Programme Structure

School of Computer Applications
BCA(Hons) with specialization
Data Science / Cloud Computing

Programme Code: CA0201

Batch: 2023-2027

BCA (Hons) with specialization Data Science / Cloud Computing

TITLE: Four Year Programme Structure for BCA (Hons) with specialization Data Science / Cloud Computing

DURATION OF THE COURSE: 4 Years

Total Credits- 160

Total credit of the 04 year UG Programme for year wise	01st Year	41
	02nd Year	41
	03rd Year	41
	04th Year	39

Vision of the University

To be recognized as an Institution of excellence, facilitating learning, fostering creativity, knowledge creation, innovations, consultancy and leadership in multiple areas to build a conscious community that will positively impact living beings for a sustainable future.

Mission of the University

1. To Create conducive environment for an interactive and application oriented experiential learning making the Institute a preferred destination for work and study.
2. To Foster creativity, research and innovation orientation in students and faculty in basic and applied areas in all of its disciplines, provide cost effective solutions and nurture entrepreneurial capabilities to accelerate growth.
3. To act as a catalyst in social change by developing academic, social, political, technological, scientific, industrial and business leadership in the spirit “Think Globally and Act Locally”; by providing ample opportunities to develop team spirit, sportsmanship and love for culture and national heritage.

Core Values

1. Integrity
2. Honesty
3. Transparency
4. Empathy

School of Computer Applications

Vision of School

To be a premier institution in computing sciences, recognized for pioneering research, transformative education, and impactful contributions to society, shaping the future of technology and driving positive.

Mission of School

To empower students with cutting-edge knowledge and skills in computing sciences, foster a culture of innovation, and prepare them to address the challenges of a rapidly evolving digital world through rigorous academics, experiential learning, and interdisciplinary collaboration.

Core Values

1. Excellence
2. Innovation
3. Sustainability
4. Global Perspective

Programme Educational Objectives (PEO's)

BCA(Hons) with specialization Data Science / Cloud Computing

PEO-1 The graduates will establish themselves as professionals by solving real-life problems using exploratory and analytical skills acquired in the field of Computer Science and Engineering.

PEO-2 The graduates will provide sustainable solutions to ever changing interdisciplinary global problems through their Research & Innovation capabilities.

PEO-3 The graduates will become employable, successful entrepreneur as an outcome of Industry-Academia collaboration.

PEO-4 The graduates will embrace professional code of ethics while providing solution to multidisciplinary social problems in industrial, entrepreneurial and research environment to demonstrate leadership qualities.

Programme Outcomes (PO's):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: 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.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSO):

PSO1: Experiment and prepare programming concepts and provide new ideas and innovations towards research and societal issues.

PSO2: Analyse and develop computer programs in the areas related to algorithms, system software, cloud computing, artificial intelligence & machine learning, bioinformatics, big data analytics, block chain, cyber security and networking for efficient design of computer-based systems of varying complexity.

PSO3: Apply standard Software Engineering practices and strategies in software project development using open-source programming environment to deliver a quality product for business success.

Semester-wise Teaching Scheme UG Program

BCA (Hons) with specialization Data Science / Cloud Computing

Programme: BCA (Hons) with specialization Data Science / Cloud Computing

Semester: I Session 2023-24

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	CC-1	SCA-23101	Computer Concepts & Programming in C	4	0	0	4	4	50	50	100	45
2	CC-2	SCA-23102	Foundation of Mathematics	4	0	0	4	4	50	50	100	45
3	CC-3	SCA-23103	Web designing using DHTML	3	0	0	3	3	50	50	100	45
4	SEC-1	SCA-23104	Professional Communication	3	0	0	3	3	50	50	100	45
5	AEC-1	SCA-23105	Principles and Practices of Management	3	0	0	3	3	50	50	100	45
6	VAC-1	SCA-23105	Environmental Studies	2	0	0	2	2	50	50	100	45
7	CC-4	SCA-23107	Programming in 'C' lab	0	0	4	4	2	60	50	100	45
8	CC-5	SCA-23108	Web designing using DHTML Lab	0	0	2	2	1	60	50	100	45
9	SEC-2	SCA-23109	MS Office & Excel Lab			1	2	0	0	0	0	0
			Total	19	0	7	26	22	420	400	800	360

CC - Core Course
OE - Open Elective/ Multidisciplinary
AE - Ability Enhancement Compulsory Course
VAC - Value Added Course
SE - Skill Enhancement

Programme: BCA (Hons) with specialization Data Science / Cloud Computing
Semester: II Session: 2023-2024

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	CC-6	SCA-23201	Data Structures Using C	3	0	0	3	3	50	50	100	40
2	CC-7	SCA-23202	Object-Oriented Programming Using Python	3	0	0	3	3	50	50	100	40
3	CC-8	SCA-23203	Probability & Statistics	4	1	0	5	3	50	50	100	40
4	AEC-3	SCA-DS-23204 / SCA-CC-23204	Computer fundamentals for Data Science/ Computer Fundamentals of Cloud Computing	3	0	0	3	2	50	50	100	40
5	AEC-2	SCA-23205	Organizational Behavior	3	1	0	4	2	50	50	100	40
6	VAC-2	SCA-23206	First Aid & Health	1	0	0	1	1	50	50	100	40
7	CC-9	SCA-23207	Data Structure Using C Lab	0	0	4	4	2	60	40	100	40
8	CC-10	SCA-23208	OOPS Lab using Python	0	0	4	4	2	60	40	100	40
9	CC-11	SCA-DSL-23209 / SCA-CCL-23209	Computer fundamentals for Data Science Lab/ Computer Fundamentals of Cloud Computing Lab	0		2	2	1	60	40	100	40
			Total	17	2	10	29	19	480	420	900	360

Programme: BCA (Hons) with specialization Data Science / Cloud Computing
Semester: III Session: 2024-2025

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	**CC-11**	**SCA-23301**	**Operating System**	3	1	0	4	**4**	50	50	100	**40**
2	**CC-12**	**SCA-23302**	**Artificial Intelligence**	3	1	0	4	**4**	50	50	100	**40**
3	**CC-13**	**SCA-DS-23301/SCA-CC-23301**	**Analyzing and Applying data Science with python / Introduction to Virtualization**	3	1	0	4	**3**	50	50	100	**40**
4	**SEC-4**	**SCA-23304**	**Digital Marketing & Trend Analysis**	4	0	0	4	**3**	50	50	100	**40**
5	**AEC-3**	**SCA-23305**	**Logical Skills Building & soft Skills**	4	0	0	4	**3**	50	50	100	**40**
6	**VAC-3**	**SCA-23306**	**Information Security & Cyber Law**	2	0	0	2	**1**	50	50	100	**40**
7	**CC-14**	**SCA-23307**	**Data Analytics using Python Lab / Virtualization Lab**	0	0	2	2	**1**	60	40	100	**40**
8	**CC-15**	**SCA-23308**	**Operating System Lab using Linux**	0	0	2	2	**1**	60	40	100	**40**
			Total	19	3	4	26	20	420	380	800	320

Programme: BCA (Hons) with specialization Data Science / Cloud Computing
Semester: IV Session: 2024-2025

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	CC-16	SCA-23401	Machine Learning using Python	3	1	0	4	4	50	50	100	40
2	SCC-17	SCA-23402	Linear Algebra	3	1	0	4	4	50	50	100	40
3	CC-18	SCA-23403	Database Management System	3	1	0	4	4	50	50	100	40
4	SEC-5	SCA-23404	Introduction to Computer Networks	3	1	0	4	4	50	50	100	40
5	VAC-4	SCA-23406	Indian values & Traditions	2	0	0	2	1	50	50	100	40
6	AEC-4	SCA-DS-23405 / SCA-CC-23405	Tableau / AWS	0	0	4	4	2	60	40	100	40
7	CC-19	SCA-23407	Machine Learning using Python Lab	0	0	2	2	1	60	40	100	40
8	CC-20	SCA-23408	Database Management System Lab	0	0	2	2	1	60	40	100	40
			Total	14	4	8	26	21	430	370	800	320

Programme: BCA (Hons) with specialization Data Science / Cloud Computing
Semester: V Session: 2025-2026

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	**CC-21**	**SCA-23501**	**Design & Analysis of Algorithm**	3	1	0	4	4	50	50	100	**40**
2	**CC-22**	**SCA-23502**	**Software Engineering**	3	1	0	4	4	50	50	100	**40**
3	**CC-23**	**SCA-DS-23503 / SCA-CC-23503**	**Data Analysis using R / Cloud Architecture**	3	1	0	4	3	50	50	100	**40**
4	**SEC-6**	**SCA-23504**	**Elective-1**	3	1	0	4	4	50	50	100	**40**
5	**AEC-5**	**SCA-23505**	**Elective-2**	3	0	0	3	3	50	50	100	**40**
6	**CC-24**	**SCA-23506**	**Data Analysis using R / Cloud Architecture Lab**	0	0	2	2	1	60	40	100	**40**
7	**CC-25**	**SCA-23507**	**Software Engineering Lab**	0	0	2	2	1	60	40	100	**40**
8	**CC-26**	**SCA-23508**	**Design & Analysis of Algorithm Lab**	0	0	2	2	1	60	40	100	**40**
			Total	15	4	6	25	21	430	370	800	320

Elective - 1 Sub Code	Elective - 1	Elective – 2 Sub Code	Elective -2
SCA-DE1-23501	**Business Analytics**	**SCA-DE2-23501**	Natural Language Processing
SCA-DE1-23502	**Soft Computing Techniques**	**SCA-DE2-23502**	MOOC
SCA-DE1-23503	**E-Commerce**	**SCA-DE2-23503**	Bioinformatics

Programme: BCA (Hons) with specialization Data Science / Cloud Computing
Semester: VI Session: 2025-2026

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	**CC-27**	**SCA-DS-23601 / SCA-CC-23601**	**Big Data Analytics using Hadoop / Advanced Cloud Computing**	3	1	0	4	3	50	50	100	40
2	**CC-28**	**SCA-23602**	**Elective- 3**	3	1	0	4	4	50	50	100	40
3	**CC-29**	**SCA-23605**	**Data Mining & Data Warehousing**	3	1	0	4	4	50	50	100	40
4	**CC-30**	**SCA-23603**	**Mini project**	0	0	16	16	8	60	40	100	40
5	**CC-31**	**SCA-DS-23604 / SCA-CC-23604**	**Big Data Analytics using Hadoop Lab / Advanced Cloud Computing Lab**	0	0	2	2	1	60	40	100	40
			Total	09	3	18	30	20	270	230	500	200

Elective – 3 Sub-Code	**Elective – 3 Sub-Name**
SCA-DE3-23601	Pattern Recognition
SCA-DE3-23602	Text Mining & Analysis
SCA-DE3-23603	Software Project Management

Programme: BCA (Hons) with specialization Data Science / Cloud Computing
Semester: VII Session: 2026-2027

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total marks	Pass Marks
				L	T	P						
1	**CC-32**	**SCA-23701**	**No SQL Database/Cloud Security**	**3**	**0**	**0**	**3**	**2**	**50**	**50**	**100**	**40**
2	**CC-33**	SCAE-2-23702 - SCAE-2-23702	**Elective-4**	**3**	**1**	**0**	**4**	**4**	**50**	**50**	**100**	**40**
3	**VAC-7**	**SCA-23703**	**Research Methodology and IPR**	**3**	**0**	**0**	**3**	**3**	**50**	**50**	**100**	**40**
5	**OE-2**	SCAOE-2-23704 - SCAOE-2-23704	**Open Elective-2**	**3**	**0**	**0**	**3**	**3**	**50**	**50**	**100**	**40**
	CC-34	SCA-5-20705	**No SQL Database/Cloud Security Lab**	**0**	**0**	**2**	**2**	**1**	**60**	**40**	**100**	**40**
6	**CC-35**	**SCA-623706**	**Major Project-1**	**0**	**0**	**16**	**16**	**8**	**60**	**40**	**100**	**40**
			Total	**12**	**1**	**18**	**31**	**21**	**320**	**280**	**600**	**240**

OPEN ELECTIVE-2 Sub Code	**OPEN ELECTIVE-2**
SCAOE-2-23704	Modelling And Simulation Of Dynamic Systems
SCAOE2-23704	Automation And Robotics
SCAOE-2-23704	Electric Vehicles

Department Elective-4 Sub Code	**Department Elective-4 Name**
SCADE-4-23702	Distributed Systems
SCADE-4-23702	Business Intelligence
SCADE-4-23702	Human computer interaction

Programme: BCA (Hons) with specialization Data Science / Cloud Computing
Semester: VIII Session: 2026-2027

S. No	Status	Paper Code	Subjects	Study Scheme Lec / Week			Hours	Credits	CIE	ESE	Total	Pass Marks
				L	T	P						
1	**CC-36**	**SCA-23801**	**Business Intelligence** /Cloud-based Disaster Recovery and Backup Solution	**3**	**0**	**0**	**3**	**2**	**50**	**50**	**100**	**40**
2	**CC-37**	**SCA-23802**	**Software Project Management**	**3**	**1**	**0**	**4**	**4**	**50**	**50**	**100**	**40**
3	**OE-3**	**SCA-23803**	**Open Elective-3**	**3**	**1**	**0**	**4**	**4**	**50**	**50**	**100**	**40**
4	**CC-38**	**SCA-23804**	**Major Project- 2**	**0**	**0**	**16**	**16**	**8**	**200**	**100**	**300**	**120**
			Total	**9**	**2**	**16**	**27**	**18**	**350**	**250**	**600**	**240**

OPEN ELECTIVE-3 Sub Code	**OPEN ELECTIVE-3**
SCAOE-3-23801	Renewable Energy Resources
SCAOE-3-23802	Rural Development
SCAOE-3-23803	Operations Research
SCAOE-3-23804	Design Thinking

DETAILED SYLLABUS

Programme: BCA (Hons) with specialization Data Science / Cloud Computing
Year: Ist Semester: I Session: 2023-2024

Computer Concepts & Programming in C

(Course Code: **SCA-23101**)

	L	T	P	C
Year: Ist				
Semester: Ist	**4**	**0**	**0**	**4**

COURSE OBJECTIVES
To acquire the fundamental principles, concepts and constructs of computer programming
To develop competency for the design, coding and debugging
To build the programming skills using 'C' to solve real world problems

Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	To Focus Fundamentals of Computers and Peripherals .	K_3
CO 2	To Introduce programming language and aware the students about programming paradigm	K_3, K_4
CO 3	To Focus Concept and Methodology of Programming.	K_2, K_3
CO 4	To give clear idea of different strategy of basic programming with C like Looping, Decision Making, Array, Structure	K_2, K_4
CO 5	Function, Pointer, etc. to solve real life problems.	K_3, K_6

Unit-1

Introduction to components of a computer system: Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker.Idea of Algorithm: Representation of Algorithm, Flowchart, Pseudo code with examples, Fromalgorithms to programs, source code.Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C,Fundamental data types, Variables and memory locations, Storage classes.

Unit-2

Operators :Types of operators, Precedence and Associativity, Expression, Statement and types of statements Build in Operators and function Console based I/O and related built in I/O function: printf(), scanf(), getch(), getchar(), putchar(); Concept of header files, Preprocessor directives: #include, #define Control structures Decision making structures: If, If-else, Nested If-else, Switch; Loop Controlstructures: While, Do-while, for, Nested for loop; other statements: break**, continue, goto, exit.**

Unit-3

Array & String: Concept of array, One and Two dimensional arrays, declaration and initialization ofarrays, String, String storage, Built-in string functions.
Functions: Concept of user defined functions, prototype, definition of function, parameters, parameter passing, calling a function, Macros, Preprocessing.
Recursion: Definitions, recursive function, Examples, Applications.

Unit-4

Introduction to problem solving Concept: problem solving, Problem solving techniques (Trail & Error, Brain Stroming, Divide & Conquer) Steps in problem solving (Define Problem, Analyze Problem, ExploreSolution) Algorithms and Flowcharts (Definitions, Symbols), Characteristics of an algorithm Conditionalsin pseudo-code, Loops in pseudo code Time complexity: Big-Oh notation, efficiency Simple

Unit-5

Simple Arithmetic Problems: Addition / Multiplication of integers, Determining if a number is +ve / -ve /even / odd, Maximum of 2 numbers, 3 numbers, Sum of first n numbers, given n numbers, Integer division,Digit reversing, Table generation for n, ab , Factorial, sine series, cosine series, nCr , Pascal Triangle, Prime number, Factors of a number, Other problems such as Perfect number, GCD numbers etc (Write algorithms and draw flowchart), Swapping.

TEXT BOOKS:

- Programming in ANSI C, Forth Edition, E Balagurusamy, TMH
- Reference Books: Let us C, Yashwant Kanitkar
- C: The Complete Reference, Herbert Schildt, McGrawHill
- Computer fundamentals and Programming in C, Pradip dey and Manas Ghosh, Oxford

Foundation of Mathematics
(Course Code: SCA-23102)

Year: Ist **L T P C**
Semester: Ist **4 0 0 4**

COURSE OBJECTIVES

1. To acquire the fundamentals of Matrix theory and its use to find the nature of solution of system of equations.
2. To built the skills in Limit, continuity and Differentiability and its applications.
3. To develop the idea of vector calculus and multiple integration.

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Students will know the solution of system of equations, rank, eigen value, eigenvector and aracterstic polynomial.	K_3
CO 2	Student will able to understand the concept of limit, continuity also its applications.	K_3, K_4
CO 3	After the completion of unit students knows the concept of differentiability and its application.	K_2, K_3
CO 4	After the completion of vector, students knows what is vector and what are its uses such as gradient, divergence, and curl.	K_2, K_4
CO 5	Apply integration to compute multiple integrals ,area volume, integral in polar coordinate in addition to change of order.	K_3, K_6

Unit 1 Linear Algebra

Linear Algebra-Matrices: Rank of a matrix, Consistency of a system of linear equations,Linear dependence and independence of vectors, Eigen-values and Eigen vectors of a matrix, Cayley-Hamilton theorem, Determinants

Unit 2 Limits and Continuity

Definition of Limits, Left hand and right hand limit**,** useful formulae in finding the limits ofcertain Functions, Definition of continuity, Properties of continuous functions**,** Types of Discontinuity, Removable discontinuity, Discontinuity of first kind and second kind

Unit 3 Differentiation

Differentiability of a function, Rolle's theorem, Lagrange's mean Value theorem, Taylor'stheorem, Maclaurin's theorem, Indeterminate Forms, L' Hospitals Rule**,** Maxima and Minima, curve tracing

Unit 4 Vector Algebra

Introduction, Representation of vector Addition and subtraction of vectors, Double andTriple Scalar and Vector Product and its Properties, System of reciprocal of Vectors, Gradient, Divergence and curl of a vector

Unit 5 Multiple Integration

Double and triple integrals, Change of variables, Change of order of integration,Applications to area and volume.

Reference Books

1. Grewal B.S., Higher Engineering Mathematics, Delhi Khanna Publishers.
2. Differential Calculus by Shanti Narayan, Publishers S. Chand & Co.
3. HK DAS “Advanced Engineering Mathematics” s.chand and company

Web designing using DHTML

(Course Code: **SCA-23103**)

Year: Ist **L T P C**

Semester: Ist **3 0 0 3**

COURSE OBJECTIVES

1. To acquire the fundamentals of Web page design and about types of websites.
2. To build the skills in HTML, CSS and JavaScript.
3. To Understand the basic concept of SEO.

Unit 1 Introduction

Introduction: Internet and World Wide Web (WWW); Evolution and History of World Wide Web, Web Pages and Contents, Web Clients, Web Servers, Web Browsers; Protocols Governing Web, URLs; Introduction to client-server computing; Introduction to Mark up Languages (HTML and DHTML).

Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Understand principle of Web page design and about types of websites	K3, K4
CO 2	Visualize and Recognize the basic concept of HTML and application in web designing.	K_1, K_2
CO 3	Recognize and apply the elements of Creating Style Sheet (CSS).	K_2, K_4
CO 4	Understand the basic concept of Java Script and its application.	K_2, K_3
CO 5	Introduce basics concept of Web Hosting and apply the concept of SEO.	K_3, K_2

Unit 2 Web Development

HTML Document Features, Fundamentals HTML Elements, Creating Links; Headers; Text styles; Text Structuring; Text colour and Background; Formatting text; Page layouts, Images; Ordered and Unordered lists; Inserting Graphics; Table Creation and Layouts; Frame Creation and Layouts; Working with Forms and Menus; Working with Radio Buttons; Check Boxes; Text Boxes. Document type definition, XML: DTD, XML schemes, Object Models, presenting and using XML.

Unit 3 Introduction to CSS

Features, Core Syntax, Types, Style Sheets, Style Rule Cascading and Inheritance, Text Properties, CSS Box Model, Normal Flow Box Layout, Positioning and other useful Style Properties.

Unit 4 Introduction to Java Script

Objects, Methods, Events and Functions, Tags, Operators, Data Types, Literals and Type Casting in JavaScript, Programming Construct, Array and Dialog Boxes, Relating JavaScript to DHTML, Dynamically Changing Text, Style, Content.

Unit 5 Core Java

Core Java: Introduction, Operator, Data type, Variable, Arrays, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming. Java Server Pages (JSP): Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives,

Reference Books

1. Burdman, Jessica, "Collaborative Web Development" Addison Wesley
2. Xavier, C, " Web Technology and Design" , New Age International
3. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication
4. Bhave, "Programming with Java", Pearson Education
5. Herbert Schieldt, "The Complete Reference:Java", TMH.
6. Margaret Levine Young, "The Complete Reference Internet", TMH
7. Naughton, Schildt, "The Complete Reference JAVA2", TMH
8. Balagurusamy E, "Programming in JAVA", TMH

Professional Communication

(Course Code: **SCA-23104**)

Year: Ist	**L**	**T**	**P**	**C**
Semester: Ist	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

1. To acquire the fundamentals of effective Communication .
2. To build the skills in Business Correspondence.
3. To Understand the basic concept of Oral Presentation and report writing.

Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Understand principle of Communication.	K_1
CO 2	Recognize the basic concept of Letter Writing, presentation, inviting quotations, sending quotations, placing orders .	K_2, K_3
CO 3	Apply the concepts for report writing.	K_2, K_4
CO 4	Understand the need to enhance the vocabulary.	K_2, K_3
CO 5	Introduce basics concept of oral representation.	K_3, K_2

Unit 1 Communication

Introduction: Nature of Communication, Process of Communication, Types of Communication (verbal & Non Verbal), Importance of Communication, Different forms of Communication, Effective principles of Communication, 7 C's. Barriers to Communication Causes, Linguistic Barriers, Psychological Barriers, Interpersonal Barriers, Cultural Barriers, Physical Barriers, Organizational Barriers.

Unit 2 Business Correspondence

Letter Writing, presentation, inviting quotations, sending quotations, placing orders, inviting tenders, Sales letters, claim & adjustment letters and social correspondence, Memorandum, Inter - office Memo, Notices, Agenda, Minutes of meeting, Job application letter, preparing the Resume.

Unit 3 Report Writing

Business reports, Types, Characteristics, Importance, Elements of structure, Process of writing, Order of writing, the final draft, and check lists for reports.

Unit 4 Vocabulary

Words often confused Words often misspelt, common errors in English.

Unit 5 Oral Presentation

Oral Presentation: Importance, Characteristics, Presentation Plan, Power point presentation, Visual aids. Corporate Communication Formal and Informal Communication Networks; Grapevine; Miscommunication (Barriers); Improving Communication. Business Ettiquetes

Reference Books

1. Bovee, and Thill, Business Communication Essentials, Pearson Education
2. Shirley Taylor, Communication for Business, Pearson Education
3. Locker and Kaczmarek, Business Communication: Building Critical Skills, McGraw Hill Education
4. Herta A Murphy, Herbert W Hildebrandt, Jane P. Thomas, Effective Business Communication (SIE), McGraw Hill Education
5. Dona Young, Foundations of Business Communication: An Integrative Approach, McGraw Hill Education
6. Raymond V. Lesikar, Marie E. Flatley, Kathryn Rentz, Paula Lentz, and Neerja Pande, Business Communication: Connecting in a Digital World (SIE), McGraw Hill Education.

Principles and Practices of Management

(Course Code: **SCA-23105**)

Year: Ist **L T P C**

COURSE OBJECTIVES

1. To acquire the fundamentals of professional management.
2. To understand the Business Ethics & Social Responsibility.
3. To Understand the models for change & Strategic Management .

Semester: Ist **3 0 0 3**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Understand the concepts of management such as administration, organization and management etc skills .	K_2
CO 2	Recognize the basic concept of evolution of management thought.	K_2, K_3
CO 3	Apply the concepts of planning, identify barriers to effective planning, levels, advantages & limitations.	K_2, K_4
CO 4	Understand the basics of motivation, controlling and coordination among team.	K_2, K_3
CO 5	The basics concepts of Strategic management.	K_3, K_2

Unit 1 Introduction

Nature of Management: Meaning, Definition, nature & purpose, importance & Functions, Management as Art, Science & Profession-Management as social System Concepts of management-Administration-Organization, Management Skills, Levels of Management.

Unit-2 Evolution of Management

Evolution of Management Thought: Contribution of F.W.Taylor, Henri Fayol, Elton Mayo, Chester Barhard & Peter Drucker to the management thought. Business Ethics & Social Responsibility: Concept, Shift to Ethics, Tools of Ethics.

Unit-3 Functions of Management: Part-I

Planning Meaning- Need & Importance, types, Process of Planning, Barriers to Effective Planning, levels, advantages & limitations. Forecasting- Need & Techniques, Decision making Types -Process of rational decision making & techniques of decision making, Organizing – Elements oforganizing & processes: Types of organizations, Delegation of authority – Need, difficulties , Delegation – Decentralization. Staffing – Meaning & Importance Direction – Nature, Principles Communication – Types & Importance

Unit-4 Functions of Management: Part-II

Motivation – Importance – theories, Leadership – Meaning –styles, qualities & function ofleader, Controlling - Need, Nature, importance, Process & Techniques, Total Quality Management, Coordination – Need – Importance

Unit-5 Management of Change

Models for Change, Force for Change, Need for Change, AlternativeChange, Techniques, New Trends in Organization Change. Strategic Management: Definition, Classes of Decisions, Levels of Decision, Strategy, Role of different Strategist, Relevance of Strategic Management and its Benefits, Strategic Managementin India

Reference Books

1. Drucker, F. Peter - Management-Tasks, Responsibilities & Practices.
2. Koontz "O" Donnel Weihrich - Elements of Management.
3. Koontz H, "O" Donnel C - Management-A Book of Reading.
4. Drucker, F. Peter - The Practice of Management.
5. Terry and Franklin - Principles of Management
6. Stoner - Principles of Management
7. William H. Newman and - The Process of Management. E. Kirby Wassen

Environmental Studies

(Course Code: **SCA-23106**)

Year: Ist	**L**	**T**	**P**	**C**
Semester: Ist	**2**	**0**	**0**	**2**

COURSE OBJECTIVES

1. To acquire the fundamentals of professional management.
2. To understand the Business Ethics & Social Responsibility.
3. To Understand the models for change & Strategic Management .

Unit 1 The Multidisciplinary Nature of Environmental Studies

Definition, Scope and Importance, Need for Public Awareness.

Unit-2 Natural Resources

Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	to critically examine all sides of environmental issues and apply understanding from different disciplines to create informed opinions about how to interact with the environment on both a personal and a social level.	K_2
CO 2	Recognize the basic concept of renewable and non-renewable resources.	K_2, K_3
CO 3	Understand the concepts of Structure and function of an ecosystem.	K_2, K_4
CO 4	Understand the biodiversity at global, national and local levels.	K_2, K_3
CO 5	Recognize the impact of human population on the Environment.	K_3, K_2

Renewable and Non-renewable Resources: Natural resources and associated problems, Forest Resources, Water Resources, Mineral Resources, Food Resources, Energy Resources Land Resources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit-3 Concept of an ecosystem

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem; Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit-4 Biodiversity And Its Conservation

Introduction – Definition: genetic, species and ecosystem diversity.Bio geographical classification of India, Value of biodiversity: Consumptive use, productive use, social, ethical, and aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation, Hot-sports of biodiversity. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-5 Human Population And The Environment

Population growth, variation among nations, Population explosion: Family Welfare Programme, Environment and human health, Human Rights, Value Education, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.

Reference Books

1. Agarwal, K.C.(2001) Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach (2003), The Biodiversity of India of India, Mapin Publishing Pvt. Ltd., Ahmedabad- 380013, India, Email: mapin@ivenet,net (R)
3. Gadgil, Madhav (2001) Ecological Journeys, The Science and Politics of conservation in India. Permanent Black.
4. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.(2001). Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
5. Dcc A.K., Environmental Chemistry, Wiley Eastern Ltd.
6. Down to Earth, Centre for Science and Environemnt (R)
7. Hawkins R.E, REncyclopedia of Indian Natural Histry, Bombay Natural History Society, Bombay(R)
8. Environmental Geography- SavindraSingh, New Delhi.
9. Environmental Geography- Saxena H.M., Rawar Publications, Jaipur
10. Environmental Geography-Sinha S.P., New DelhiGleeson,B. and Low, N.(eds) 1999. Global Ethics and Environment, London, Rputledge.
11. World Commission on environment and development. 1987. Our Common Future, Oxford University Press.
12. Odum,E.P., Odum, h.T. & Andrews, J.!971. Fundamnetals of Ecology. Philadelphia: Saunders.

Programming in 'C' lab

(Course Code: **SCA-23107**)

Year: Ist	**L**	**T**	**P**	**C**
Semester: Ist	**0**	**0**	**4**	**2**

List of Experiments (Indicative & not limited to)

1. Basic Introduction to C program and turbo C setup(Compile/Run program).
2. Simple program using scanf/printf.
3. Program using if/else.
4. Program using operators(++,--,%,&,|,etc).
5. Switch case programs.
6. Programs of loops(while loop) Programs of loops(do…while loop).
7. Simple program of one-Dimentional/2-Dimensional array.
8. String Programs(using all string functions).
9. Program to implement union and structures.
10. Program to demonstrate working of pointers.
11. Program to read data from file and write into a file.

Web designing using DHTML Lab

(Course Code: **SCA-23108**)

Year: Ist	**L**	**T**	**P**	**C**
Semester: Ist	**0**	**0**	**2**	**1**

List of Experiments (Indicative & not limited to)

B Write HTML/Java scripts to display your CV in navigator, your Institute website, Department Website and Tutorial website for specific subject.

C Write an HTML program to design an entry form of student details

D Writing program in CSS to display hover effect.

E Writing program in XML for creation of DTD, which specifies set of rules. Create a style sheet in CSS/ XSL & display the document.

F Write programs using Java script for Web Page to display all pop box.

G Write a program using java script to display application Program calculator.

H Write a program to show the use exception handling using java

I Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a jsp for doing the following. Create a Cookie and add these four user id's and passwords to this Cookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.

J Write a JSP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password without using cookies.

K Design simple website for e-commerce using session tracking.

DATA STRUCTURES USING C

(Course Code:SCA-23201)

Year: 1st **Semester: II**

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4 1 6

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Describe how arrays, linked lists, stacks, queues, trees, and graphs are represented in memory, used by the algorithms and their common applications.	K1, K2
CO 2	Discuss the computational efficiency of the sorting and searching algorithms.	K2
CO 3	Implementation of Trees and Graphs and perform various operations on these data structure.	K3
CO 4	Understanding the concept of recursion, application of recursion and its implementation and removal of recursion.	K4
CO 5	Identify the alternative implementations of data structures with respect to its performance to solve a real world problem.	K5, K6

Unit	Topic	Proposed Lecture
1	Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D,3-D and n-D Array Application of arrays, Sparse Matrices and their representations. Linked Lists: Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable & Two variables Polynomial.	8
2	Stacks: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Queues: Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.	8

3	Searching: Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collision resolution Techniques used in Hashing. Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort, Heap Sort.	8
4	Graphs: Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning	8
5	Trees: Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer (Linked List) Representation, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree. A Extended Binary Trees, Tree Traversal	8

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publications Pvt Ltd Delhi India.
2. Lipschutz, “Data Structures” Schaum’s Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd. Thareja, “Data Structure Using C” Oxford Higher Education.
3. AK Sharma, “Data Structure Using C”, Pearson Education India.
4. Rajesh K. Shukla, “Data Structure Using C and C++” Wiley Dreamtech Publication.
5. Michael T. Goodrich, Roberto Tamassia, David M. Mount “Data Structures and Algorithms in C++”, Wiley India. 8. P. S. Deshpandey, “C and Data structure”, Wiley Dreamtech Publication.
6. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education

OBJECT ORIENTED PROGRAMMING USING PYTHON

(Course Code:SCA-23202)

Year: 1st **Semester: II**

L T P

3 1 4

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	To read and write simple Python programs.	K1, K2
CO 2	To develop Python programs with conditionals and loops.	K2, K4
CO 3	To define Python functions and to use Python data structures –- lists, tuples, dictionaries	K3
CO 4	To do input/output with files in Python	K2
CO 5	To do Object Oriented programs	K2, K4

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
1	Introduction: The Programming Cycle for Python, Python IDE, Interacting with Python Programs, Elements of Python, Type Conversion. Basics: Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression	8
2	Conditionals: Conditional statement in Python (if-else statement, its working and execution), Nested-if statement and Elif statement in Python, Expression Evaluation & Float Representation. Loops: Purpose and working of loops, While loop including its working, For Loop , Nested Loops , Break and Continue.	8
3	Function: Parts of A Function, Execution of A Function, Keyword and Default Arguments, Scope Rules. Strings: Length of the string and perform Concatenation and Repeat operations in it. Indexing and Slicing of Strings.	8
4	Abstract Data Types: Abstract data types and ADT interface in Python Programming. Classes: Class definition and other operations in the classes, Special Methods (such as _init_, _str_, comparison methods and Arithmetic methods etc.), Class Example, Inheritance, Inheritance and OOP.	8
5	Python Data Structure: Tuples, Unpacking Sequences, Lists, Mutable Sequences, List Comprehension, Sets, Dictionaries Higher Order Functions: Treat functions as first-class Objects, Lambda Expressions	

	Modules: Introduction, Importing Modules	8

Text books:

1. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

2.John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013

Reference Book:

3.Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

4.Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015. 5.Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.

6 .Charles Dierbach, ―Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition, 2013.

Probability and Statistics

(Course Code: SCA-23203)

Year: 1st **Semester: II**

L T P

	Course Outcome (CO) At the end of course, the student will be able to		Bloom's Knowledge Level (KL)
	CO 1	Understand and apply basic statistical concepts for analyzing and interpreting data using descriptive statistical techniques, such as measures of central tendency and dispersion.	K2, K3
	CO 2	Apply the concept of Regression analysis in real world problems	K3, K4
	CO 3	Understand the applications of probability theory and statistics in emerging sciences and technology such as Machine learning, data science etc.	K2, K5
	CO 4	Apply these concepts to solve practical problems and analyze real-world situations involving uncertainty.	K3,4,5
	CO 5	Apply inferential statistical techniques, such as hypothesis testing, confidence intervals etc. to make decisions based on data.	K6
	DETAILED SYLLABUS		
Unit		Topic	Proposed Lecture
I	Descriptive Statistics	Introduction of Statistics and types, Measures of Central Tendency: Arithmetic mean, Median, Mode, Harmonic Mean, Geometric mean Measures of Dispersion : Variance, Standard Deviation, Skewness and Kurtosis	10
II	Regression Analysis	Concept, Linear Regression, Multiple Regression, Non Linear Regression, Random Forests	10
III	Probability and Probability Distributions	Basic Concepts of Probability, Conditional Probability and Bayes' Theorem, Random Variables and Probability Distributions: Binomial, Poisson& Normal, Definition of a random variable, discrete and continuous random variables, functions of random variables, probability mass function and probability density function.	10

IV	Sampling Theory and Estimation	Sampling Techniques, Estimation of Population Parameters: Point Estimation and Interval Estimation, Sampling Distribution of the Sample Mean and Proportion, Centre Limit Theorem, Point of Estimation: Characteristics of Good Estimator and problems	8
V	Testing of Hypothesis	Hypothesis Testing: Null and Alternative Hypotheses, Type I and Type II Errors, p-values and Significance Level, One-Sample and Two-Sample Tests for Means and Proportions, Chi Square test, |Anova test	8

Text Books:

1. S.C. Gupta - Fundamentals of statistics - Sultan Chand & sons, Delhi.
2. D.N. Elhance - Fundamentals of statistics - Kitab Mahal, Allahabad.

Reference Book:

3. Montogomery D.C. - Statistical Quality Control - John Welly and Sons 4. Goon, Gupta And Dasgupta- Fundamentals of statistics- The world press private ltd., Kolkata 5. Hogg R.V. and Craig R.G. - Introduction to mathematical statistics Ed 4 {1989} - Macmillan Pub. Co. New York.
6. Gupta S.P. - Statistical Methods, Pub - Sultan Chand and sons New Delhi

Suggested Books:

1. Statistical Methods, “Dr. S.P. Gupta, Sultan Chand & Sons”.
2. Quantitative Techniques by “C. Sathyadevi, S. Chand”.
3. Fundamental of Mathematical Statistics, “S.C. Gupta & V.K. Kapoor, Sultan Chand”
4. Statistical Methods, “Snedecor G.W. &Cochran W.G. oxford&+

ORGANISATION BEHAVIOUR

(Course Code:SCA-23205)

Year: 1st **Semester: II**

L T P

3 - -

COURSE OUTCOME

Course Outcomes	Bloom's taxonomy
CO 1: Developing understanding of managerial practices and their perspectives.	K2,K1
CO2: Understanding and Applying the concepts of organizational behaviour	K2, K4
CO 3: Applying the concepts of management and analyze organizational behaviours in real world situations	K4, K5
CO 4: Comprehend and practice contemporary issues in management.	K3
CO 5: Applying managerial and leadership skills among students	K4

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
1	Introduction, nature and scope of OB, Challenges and opportunities for OB, Organization Goals, Models of OB, Impact of Global and Cultural diversity on OB	8
2	Individual behaviour: Personality, Perception and its role in individual decision making, Learning, Motivation, Hierarchy of needs theory, Theory X and Y, Motivation- Hygiene theory, Vrooms Expectancy theory.	8
3	Behaviour Dynamics: Interpersonal behaviour, Attitude and Values, Job anxiety and stress, The Johari Window, Leadership, Its Theories and Prevailing Leadership styles in Indian Organizations	8
4	Group Behaviour: Definition and classification of Groups, Types of Group Structures, Group decision making, Teams Vs Groups, Inter group problems in organizational group dynamics, Management of conflict.	8
5	Management of Change: Change and Organizational development, Resistance to change, Approaches to managing organizational change, Organizational effectiveness, Organizational culture, Recent advances in OB.	8

Text Book:

1. Robbins, S. P., Organizational behaviour., Prentice Hall of India.
2. Pareek, U., Organizational Processes, Oxford and IBH, New Delhi.

Reference Book

3. Koontz, H. and Wehrich , H., Management-A Global Perspective.
4. Sharma, R.A. ; Organizational Theory and behaviour.
5. L.M Prasad ; Organizational behaviour.

Fundamentals of Cloud Computing

(Course Code: SCA-23204(CC)

Year: 1st **Semester: II**

L T P

4 - -

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Understand the concepts of Cloud Computing, key technologies,strengths and limitations of cloud computing.	K1 , K2
CO 2	Develop the ability to understand and use the architecture to computeand storage cloud, service and models.	K1, K3
CO 3	Understand the application in cloud computing.	K4, K5
CO 4	Learn the key and enabling technologies that help in the development ofcloud.	K3, K4
CO 5	Explain the core issues of cloud computing such as resource management and security.	K2, K6

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	Introduction - cloud-definition, benefits, history of cloud computing,applications in cloud computing, characteristics of cloud computing, grid computing, cluster computing, distributed computing, utility computing, cloud service providers, properties, characteristics & disadvantages, pros and cons of cloud computing, issues in cloud.	8
II	Cloud computing architecture, comparison with traditional computing architecture (client/server), how cloud computing works, types of cloud: public cloud, private cloud, hybrid cloud, community cloud. Cloud services; software as a service (saas)-platform as a service (paas) – infrastructure as a service (iaas),everything/anything as a service (xaas)	8
III	Cloud service providers: google, amazon, microsoft azure, security in cloud computing, - eucalyptus – nimbus, cloud service management, collaborating using cloud services, email communication over the cloud - crm management - project management-event management - task management – calendar - schedules - word processing – presentation – spreadsheet - databases – desktop - social networks and groupware.	8

IV	Cloud security; infrastructure as a service security, network level security, host level security, application-level security, data security and storage, data privacy and security issues, identity & access management, access control, risk authentication in cloud computing, client access in cloud	8
V	Virtualization for cloud need for virtualization – pros and cons of virtualization – types of virtualization –system vm, process vm, virtual machine monitor – virtual machine properties.	8

TEXT BOOKS:

1. John Rittinghouse& James Ransome, Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010.

2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You

Reference Book:

4. Work and Collaborate Que Publishing, August 2008.

5. James E Smith, Ravi Nair, Virtual Machines, Morgan Kaufmann Publishers, 2006.

Computer Fundamentals of Data Science

(Course Code:SCA-23204)

Year: 1st **Semester: II**

L T P

4 - 2

Course Outcome (CO)	Bloom's Knowledge Level (KL)

At the end of course, the student will be able to understand		
CO 1	Describe the significance of data science and understand the Data Science process.	K2, K1
CO 2	Explain how data is collected, managed and stored for data science.	K2, K4
CO 3	Build, and prepare data for use with a variety of statistical methods and models	K4, K5
CO 4	Analyse Data using various Visualization techniques.	K3
CO 5	Choose contemporary models, such as machine learning, AI, techniques to solve practical problems	K4

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	Benefits and uses – facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model– presenting findings and building applications – Data Mining – Data Warehousing – Basic Statistical descriptions of Data	8
II	Types of Data – Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores	8
III	Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean	8
IV	Mathematical Preliminaries: Probability, Descriptive Statistics, Correlation Analysis. Data Munging: Properties of Data, Languages for Data Science, Collecting Data, Cleaning Data, Crowdsourcing	8
V	Supervised Learning: Linear Regression, Better Regression Models, Regression as Parameter Fitting, Simplifying Models through Regularization Classification and Logistic Regression, Issues in Logistic Classification, Naive Bayes, Decision Trees Classifiers	8

TEXT BOOKS:

1. **Joel Grus," Data Science from Scratch" First Edition, April 2015**
2. **Gareth James, Daniela Witten, Trevor Hatie, RoberstTibhirani , "An Introduction to Statistical Learning-with Applications in R", 2013**

Reference Book:

3. **Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2 edition (30 September 2014)**
4. **R Programming for Data Science, Roger D. Peng, LeanPub, 2015**

Data Structure using C Lab

Course Code: SCA-23207

Credit: 02 **P: 02**

List of Experiments/Practical

S.No	Name of Experiment	Specification of Hardware	Specification of Software (Only for the Programming)
1.	1) Write a program to input and display array elements. 2) Write a program to insert an element in array.		
2.	1) Write a program to delete an element in array. 2) Write a program to find maximum element in an array.		
3.	1) Write a program to find minimum element in an array. 2) Write a program to input array elements and find the sum of even and odd numbers.		
4.	1) Write a program to perform addition of two matrices. 2) Write a program to transpose of a matrix.		
5.	1) Write a program to find sum of lower triangular matrix element. 2) Write a program to find sum of upper triangular matrix element.		
6.	1) Write a program to perform binary search. 2) Write a program to find factorial of a number using recursion.		
7.	1) Write a program to sort an array using selection sort. 2) Write a program to sort an array using insertion sort.		
8.	1) Write a program to perform reverse a string using stack. 2) Write a program to perform push and pop in stack.		
9.	1) Write a program to create and display singly linked list. 2) Write a program to create a singly link list and count total number of nodes in a list.		
10	1) Write a program to search an element in singly link list. 2) Write a program to insertion at last in singly link list.		
11	1) Write a program to perform deletion at last in singly link list. 2) Write a program to perform deletion at beginning in singly link list.		

Course Title: Object Oriented Programming Using Python Lab **Course Code: SCA-23208**

Credit: 02 **P: 02**

List of Experiments/Practical

S.No	Name of Experiment	Specification of Hardware	Specification of Software(Only for the Programming)
1.	1.Program to print Resume. 2.Program to add two numbers.		
2.	3.Program to swap the variables. 4.Program to calculate the simple Interest.		
3.	5 Program to find the area of triangle. 6.Program to find the square root of number.		
4.	7.Program to find odd even number. 8.Program to check the number is positive or negative.		
5.	9.Program to check number is Armstrong. 10.Program to print sum of series.		
6.	11.Programs to print pyramid patterns. 12program to reverse the number.		
7.	13.Program to print Fibonacci series. 14.Program to find the largest number among three numbers.		
8.	15.Program to find the factorial of number using recursion. 16.Program to make simple calculator.		
9.	17.Program to find HCF & LCM of number. 18.Program to find ASCII value of character.		
10	19.Program to convert decimal to binary, octal and Hexadecimal. 20.Program to acess index of a list using for loop.		
11	21.program to print numbers and multiplication table. 22.Program to flatten a nested list.		
12	23.Program to slice lists. 24.Program to sort dictionary &merge two dictionaries.		
13	25.Program to find the list and add the elements of the list. 26.program to convert string to date time to get a sub string.		
14	27.Program to append to a file. 28.python class and object using of in_ it functions.		
15	29.Program to generate random numbers using random () functions.		

Course Title: Fundamentals of Data Science Lab **Course Code: SCA-23209(DSL)**

Credit: 2 **P: 02**

List of Experiments/Practical

S.No	Name of Experiment	Specification of Hardware	Specification of Software (Only for the Programming)
1.	Working with Numpy arrays		
2.	Working with Pandas data frames		
3.	Basic plots using Matplotlib		
4.	Frequency distributions		
5.	Averages		
6.	Variability		
7.	Normal curves		
8.	Correlation and scatter plots		
9.	Correlation coefficient		
10	Regression		

Course Title: Fundamentals of Cloud Computing Lab **Course Code: SCA-23209(CCL)**

Credit: 03 **P: 02**

List of Experiments/Practical

S.No	Name of Experiment	Specification of Hardware	Specification of Software (Only for the Programming)
1.	Install Virtualbox /VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.		
2.	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.		
3.	Install Google App Engine. Create hello world app and other simple web applications using python/java.		
4.	Use GAE launcher to launch the web applications.		
5.	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.		
6.	Find a procedure to transfer the files from one virtual machine to another virtual machine.		
7.	Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)		
8.	Install Hadoop single node cluster and run simple applications like wordcount		

Operating Systems

(Course Code: **SCA-23301**)

Year: 2nd	**L**	**T**	**P**	**C**
Semester: IIIrd	**5**	**0**	**0**	**4**

Unit 1 Introduction

Introduction : Operating system and functions, Classification of Operating systems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multiprocess Systems,

COURSE OBJECTIVES	
1. To understand the basic concepts of Operating Systems .	
2. To understand the concepts and functions Operating System.	
3. To recognize I/O management and File systems.	

Course Outcome (CO)	**At the end of course , the student will be able to understand**	**Bloom's Knowledge Level (KL)**
CO 1	Understand the structure and functions of OS.	K_1, K_2
CO 2	Learn about Processes, Threads and Scheduling algorithms.	K_1, K_2
CO 3	Understand the principles of concurrency and Deadlocks.	K_2
CO 4	Learn various memory management scheme.	K_2
CO 5	Study I/O management and File systems.	K_4, K_2

Multithreaded Systems, Operating System Structure- Layered structure, System Components, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.

Unit 2 Concurrent Processes

Concurrent Processes: Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation; Classical Problem in Concurrency- Dining Philosopher Problem, Sleeping Barber Problem; Inter Process Communication models and Schemes, Process generation.

Unit 3 CPU Scheduling

: Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.

Unit 4 Memory Management

Memory Management: Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.

Unit 5 I/O Management and Disk Scheduling

I/O Management and Disk Scheduling: I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.

Reference Books

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley

2. Sibsankar Halder and Alex A Aravind, “Operating Systems”, Pearson Education
3. Harvey M Dietel, “ An Introduction to Operating System”, Pearson Education
4. D M Dhamdhere, “Operating Systems : A Concept based Approach”, 2nd Edition,
5. TMH 5. William Stallings, “Operating Systems: Internals and Design Principles ”, 6th Edition, Pearson Education

Artificial Intelligence

(Course Code: **SCA-23302**)

	L	T	P	C
Year: 2nd				
Semester: IIIrd	**5**	**0**	**0**	**3**

COURSE OBJECTIVES
1. To understand the basic concepts of Intelligent Agents .
2. To understand the concept and working of Predicate Logic .
3. To recognize various AI applications .

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents.	K_1, K_2
CO 2	Understand search techniques and gaming theory.	K_2, K_3
CO 3	The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.	K_4, K_3
CO 4	Student should be aware of techniques used for classification and clustering.	K_2, K_3
CO 5	Student should aware of basics of pattern recognition and steps required for it.	K_4, K_2

Unit 1 Introduction

Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

Unit 2 Problem Solving Methods

Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games

Unit 3 Knowledge Representation

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information

Unit 4 Software Agents

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

Unit 5 AI Applications

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving

Reference Books

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. I. Bratko, ―Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008
4. Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
5. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.
6. Gerhard Weiss, ―Multi Agent Systems‖, Second Edition, MIT Press, 2013.
7. David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.

Data Analytics Using Python

(Course Code: **SCA-DS-23301**)

Year: 2nd | **L** | **T** | **P** | **C**
Semester: IIIrd | **5** | **0** | **0** | **3**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Discuss various concepts of data analytics pipeline	K_1, K_2
CO 2	Apply classification and regression techniques	K_3
CO 3	Explain and apply mining techniques on streaming data	K_2, K_3
CO 4	Compare different clustering and frequent pattern mining algorithms.	K_4
CO 5	Describe the concept of R programming and implement analytics on Big data using R.	K_3, K_2

COURSE OBJECTIVES

1. To understand the basic concepts of data analytics.
2. To understand the concept and working of data streams.
3. To recognize various data visualization tools.

Unit 1 Introduction to Data Analytics

Introduction, Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics. Data Analytics Lifecycle: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization.

Unit 2 Data Analysis

Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, neural networks: learning and generalisation, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.

Unit 3 Data Streams

Mining Data Streams: Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, Real-time Analytics Platform (RTAP) applications, Case studies – real time sentiment analysis, stock market predictions.

Unit 4 Frequent Itemsets and Clustering

Frequent Itemsets and Clustering: Mining frequent itemsets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets in a stream, clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based clustering methods, clustering in noneuclidean space, clustering for streams and parallelism.

Unit 5 Frame Works and Visualization

MapReduce, Hadoop, Pig, Hive, HBase, MapR, Sharding, NoSQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications. Introduction to R - R graphical user interfaces, data import and export, attribute and data

types, descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data.

Reference Books

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press.
3. Bill Franks, Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & Sons.
4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
5. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Analytics”, EMC Education Series, John Wiley
6. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series.
7. Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”, Elsevier.
8. Anil Maheshwari, “Data Analytics”, McGraw Hill Education.
9. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill.
10. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer.
11. Mark Gardner, “Beginning R: The Statistical Programming Language”, Wrox Publication
12. Pete Warden, Big Data Glossary, O’Reilly
13. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons
14. Pete Warden, Big Data Glossary, O’Reilly.
15. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, "Handbook of Big Data", CRC Press.
16. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier

Introduction to Virtualization

(Course Code: **SCA-CC-23301**)

	L	T	P	C
Year: 2nd				
Semester: IIIrd	**5**	**0**	**0**	**3**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	various concepts of Virtualization in cloud computing.	K_1, K_2
CO 2	Hypervisors and Virtual machines.	K_3
CO 3	Explain and apply Virtualization Solutions.	K_2, K_3
CO 4	Compare challenges while migrating to cloud.	K_4
CO 5	To understand about cloud and virtualization along with its role in Big data usage.	K_3, K_2

COURSE OBJECTIVES

1. To get an insight into the basics of cloud computing along with virtualization.
2. To understand the concept and working of data streams.
3. To understand about cloud and virtualization along with its role in Big data usage over it.

Unit 1 Introduction to Virtualization

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization Desktop virtualization: Software virtualization – Memory virtualization - Storage virtualization – Data virtualization – Network virtualization.

Unit 2 Hypervisors and Virtual machines

Server Virtualization: Understanding Server Virtualization, types of server virtualization, Virtual machine basics, types of virtual machines, hypervisor concepts and types

Unit 3 Virtualization Solutions

Understanding Microsoft's Virtualization solutions: Microsoft's Infrastructure Optimization Model, Virtualization and the Infrastructure Optimization Model, Benefits of Virtualization, Achieving the Benefits of Datacenter Virtualization, Achieving the Benefits of Client Virtualization, Achieving the Benefits of Cloud Virtualization.

Unit 4 Migrating into a Cloud

Introduction, Challenges while migrating to Cloud, Broad approaches to migrating into the cloudwhy migrate -deciding on cloud migration, the Seven-step model of migration into a cloud, Migration Risks and Mitigation, Enterprise cloud computing paradigm, relevant Deployment Models for Enterprise Cloud Computing, Adoption and Consumption Strategies, issues for enterprise applications on the cloud

Unit 5 Introduction to Python

Python basics, data import and export, attribute and data types, descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data.

Reference Books

1. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach
2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008

3. Publications, 2006. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
4. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010

Digital Marketing & E-Commerce

(Course Code: **SCA-23304**)

Year: 2nd	**L**	**T**	**P**	**C**
Semester: IIIrd	**5**	**0**	**0**	**2**

COURSE OBJECTIVES
1. To help Student understand the concept of Digital Marketing & E-commerce in today's scenario
2. To enable student in creating and maintaining a good website and blog posts.
3. To make student understand the importance of SEO and Email Marketing in today's modern world.

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Understand the Digital Marketing Process .	K_1, K_2
CO 2	Learn SEO& Email-Marketing .	K_1, K_2
CO 3	Understand the principles of SEM & Social Media Marketing .	K_2
CO 4	To understand the functioning and importance of Social Media Marketing via various platforms.	K_2, K_3
CO 5	To understand various Analytics tools of online marketing.	K_3, K_2

Unit 1 Introduction to Digital Marketing

Introduction to Digital Marketing and its Significance; Traditional Marketing Vs Digital Marketing, Digital Marketing Process; The contemporary digital revolution, digital transformation framework. Types of websites, Keywords, Understanding Domain and Webhosting, Building Website/Blog using CMS WordPress, Using WordPress Plug-ins; Blog Creation: Including Headlines, Links, Posts ; Using various plug- ins like Elimentor.

Unit 2 SEO& Email-Marketing

Introduction to SEO; SEO Keyword Planner Tools; On Page SEO Techniques: Indexing and Key Word Placement, Content Planning & Optimization, Display Advertising, Various SEO Plug-in, Off –Page SEO Techniques; Email Marketing- Introduction and Significance, campaigns using Mail Chimp; Email Marketing Strategy and Monitoring.

Unit 3 SEM & Social Media Marketing

Introduction to SEM, Mobile Marketing, Video Marketing on YouTube. Introduction to Social Media Marketing: Facebook, Instagram, Linked-in, Twitter, Google G Suit and online marketing campaigns on theses Social Media platforms. Content Marketing, Content creation process, Influencer marketing.

Unit 4 Marketing Strategies & Analytics Tools

Using Marketing Strategies & Analytics Tools, Understanding Digital marketing Strategies, Using Marketing analytics tools to segment, target, position; Online PR and reputation management, Digital Marketing Strategies and its ROI. Using Google Analytics and other social media analytics tools. Using Apps and Gamification.

Unit 5 E-Commerce

Applications of E-Commerce: Introduction, History of Electronic Commerce, Advantages and Disadvantage of E-commerce, Roadmap of e-commerce in India, E-business Models Based on the Relationship of Transaction Parties, e-commerce Sales Life Cycle (ESLC) Model, Electronic Payment Systems, Electronic Cash, Smart Cards and Electronic Payment Systems, Credit Card Based Electronic Payment Systems, Risks and Electronic Payment Systems, Electronic Data Interchange (EDI)

Reference Books

1. Vandana, Ahuja; Digital Marketing, Oxford University Press India November, 2015).
2. Seema Gupta; Digital Marketing, McGraw Hill Education; First edition (November 2017)
3. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page (3rd Edition, 2014).
4. Ravi Kalakota : Frontiers of E Commerce (Pearson).

Data Analytics Lab

(Course Code: **SCA-23307**)

Year: 2nd	**L**	**T**	**P**	**C**
Semester: IIIrd	**0**	**0**	**2**	**2**

1. To get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) using in Python.

2. To perform data import/export (.CSV, .XLS, .TXT) operations using data frames in Python.

3. To get the input matrix from user and perform Matrix addition, subtraction, multiplication, inverse transpose and division operations using vector concept in Python.

4. To perform statistical operations (Mean, Median, Mode and Standard deviation) using Python.

5. To perform data pre-processing operations i) Handling Missing data ii) Min-Max normalization

6. To perform dimensionality reduction operation using PCA for Houses Data Set

7. To perform Simple Linear Regression with Python.

8. To perform K-Means clustering operation and visualize for iris data set

9. Write R script to diagnose any disease using KNN classification and plot the results.

10. To perform market basket analysis using Association Rules (Apriori).

Operating System Lab using Linux

(Course Code: **SCA-23308**)

Year: 2nd	**L**	**T**	**P**	**C**
Semester: IIIrd	**0**	**0**	**0**	**2**

List of Experiments (Indicative & not limited to)

1. Study of hardware and software requirements of different operating systems (UNIX,LINUX,WINDOWS XP, WINDOWS7/8.
2. Execute various UNIX system calls for
   i. Process management
   ii. File management
   iii. Input/output Systems calls
3. Implement CPU Scheduling Policies:
   i. SJF
   ii. Priority
   iii. FCFS
   iv. Multi-level Queue
4. Implement file storage allocation technique:
   i. Contiguous(using array)
   ii. Linked –list(using linked-list)
   iii. Indirect allocation (indexing)
5. Implementation of contiguous allocation techniques:
   i. Worst-Fit
   ii. Best- Fit
   iii. First- Fit
6. Calculation of external and internal fragmentation
   i. Free space list of blocks from system
   ii. List process file from the system
7. Implementation of compaction for the continually changing memory layout and calculate total movement of data.
8. Implementation of resource allocation graph RAG.
9. Implementation of Banker‟s algorithm.
10. Conversion of resource allocation graph (RAG) to wait for graph (WFG) for each type of method used for storing graph.
11. Implement the solution for Bounded Buffer (producer-consumer)problem using inter process communication techniques-Semaphores.
12. Implement the solutions for Readers-Writers problem using inter process communication technique - Semaphore.

Machine Learning using Python

(Course Code: SCA-23401)

Year: 2nd **L T P C**

Semester: IVth **5 0 0 3**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Understand modern programming language features and constructs.	K_3
CO 2	Identify the different optimization techniques that are possible for any specific block of code.	K_3, K_4
CO 3	Design program specific and generic optimization techniques.	K_2, K_3
CO 4	Manage procedures to reduce execution and resource overheads.	K_2, K_4
CO 5	Learn to work and apply performance enhancement on any larger software project.	K_3, K_4

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**INTRODUCTION** Machine Learning–Types of Machine Learning : Supervised Learning, Unsupervised Learning – Machine Learning process- Testing machine learning algorithms - Parametric Vs non-parametric models - Mathematical Basics for Machine Learning : Probability and Statistics for Machine Learning – Probability Distributions – Decision Theory – Information theory – Bias Variance tradeoff.	**09**
II	**SUPERVISED LEARNING METHODS** Regression: Introduction - Linear Regression - Least Squares - Under fitting and Overfitting - Cross- Validation - Lasso Regression - Logistic Regression; Classification: Linear and Non-linear models - - Support Vector Machines - Kernel Methods; K-Nearest Neighbours; Learning with Trees: constructing Decision Tree using ID3 - Classification and regression trees (CART); Decision by Committee : Ensemble Methods -- Bagging -- Boosting -- Random Forest; Evaluation of Classification Algorithms.	**09**
III	**UNSUPERVISED AND REINFORCEMENT LEARNING** Clustering- K-means – Mixtures of Gaussians – Vector Quantization – The Self Organizing Feature Map- Dimensionality Reduction, Linear Discriminant Analysis, Principal Components Analysis, Independent Components Analysis - Reinforcement Learning : Q learning, Deterministic and Non- deterministic Rewards and Actions Temporal Difference Learning - Markov Decision Process.	**09**

IV	**PROBABILISTIC GRAPHICAL MODELS AND EVOLUTIONARY LEARNING** Graphical Models – Undirected Graphical Models : Markov Random Fields – Directed Graphical Models : Bayesian Networks – Conditional Independence properties – Markov Random Fields, Hidden Markov Models – Conditional Random Fields(CRFs) - Evolutionary Learning : The Genetic Algorithm , Generating offspring - Map Colouring, Punctuated Equilibrium - Knapsack problem - Limitations of the GA.	**09**
V	**NEURAL NETWORKS AND DEEP LEARNING** Neural Networks: The Brain and the Neuron - Perceptron learning algorithm; Multi-Layer Perceptron: Back propagation algorithm - Multi-layer perceptron in Practice, Deep Learning: Introduction - Convolution Neural Networks - Recurrent Neural Networks – Stochastic Neurons : the Boltzmann Machine – Deep Belief Networks.	**09**

REFERENCES

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Chapman and Hall, CRC Press, Second Edition, 2014.
2. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
4. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
5. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

Linear Algebra

(Course Code: SCA-23402)

Year: 2nd **L T P C**

Semester: IVth **5 0 0 3**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Apply knowledge of database for real life applications.	K_3
CO 2	Apply query processing techniques to automate the real time problems of databases.	K_3, K_4
CO 3	Identify and solve the redundancy problem in database tables using normalization.	K_2, K_3
CO 4	Understand the concepts of transactions, their processing so they will familiar with broad range of database management issues including data integrity, security and recovery.	K_2, K_4
CO 5	Design, develop and implement a small database project using database tools.	K_3, K_6

DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	Fields, Vector-spaces, sub-spaces, linear-combination, linear-dependence and independence. Basis, dimensions and coordinates (each and every fact to be illustrated by suitable examples).	**09**
II	Linear-transformation, definition and examples, matrix representation, similarity, range and kernel, rank-nullity theorem and its consequences.	**09**
III	Singular and non singular linear transformations, sum and product of linear transformations, vector space of linear transformations, nilpotent linear transformations.	**09**
IV	Inner product spaces, definition and examples, orthogonality, Cauchy-Schwartz Inquality, Minkowski Inequality, polarization Identity, complete ortho normal set, Bessel's Inequality, Gram-Schmidt's orthogonalization process.	**09**
V	Linear functional, definition and examples, vector space of linear functional, dual vector spaces, adjoint, self adjoint, unitary and normal operators, examples and properties, eigen values and eigen vectors, diagonalisation of linear operators, quadratic forms, principle axis theorem(without proof), some applications to engineering problems.	**09**

Text books:

1. Dym, H. Linear Algebra in action, University Press.2012
2. Halmos, P.R.: Finite Dimensional Vector Spaces (1990) Narosa.
3. Hoffman, K. and Kunze, R.: Linear Algebra PHI (2012)
4. Kolman, B. And Hill, D.R.: Introductory linear algebra with applications(2008) Pearson
5. Lipschutz, S. and Lipson M.: Linear Algebra (2005) Schaum's Series.
6. Noble, B. And Daniel, J.W.: Applied linear algebra. (1988) PHI

DataBase Management Systems

(Course Code: SCA-23403)

Year: 2nd **L T P C**

Semester: IVth **5 0 0 3**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Apply knowledge of database for real life applications.	K_3
CO 2	Apply query processing techniques to automate the real time problems of databases.	K_3, K_4
CO 3	Identify and solve the redundancy problem in database tables using normalization.	K_2, K_3
CO 4	Understand the concepts of transactions, their processing so they will familiar with broad range of database management issues including data integrity, security and recovery.	K_2, K_4
CO 5	Design, develop and implement a small database project using database tools.	K_3, K_6

DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.	**09**
II	**Relational data Model and Language:** Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction on SQL: Characteristics of SQL, Advantage of SQL. SQl Data Type and Literals. Types of SQL Commands. SQL Operators and Their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers,Procedures in SQL/PL SQL	**09**
III	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, & third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.	**09**

IV	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.	**09**
V	**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.	**09**

Text books:

7. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill
8. Date C J, "An Introduction to Database Systems", Addision Wesley
9. Elmasri, Navathe, " Fundamentals of Database Systems", Addision Wesley
10. O'Neil, Databases, Elsevier Pub.
11. RAMAKRISHNAN"Database Management Systems",McGraw Hill
12. Leon &Leon,"Database Management Systems", Vikas Publishing House
13. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications
14. Majumdar& Bhattacharya, "Database Management System", TMH

Computer Networks

(Course Code: SCA-23404)

Year: 2nd **L T P C**

Semester: IVth **5 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO1	Explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission	K_1,K_2
CO2	Apply channel allocation, framing, error and flow control techniques.	K_3
CO3	Describe the functions of Network Layer i.e. Logical addressing, subnetting& Routing Mechanism.	K_2,K_3
CO4	Explain the different Transport Layer function i.e. Port addressing, Connection Management, Error control and Flow control mechanism.	K_2,K_3
CO5	Explain the functions offered by session and presentation layer and their Implementation.	K_2,K_3

DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introductory Concepts**: Goals and applications of networks, Categories of networks, Organization of the Internet, ISP, Network structure and architecture (layering principles, services, protocols and standards), The OSI reference model, TCP/IP protocol suite, Network devices and components. **Physical Layer:** Network topology design, Types of connections, Transmission media, Signal transmission and encoding, Network performance and transmission impairments, Switching techniques and multiplexing.	**12**
II	**Link layer:** Framing, Error Detection and Correction, Flow control (Elementary Data Link Protocols, Sliding Window protocols). Medium Access Control and Local Area Networks: Channel allocation, Multiple access protocols, LAN standards, Link layer switches & bridges (learning bridge and spanning tree algorithms).	**09**
III	**Network Layer:** Point-to-point networks, Logical addressing, Basic internetworking (IP, CIDR, ARP, RARP, DHCP, ICMP), Routing, forwarding and delivery, Static and dynamic routing, Routing algorithms and protocols, Congestion control algorithms, IPv6.	**09**

IV	**Transport Layer:** Process-to-process delivery, Transport layer protocols (UDP and TCP), Multiplexing, Connection management, Flow control and retransmission, Window management, TCP Congestion control, Quality of service.	**10**
V	**Application Layer:** Domain Name System, World Wide Web and Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login, Network management, Data compression, Cryptography – basic concepts.	**10**

Text books and References:

1. Behrouz Forouzan, "Data Communication and Networking", McGraw Hill

2. Andrew Tanenbaum "Computer Networks", Prentice Hall.

3. William Stallings, "Data and Computer Communication", Pearson.

4. Kurose and Ross, "Computer Networking- A Top-Down Approach", Pearson.

5. Peterson and Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann

6. W. A. Shay, "Understanding Communications and Networks", Cengage Learning.

7. D. Comer, "Computer Networks and Internets", Pearson.

8. Behrouz Forouzan, "TCP/IP Protocol Suite", McGraw Hill.

Tableau

(Course Code: SCA-DS-23405)

	L	T	P	C
Year: 2nd				
Semester: IVth	**2**	**0**	**0**	**3**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Application of Tableau skills to solve real-world data analysis problems and business challenges.	K_3
CO 2	how to analyze data trends, patterns, and outliers using Tableau's visual analytics capabilities.	K_3, K_4
CO 3	Principles of effective data visualization design, including choosing appropriate chart types, color usage, and layout..	K_2, K_3
CO 4	How to connect to various data sources (Excel, CSV, databases) and import data into Tableau.	K_2, K_4
CO 5	Variety of visualizations such as bar charts, line charts, scatter plots, maps, and advanced charts like treemaps and box plots.	K_3, K_4

DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Tableau** Overview of Tableau software and its features, Understanding the Tableau interface and navigation, Connecting to Data, Connecting to various data sources (Excel, CSV, databases, etc.), Data preparation and cleaning within Tableau.	**09**
II	**Visualization Techniques** Creating basic charts (bar charts, line charts, scatter plots, etc.), Using filters, sorting, and grouping data, Advanced Visualization Techniques**;** Geographic mapping and spatial analysis ,Advanced chart types (tree maps, heat maps, box plots, etc.)	**09**
III	**Dashboard and Story Creation** Using calculated fields for complex calculations, Creating parameters for dynamic user inputs, Designing interactive dashboards, Creating stories to present insights effectively.	**09**
IV	**Data Blending and Joins** Integrating multiple data sources using joins and blending, Handling data relationships and data blending challenges, Advanced Features; Working with sets, groups, and bins, Using Tableau functions (Table Calculations, LOD expressions)	**09**

V	**Sharing and Publishing** Publishing dashboards to Tableau Server or Tableau Public, Setting permissions and managing access to visualizations, Case Studies and Practical Projects**;** Applying Tableau to real-world datasets, Solving business problems through data visualization, Integration with Other Tools; Connecting Tableau with R, Python, or other analytics tools, Embedding Tableau visualizations in web applications.	**09**

REFERENCES

1. "Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software" by Daniel G.
2. "Tableau Cookbook: Recipes for Data Visualization" by Shweta Sankhe .
3. "Learning Tableau 2020: A Beginner's Guide to Mastering Tableau Quickly and Easily" by Joshua N. Milligan
4. "Communicating Data with Tableau: Designing, Developing, and Delivering Data Visualizations" by Ben Jones.
5. "Tableau Desktop: A Practical Guide for Business Users" by Jane Crofts.
6. "Mastering Tableau 2020.2: A comprehensive guide for effective data visualization and business intelligence with Tableau 2020.2" by Marleen Meier and David Baldwin.
7. "Tableau Data Visualization Cookbook" by Ashutosh Nandeshwar.

AWS

(Course Code: SCA-CC-23405)

Year: 2nd	**L**	**T**	**P**	**C**
Semester: IVth	**2**	**0**	**0**	**3**

Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	The basic concepts of cloud computing and AWS services.	K_3
CO 2	How to deploy and manage Amazon EC2 instances for various use cases (e.g., web hosting, application servers).	K_3, K_4
CO 3	The Security and Identity Services of AWS.	K_2, K_3
CO 4	The Integration and Messaging Services used in cloud.	K_2, K_4
CO 5	How to configure Amazon VPCs (Virtual Private Clouds) and subnetting for network isolation.	K_3, K_4

DETAILED SYLLABUS

Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Cloud Computing and AWS** Overview of cloud computing concepts (IaaS, PaaS, SaaS), Introduction to AWS: history, global infrastructure, and core services.	**09**
II	**AWS Core Services** Compute Services:Amazon EC2 (Elastic Compute Cloud), Amazon Lambda, Amazon ECS (Elastic Container Service), Storage Services:Amazon S3 (Simple Storage Service), Amazon EBS (Elastic Block Store), Amazon Glacier, Database Services:Amazon RDS (Relational Database Service), Amazon DynamoDB, Amazon Aurora, Networking and Content Delivery:Amazon VPC (Virtual Private Cloud), Amazon Route 53 (DNS service), Amazon CloudFront (CDN service).	**09**
III	**Security and Identity Services** AWS IAM (Identity and Access Management), AWS KMS (Key Management Service), AWS Shield, WAF (Web Application Firewall), Monitoring and Management Services:Amazon CloudWatch, AWS CloudTrail, AWS Config.	**09**
IV	**Deployment, Management and Migration** AWS Elastic Beanstalk, AWS OpsWorks, AWS CloudFormation, Migration and Transfer Services: AWS Server Migration Service, AWS Snowball, AWS Database Migration Service. Analytics: Amazon Redshift, Amazon EMR (Elastic MapReduce), Amazon Athena.	**09**

V	**Application Integration & Advanced Topics** Amazon SQS (Simple Queue Service): Amazon SNS (Simple Notification Service), Amazon SWF (Simple Workflow Service), Advanced Topics: High Availability, Scalability, and Fault Tolerance, AWS Auto Scaling, AWS Elastic Load Balancing	**09**

REFERENCES

1. "AWS Certified Solutions Architect Study Guide: Associate SAA-C02 Exam" by Ben Piper, David Clinton
2. "AWS Certified Developer - Associate Guide: Your one-stop solution to passing the AWS developer's certification" by Vipul Tankariya, Bhavin Parmar
3. "AWS Certified SysOps Administrator Study Guide: Associate SOA-C01 Exam" by Stephen Cole, Gareth Digby
4. "AWS Certified Solutions Architect Study Guide: Professional SAA-C02 Exam" by Zeal Vora
5. "AWS Certified Security – Specialty Study Guide: Specialty SCS-C01 Exam" by Zeal Vora
6. "AWS Certified Advanced Networking Official Study Guide: Specialty Exam" by Sidhartha Chauhan
7. "Mastering AWS Security: Create and maintain a secure cloud ecosystem" by Albert Anthony
8. "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis
9. "AWS Certified Big Data Specialty Study Guide: Specialty BDS-C00 Exam" by Charles G. Davis, Robert Stackowiak, et al.
10. "Cloud Native Development Patterns and Best Practices: Practical architectural patterns for building modern, distributed cloud-native systems" by John Gilbert

Indian Values & Traditions

(Course Code: SCA-23406)

Year: 2nd **L T P C**

Semester: IVth **2 0 0 1**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO1	Understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.	K_1,K_2
CO2	Understand the holistic life styles of Yogic-science and wisdom capsules in Sanskrit literature that are important in modern society with rapid technological advancements and societal disruptions.	K1,K2
CO3	To acquaint students with Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.	K1,K2
CO4	Understand the importance of our surroundings and encourage the students to contribute towards sustainable development.	K1,K2
CO5	Be sensitized towards issues related to 'Indian' culture, tradition and its composite character.	K1,K2

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Society State and Polity in India State in Ancient India:** Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women. Four-class Classification, Slavery.	**05**
II	**Indian Literature, Culture, Tradition, and Practices Evolution of script and languages in India:** Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali,Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature,Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature	**05**
III	**Indian Religion, Philosophy, and Practices** Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.	**05**
IV	**Science, Management and Indian Knowledge System** Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India ,Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India ,Writing Technology in India Pyrotechnics in India Trade in Ancient India/,India's Dominance up to Pre-colonial Times	**05**

V	**Cultural Heritage and Performing** Arts Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema	**05**

Text books and References:

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. S. Baliyan, Indian Art and Culture, Oxford University Press, India
3. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
4. Romila Thapar, Readings In Early Indian History Oxford University Press , India
5. Fritz of Capra, Tao of Physics
6. Fritz of Capra, The wave of Life
7. V N Jha (English Translation), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation,Velliarnad,Amaku,am
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
9. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi,2016
10. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
11. P R Sharma (English translation), Shodashang Hridayam
12. Basham, A.L., The Wonder that was India (34th impression), New Delhi, Rupa & co
13. Sharma, R.S., Aspects of Political Ideas and Institutions in Ancient India(fourth edition), Delhi, Motilal Banarsidass,

DBMS Lab

(Course Code: SCA-23408)

	L	T	P	C
Year: 2nd				
Semester: IVth	**0**	**0**	**2**	**2**

List of Experiments (Indicative & not limited to)

1. Installing oracle/ MYSQL
2. Creating Entity-Relationship Diagram using case tools.
3. Writing SQL statements Using ORACLE /MYSQL:
   a) Writing basic SQL SELECT statements.
   b) Restricting and sorting data. c)Displaying data from multiple tables.
   d)Aggregating data using group function.
   e)Manipulating data.
   e)Creating and managing tables.
4. Normalization
5. Creating cursor
6. Creating procedure and functions
7. Creating packages and triggers
8. Design and implementation of payroll processing system
9. Design and implementation of Library Information System
10. Design and implementation of Student Information System
11. Automatic Backup of Files and Recovery of Files
12. Mini project (Design & Development of Data and Application) for following :
    a) Inventory Control System.
    b) Material Requirement Processing.
    c) Hospital Management System.
    d) Railway Reservation System.
    e) Personal Information System.
    f) Web Based User Identification System.
    g) Timetable Management System.
    h) h) Hotel Management System

Machine Learning using Python Lab

(Course Code: SCA-23407)

	L	T	P	C
Year: 2nd				
Semester: IVth	**0**	**0**	**2**	**2**

List of Experiments (Indicative & not limited to)

1. Problem solving using Regression models: Linear regression, Logistic regression and to evaluate the performance.
2. Problem solving using Classification: SVM, K-nearest Neighbour, and Decision Trees and evaluate the performance.
3. Solving problems based on Decision by committee approach : Bagging and Boosting application
4. Problem solving using unsupervised learning models : Clustering algorithms and to evaluate the performance.
5. Application of dimensionality reduction techniques for numeric and text and image data.
6. Game development and robotic application development using reinforcement learning model.
7. Implement Bayesian Inference in Gene Expression Analysis
8. Implement Sequential Learning using Hidden Markov Model
9. Application of CRFs in Natural Language Processing
10. Building and training Nueral networks using back propagation algorithm with gradient descent.
11. Image Classification using Convolutional Neural Networks with cross validation.

Design & Analysis of Algorithm

(Course Code: SCA-23501)

Year: 3rd | **L** | **T** | **P** | **C**
Semester: Vth | **5** | **0** | **0** | **4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.	K_3
CO 2	Find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate).	K_3, K_4
CO 3	Understand the mathematical criterion for deciding whether an algorithm is efficient, and know many practically important problems that do not admit any efficient algorithms.	K_2, K_3
CO 4	Apply classical sorting, searching, optimization and graph algorithms. K2, K4	K_2, K_4
CO 5	Understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.	K_3, K_2

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction** Algorithms, Analyzing Algorithms, Complexity of Algorithms, Growth of Functions, Performance Measurements, Sorting and Order Statistics - Shell Sort, Quick Sort, Merge Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time.	**10**
II	**Advanced Data Structures** Red-Black Trees, B – Trees, Binomial Heaps, Fibonacci Heaps, Tries, Skip List	**10**
III	**Algorithm Design Approaches** Divide and Conquer with Examples Such as Sorting, Matrix Multiplication, Convex Hull and Searching. Greedy Methods with Examples Such as Optimal Reliability Allocation, Knapsack, Minimum Spanning Trees – Prim's and Kruskal's Algorithms, Single Source Shortest Paths - Dijkstra's and Bellman Ford Algorithms.	**12**
IV	**Dynamic Programming Approach** Dynamic Programming with Examples Such as Knapsack. All Pair Shortest Paths – Warshal's and Floyd's Algorithms, Resource Allocation Problem. Backtracking, Branch and Bound with Examples Such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of Subsets.	**10**
V	**NP-Completeness** Fast Fourier Transform, String Matching, Theory of NPCompleteness, Approximation Algorithms and Randomized Algorithms.	**09**

Text books:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, Printice Hall of India.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms", Computer Science Press.
3. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education, 2008.
4. LEE "Design & Analysis of Algorithms (POD)",McGraw Hill.
5. Jon Kleinberg and ÉvaTardos, Algorithm Design, Pearson, 2005.
6. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Wiley, 2006.
7. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins, 1997.
8. Robert Sedgewick and Kevin Wayne, Algorithms, fourth edition, Addison Wesley, 2011.

Software Engineering

(Course Code: SCA-23502)

Year: 3rd **L T P C**

Semester: Vth **5 0 0 3**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Explain various software characteristics and analyze different software DevelopmentModels	K_1, K_2
CO 2	Demonstrate the contents of a SRS and apply basic software quality assurance practices toensure that design, development meet or exceed applicable standards	K_1, K_2
CO 3	Compare and contrast various methods for software design.	K_2, K_3
CO 4	Formulate testing strategy for software systems, employ techniques such as unit testing, Testdriven development and functional testing	K_3
CO 5	Manage software development process independently as well as in teams and make use ofVarious software management tools for development, maintenance and analysis.	K_5
DETAILED SYLLABUS		
Unit		**Proposed Lecture**
I	**Introduction:** Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.	**09**
II	**Software Requirement Specifications (SRS):** Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.	**09**
III	**Software Design:** Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.	**09**

IV	**Software Testing:** Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, TopDown and Bottom- Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.	**09**
V	**Software Maintenance and Software Project Management:** Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.	**09**

Text books:

1. RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Pankaj Jalote, Software Engineering, Wiley
3. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
4. KK Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
5. Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.
6. Ian Sommerville, Software Engineering, Addison Wesley.
7. Kassem Saleh, “Software Engineering”, Cengage Learning.

Data Analysis using R

(Course Code: SCA-DS-23503)

Year: 3rd **L T P C**

Semester: Vth **5 0 0 3**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Discuss various concepts of data analytics pipeline	K_1, K_2
CO 2	Apply classification and regression techniques	K_3
CO 3	Explain and apply mining techniques on streaming data	K_2, K_3
CO 4	Compare different clustering and frequent pattern mining algorithms	K_4
CO 5	Describe the concept of R programming and implement analytics on Big data using R.	K_2,K_3
DETAILED SYLLABUS		
Unit		**Proposed Lecture**
I	**Introduction to Data Analytics:** Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics. **Data Analytics Lifecycle:** Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization.	**09**
II	**Data Analysis:** Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, neural networks: learning and generalisation, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.	**09**
III	**Mining Data Streams:** Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, Real-time Analytics Platform (RTAP) applications, Case studies – real time sentiment analysis, stock market predictions.	**09**
IV	**Frequent Itemsets and Clustering:** Mining frequent itemsets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets in a stream, clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based clusteringmethods, clustering in non-euclidean space, clustering for streams and parallelism.	**09**

V	**Frame Works and Visualization:** MapReduce, Hadoop, Pig, Hive, HBase, MapR, Sharding, NoSQL Databases, S3, Hadoop Distributed File Systems, **Introduction to R** - R graphical user interfaces, data import and export, attribute and data types, descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data.	**09**

Text books and References:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press.
3. John Garrett,Data Analytics for IT Networks : Developing Innovative Use Cases, Pearson Education

Cloud Architecture

(Course Code: SCA-CC-23503)

Year: 3rd **L T P C**

Semester: Vth **5 0 0 3**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.	K_3
CO 2	Find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate).	K_3, K_4
CO 3	Understand the mathematical criterion for deciding whether an algorithm is efficient, and know many practically important problems that do not admit any efficient algorithms.	K_2, K_3
CO 4	Apply classical sorting, searching, optimization and graph algorithms. K2, K4	K_2, K_4
CO 5	Understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.	K_3, K_2
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Advanced Cloud Computing Concepts** Review of cloud service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid), Cloud-native architectures and microservices design principles.	**09**
II	**Cloud Infrastructure Design and Optimization** Designing for scalability, elasticity, and high availability in cloud architectures Cost optimization strategies and tools (e.g., AWS Cost Explorer, Azure Cost Management)	**09**
III	**Advanced Networking and Hybrid Cloud Architectures** Network architecture design in complex cloud environments, Hybrid cloud strategies and integration with on-premises infrastructure (e.g., VPN, Direct Connect, Azure ExpressRoute).	**09**
IV	**Advanced Data Management and Storage Architectures** Designing scalable and fault-tolerant storage solutions (e.g., multi-region replication, geo-redundancy), Big data and analytics architectures using cloud-native services (e.g., AWS EMR, Google BigQuery)	**09**
V	**Advanced Containerization and Orchestration** Container orchestration with Kubernetes in cloud environments (e.g., AWS EKS, Azure Kubernetes Service), Serverless computing architectures and design patterns (e.g., AWS Lambda, Azure Functions).	**09**

Text books:

1. Cloud Architecture Patterns: Using Microsoft Azure" by Bill Wilder.
2. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis.
3. Cloud Native Architectures: Design high-availability and cost-effective applications for the cloud" by Tom Laszewski, Kamal Arora, Erik Farr.
4. Cloud Computing Design Patterns" by Thomas Erl.
5. Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Ricardo Puttini, Zaigham Mahmood.
6. Cloud Native Infrastructure: Patterns for Scalable Infrastructure and Applications in a Dynamic Environment" by Justin Garrison, Kris Nova.
7. Building Cloud Native Applications in Java" by Rafał Leszko.

Software Engineering Lab

(Course Code: SCA-23507)

	L	T	P	C
Year: 3rd				
Semester: Vth	**0**	**0**	**2**	**2**

List of Experiments (Indicative & not limited to)

For any given case/ problem statement do the following;

1. Prepare a SRS document in line with the IEEE recommended standards.
2. Draw the use case diagram and specify the role of each of the actors. Also state the precondition, postcondition and function of each use case.
3. Draw the activity diagram.
4. Identify the classes. Classify them as weak and strong classes and draw the class diagram.
5. Draw the sequence diagram for any two scenarios.
6. Draw the collaboration diagram.
7. Draw the state chart diagram.
8. Draw the component diagram.
9. Perform forward engineering in java. (Model to code conversion)
10. Perform reverse engineering in java. (Code to Model conversion)
11. Draw the deployment diagram.

Design & Analysis of Algorithm Lab

(Course Code: SCA-23508)

Year: 3rd	**L**	**T**	**P**	**C**
Semester: Vth	**0**	**0**	**2**	**2**

List of Experiments (Indicative & not limited to)

1. Program for Recursive Binary & Linear Search.

2. Program for Heap Sort.

3. Program for Merge Sort.

4. Program for Selection Sort.

5. Program for Insertion Sort.

6. Program for Quick Sort.

7. Knapsack Problem using Greedy Solution

8. Perform Travelling Salesman Problem

9. Find Minimum Spanning Tree using Kruskal's Algorithm

10. Implement N Queen Problem using Backtracking

11. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.

12. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.

Minor Project

(Course Code: SCA-23506)

Year: 3rd	**L**	**T**	**P**	**C**
Semester: Vth	**2**	**0**	**0**	**2**

Mini Project or Internship Assessment		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Developing a technical artifact requiring new technical skills and effectively utilizing a new software tool to complete a task	K_4 , K_5
CO 2	Writing requirements documentation, Selecting appropriate technologies, identifying and creating appropriate test cases for systems.	K_5 , K_6
CO 3	Demonstrating understanding of professional customs & practices and working with professional standards.	K_4 , K_5
CO 4	Improving problem-solving, critical thinking skills and report writing.	K_4 , K_5
CO 5	Learning professional skills like exercising leadership, behaving professionally, behaving ethically, listening effectively, participating as a member of a team, developing appropriate workplace attitudes.	K_2, K_4

DISCIPLINE SPECIFIC ELECTIVE-I

Soft Computing Techniques

(Course Code: SCA-DE1-23502)

Year: 3rd	**L**	**T**	**P**	**C**
Semester: Vth	**2**	**0**	**0**	**2**

I	**Introduction to Soft Computing:** Introduction, Comparison with hard computing, Concept of learning and adaptation, Constituents of soft computing, Applications of soft computing. **Artificial Neural Networks:** Basic concepts of neural networks, Human brain, Biological neural network, History of artificial neural networks, Basic building blocks of an artificial neuron, Neural network architectures, Activation functions, Characteristics and limitation of neural networks.	**08**
II	**Artificial Neural Networks:** Learning methods - Supervised, Unsupervised, Reinforcement, Hebbian, Gradient descent, Competitive, Stochastic. **Major classes of neural networks:** Perceptron networks, Multilayer perceptron model, Back-propagation network, Radial basis function network, Recurrent neural network, Hopfield networks, Kohonen self-organizing feature maps.	**08**
III	**Fuzzy Logic:** Introduction to Fuzzy Logic, Comparison with crisp logic, Properties of classical sets, Operations on classical sets, Properties of fuzzy sets, Operations on fuzzy sets, Classical relations, Fuzzy relations, Features andtypes of fuzzy membership functions, Fuzzy arithmetic, Fuzzy measures. **Fuzzy Systems:** Crisp logic, Predicate logic, Fuzzy logic, Fuzzy propositions, Inference rules, Fuzzy inference systems- Fuzzification, Inference, Defuzzification, Types of inference engines.	**08**
IV	**Evolutionary Computing:** Introduction, Evolutionary algorithm, Biological evolutionary process, Paradigms of evolutionary computing – Genetic algorithm and Genetic programming, Evolutionary strategies, Evolutionary programming. **Genetic Algorithm:** Introduction, Traditional optimization and search techniques, Comparison with traditional algorithms, Operations- Encoding, Selection, Crossover and Mutation, Classification of Genetic algorithm.	**08**
V	**Hybrid Soft Computing Techniques:** Introduction, Classification of hybrid systems, Neuro-fuzzy hybrid systems, Neuro-genetic hybrid systems, Fuzzy-genetic hybrid systems. **Other Soft Computing Techniques:** Tabu Search, Ant colony based optimization, Swarm Intelligence.	**08**

Suggested Readings:

1. Sivanandam S.N. and Deepa S.N., “Principles of Soft Computing”, Wiley-India.
2. Rajasekaran S. and Vijayalakshmi Pai G.A., “Neural Networks, Fuzzy Logic and Genetic Algorithms- Synthesis and Applications”, PHI Learning.
3. Chakraverty S., Sahoo D.M. and Mahato N. R., “Concepts of Soft Computing- Fuzzy and ANN with Programming”, Springer.
4. Kaushik S. and Tiwari S., “Soft Computing – Fundamentals, Techniques and Applications’, McGrawHill Education.
5. Jang J.-S.R., Sun C.-T. and Mizutani E., “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India.
6. Karray F. O. and Silva C. D., “Soft Computing and Intelligent Systems Design – Theory, Tools and Applications”, Pearson Education.
7. Freeman J. A. and Skapura D. M., “Neural Networks: Algorithms, Applications and Programming Techniques”, Pearson.
8. Siman H., “Neural Netowrks”, Prentice Hall of India.

DISCIPLINE SPECIFIC ELECTIVE-I

Business Analytics

(Course Code: SCA-DE1-23501)

Year: 3rd	**L**	**T**	**P**	**C**
Semester: Vth	**2**	**0**	**0**	**2**

Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to :		
CO 1	Understand the basic concepts, principles, and importance of business analytics in organizations.	K_2, K_4
CO 2	Understand how data-driven decision-making can impact business strategy and performance.	K2,K_4, K_6
CO 3	Identify and gather relevant data sources for analysis.	K_3, K_5
CO 4	Build predictive models using techniques like regression, classification, and time series forecasting.	K_3, K_4
CO 5	Understand ethical issues related to data privacy, confidentiality, and bias in data analysis.	K3, K5

DETAILED SYLLABUS

Unit		**Proposed Lecture**
I	**Introduction to Business Analytics** Overview of business analytics, its importance, and applications in various industries, Introduction to data-driven decision-making and its impact on business strategy, Data Collection and Preparation:Data sources and types (structured vs. unstructured data), Data cleaning, transformation, and integration processes. Exploratory Data Analysis (EDA):Techniques for summarizing and visualizing data (descriptive statistics, data visualization), Identifying patterns, trends, and outliers in data.	**08**
II	**Statistical Methods for Business Analytics** Probability theory and distributions, Statistical inference (hypothesis testing, confidence intervals) Predictive Analytics, Regression analysis (linear and logistic regression), Time series analysis and forecasting techniques.	**08**
III	**Machine Learning Basics** Introduction to machine learning algorithms (supervised vs. unsupervised learning), Model evaluation and performance metrics, Data Mining and Pattern Recognition, Association rule mining (market basket analysis), Clustering techniques (k-means clustering, hierarchical clustering).	**08**
IV	**Big Data Analytics** Challenges and opportunities of analyzing big data, Tools and technologies for big data analytics (Hadoop, Spark), Text Analytics and Sentiment Analysis: Analyzing textual data for insights (natural language processing, sentiment analysis), Applications of text analytics in business decision-making.	**08**
V	**Ethical and Legal Issues in Business Analytics:** Privacy concerns, data security, and regulatory compliance (e.g., GDPR, HIPAA) - Ethical considerations in data collection, analysis, and use. Real-world applications of business analytics in various industries (e.g., marketing, finance, operations).	**08**

Text books:

1. “Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett
2. "Business Analytics: Data Analysis & Decision Making" by S. Christian Albright, Wayne L. Winston, Christopher Zappe
3. "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die" by Eric Siegel
4. "Storytelling with Data: A Data Visualization Guide for Business Professionals" by Cole Nussbaumer Knaflic.
5. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney.
6. "Big Data Analytics: Turning Big Data into Big Money" by Frank J. Ohlhorst.
7. "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling" by Ralph Kimball and Margy R
8. "Data-Driven: Creating a Data Culture" by Hilary Mason and DJ Patil.
9. "Practical Statistics for Data Scientists: 50 Essential Concepts" by Peter Bruce and Andrew Bruce.
10. "Machine Learning for Business: Using Amazon SageMaker and Jupyter" by Doug Hudgeon and Richard Nichol.

DISCIPLINE SPECIFIC ELECTIVE-I

E-Commerce

(Course Code: SCA-DE1-23503)

Year: 3rd

Semester: Vth

L	T	P	C
2	0	0	2

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to :		
CO 1	Understand the concept, evolution, and significance of E-commerce in the digital economy.	K_2, K_4
CO 2	Understand the various types of E-commerce models (B2B, B2C, C2C, etc.) and their applications.	K2,K_4, K_6
CO 3	Identify and evaluate E-commerce infrastructure components (e.g., web hosting, domain management, security protocols).	K_3, K_5
CO 4	Integrate secure payment gateways and ensure compliance with PCI DSS standards.	K_3, K_4
CO 5	Understand E-commerce regulations (e.g., GDPR, CCPA) and compliance requirements.	K3, K5

DETAILED SYLLABUS

Unit		Proposed Lecture
I	**Introduction to E-Commerce** Overview of electronic commerce: definition, evolution, and significance in modern business, Types of E-commerce: B2B, B2C, C2C, and emerging models (e.g., P2P, mobile commerce), E-Commerce Business Models; Analysis of different E-commerce business models (e.g., marketplace, subscription, direct-to-consumer), Case studies of successful E-commerce businesses and their strategies.	**08**
II	**E-Commerce Infrastructure and Technologies** Overview of E-commerce infrastructure: web hosting, domain names, SSL certificates, E-commerce platforms and content management systems (e.g., Shopify, Magento, WooCommerce). Principles of effective website design for E-commerce.	**08**
III	**Online Payment Systems and Security** Payment gateway integration: PayPal, Stripe, credit card processors, Security measures in E-commerce: SSL/TLS encryption, PCI DSS compliance.	**08**
IV	**E-Commerce Marketing Strategies** Digital marketing techniques for E-commerce: SEO, SEM, email marketing, social media marketing, Conversion rate optimization (CRO) and customer acquisition strategies, Customer Relationship Management (CRM):Building customer relationships through E-commerce, Implementing CRM systems and strategies for personalized marketing and customer support.	**08**
V	**Legal and Ethical Issues in E-Commerce** E-commerce regulations and compliance (e.g., GDPR, CCPA), Intellectual property rights, consumer protection, and online dispute resolution, International E-Commerce: Global E-commerce trends and challenges, Cross-border E-commerce strategies and localization considerations.	**08**

Text books:

1. "E-commerce 2021: Business, Technology, Society" by Kenneth C. Laudon and Carol Guercio Traver
2. "E-commerce for Dummies" by Don Jones and Mark D. Scott
3. "The Everything Store: Jeff Bezos and the Age of Amazon" by Brad Stone
4. "Shopify Empire: Dominate E-commerce & Become a Shopify Ninja!" by Josh Highland
5. "E-commerce Evolved: The Essential Playbook to Build, Grow & Scale a Successful E-commerce Business" by Tanner Larsson
6. "E-commerce Website Optimization: Why 95% of Your Website Visitors Don't Buy, and What You Can Do About It" by Dan Croxen-John and Johann van Tonder
7. "The Long Tail: Why the Future of Business is Selling Less of More" by Chris Anderson
8. "Hooked: How to Build Habit-Forming Products" by Nir Eyal
9. "E-commerce Marketing: How to Drive Traffic That Buys to Your Website" by Susan Hallam
10. "E-commerce Analytics: Analyze and Improve the Impact of Your Digital Strategy" by Judah Phillips
11. "Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business" by Paul May

DISCIPLINE SPECIFIC ELECTIVE-2

Natural Language Processing

(Course Code: SCA-DE2-23501)

Year: 3rd **Semester: Vth**

L	T	P	C
2	0	0	2

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able :		
CO 1	To learn the fundamentals of natural language processing	K_1 , K_2
CO 2	To understand the use of CFG and PCFG in NLP	K_1 , K_2
CO 3	To understand the role of semantics of sentences and pragmatic	K_2
CO 4	To Introduce Speech Production And Related Parameters Of Speech.	K_1 , K_2
CO 5	To Show The Computation And Use Of Techniques Such As Short Time Fourier Transform, Linear Predictive Coefficients And Other Coefficients In The Analysis Of Speech.	K_3, K_4

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**INTRODUCTION:** Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance **WORD LEVEL ANALYSIS :** Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.	**08**
II	**SYNTACTIC ANALYSIS:** Context Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.	**08**
III	SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.	**08**
IV	**BASIC CONCEPTS of Speech Processing :** Speech Fundamentals: Articulatory Phonetics – Production And Classification Of Speech Sounds; Acoustic Phonetics – Acoustics Of Speech Production; Review Of Digital Signal Processing Concepts; Short-Time Fourier Transform, Filter-Bank And LPC Methods.	**08**

V	**SPEECH-ANALYSIS**: Features, Feature Extraction And Pattern Comparison Techniques: Speech Distortion Measures– Mathematical And Perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances And Filtering, Likelihood Distortions, Spectral Distortion Using A Warped Frequency Scale, LPC, PLP And MFCC Coefficients, Time Alignment And Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths. **SPEECH MODELING** : Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-Estimation, Implementation Issues.	**08**

Text books:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural LanguageProcessing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReillyMedia, 2009.
3. Lawrence Rabiner And Biing-Hwang Juang, "Fundamentals Of Speech Recognition", Pearson Education, 2003.
4. Daniel Jurafsky And James H Martin, "Speech And Language Processing – An Introduction To Natural LanguageProcessing, Computational Linguistics, And Speech Recognition", Pearson Education, 2002.
5. Frederick Jelinek, "Statistical Methods Of Speech Recognition", MIT Press, 1997.
6. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.
7. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapmanand Hall/CRC Press, 2010.
8. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

DISCIPLINE SPECIFIC ELECTIVE-2

BioInformatics

(Course Code: SCA-DE2-23503)

Year: 3rd **L T P C**

Semester: Vth **2 0 0 2**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to :		
CO 1	Gather knowledge of basic bioinformatics and computational biology concepts.	K_2, K_4
CO 2	Perform analysis of biological data including proteomic, genomic and transcriptomic data and provide meaningful interpretation of the results.	K2,K_4, K_3
CO 3	Understand machine learning techniques, microarray data analysis and interpretation of results.	K_3, K_5
CO 4	Understand the concepts of modelling for bioinformatics.	K_3, K_4
CO 5	Perform analysis of various methods of phylogenetic tree construction and its evolutions.	K3, K4
DETAILED SYLLABUS		
Unit		**Proposed Lecture**
I	INTRODUCTION Bio Bioinformatics- Need for Bioinformatics technologies; overview of technologies; structural bioinformatics, data format and processing, secondary resources and applications, role of structural bioinformatics, biological data integration system.	**08**
II	**DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS** Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics- Case Study on Artificial Neural Networks Applications in Protein secondary structure prediction.	**08**
III	**GRAPHS** Hidden Markov modeling for biological data analysis and protein, gene families Sequence identification –Sequence classification – multiple alignment generation – Comparative modeling – Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks – Molecular modeling – Computer programs for molecular modeling.	**08**
IV	**PHYLOGENETICS AND MODELS OF EVLOUTION** Introduction to Phylogenetics, Jukes Cantor and Kimura Models of Evolution, Distance and Character based methods for phylogenetic tree construction: Unweighted Pair Group Method of Arithmetic Averages, Neighbour joining Trees, Maximum Likelihood Trees, Ultra metric and Min ultra metric trees, Parsimonous trees, Additive trees, Assessing there liability of phylogenetic trees- Bootstrapping	**08**
V	**MICROARRAY ANALYSIS** Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster	**08**

	analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model – Benchmark – Tradeoffs.	

Text books:

1. David W. Mount Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, 2nd ed., 2004
2. Arthur M .Lesk, Introduction to Bioinformatics, Oxford University Press, 2014
3. Big Data Analysis for Bioinformatics and Biomedical Discoveries Edited by Shui Qing Ye, CRC Press, Taylor and Francis Group, 2015
4. Bolón-Canedo, V., & Alonso-Betanzos, A. (Eds.). Microarray Bioinformatics. Methods in Molecular Biology, 2019
5. Andrew R.Leach, Molecular Modeling Principles And Applications, Prentice Hall,2009.
6. Baldi,P.,Brunak, S.Bioinformatics: The Machine Learning Approach, East West Press, 2nd 2001
7. Orpita Bosu, Bioinformatics – Databases, Tools and Algorithms, Oxford University Press, 2007.

Big Data Analytics using Hadoop

(Course Code: SCA-DS-23601)

Year: 3rd **L T P C**

Semester: VIth **5 0 0 4**

At the end of course , the student will be able:		
CO 1	To Understanding of Big Data Concepts, characteristics, challenges, and opportunities associated with Big Data.	K_1 , K_2
CO 2	To understand Describe the architecture and components of the Hadoop ecosystem, including HDFS, YARN, and MapReduce.	K_1 , K_3
CO 3	To identify key Hadoop ecosystem projects (e.g., Hive, Pig, HBase, Spark) and their roles in Big Data analytics.	K_2 , K_3
CO 4	To understand MapReduce programming paradigm for distributed data processing.	K_4 , K_6
CO 5	To discuss ethical considerations related to data privacy, security, and bias in Big Data analytics.	K_4, K_5

DETAILED SYLLABUS

Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Big Data and Hadoop** Overview of Big Data: characteristics, challenges, and opportunities.Introduction to Hadoop: history, architecture, and components (HDFS, YARN, MapReduce). Hadoop Installation and Configuration, Setting up a Hadoop cluster: installation steps, configuration of nodes, and cluster management, Hands-on lab: configuring Hadoop on a local or cloud-based environment.	**10**
II	**Hadoop Distributed File System (HDFS)** HDFS architecture and data storage principles, Performing basic file operations (uploading, downloading, managing files) using HDFS commands. MapReduce Programming Model Introduction to MapReduce paradigm for distributed data processing. Writing MapReduce programs in Java: mapper, reducer, partitioner, and combiner functions.	**10**
III	**Hadoop Ecosystem Components** Overview of Hadoop ecosystem projects: HBase, Hive, Pig, Spark, Kafka, etc. Use cases and scenarios for integrating different Hadoop ecosystem components. Hive and HBase for Data Warehousing and NoSQL Introduction to Hive for SQL-like querying and data warehousing on Hadoop.Introduction to HBase for real-time read/write access to Big Data using NoSQL database principles.	**10**
IV	**Data Ingestion and Integration** Techniques for ingesting data into Hadoop ecosystem (batch processing, real-time streaming). Using tools like Apache Flume and Apache Kafka for data ingestion. Data Analysis and Visualization Performing data analysis on Hadoop using tools like Apache Pig and Spark SQL.	**10**
V	**Security and Governance** Ensuring data security in Hadoop: authentication, authorization, encryption. Implementing governance policies and compliance standards (e.g., GDPR, HIPAA) in Big Data environment.	**10**

Textbooks

1. "Hadoop: The Definitive Guide" by Tom White
2. "Hadoop Operations" by Eric Sammer
3. "Hadoop in Practice" by Alex Holmes
4. "Big Data Analytics with Hadoop 3" by Benjamin Bengfort, Jenny Kim
5. "Mastering Hadoop" by Sandeep Karanth
6. "Data Algorithms: Recipes for Scaling Up with Hadoop and Spark" by Mahmoud Parsian
7. "Learning Spark: Lightning-Fast Big Data Analysis" by Holden Karau, Andy Konwinski, et al.
8. "Big Data: Principles and Best Practices of Scalable Real-Time Data Systems" by Nathan Marz, James Warren
9. "Programming Pig: Dataflow Scripting with Hadoop" by Alan Gates

Advanced Cloud Computing

(Course Code: SCA-CC-23601)

Year: 3rd **L T P C**
Semester: VIth **5 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Earn basic knowledge of Cloud Technologies in use today .	K_1, K_2
CO 2	Understand strategic plan to move applications and services to the Cloud .	K_3
CO 3	Understand Cloud Segments and Cloud Deployment Models .	K_2, K_3
CO 4	Understand the importance of security in cloud computing.	K_4
CO 5	Understand static application development using service models .	K_2,K_3

DETAILED SYLLABUS		
Unit		**Proposed Lecture**
I	**Cloud Based Applications**:- Introduction, Contrast traditional software development and development for the cloud. Public v private cloud apps. Understanding Cloud ecosystems – what is SaaS/PaaS, popular APIs, mobile.	**10**
II	**Designing code for the cloud:** Class and Method design to make best use of the Cloud infrastructure;Web Browsers and the Presentation Layer: Understanding Web browsers attributes and differences. Building blocks of the presentation layer: HTML, HTML5, CSS.	**10**
III	**Web development techniques and frameworks:-** Building Ajax controls, introduction to Javascriptusing JQuery, working with JSON, XM. Deployment Environments – Platform As A Service (PAAS) ,Amazon and Google App Engine.	**10**
IV	**Developing Cloud Application with SDK for Node.JS**: Explaining the origin and purpose of the Node.js JavaScript framework , Writing a simple web server with Node.js, Import Node.js modules into your script, Deploying an IBM SDK for Node.js application on an IBM Cloud account, Explaining the concept of anonymous callback functions, Explaining the concept of asynchronous callback functions, Handling inbound HTTP method calls for a server resource .	**10**
V	**Web Services and Application Deployment:** Understanding the Watson Natural Language Understanding service, Create and Deploy Applications.	**10**

Text Books
1. Chris Hay, Brian Prince, Azure in Action [ISBN: 978-1935182481]
2. Henry Li, Introducing Windows Azure [ISBN: 978-1-4302-2469-3]

Reference Books
1. Eugenio Pace, Dominic Betts, Scott Densmore, Ryan Dunn, Masashi Narumoto, MatiasWoloski, Developing Applications for the Cloud on the Microsoft Windows Azure Platform [ISBN: 9780735656062]
2. Eugene Ciurana, Developing with Google App Engine [ISBN: 978-1430218319]
3. Charles Severance, Using Google App Engine [ISBN: 978-0596800697]

Big Data Analytics using Hadoop Lab

(Course Code: **SCA-DS-23604**)

	L	T	P	C
Year: 3rd				
Semester: VIth	**0**	**0**	**2**	**2**

List of Experiments (Indicative & not limited to)

1. Install Hadoop on a virtual machine or cloud platform (e.g., AWS, Google Cloud).

2. Perform basic operations with HDFS (file system commands, file uploads, downloads).

3. Implement the classic Word Count program using MapReduce.

4. Write MapReduce programs for specific data processing tasks (e.g., data aggregation, filtering).

5. Create tables, load data, and execute HiveQL queries for data warehousing tasks.

6. Perform joins, aggregations, and transformations using Hive.

7. Write Pig Latin scripts for data processing workflows (e.g., ETL operations).

8. Implement data pipelines using Pig for cleaning and transforming datasets.

9. Set up and interact with HBase tables for real-time data management.

10. Perform CRUD (Create, Read, Update, Delete) operations using HBase API.

Advanced Cloud Computing Lab

(Course Code: SCA-CC-23604)

	L	T	P	C
Year: 3rd				
Semester: VIth	**0**	**0**	**2**	**2**

List of Experiments (Indicative & not limited to)

1. Provision cloud instances on AWS, Azure, or Google Cloud Platform (GCP).
2. Explore compute, storage, networking, and database services offered by major cloud providers.
3. Deploy and manage virtual machines (VMs) on cloud platforms.
4. Implement auto-scaling policies and set up load balancers for high availability.
5. Configure network settings, subnets, and security groups.
6. Use cloud-native tools for network monitoring and logging.
7. Configure IAM roles, policies, and permissions.
8. Monitor and optimize cloud costs using cost management tools and best practices.
9. Use Terraform or AWS CloudFormation for provisioning infrastructure.
10. Configure and manage data lakes using services like AWS S3 and EMR or Azure Data Lake and HDInsight.

Data Mining & Data Warehousing

(Course Code: SCA-23605)

Year: 3rd	**L**	**T**	**P**	**C**
Semester: VIth	**4**	**0**	**0**	**2**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Be familiar with mathematical foundations of data mining tools..	K1 , K2
CO 2	Understand and implement classical models and algorithms in data warehouses and data mining	K3
CO 3	Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.	K1 , K2
CO 4	Master data mining techniques in various applications like social, scientific and environmentalcontext.	K3
CO 5	Develop skill in selecting the appropriate data mining algorithm for solving practical problems.	K1 , K2
DETAILED SYLLABUS		
Unit		**Proposed Lecture**
I	**Data Warehousing:** Overview, Definition, Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept	**08**
II	**Data Warehouse Process and Technology:** Warehousing Strategy, Warehouse /management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, Distributed DBMS implementations, Warehousing Software, Warehouse Schema Design,	**08**
III	**Data Mining:** Overview, Motivation, Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation, Decision Tree.	**08**
IV	**Classification**: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms. Clustering: Introduction, Similarity and Distance Measures, Hierarchical and Partitional Algorithms. Hierarchical Clustering- CURE and Chameleon. Density Based Methods- DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method – Statistical Approach, Association rules: Introduction, Large Item sets, Basic Algorithms, Parallel and Distributed Algorithms, Neural Network approach.	**08**
V	**Data Visualization and Overall Perspective:** Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. Warehousing applications and Recent Trends: Types of Warehousing Applications, Web Mining, Spatial Mining and Temporal Mining	**08**

Text books:

1. Alex Berson, Stephen J. Smith “Data Warehousing, Data-Mining & OLAP”, TMH
2. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, “ Data Warehousing: Architecture and Implementation”,Pearson
3. Margaret H. Dunham, S. Sridhar,”Data Mining:Introductory and Advanced Topics” Pearson Education
4. Arun K. Pujari, “Data Mining Techniques” Universities Press
5. Pieter Adriaans, Dolf Zantinge, “Data-Mining”, Pearson Education

Major Project

(Course Code: SCA-23603)

Year: 3rd **L T P C**

Semester: VIth **0 0 6 8**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Analyze and understand the real life problem and apply their knowledge to get programming solution.	K_4 , K_5
CO 2	Engage in the creative design process through the integration and application of diverse technical knowledge and expertise to meet customer needs and address social issues.	K_4 , K_5
CO 3	Use the various tools and techniques, coding practices for developing real life solution to the problem.	K_5 , K_6
CO 4	Find out the errors in software solutions and establishing the process to design maintainable software applications	K_4 , K_5
CO 5	Write the report about what they are doing in project and learning the team working skills	K_5, K_6

ELECTIVE – 3
Pattern Recognition
(Course Code - SCA-DE3-23601)

Year: 3rd **L T P C**

Semester: VIth **4 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Be familiar with foundations of pattern recognition.	K1 , K2
CO 2	Statistical Patten Recognition.	K3
CO 3	Characterize the Parameter estimation methods.	K1 , K2
CO 4	Master Nonparametric Techniques**.**	K3
CO 5	Develop skill in Unsupervised Learning & Clustering**.**	K1 , K2
DETAILED SYLLABUS		
Unit		**Proposed Lecture**
I	**Introduction:** Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.	**10**
II	**Statistical Patten Recognition:** Bayesian Decision Theory, Classifiers, Normal density and discriminant functions.	**10**
III	**Parameter estimation methods:** Maximum-Likelihood estimation, Bayesian Parameterestimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.	**10**
IV	**Nonparametric Techniques:** Density Estimation, Parzen Windows, K-Nearest NeighborEstimation, Nearest Neighbor Rule, Fuzzy classification.	**10**
V	**Unsupervised Learning & Clustering:** Criterion functions for clustering, Clustering Techniques:Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.	**10**

Text books:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006.
2. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2009.
3. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Edition, Academic Press, 2009.

ELECTIVE – 3
Text Mining & Analysis
(Course Code - SCA-DE3-23602)

Year: 3rd **L T P C**

Semester: VIth **4 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	The fundamental principles of text mining, including text preprocessing, feature extraction, and data representation techniques.	K1 , K2
CO 2	The challenges and opportunities associated with analyzing unstructured textual data.	K3
CO 3	text mining techniques such as information retrieval, sentiment analysis, topic modeling, and entity recognition.	K1 , K2
CO 4	supervised learning algorithms (e.g., Naive Bayes, SVM) for text classification tasks and apply unsupervised clustering techniques (e.g., k-means, hierarchical clustering) to group similar documents based on content.	K3
CO 5	Develop skill in Web Scraping**.**	K1 , K2
DETAILED SYLLABUS		
Unit		**Proposed Lecture**
I	**Introduction: I**ntroduction to Text Mining, Overview of Text Mining: Definition, goals, and applications in various domains. Text Preprocessing: Techniques for cleaning and preprocessing textual data (e.g., tokenization, stemming, stop words removal). Text Retrieval and Information Extraction Information Retrieval: Basics of document retrieval using techniques like TF-IDF and cosine similarity. Named Entity Recognition (NER): Methods for identifying and extracting entities (e.g., names, organizations) from text.	**10**
II	**Sentiment Analysis and Opinion Mining** Sentiment Analysis: Techniques for determining sentiment polarity (positive, negative, neutral) in text. Opinion Mining: Methods for extracting opinions, attitudes, and emotions from textual data.	**10**
III	**Text Classification**: Supervised learning algorithms (e.g., Naive Bayes, SVM) for classifying text into predefined categories. **Text Clustering**: Unsupervised techniques (e.g., k-means clustering, hierarchical clustering) for grouping similar documents.	**10**
IV	**Text Summarization:** Techniques for generating concise summaries from large text documents (e.g., extractive vs. abstractive). **Text Generation**: Introduction to natural language generation (NLG) techniques for generating human-like text.	**10**
V	**Web Scraping and Text Collection** Web Scraping: Techniques for collecting textual data from web sources using Python libraries (e.g., BeautifulSoup, Scrapy). Ethical Considerations: Guidelines and ethical considerations in web scraping and data collection.	**10**

Text books:

1. Introduction to Information Retrieval by Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze
2. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit by Steven Bird, Ewan Klein, and Edward Loper
3. Text Mining: Applications and Theory by Michael W. Berry and Jacob Kogan
4. Mining Text Data by Charu C. Aggarwal and ChengXiang Zhai
5. Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data by Dipanjan Sarkar
6. Foundations of Statistical Natural Language Processing by Christopher D. Manning and Hinrich Schütze
7. Applied Text Analysis with Python: Enabling Language-Aware Data Products with Machine Learning by Benjamin Bengfort, Rebecca Bilbro, and Tony Ojeda
8. Text Mining in Practice with R by Ted Kwartler
9. Text Mining: From Ontology Learning to Automated Text Processing Applications by Mark A. Greenwood
10. Practical Text Mining and Statistical Analysis for Non-structured Text Data Applications by Gary Miner, John Elder IV, Andrew Fast, Thomas Hill, and Robert Nisbet

ELECTIVE – 3
Software Project Management
(Course Code - SCA-DE3-23603)

Year: 3rd **L T P C**

Semester: VIth **4 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Be familiar with foundations of Software Project Management.	K1 , K2
CO 2	Project Organization and Scheduling	K3
CO 3	Characterize the dimensions of Project Monitoring & Control.	K1 , K2
CO 4	Explore various components of Software Quality Assurance and Testing**.**	K3
CO 5	Develop skill in Project Management and Project Management Tools.	K1 , K2

DETAILED SYLLABUS

Unit		Proposed Lecture
I	**Introduction:** Introduction and Software Project Planning, Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.	**10**
II	**Project Organization and Scheduling** Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts.	**10**
III	**Project Monitoring and Control** Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.	**10**
IV	**Software Quality Assurance and Testing** Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Cleanroom process.	**10**
V	**Project Management and Project Management Tools** Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.	**10**

Text books:

1. M. Cotterell, Software Project Management, Tata McGraw-Hill Publication.
2. Royce, Software Project Management, Pearson Education
3. Kieron Conway, Software Project Management, Dreamtech Press
4. S. A. Kelkar, Software Project Management, PHI Publication.
5. Harold R. Kerzner, Project Mangment "A Systems Approach to Planning, Scheduling, and Controlling" Wiley.
6. Mohapatra, Software Project Management, Cengage Learning.

Deep Learning

(Course Code: SCA-23701)

Year: 4th **Semester: VIIth**

L	T	P	C
3	0	0	4

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able :		
CO 1	To present the mathematical, statistical and computational challenges of building neural networks	K_1 , K_2
CO 2	To study the concepts of deep learning	K_1 , K_2
CO 3	To introduce dimensionality reduction techniques	K_2
CO 4	To enable the students to know deep learning techniques to support real-time applications	K_2 , K_3
CO 5	To examine the case studies of deep learning techniques	K_3, K_6

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	INTRODUCTION : Introduction to machine learning- Linear models (SVMs and Perceptrons,logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universalfunction approximates	**10**
II	DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep VsShallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning	**10**
III	DIMENTIONALITY REDUCTION 9 Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization	**10**
IV	OPTIMIZATION AND GENERALIZATION : Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience	**10**
V	CASE STUDY AND APPLICATIONS : Image net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene Understanding-Gathering Image Captions	**10**

Text books:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.

2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.

4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

DEPARTMENT ELECTIVE - 4

Distributed System

(Course Code: SCADE-4-23701)

Year: 4th | **L** | **T** | **P** | **C**

Semester: VIIth | **3** | **0** | **0** | **4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	To provide hardware and software issues in modern distributed systems.	K1 , K2
CO 2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.	K2
CO 3	To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.	K4
CO 4	To know about Shared Memory Techniques and have Sufficient knowledge about file access	K1
CO 5	Have knowledge of Synchronization and Deadlock.	K1
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Characterization of Distributed Systems**: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Architectural models, Fundamental Models. Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks ,Lamport's& vectors logical clocks. Concepts in Message Passing Systems: causal order, total order, total causal order, Techniques for Message Ordering, Causal ordering of messages, global state, termination detection.	**10**
II	**Distributed Mutual Exclusion:** Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non token based algorithms, performance metric for distributed mutual exclusion algorithms. Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms.	**10**
III	**Agreement Protocols:** Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system. Distributed Resource Management: Issues in distributed File Systems, Mechanism for building distributed file systems, Design issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory.	**10**
IV	Failure Recovery in Distributed Systems: Concepts in Backward and Forward recovery, Recovery in Concurrent systems, Obtaining consistent Checkpoints, Recovery in Distributed Database Systems. Fault Tolerance: Issues in Fault Tolerance, Commit Protocols, Voting protocols, Dynamic voting protocols	**10**

V	**Transactions and Concurrency Control**: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control. Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.	**10**

Text books:

1. Singhal&Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill

2. Ramakrishna,Gehrke," Database Management Systems", McGraw Hill

3. Vijay K.Garg Elements of Distributed Compuitng , Wiley

4. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education

5. Tenanuanbaum, Steen," Distributed Systems", PHI

DEPARTMENT ELECTIVE - 4

Business Intelligence

(Course Code: SCADE-4-23702)

Year: 4th **L T P C**

Semester: VIIth **3 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand the essentials of BI & data analytics and the corresponding terminologies	K_2
CO 2	Analyze the steps involved in the BI - Analytics process	K_3, K_4
CO 3	Illustrate competently on the topic of analytics	K_2, K_3
CO 4	Understand & Implement the K-Means Clustering with Iris Dataset	K_2, K_3
CO 5	Demonstrate the real time scenario (Case study) by using BI & Analytics techniques	K_5, K_6

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**BUSINESS INTELLIGENCE – INTRODUCTION:** Introduction - History and Evolution: Effective and Timely decisions, Data Information and Knowledge, Architectural Representation, Role of mathematical Models, Real Time Business Intelligent System.	**10**
II	**BI – DATA MINING & WAREHOUSING:**Data Mining - Introduction to Data Mining, Architecture of Data Mining and How Data mining works(Process) , Functionalities & Classifications of Data Mining, Representation of Input Data, Analysis Methodologies. Data Warehousing - Introduction to Data Warehousing, Data Mart, Online Analytical Processing (OLAP) – Tools, Data Modelling, Difference between OLAP and OLTP, Schema – Star and Snowflake Schemas, ETL Process – Role of ETL	**10**
III	**BI – DATA PREPARTTION:** Data Validation - Introduction to Data Validation, Data Transformation – Standardization and Feature Extraction, Data Reduction – Sampling, Selection, PCA, Data Discretization	**10**
IV	**BI – DATA ANALYTICS PROCESS -** Introduction to analytics process, Types of Analytical Techniques in BI –Descriptive, Predictive, Perspective, Social Media Analytics, Behavioral, Iris Datasets	**10**
V	**IMPLEMENTATION OF BI –** Business Activity Monitoring, Complex Event Processing, Business Process Management, Metadata, Root Cause Analysis.	**10**

Text Books:

1. Carlo-Vercellis, “Business Intelligence Data Mining and Optimization for Decision-Making”, First Edition
2. Drew Bentely, “Business Intelligence and Analytics” ,@2017 Library Pres., ISBN: 978-1-9789-2136-8
3. Larissa T. Moss & Shaku Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle
4. For Decision-Support Applications”, First Edition, Addison-Wesley Professional,2003
5. Kimball, R., Ross, M., Thornthwaite, W., Mundy, J., and Becker, B. John, “The Data Warehouse
6. Lifecycle Toolkit: Practical Techniques for Building Data Warehouse and Business Intelligence Systems”, Second Edition, Wiley & Sons, 2008.
7. Cindi Howson, “Successful Business Intelligence”, Second Edition, McGraw-Hill Education, 2013.

Human Computer Interaction
(Course Code: SCADE-4-23703)

Year: 4th **L T P C**

Semester: VIIth **3 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand the essentials of BI & data analytics and the corresponding terminologies	K_2
CO 2	Analyze the steps involved in the BI - Analytics process	K_3, K_4
CO 3	Illustrate competently on the topic of analytics	K_2, K_3
CO 4	Understand & Implement the K-Means Clustering with Iris Dataset	K_2, K_3
CO 5	Demonstrate the real time scenario (Case study) by using BI & Analytics techniques	K_5, K_6

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Foundations Of Human-Computer Interaction** Motivation: contexts for HCI (tools, web hypermedia, communication), human centered development and evaluation, Human performance models: perception, movement, and cognition, Principles of good design and good designers, engineering tradeoffs, introduction to usability testing, Text entry devices, display devices, WIMP.	**10**
II	**Design Process** Interactive design basics, HCI in software process, HCI patterns, Implantation support, Software life cycle, Design Rules, Evaluation technique.	**10**
III	**Implementation And Evaluation** Elements of windowing systems, Toolkits, User interface systems, Goals of evaluation, Evaluation through expert system, User participation, Choosing evaluation method, Universal design principles, multi-modal interaction ,design focus, user support	**10**
IV	**Graphical User-Interface Design And Mobile Hci** Principles of graphical user interfaces, GUI toolkits, Choosing interaction styles and interaction techniques, HCI aspects of common widgets, HCI aspects of screen design, Labeling, handling human failure, beyond simple screen design, multi-modal interaction,3D interaction and virtual reality, Mobile Ecosystem, Types of Mobile Applications, Games, Mobile Design	**10**
V	**Hci Aspects Of Multimedia Systems** Categorization and architectures of information, Web search, Usability of database query language, Graphics, Sound, HCI design of multimedia information systems, speech recognition and natural language processing, information appliances and mobile computing	**10**

Text Books:

1. Julie A. Jacko, Andrew Scars, “Human Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications”, 1st Edition, CRC Press, 2017.
2. Alan Dix, Janet Finlay, Gregory D. Abowd and Russel Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004.
3. K.Meena and R.Sivakumar, "Human-Computer Interaction", 2015, Prentice Hall India, ISBN: 978-8120350502
4. Ben Schneiderman, “Designing the User Interface ", 5th Edition, Addison Wesley,2010.
5. Alan Cooper, “The Essentials of User Interface Design ", IDG Books,1995
6. Wilbent. O. Galitz ,“The Essential Guide To User Interface Design”, John Wiley& Sons, 2007

Research Methodology and IPR
(Course Code: SCA-23702)

Year: 4th **L T P C**

Semester: VIIth **3 0 0 3**

Course Outcome (CO)	
At the end of course , the student will be able to understand	
CO 1	To give an overview of the research methodology and explain the technique of defining a research problem.
CO 2	To explain the functions of the literature review in research.
CO 3	To explain the art of interpretation and the art of writing research reports.
CO 4	To explain several parametric tests of hypotheses and Chi-square test.
CO 5	To discuss leading International Instruments concerning Intellectual Property Rights.

Unit	Content
Unit I	**Introduction to Research** Definition of research, Characteristics of research, Types of research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Overview of research methodology in various areas, Introduction to problem solving, basic research terminology such as proof, hypothesis, lemma etc., Role of Information and Communication Technology(ICT) in research.
Unit II	**Research Problem Formulation and Methods** Literature review, sources of literature, various referencing procedures, maintain literature data using Endnote2, Identifying the research areas from the literature review and research database, Problem Formulation, Identifying variables to be studied, determining the scope, objectives, limitations and or assumptions of the identified research problem, Justify basis for assumption, Formulate time plan for achieving targeted problem solution. Important steps in research methods: Observation and Facts, Laws and Theories, Development of Models, Developing a research plan: Exploration, Description, Diagnosis and Experimentation
Unit III	**Data collection** Static and dynamic characteristics of instruments, calibration of various instruments, sampling methods, methods of data collection, Basic Concepts concerning testing of hypotheses, procedures of hypothesis testing, generalization and interpretation Applied statistics: Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis Software tools for modeling, Simulation and analysis.
Unit IV	**Research reports and Thesis writing** Introduction: Structure and components of scientific reports, types of report, developing research proposal. Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, Oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.

Unit V	**Ethics** Ethical issues. IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Reference Books

1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications Ltd., 2011.
2. Wayne Goddard, Stuart Melville, "Research Methodology: An Introduction" JUTA and Company Ltd, 2004.
3. C.R. Kothari ,"Research Methodology: Methods and Trends", New Age International,2004
4. S.D. Sharma , "Operational Research", Kedar Nath Ram Nath & Co.,1972
5. B.L. Wadehra,"Law Relating to Patents,Trademarks, Copyright Designs and Geographical Indications", Universal Law Publishing, 2014.
6. Donald Cooper, Pamela Schindler, "Business Research Methods", McGraw-Hill publication, 2005.

Major Project Phase I

(Course Code: SCA-23703)

Year: 4th

Semester: VIIth

L	T	P	C
0	0	8	6

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Analyze and understand the real life problem and apply their knowledge to get programming solution.	K_4 , K_5
CO 2	Engage in the creative design process through the integration and application of diverse technical knowledge and expertise to meet customer needs and address social issues.	K_4 , K_5
CO 3	Use the various tools and techniques, coding practices for developing real life solution to the problem.	K_5 , K_6
CO 4	Find out the errors in software solutions and establishing the process to design maintainable software applications	K_4 , K_5
CO 5	Write the report about what they are doing in project and learning the team working skills	K_5, K_6

ELECTIVE - 5

Pattern Recognition

(Course Code: SCADE-5-23801)

Year: 4th	**L**	**T**	**P**	**C**
Semester: VIIIth	**3**	**0**	**0**	**4**

Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	To provide basic conceptual understanding of pattern recognition.	K2 , K3
CO 2	To understand about Statistical Patten Recognition.	K1 , K2
CO 3	To understand basic measures for Parameter estimation methods.	K1
CO 4	To explore about Nonparametric Techniques.	K2
CO 5	Explore Unsupervised Learning & Clustering.	K1

Unit-I Introduction:

Basics of pattern recognition, Design principles of pattern recognition system,Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.

Unit-II

Statistical Patten Recognition:

Bayesian Decision Theory, Classifiers, Normal density anddiscriminant functions,

Unit – III

Parameter estimation methods:

Maximum-Likelihood estimation, Bayesian Parameterestimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.

Unit - IV

Nonparametric Techniques:

Density Estimation, Parzen Windows, K-Nearest NeighborEstimation, Nearest Neighbor Rule, Fuzzy classification.

Unit - V

Unsupervised Learning & Clustering:

Criterion functions for clustering, Clustering Techniques:Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.

REFERENCES:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006.

2. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2009.

3. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Edition, Academic Press, 2009.

ELECTIVE - 5

Agile Software Engineering

(Course Code: SCADE-5-23802)

Year: 4th **L T P C**

Semester: VIIIth **3 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Interpret the concept of agile software engineering and its advantages in software development.	K_2
CO 2	Analyze the core practices behind several specific agile methodologies.	K_3, K_4
CO 3	Identify the roles and responsibilities in agile projects and their difference from projects following traditional methodologies.	K_2, K_3
CO 4	Understand then need of scrum, Scrum practices –Working of scrum etc.	K_2, K_3
CO 5	Access implications of functional testing, unit testing, and continuous integration.	K_5, K_6

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction:** Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software agility.	**8**
II	**Project Planning:** Recognizing the structure of an agile team– Programmers, Managers, Customers. User stories– Definition, Characteristics and content. Estimation– Planning poker, Prioritizing, and selectinguser stories with the customer, projecting team velocity for releases and iterations.	**8**
III	Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation.	**8**
IV	Design Methodologies: Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team. Extreme Programming- Core principles, values and practices. Kanban, Feature-driven development, Lean software development.	**8**
V	Testing: The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test	**8**

	automation.	

Text Books:

1. Carlo-Vercellis, “Business Intelligence Data Mining and Optimization for Decision-Making”, First Edition
2. Drew Bentely, “Business Intelligence and Analytics” ,@2017 Library Pres., ISBN: 978-1-9789-2136-8
3. Larissa T. Moss & Shaku Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle
4. For Decision-Support Applications”, First Edition, Addison-Wesley Professional,2003
5. Kimball, R., Ross, M., Thornthwaite, W., Mundy, J., and Becker, B. John, “The Data Warehouse
6. Lifecycle Toolkit: Practical Techniques for Building Data Warehouse and Business Intelligence Systems”, Second Edition, Wiley & Sons, 2008.
7. Cindi Howson, “Successful Business Intelligence”, Second Edition, McGraw-Hill Education, 2013.

ELECTIVE - 5

Gaming Theory

(Course Code: SCADE-5-23803)

Year: 4th **L T P C**

Semester: VIIIth **3 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.	K_1 , K_2
CO 2	Discuss the use of Nash Equilibrium for other problems.	K_2 , K_3
CO 3	Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.	K_2 , K_3
CO 4	Identify some applications that need aspects of Bayesian Games.	K_3 , K_4
CO 5	Implement a typical Virtual Business scenario using Game theory.	K_3, K_6
DETAILED SYLLABUS		
Unit		**Proposed Lecture**
I	**Introduction** Introduction – Making rational choices: basics of Games – strategy – preferences – payoffs – Mathematical basics –Game theory –Rational Choice – Basic solution concepts-non-cooperative versus cooperative games – Basic computational issues – finding equilibria and learning in gamesTypical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).	**08**
II	**Games With Perfect Information** Games with Perfect Information – Strategic games – prisoner's dilemma, matching pennies-Nash equilibria- theory and illustrations – Cournot and Bertrand models of oligopoly-auctions- mixed strategy equilibrium- zero-sum games- Extensive Games with Perfect Information-repeated games (prisoner's dilemma)- subgame perfect Nash equilibrium; computational issues.	**08**
III	**Games With Imperfect Information** Games with Imperfect Information – Bayesian Games – Motivational Examples – General Definitions –Information aspects – Illustrations – Extensive Games with Imperfect – Information – StrategiesNash Equilibrium – Beliefs and sequential equilibrium – Illustrations – Repeated Games – The Prisoner's Dilemma – Bargaining	**08**

IV	**Non-Cooperative Game Theory** Non-cooperative Game Theory – Self-interested agents- Games in normal form – Analyzing games: from optimality to equilibrium – Computing Solution Concepts of Normal-Form Games – Computing Nash equilibria of two-player, zero-sum games –Computing Nash equilibria of two- player, generalsum games – Identifying dominated strategies	**08**
V	**Mechanism Design** Aggregating Preferences-Social Choice – Formal Model- Voting – Existence of social functions – Ranking systems – Protocols for Strategic Agents: Mechanism Design – Mechanism design with unrestricted preferences- Efficient mechanisms – Vickrey and VCG mechanisms (shortest paths) – Combinatorial auctions – profit maximization Computational applications of mechanism design – applications in Computer Science – Google's sponsored search – eBay auctions – K-armed bandits	**08**

REFERENCES

1. Thomas S. Ferguson, Game Theory, Web notes available at (https://www.cs.cmu.edu/afs/cs/academic/class/15859s05/www/ferguson/comb.pdf)
2. M. J. Osborne," An Introduction to Game Theory", Oxford University Press, 2012.
3. M. Machler, E. Solan, S. Zamir, "Game Theory", Cambridge University Press, 2013.
4. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani (Editors), "Algorithmic Game Theory" Cambridge University Press, 2007.
5. A.Dixit and S. Skeath, "Games of Strategy", Second Edition, W W Norton & Co Inc, 2004.
6. Yoav Shoham, Kevin Leyton-Brown, "Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations", Cambridge University Press, 2008.
7. Zhu Han, Dusit Niyato, Walid Saad, Tamer Basar and Hjorungnes, "Game Theory in Wireless and Communication Networks", Cambridge University Press, 2012.
8. Y.Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific, 2015.
9. Anna R. Karlin and Yuval Peres, Game Theory, Alive, AMS, 2016 (E-book available online from the author at (https://homes.cs.washington.edu/~karlin/GameTheoryBook.pdf)
10. Ivan Pastine, Tuvana Pastine, Tom Humberstone, Introducing Game Theory: A Graphic Guide, Icon Books, 2017.
11. Steven Tadelis, Game Theory: An Introduction, Princeton University Press, 2013.

ELECTIVE - 5

QUANTUM COMPUTING

(Course Code: SCADE-5-23804)

Year: 4th **L T P C**

Semester: VIIIth **3 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Distinguish problems of different computational complexity and explain why certain problems are rendered tractable by quantum computation with reference to the relevant concepts in quantum theory.	K_1 , K_2
CO 2	Demonstrate an understanding of a quantum computing algorithm by simulating it on a classical computer, and state some of the practical challenges in building a quantum computer.	K_2 , K_3
CO 3	Contribute to a medium-scale application program as part of a co-operative team, making useof appropriate collaborative development tools (such as version control systems).	K_2 , K_3
CO 4	Produce code and documentation that is comprehensible to a group of different programmersand present the theoretical background and results of a project in written and verbal form.	K_3 , K_4
CO 5	Apply knowledge, skills, and understanding in executing a defined project of research,development, or investigation and in identifying and implementing relevant outcomes.	K_3, K_6
DETAILED SYLLABUS		
Unit		**Proposed Lecture**
I	**Fundamental Concepts:** Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	**08**
II	**Quantum Computation**: Quantum Circuits – Quantum algorithms, Single Orbit operations,Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	**08**
III	**Quantum Computers:** Guiding Principles, Conditions for Quantum Computation, HarmonicOscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	**08**
IV	**Quantum Information:** Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	**08**

V	**Quantum Error Correction:** Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource .	**08**

Text books:

1. Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", CambridgeUniversity Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel, Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific andEngineering Computation) Paperback – Import, Oct 2014
3. Computing since Democritus by Scott Aaronson, Computer Science: An Introduction by N. DavidMermin.
4. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

Disaster Management

(Course Code: SCA-23802)

Year: 4th

L T P C

Semester: VIIIth **2 0 0 4**

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	To provide basic conceptual understanding of disasters.	K2 , K3
CO 2	To understand Types of Disasters.	K1 , K2
CO 3	To understand basic measures for Disaster management.	K1
CO 4	To explore about disaster preparedness and training.	K2
CO 5	Explore disaster mitigation Strategies.	K1
DETAILED SYLLABUS		
Unit		**Proposed Lecture**
I	Introduction to Disasters Understanding of Hazard, Vulnerability & Disasters.Concept of Risks, Evaluation of Risks.Climate change Risk (IPCC Report): Natural & man-made factors.Driving forces of Vulnerability of cities.Landforms Developingforces:Endogenetic&Exogenetic.Concept of on-site Disasters.	**0 8**
II	Types of Disasters Classification of Disasters. (Natural & man-made)Natural Disasters:Climatic Disasters (wind & water related): Tropical Cyclone, Floods & Drought.Earth related Disasters (Geological Disaster): Earthquake, Tsunami, Landslides& Volcano Eruption.	**0 8**
III	Disaster Management Basic measures for Disaster management: Preventive Measures, Preparedness Measures (Disaster mapping profile), Predictability, Forecasting & Warning.Response and Relief measures.Recovery & Rehabilitation measures.	**0 8**
IV	Disaster Preparedness and Training Disaster Management Bill, 2005.Institutional Framework for Disaster Management.Role of Media in Disaster Management.Basic Safety Measures (Pre and During): Earthquake & Floods.	**0 8**
V	Mitigation Strategies Disaster Mitigation – Emerging Trends in Disaster Management - UN Draft Resolution on Strengthening of Coordination of Humanitarian Emergency Assistance	**0 8**

Text books:

1. IPCC, 2001: Impacts Adaptation and Vulnerability, GRID, Aewndal.
2. Natural Hazards, Bryant Edwards (2005), Cambridge University Press, U.K.
3. Space Technology for Disaster management: A Remote Sensing & GIS Perspective, Roy, P.S. (2000), Indian Institute of Remote Sensing (NRSA), Dehradun.
4. Natural Disaster, Sharma, R.K. & Sharma, G. (2005), (ed) APH Publishing Corporation, New Delhi
5. Disaster Management : A disaster Manager's Handbook, Carter, N W. (1992), Asian Development Bank, Manila.

Major Project Phase II

(Course Code: SCSE-23803)

Year: 4th

Semester: VIIIth

L	T	P	C
0	0	18	8

Course Outcome (CO)	Bloom's Knowledge Level (KL)

At the end of course , the student will be able to understand		
CO 1	Analyze and understand the real life problem and apply their knowledge to get programming solution.	K_4 , K_5
CO 2	Engage in the creative design process through the integration and application of diverse technical knowledge and expertise to meet customer needs and address social issues.	K_4 , K_5
CO 3	Use the various tools and techniques, coding practices for developing real life solution to the problem.	K_5 , K_6
CO 4	Find out the errors in software solutions and establishing the process to design maintainable software applications	K_4 , K_5
CO 5	Write the report about what they are doing in project and learning the team working skills	K_5, K_6