce Fundamentals and HBase • The Map Reduce Framework, Uses of MapReduce • Role of HBase in Big Data Processing	 2 2	
Module III: Title: **Processing your Data with MapReduce** • Developing Simple MapReduce Application **Customizing MapReduce Execution and Implementing MapReduce program** • Controlling MapReduce Execution with Input Format • Reading Data with Custom Record Reader • Organizing Output Data with Output Format • Customizing Data with Record Writer • Optimizing MapReduce Execution with Combiner • Controlling Reducer Execution with Partitioner	**(12)** 2 1 2 2 2 2 1	Assignments
Module IV: **Understanding Hadoop YARN Architecture:** • Background and Advantages of YARN • YARN Architecture, Working of YARN, YARN Schedulers • YARN Configurations, YARN Commands, YARN Containers **Exploring HIVE** • Introducing Hive, Getting started with Hive • Data Types and Built-in functions in Hive, Hive DDL • Data manipulation in Hive, Data Retrieval Queries, Using Joins in Hive	**(12)** 2 2 2 2 2 2	Lectures
Module V: **Analyzing Data with Pig** • Introducing Pig, Running Pig • Getting Started with Pig Latin • Working with Operators in Pig • Working with Functions in Pig • Debugging Pig, Error Handling in Pig **NoSQL Data Management:** • Introduction to NoSQL • Types of NoSQL Data Models • Schema-Less Databases, Materialized Views • Distribution Models, Sharding	**(12)** 1 1 2 2 1 1 2 1 1	Assignments / Lectures

Learning Resources	
1.	Textbook: 1.DT Editorial Services. 2016. Big Data Black Book. Dream tech Press.
2.	Reference books: Textbook name, the author's last name, the year, edition.
3.	Journals & Periodicals: International Journal of Research Methodology
4.	Other Electronic resources: https://www.intechopen.com/online-first/research-design-and-methodology

BIG DATA ANALYTICS LAB

Credits: 1 **Semester: VI**

Subject code:DS21604 **No. of lecture hours: 15**

S.No. Program

1.Implement the following file management tasks in Hadoop:

a) Adding file and directories

b) Creating file, Retrieving file and deleting files

2.Map Reduce program for basic word count.

3.Map Reduce program for sorting text data.

4.Map Reduce program for weather data.

5.Using Hive to implement DDL Commands

6.Using Hive to implement DML commands

7.Using Hive to retrieve data.

8.Using Hive to implement bucketing and partitioning.

9.Using Hive to implement built-in functions

10.Pig Latin script to work with operators

11.Pig Latin scripts using eval functions to analyse your data.

12.Pig Latin scripts using math functions to analyse your data.

13.Pig Latin scripts using string functions to analyse your data.

14.Pig Latin scripts to create user defined function.

15.Simple script to understand the using NoSQL in Hadoop systems

MAJOR PROJECT

(Discipline Specific Elective-4)

EVALUATION CRITERIA FOR MAJOR PROJECT

Credits: 6 **Semester: VI**

Course Code:DS18605 **No. of Practical Hours: 15**

Third year students in the Sixth Semester are required to take up a project work which carries a total of 100 marks i.e. internal 40 marks and external 60 marks.

The criteria for the Internal Evaluation of Project for 40 marks are as follows:

1.Attendance **5 marks**

2.Review of weekly report **5 marks**

3.Internal Project Presentation–every week end (Presentation & communication skills, objectives, Work submission, methodology, results, and Practical relevance.) **10 marks**

4. Final internal presentation- at the end of semester (50% marks Evaluation done by the internal guide, and 50% marks evaluated by other internal lecturers guiding the projects) **15marks**

5. Project Report **5 marks**

External Evaluation of the Project (60 marks):

The Controller of Examination sends the Project Reports to the External Examiner in advance.

The External Examiner evaluates the project for 60 marks based on project work done by the student. (The Project Report is evaluated for 40 marks and Viva-voce for 20 marks).

ANNEXURE-VI
B.Sc COMPUTER DATA SCIENCE AND DATA ANALYTICS ENGG.
BRIDGE COURSE SYLLABUS

FUNDAMENTALS OF COMPUTERS

Semester: I **No. of Hours : 15 Hrs**

Objective: To provide Students foundational knowledge of computer systems, data representation, operating systems, user interfaces, and system development for students bridging into Computer Data Science and Data Analytics Engineering.

UNIT I	
Introduction to Computers	**4Hrs**
1. Definition-Characteristics and limitations of computers	1
2. Block diagram of a computer, CPU	1
3. Primary and secondary storage	1
4. Input and output devices	1
UNIT II	
Data Representation	**4Hrs**
1. Data representation in computers, bits and bytes	1
2. Number systems(Binary, Octal and Hexadecimal)	1
3. Conversion from decima l to binary, octal, hexa decimal and vice versa	2
UNIT III	
Operating Systems	**3Hrs**
1. Meaning, Definition, Types(Batch Processing, Real time, Time Sharing)	1
2. Desktop OS, Server OS and Mainframe OS, MS-DOS Basic Commands	2
UNIT IV:	
UserInterfaces	**2Hrs**
1. GUI, Pen based, Touchscreen &Conversational interfaces	1
2. Common Operating Systems: DOS, Windows95/98 and UNIX	2
UNIT V:	
Systems Development	**2Hrs**
1.The six phases of Systems Analysis &Design	2

ESSENTIAL READING

1. "**Information Technology: The Breaking Wave, 8th Edition**" by Dennis P. Curtin & Kim Foley, 2021, McGraw-Hill Education.
2. "**Using Information Technology: A Practical Introduction to Computers and Communications, 10th Edition**" by Brian K. Williams & Stacey C. Sawyer, 2023, McGraw-Hill Education.
3."**Computer Fundamentals, Concepts, Systems, and Applications, 7th Edition**" by Pradeep K. Sinha &Preeti Sinha, 2021, BPB Publications.
4. "**Fundamentals of Computers, 6th Edition**" by V. Rajaraman, 2022, PHI Learning Pvt. Ltd.

5. "**Fundamentals of Information Technology, 3rd Edition**" by Deepak Bharihoke, 2020, Excel Books**.**

SUGGESTED READING

1.Sinha Pradeep .K. and Sinha Preeti.2007. **Computer Fundamentals, Concepts, Systems and Applications**. 4th edition. BPB Publications
2. Rajaraman.2006.**Fundamentals of Computers**. 4th edition. PHI Publications.

3.BharihokeDeepak.2000. **Fundamentals of Information Technology**. 2ndedition.Excel Books.
4. **"Data Science from Scratch: First Principles with Python, 2nd Edition**" by Joel Grus, 2020, O'Reilly Media.
5. **"Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 3rd Edition**" by Wes Mckinney, 2022, O'Reilly Media.

INFORMATION TECHNOLOGY ACT

(SELF-LEARNING COURSE)

Subject Code:031S
Semester: IV **No. of Hours: 15**
Objectives:

- To keep cybercrimes in check
- To protect sensitive data against potential cyber threats

Outcome: Students will be able gain knowledge on cyber laws and IT security.

UNIT - I **3Hrs**

1. Introduction to Cyber Law & IT Act Overview
2. Cyberspace, Cyber security, Cyber security Policy and Cyber Crime
3. Information Technology Act, Mission and Vision Cyber security Program
4. Cyber Law – Objectives, Emerging Trends of Cyber Law
5. Create Awareness, Areas of Development

UNIT - II **3Hrs**

1. Cyber Law - Intellectual Property Right
2. Types of Intellectual Property Rights
3. Advantages of Intellectual Property Rights
4. Intellectual Property Rights in India
5. Intellectual Property in Cyber Space

UNIT - III **3Hrs**

1. Cyber Law - Strategies For Cyber Security
2. Strategy 1 − Creating a Secure Cyber Ecosystem
3. Strategy 2 − Creating an Assurance Framework
4. Strategy 3 − Encouraging Open Standards
5. Strategy 4 − Strengthening the Regulatory Framework
6. Strategy 5 − Creating Mechanisms for IT Security
7. Strategy 6 − Securing E-Governance Services
8. Strategy 7 − Protecting Critical Information Infrastructure

UNIT - IV **3Hrs**

1. Cyber Law - Policies to Mitigate Cyber Risk
2. Mitigate Risks through Human Resource Development
3. Cyber Law - Network Security, Types of Network Security Devices and Firewalls
4. Antivirus, Content Filtering, Intrusion Detection Systems
5. Cyber Law - I.T ACT, Features of I.T Act

UNIT - V **3Hrs**

1. Scheme of I.T Act, Application of the I.T Act and Amendments Brought in the I.T Act
2. Intermediary Liability, Highlights of the Amended Act

3. Cyber Law – Signatures: Digital Signature
4. Electronic Signature and Digital Signature to Electronic Signature
5. Cyber Law - Offence & Penalties, Offences and Compounding of Offences

ESSENTIAL READING

1. Brian Craig. 2012. **Cyber law: The Law of the Internet and Information Technology.** 1st Edition. Pearson Education.
2. Heather Harrison Dinniss**. 2014.** Cyber Warfare and the Laws of War (Cambridge Studies in International and Comparative Law)**. Cambridge University Press.** Reprint Edition

SUGGESTED READING

1. Saurabh Sharma. 2010. **Information Security and Cyber Laws Paperback.** Vikas Publishing House Pvt. Ltd.

LINUX ADMINISTRATION

(Add-on course)

Semester: VI **No. of Lecture Hours: 30**

Subject code: 031A

Objective: To learn the basics of Unix/Linux and different services of Linux Course **Outcomes:**

CO1: Describe Installation of Linux and User, Group Administration, ACL

CO2: Explain the configuration NFS, FTP server

CO3: Explain configuration DHCP and SE linux

CO4: Explain configuration SAMBA and DNS server

CO5: Explain the configuration of disk quotas and firewalls

UNIT-I	**6Hrs**
1. History of Linux & GNU- LINUX, Features and Overview of Linux.	1
2. Compressing & Archiving files(bzip2 , b2cat, bunzip 2, tar).	1
3. Permissions, Access control lists(getfacl, setfacl)	1
4. User Administration & group Administration.	1
5. Backing up file, choosing a backup medium, backup utilities, Performing simple backup	
6. Scheduling task using at &crond.	1
UNIT-II	**6Hrs**
1. Introduction to FTP, security, FTP Connections, FTP Clients.	1
2. Running FTP and SFTP clients Basic commands: hostname, get, put, open, prompt, mget.	1
3. Software Package Administration, Installation/uninstallation/ querying And updating software packages	1
4. Introduction to NFS, NFS Client/Server setup, Running an NFS Client	1
5. Mounting a remote directory configuring NFS using system-config-nfs	2
UNIT-III	**6Hrs**
1. Securing a system, SE Linux config: The SE Linux configuration file	1

2. Introduction to DHCP, working of DHCP, DHCP client	2
3. Virtualization with Xen	1
4. RAID levels	1
5. Intro to Web Based administration	1

UNIT-IV **6Hrs**

1. Introduction to SAMBA, Samba utilities & daemons, Samba Users	2
2. Working with Shares from Linux, Working with shares from windows	2
3. Intro to DNS nodes, domains and subdomains, Zones	1
4. Setting up a domain using System-config-bind, Setting up a Domain server	
5. Adding resource records	1

UNIT-V **6Hrs**

1.Introduction to Firewall, Firewall configuration window	2
2.Building a firewall using system-config-firewall.	2
Introduction to Iptables,	
Filtering a packet in kernel, Anotomy of iptables command.	
3. Disk Quota, Enabling Quota's on partition, Creating Quota's for user.	2

ESSENTIAL READING 1.

Sobell Mark, G. 2014. A Practical Guide to **Fedora and Red Hat Enterprise Linux**. 7th Edition. New Delhi: Prentice Hall of India.