Koneru Lakshmaiah Education Foundation
(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)
Accredited by NAAC as 'A++' ❖Approved by AICTE ❖ ISO 21001:2018 Certified
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KL CENTRE FOR DISTANCE & ONLINE EDUCATION

ANNEXURE 1B

KL CENTRE FOR DISTANCE & ONLINE EDUCATION

MCA PROGRAM STRUCTURE

SEM	SL NO	CAT	COURSE CODE	COURSE TITLE	SNAME	L	T	P	S	Cr	CH	PRE-REQ
SEM 1	1	AUC	23UC5201O	PROFESSIONAL COMMUNICATION SKILLS	PCS	0	0	4	0	0	4	NIL
	2	PCC	23CA5101O	COMPUTER NETWORKS AND COMMUNICATIONS	CNC	3	0	2	0	4	5	NIL
	3	PCC	23CA5102O	DATA STRUCTURES AND ALGORITHMS	DSA	3	0	2	4	5	9	NIL
	4	PCC	24CA5103O	OPERATING SYSTEMS CONCEPTS	OSC	3	1	0	0	4	4	NIL
	5	PCC	23CA5104O	DATABASE SYSTEMS	DS	3	0	2	4	5	9	NIL
	TOTAL					**12**	**1**	**10**	**8**	**18**	**31**	

SEM 2	6	PCC	23CA5205O	Object Oriented Programming	OOP	3	0	2	4	5	9	NIL
	7	PCC	23CA5206O	DATAANALYTICS	DA	3	0	2	0	4	5	NIL
	8	PCC	23CA5207O	COMPREHENSIVE SOFTWARE ENGINEERING	CSE	2	1	0	0	3	3	NIL
	9	PEC		PE1	PE	3	0	2	4	5	9	NIL
	10	PEC		PE2	PE	3	0	0	0	3	3	NIL
	TOTAL					**14**	**1**	**6**	**8**	**20**	**29**	
1S	11	**PRI**	24IE6101O	INTERNSHIP	INT1	0	0	6	0	3	6	NIL
SEM3	12	PCC	24CA6108O	WEB TECHNOLOGIES	WT	3	0	2	4	5	9	NIL
	13	**PRI**	23IE5201O	ESSENTIALS OF RESEARCH DESIGN	ERD	1	1	0	0	2	2	NIL
	14	PEC		PE3	PE	3	0	2	4	5	9	NIL
	15	PEC		PE4	PE	3	0	0	0	3	3	NIL

	16	PEC		PE5	PE	3	0	2	0	4	5	NIL
	17	**PRI**	24IE6102O	TERM PAPER	TP	0	0	4	0	2	4	NIL
	TOTAL					**13**	**1**	**16**	**8**	**24**	**38**	
SEM4	18	OEC		OE1	OE	4	0	0	0	4	4	NIL
	19	OEC		OE2	OE	4	0	0	0	4	4	NIL
	20	PRI	24IE6203O	PROJECT	PRO	0	0	20	0	10	20	NIL
	TOTAL					**8**	**0**	**20**	**0**	**18**	**28**	
GRAND TOTAL						**47**	**3**	**52**	**24**	**80**	**126**	

Sl No	Category	Course Code	Course Title	Short Name	L	T	P	S	Cr	CH	Pre-Requisite
PROFESSIONAL ELECTIVE – ARTIFICIAL INTELLIGENCE											
1	PE	23CA52A1O	Applied Mahine Learning	AML	3	0	2	4	5	9	NIL
2	PE	23CA52A2O	PATTERN RECOGNITION	PR	3	0	0	0	3	3	NIL
3	PE	23CA61A3O	COMPUTER VISION	CV	3	0	2	4	5	9	NIL
4	PE	23CA61A4O	Applied Deep Learning	ADL	3	0	0	0	3	3	NIL
5	PE	23CA61A5O	APPLICATIONS OF NATURAL LANGUAGE PROCESSING	ANLP	3	0	2	0	5	9	NIL
PROFESSIONAL ELECTIVE – DATA SCIENCE											
6	PE	23CA52A1O	Applied Mahine Learning	AML	3	0	2	4	5	9	NIL
7	PE	23CA52D2O	HADOOP AND BIGDATA	HAD	3	0	0	0	3	3	NIL

8	PE	23CA61D3O	DATA VISUALIZATION TECHNIQUES	DVT	3	0	2	4	5	9	NIL
9	PE	23CA61D4O	STATISTICS FOR DATA SCIENCE	SDS	3	0	0	0	3	3	NIL
10	PE	23CA61D5O	GRAPH AND WEB ANALYTICS	GWA	3	0	2	0	5	9	NIL
PROFESSIONAL ELECTIVE – CLOUD TECHNOLOGY											
11	PE	23CA52C1O	CLOUD COMPUTING	CC	3	0	2	4	5	9	NIL
12	PE	23CA52C2O	CLOUD INFORMATION SECURITY	CIS	3	0	0	0	3	3	NIL
13	PE	23CA61C3O	CLOUD ARCHITECTURES	CA	3	0	2	4	5	9	NIL
14	PE	23CA61C4O	Cloud and Serverless Computing	CSC	3	0	0	0	3	3	NIL
15	PE	23CA61C5O	Cloud Web Services	CWS	3	0	2	0	5	9	NIL
PROFESSIONAL ELECTIVE – CYBER SECURITY											
16	PE	23CA52S1O	CYBER SECURITY AND ETHICAL HACKING	CSEH	3	0	2	4	5	9	NIL
17	PE	23CA52S2O	CYBER FORENSICS	CF	3	0	0	0	3	3	NIL
18	PE	23CA61S3O	MALWARE ANALYSIS	ML	3	0	2	4	5	9	NIL
19	PE	23CA61S4O	SECURITY GOVERNANCE AND MANAGEMENT	SGM	3	0	0	0	3	3	NIL
20	PE	23CA61S5O	CLOUD SECURITY	CS	3	0	2	0	5	9	NIL

PROFESSIONAL COMMUNICATION SKILLS (PCS)

COURSE CODE	24UC5201O	MODE	OL	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	To develop and demonstrate principles of listening, speaking, reading and writing in various functional contexts	3	PO 5
CO2	To demonstrate different types of personal and professional skills and apply them for growth in professional zone.	3	PO 5

CO3	Apply the concepts of Mathematical Principles to solve problems on Arithmetic , Algebra & Geometry to improve problem solving ability.	3	PO5
CO4	Apply the concepts and using Logical thinking to solve problems on verbal & Non-Verbal Reasoning to develop Logical thinking skills.	3	PO5

Syllabus

Module 1	A)Vocabulary: Synonyms, Antonyms and One-word substitutes, (B)Reading comprehension, Critical reading, (C) Writing skills: Email writing, report writing and paragraph writing (D) Listening/Speaking Skills: listen & speak, Functional grammar
Module 2	(A) Personal Skills: Intra & Interpersonal skills (B) Assertiveness (C) Group Discussion (D) Resume writing (E) Video resumes (F) Interview skills
Module 3	Simple Equations, Ratio & Partnership, Averages, Percentages, Profit & Loss, Simple & Compound Interest, Numbers, Quadratic Equations & Inequalities, Time & Work, Time, Speed & Distance, Permutations & Combinations, Probability, Mensuration, Data Interpretation.
Module 4	Syllogism, Logical Venn Diagrams, Cubes & Dice, Number& letter series, Number, letter & word Analogy, Odd Man Out, Coding & Decoding, Blood Relations, Directions, clocks, calendars, Number, ranking & Time sequence test, Seating Arrangements, Data Sufficiency.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The Business Student's Handbook: Skills for Study and Employment	Fisher, Julie and Bailey, Peter	Cengage Learning	2017
2	The Complete Guide to mastering soft skills for workplace success	Adams, John	Adams media	2019
3	Writing Tools: 55 Essential Strategies for Every Writer	Roy Peter Clark	Little, Brown and Company	2006
4	Quantitative Aptitude	R. S. Agarwal	SCHAND	
5	A Modern Approach to Verbal Reasoning	R. S. Agarwal	SCHAND	

SYLLABUS OF COURSES UNDER

PROFESSIONAL CORE

COMPUTER NETWORKS AND COMMUNICATIONS(CNC)

COURSE CODE	24CA5101O	MODE	OL	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping

CO1	Understand the fundamentals of computer networks and data communication	2	PO1
CO2	Choose the issues in Data Link Layer, IEEE Standards in networks	3	PO2
CO3	Analyse Internet Transport Protocols and different types of protocols	4	PO2
CO4	Examine various types of Network Devices and different types of Networks	4	PO3
CO5	Develop networking solutions using Routing Algorithms	5	PO5

Syllabus

Module 1	Introduction to Computer Networks: Introduction, Network Hardware, Network Software, Reference Models, Data Communication Services & Network Examples, Internet Based Applications, Data Communications: Transmission Media, Wireless Transmission, Multiplexing, Switching, Transmission in ISDN, Broad Band ISDN, ATM Network. Data Link Control, Error Detection & Correction, Sliding Window Protocols
Module 2	LANs &MANs: IEEE Standards for LANs & MANs-IEEE Standards 802.2, 802.3, 802.4, 802.5,802.6, High Speed LANs. Design Issues in Networks: Routing Algorithms, Congestion Control Algorithms, Network Layer in the Internet, IP Protocol, IP Address, Subnets, and Internetworking.
Module 3	Internet Transport Protocols: Transport Service, Elements of Transport Protocols, TCP and UDP Protocols, Quality of Service Model, Best Effort Model, Network Performance Issues. Overview of DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols, World Wide Web, Firewalls.
Module 4	Network Devices: Overview of Repeaters, Bridges, Routers, Gateways, Multiprotocol Routers, routers, Hubs, Switches, Modems, Channel Service Unit CSU, Data Service Units DSU, NIC, Wireless Access Points, Transceivers, Firewalls, Proxies. Overview of Cellular Networks, Ad-hoc Networks, Mobile Ad-hoc Networks, Sensor Networks

Textbooks/Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Computer Networks	Andrews S Tanenbaum	5th Edition	2010
2	Data Communications and Networking	Behrouz A Forouzan	2nd Edition	2017
3	Computer Networks	Mayank Dave		2012
4	Computer Networks, A System Approach	Larry L Peterson and Bruce S Davie	5th Edition	2011
5	An Engineering Approach to Computer Networks	S.Keshav	2nd Edition	2002
6	Understanding Communications and Networks	W.A. Shay, Thomson	3rd Edition	2004

DATA STRUCTURES AND ALGORITHMS (DSA)

COURSE CODE	24CA5102O	MODE	OL	LTPSIN	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Outline basic data structures such as arrays, pointers	2	PO1
CO2	Demonstrate the basic structure such as stacks and queues.	2	PO2
CO3	Solve problem involving trees and Linked List	3	PO2,PO4
CO4	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	3	PO1,PO4
CO5	Evaluate applications using control structures for linear and non-linear data structures	5	PO6
C06	Asses the data structure for its functions based on performance metrics.	5	PO2,PO3

Syllabus

Module 1	Introduction to Data Structures: Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm, Introduction and Definition of Data Structure, Classification of Data, Arrays, Various types of Data Structure, Static and Dynamic Memory Allocation, Function, Recursion. Arrays, Pointers and Strings: Introduction to Arrays, Definition, One Dimensional Array and Multidimensional Arrays, Pointer, Pointer to Structure, various Programs for Array and Pointer. Strings. Introduction to Strings, Definition, Library Functions of Strings."
Module 2	Stacks and Queue :-Introduction to Stack, Definition, Stack Implementation, Operations of Stack, Applications of Stack and Multiple Stacks. Implementation of Multiple Stack Queues, Introduction to Queue, Definition, Queue Implementation, Operations of Queue, Circular Queue, De-queue and Priority Queue"
Module 3	Linked Lists and Trees: Introduction, Representation and Operations of Linked Lists, Singly Linked List, Doubly Linked List, Circular Linked List, And Circular Doubly Linked List. Trees: Introduction to Tree, Tree Terminology Binary Tree, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Tree Traversal, Threaded Binary Tree, AVL Tree, B Tree, B+ Tree"
Module 4	Graphs: Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms. Searching and Sorting: Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort. Hashing: Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique(CRT), Perfect Hashing"

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Data structures	Tata McGraw-Hill	McGraw Hill Education	2014
2	Data Structures	E. Balagurusamy	McGraw Hill Education	2017
3	Algorithms II	Robert Sedgewick and Kevin Wayne	Pearson Education	2014
4	Design and Analysis of Algorithms	S.Sridhar	Oxford Unioversity Press	2014
5	Introduction to Algorithms	Thomas H.Cormen,Charles E.Leiserson	Prentice-Hall	1989

OPERATING SYSTEMS CONCEPTS

COURSE CODE	24CA5103O	MODE	OL	LTPS	3-1-0-0	PRE-REQUISITE	NIL

CO.No	Course Outcome	BTL	PO
CO1	Discuss Operating System Functionalities, Types of Operating Systems, Computer Architecture support to Operating Systems.	2	PO1
CO2	Explain the Process and CPU scheduling.	2	PO1
CO3	Demonstrate Process Synchronization, and Deadlocks	3	PO2
CO4	Illustrate Memory management, Fragmentation and File systems.	3	PO2

Syllabus

Module 1	What is an OS, Brief history, Functionalities of OS,. Basics Computer System Architecture overview. Operating System Structures, Types of Different OS, Basic Oss: Batch, Multi-programmed batch, Timesharing, Real-Time OS (RTOS), Distributed OS.
Module 2	Processes: Definition, Process States, 5 state model, Process structure: PCB and components, Interprocess Communication, Operations on Processes, Threads, CPU Scheduling: I/O burst cycle, Context Switching, Short Term, Long Term and Scheduling Criteria, Algorithms: First Come First Serve, Shortest Job First, Priority Scheduling, Round Robin.
Module 3	Process Synchronization: Critical Section Problem, Mutual Exclusion, Races, Semaphores, Classic Synchronization Problems, Readers/Writers, Dining Philosophers. Deadlocks: Deadlocks and Starvation, System Model, Necessary Conditions for a deadlock, Mutual Exclusion, Hold and Wait, No Pre-emption, Circular wait, Resource Allocation Graphs, Handling Deadlocks, Prevention, Avoidance, Bankers Algorithm.. I/O Device Management, I/O Device Types and Characteristics.
Module 4	Memory Management: Swapping, Multiple Partition-First Fit-Best Fit-Worst Fit, RAID and Data Redundancy. Fragmentation: Internal and External Fragmentation, Paging and Demand Paging, Page Replacement, Page Replacement Algorithms: FIFO, Be lady's, anomaly, Optimal, LRU, MFT, Thrashing. File-System: File-System structure, Access Methods, Directory structure, File-System Implementation, Protection.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Modern Operating Systems	Andrew S. Tanenbaum, Herbert Bos	Pearson Education	2014
2	Operating Systems: Internals and Design Principles	William Stallings	Pearson Education	2017
3	Linux Kernel Development	Robert Love	Addison-Wesley Professiona	2010
4	Windows Internals	Mark Russinovich, David A. Solomon, Alex Ionescu	Microsoft Press	2012

DATABASE SYSTEMS(DBS)

COURSE CODE	24CA5104O	MODE	OL	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate the functional components of DBMS and Design an ER Model for a database.	2	PO1,PO2,PO3
CO2	Design a relational model for a database & Implement SQL concepts and relational algebra.	3	PO1,PO2,PO3
CO3	Implement PL/SQL programs, normalization techniques, indexing to construct and access database	4	PO1,PO3
CO4	Analyse the importance of transaction Processing, concurrency control and recovery techniques.	4	PO1,PO3
CO5	Choose the MangoDB to perform CURD, Indexing, Aggregation, Replication, Sharding, Performance analysis for distributed Databases	5	PO1,PO3, PO5
CO6	Choose a MongoDB and implement SQL queries and PL/SQL programs to do various operations on data.	5	PO1,PO3, PO5

Syllabus

Module 1	Database Fundamentals: DBMS Characteristics & Advantages, Database Environment, Database Users, Database Architecture, Data Independence, Languages, Tools and Interface in DBMS, DBMS types. Data Modeling: ER Model, Notation used in ER Diagram, Constraint, Types, Relationships in ER Model and other considerations in designing ER diagram. Enhanced, ER data Model, EER Diagram
Module 2	Relational Model: concepts, constraints, schemas, ER to Relational Model. SQL & Relational Algebra: Data Definition and other languages in SQL, Creating tables and Data types, Constraints, DML statements, Functions and writing SQL statements using nested sub queries, complex queries, joining relations, views, compound statements, user defined functions, user defined procedures, cursors, Triggers, Relational Algebra :Operators in relational algebra, Database Design: Guidelines for good database design
Module 3	Normalization- Normal Forms, First, Second, Third Normal Forms, BCNF, Multi value and join dependencies, 4th and 5th normal forms. Decomposition algorithms for normalization. File and Storage Structures: File storage, Index structures, Indexing and hashing, Query processing and optimization.
Module 4	Transaction Management: Transaction processing issues, Transaction states, problems during multiple transactions processing, ACID properties, system log and concurrency control Techniques: Lock based techniques, and Timestamp based techniques, Multiversion based Techniques. Recovery Techniques: Recovery concepts, shadow paging, ARIES

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	Database System Concepts	Abraham Silberschatz, Yale University Henry, F. Korth Lehigh University, S. Sudarshan Indian Institute of Technology, Bombay.	tata mcgraw hill books	2009
2	Fundamentals of Database Systems	RamezElmasri, University of Texas at Arlington, Shamkant B. Navathe, University of Texas at Arlington.	Pearson	2010
3	An Introduction to Database Systems	Bipin C. Desai	Galgotia Publications Pvt Ltd	2010
4	Principles of Database Systems	Jeffrey D. Ullman	Galgotia Publications	1980
5	Database Management Systems	Raghu RamaKrishnan, Johannes Gehrke	Tata McGraw Hill, 2014.	1996

OBJECT ORIENTED PROGRAMMING

COURSE CODE	23CA5205O	MODE	OL	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understanding the basic OOP concepts	2	PO1
CO2	Apply concepts of inheritance, Exception Handling	2	PO1
CO3	Analyse and Implement interfaces, Packages	3	PO2
CO4	Analyse Multi-Threading and Collections	4	PO1
CO5	Analyse java Swings and data base connections	5	PO5
CO6	Solve various problem using oops techniques	5	PO5

Syllabus

Module 1	Introduction, Principles of Object-Oriented Languages, Applications of OOP, Programming Constructs, Data Types, Operators, Classes and Objects - classes, Objects, Creating Objects, Types of Objects, Passing Objects and passing array of Objects, Methods, constructors - Constructor overloading, cleaning up unused objects -Garbage collector, Class variable and Methods -Static keyword, this keyword, Arrays,

Module 2	Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class. Interfaces, Packages and Enumeration: Interface -Extending interface, Interface Vs Abstract classes, Packages -Creating packages, using Packages, Access protection, java. Lang package. Exceptions & Assertions – Introduction, Exception handling techniques -try… catch, throw, throws , finally block, user defined exception, Exception Encapsulation and Enrichment, Assertions
Module 3	Multi-Threading: java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading - Using isAlive () and join (), Synchronization , suspending and Resuming threads, Communication between Threads Input/Output: reading and writing data, java.io package, Collections Framework overview, Collection classes- Array List, LinkedList, HashSet. The For-Each loop Mapclass: HashMap
Module 4	Swing : Introduction, JFrame, JPanel, Components in swings, Layout Managers, JList and JScroll Pane, Split Pane, JTabbedPane, Dialog Box Pluggable Look and Feel. Introduction to JDBC, Database Connectivity, JDBC Architecture, JDBC Drivers, JDBC API,Statement interface,ResultSet interface,PreparedStatement interface,Store & retrieve image,file.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Java the Complete Reference	Herbert Schild	Oracle Press	2010
2	Java for Programmers, P.J.Deitel and H.M.Deitel, PEA (or) Java: How to Program ,	P.J.Deitel and H.M.Deite	PHI	2011
3	Programming in Java	S. Malhotra and S. Choudhary	Oxford UniversitiesPress	2008
4	Thinking in Java	Bruce Eckel	PE	2007
5	Design Patterns Erich Gamma	Richard Helm, Ralph Johnson and John Vlissides	PE	2010

DATAANALYTICS(DA)

COURSE CODE	24CA5206O	MODE	OL	LTPS	3-0-2-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Summarize the importance and environment of R Programming	2	PO1,PO2
CO2	Experiment with basic control and functions in R	3	PO2,PO3
CO3	Examine the function of datastructures in R	4	PO2,PO3
CO4	Inference data analysis pattern suing Statistics and Data visualization	4	PO2, PO4
CO5	Experiment with pattern detection and data analytics function with data set	4	PO2,PO5
CO6	Examine statistical, data structures and data frame manipulation	4	PO2,PO5

Syllabus

Module 1	Introduction to Data Analytics: What are Data Analytics? – Why Data Analytics? , Data basics: Quantitative data : Nominal data, Ordinal data. What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Important commands to get started: installed. package (), package Description (), help(), find. package (), library () - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits.
Module 2	R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Variables: Variable assignment, Data types of Variable, Finding Variable, Deleting Variables. R- Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - R Decision Making: if statement, if – else statement, if– else if statement, switch statement – R Loops: repeat loop, while loop, for loop – Loop control statement: break statement, next statement. R-Function: function definition, Built in functions: mean(), paste(), sum(), min(), max(),seq(), user-defined function, calling a function, R-Strings – Manipulating Text in Data: substr(),strsplit(), paste(), grep(), toupper(), tolower()
Module 3	R Vectors – Sequence vector, rep function, vector access, vector names, vector math, R List - Creating a List, Add/Delete Element to or from a List, Size of List, Merging Lists, Matrix Computations: Addition, subtraction, Multiplication and Division- R Arrays: Accessing Array Elements, Calculation Across Array Elements - R Factors –creating factors, generating factor levels. Basics in Statistics: Descriptive and Inferential, Sample and Population. Data Frames – Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, Expand Data Frame: Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge(),
Module 4	Descriptive Statistics: Data Causation, Spotting Problems in Data with Visualization: visually Checking distributions for a single Variable - R –Pie Charts: Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – R Histograms – Density Plot - R – BarCharts: Bar Chart Labels, Title and Colors.Loading and handling Data in R: Getting and Setting the Working Directory – getwd(),setwd(), dir() - R-CSV Files - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() - Writing into a CSV File –R -Excel File – Reading the Excel file. Range, Frequencies, Mode, Mean and Median: Mean Applying Trim Option, Applying NA Option, Median - Mode – Summation, Variance, Standard Deviation, Analyzing a sample, The Normal Distribution, Skewness, Central Limit Theorem, Outlier. Correlation and

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	R Programming for Beginners	Sandip Rakshit	Mcgraw hill Education	2017
2	Data Analytics using R	Seema Acharya	McGrawHill Education	2018
3	R for Dummies	Andrie de Vries, JorisMeys	John Wiley and Sons	2015

COMPREHENSIVE SOFTWARE ENGINEERING(CSE)

COURSE CODE	24CA5207O	MODE	OL	LTPS	2-1-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand Fundamentals Object Oriented Software Engineering	2	PO1
CO2	Design UML diagrams for Echo Systems	3	PO4
CO3	Design and apply software architectures	3	PO3
CO4	Analyze software testing and software process models	3	PO3

Syllabus

Module 1	Software and Software Engineering, Nature of software, software application domains, unique nature of web applications, software engineering, software process, software engineering practice, SDLC, software myths.
Module 2	Process Models: Generic process model, prescriptive process models, specialized process models, unified process, personal and team process models, product and process.
Module 3	Reverse Engineering, Agile Development, Agile manifesto and principles, Extreme programming, Scrum, Feature Driven Development (FDD), Lean Software Development (LSD), Requirements Engineering, Requirements classification, Requirements modeling approaches, SRS and User Stories, Analysis to Design, Coupling and Cohesion, Refactoring Design Concepts, Design Principles, Software architecture, architectural styles, Use cases, Classes, Relationships, common Mechanisms and their diagrams. Interfaces, Modeling techniques for Class & Object Diagrams.
Module 4	Behavioral Modeling : Interaction diagrams. Activity Diagrams. Software testing & reliability, A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Testing methods, The Human and The Computer, Golden Rules, user interface analysis and design, interface analysis, interface design steps. Software Process Improvement, Software Quality Assurance: Six Sigma & the CMMI.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Object Oriented Software Engineering: Practical Software Development using UML and Java.	Timothy C Lethbridge & Robert, Langaneire,	Mc Graw Hill	
2	The Unified Modeling Language User Guide	Grady Booch, James Rumbaugh and Ivar Jacobson	Addison-Wesley	
3	Software Engineering; A Practitioner's Approach	Roger SPressman		
4	Object-Oriented Software Engineering: Using UML, Patterns and Java	Bernd Bruegge and Allen H. Dutoit	2nd Edition, Pearson Education	

WEB TECHNOLOGIES (WT)

COURSE CODE	24CA6108O	MODE	OL	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	illustrate the basic concepts of HTML and CSS & apply those concepts to design static web pages	2	PO1
CO2	Identify and understand various concepts related to dynamic web pages and validate them using JavaScript	2	PO1
CO3	Apply the concepts of Extensible markup language	3	PO2
CO4	Examine web Applications using Scripting Languages & Frameworks	4	PO1
CO5	Create and deploy secure, usable database driven web applications using PHP	5	PO5
CO6	Design Dynamic Web Pages by using HTML, CSS, JS, PHP	5	PO5

Syllabus

Module 1	Introduction to Web Technology: HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Html styles, Elements, Attributes, Heading, Layouts, Html media, I frames Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5 Dynamic HTML. CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution, CSS3.
Module 2	Introduction to JavaScript: Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions, Fundamentals of Angular JS and NODE JS Introduction to XML: Syntax of XML, Document Structure, Document type definition, Namespaces, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX.
Module 3	Introduction to PHP: Overview of PHP, general server characteristics, Creating PHP Pages, Form handling, Data Base access with PHP & MySQL. Web Servers- IIS (XAMPP, LAMP) and Tomcat Servers.
Module 4	Java Web Technologies-Introduction to Servlet, Life cycle of Servlet, Servlet methods, Java Server Pages. Database connectivity – Servlets, JSP, PHP, Practice of SQL Queries. Web development frameworks – Introduction to Ruby, Ruby Scripting, Ruby on rails –Design, Implementation and Maintenance aspects.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Programming the World Wide Web 7th Edition	Robet W Sebesta	Pearson	2013
2	Web Technologies, 1st Edition 7th impression	Uttam K Roy	Oxford	2012
3	Java Script & jQuery the missing manual, 3rd Edition	David sawyer McFarland	O'Reilly	2014
4	Web Hosting for Dummies, 1st Edition	Peter Pollock	John Wiley & Sons	2013
5	RESTful web services, 1st Edition	Leonard Richardson, Ruby	O'Reilly	2007

ESSENTIALS OF RESEARCH DESIGN (ERD)

COURSE CODE	**24IE5201O**	MODE	OL	LTPS	1-1-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate Research objects, steps involved in research and articulate appropriate Research Questions	3	PO1
CO2	Perform Literature Review in a Scholarly style and apply appropriate methods for Data collection	3	PO2
CO3	Represent the data in tabular/Graphical form and prepare data for analysis	3	PO2
CO4	Perform statistical modelling and analysis to optimize the data, prepare the data for publishing.	4	PO2

Syllabus

Module 1	Definition and objectives of Research-Types of research, Various Steps in Research process, Applied Mathematical tools for analysis, developing a research question-Choice of a problem, Literature review, Surveying, Synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.
Module 2	Literature Review (LR)-Meaning and its Types-Narrative and Systematic, LR using Web of Science, Google and Google Scholar, Citations-Types, referencing in academic writing, Citation vs Referencing Vs Bibliography, Citation tools- Zotero, Qualitative Research and its methods, Quantitative Research, and its Methods. Data Collection-Primary data collection using Questionnaire, Google forms, survey

	monkey, Testing the validity and Reliability of Questionnaire using Factor Analysis and Cronbach's Alpha respectively, Secondary data-sources.
Module 3	Diagrammatic and graphical presentation of data: Diagrams and Graphs of frequency data of one variable- histogram, barcharts-simple, sub-divided and multiple; line charts, Diagrams and Graphs of frequency data of two variables -scatter plot, preparing data for analysis. Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Error Analysis.
Module 4	Analyzing data using one-dimensional statistics, two-dimensional statistics and multidimensional statistics. Technical Writing and Publishing, Conference presentations, Poster Presentations, Plagiarism-check and tools, Self-Plagiarism. Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, Design Thinking for Contextualized Problem-Solving and Empathetic Research

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Research Methods for Engineers	C.R. Kothari		
2	Engineering Research Methodology	y Krishnan Nallaperumal		
3	Engineering Research Methodology -A Practical Insight for Researchers	Dipankar Deb and Balas		

SYLLABUS OF COURSES UNDER

PROFESSIONAL ELECTIVE

APPLIED MACHINE LEARNING(AML)

COURSE CODE	24CA52A1O	MODE	OL	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Demonstrate the types of machine learning model representation and Supervised Learning- Simple Linear Regression Analysis	2	PO1,PO2,PO3
CO2	Implementing Multiple Regression model for supervised learning	3	PO1,PO2,PO3
CO3	Experimenting Multiple Linear Regression model	3	PO3,PO4,PO5
CO4	Estimating various Regression coefficient	4	PO3,PO4,PO7
CO5	Evaluate applications using linear regression techniques	5	PO4,PO5,PO7
CO6	Developing Solutions for the real-world problems using Python programming.	5	PO4,PO5,PO7

Syllabus

Module 1	Introduction to Machine Learning Algorithms: Introduction to Machine learning –Statistical Learning –types of Machine Learning –learning models: geometric, probabilistic and logistic models, introduction to supervised, unsupervised and reinforcement learning – model evaluation –model implementation –model accuracy indicators. Supervised Learning –Simple Linear Regression Analysis: Introduction to parametric machine learning method, assumptions of parametric machine learning methods, linear model and its assumptions, simple linear regression, scatter diagram, Simple linear Regression parameter estimation, properties of regression parameters, testing the significance of regression parameters
Module 2	Supervised Learning –Multiple Linear Regression Analysis I .Multiple linear regression model, assumptions of Multiple linear regression variables –multicollinearity, homoscedasticity, autocorrelation, effects of multicollinearity, effect of homoscedasticity and auto autocorrelation in parameter estimation, Least -Squares Estimation of the Regression Coefficients, Geometrical Interpretation of Least Squares, Properties of the Least -Squares Estimators, Estimation of σ2, Inadequacy of Scatter Diagrams in Multiple Regression
Module 3	Supervised Learning –Multiple Linear Regression Analysis II : testing the general linear hypothesis, Test for Significance of Regression, Tests on Individual Regression Coefficients and Subsets of Coefficients, Special Case of Orthogonal Columns in X, Confidence Intervals on the Regression Coefficients, CI Estimation of the Mean Response, Simultaneous Confidence Intervals on Regression Coefficients, predicting new observations, residual analysis, model adequacy and validation.
Module 4	Supervised Learning –Non Linear Regression Analysis Introduction to non-linear regression models, non-linear least square method to estimating the regression parameters, transformation of non-linear model to linear model, linearization, other parameter estimation methods, starting values, statistical inference in non-linear regression

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Introduction to Linear Regression Analysis	DOUGLAS C. MONTGOMERY, ELIZABETH A. PECK, G. GEOFFREY VINING	A JOHN WILEY & SONS, INC., PUBLICATION	Sixth Edition, 2021
2	Introduction to Machine Learning	EthemAlpaydm	MIT Press	Third, 2014
3	Python Machine Learning	Sebastian Raschka	PACKT Publishing	Second
4	Using Multivariate Statistics	Barbara G. Tabachnick, Linda S. Fidell	Pearson Education Inc	Sixth
5	Introduction to machine learning with Python	Andreas Muller	Shroff/O'Reilly	First

CLOUD COMPUTING (CC)

COURSE CODE:	24CA52C1O	MODE	OL	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	PO Mapping	BTL
CO 1	Ability to explain various concepts, architectures and deployment models relating to the cloud computing technologies	PO1	2
CO 2	Know the fundamentals of cloud, cloud Architectures and types of services in cloud	PO1	2
CO 3	Understand the concept of virtualization and how this has enabled the development of Cloud Computing	PO2	3
CO 4	Design different sample applications using IaaS, PaaS and SaaS deployment Model	PO2	3
CO 5	Develop application programs using different platforms and languages	PO4	5
CO6	Interpret and Learn the Concept of Advanced Cloud Technologies and Cloud Databases	PO4	5

Syllabus

Module 1	**troduction to Cloud Computing:** meaning of Cloud Computing, variations of cloud computing from other models, Essential Characteristics, Cloud computing Architectures, Technological Influences. Cloud Computing Architecture, the three-deployment model's IaaS, PaaS, SaaS, and Types of clouds (Public, Private and Hybrid) **LOUD INFRASTRUCTURE:** Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.
Module 2	**rvice Models (XaaS):** Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS); **ployment Models:** Public cloud, Private cloud, Hybrid cloud, Community cloud. Establishing and using a private cloud: Network topology, HW-SE specification, installing open stack, configuring open stack availing services through open stacks, establishing virtual networks.
Module 3	**frastructure as a Service (IaaS):** Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, and Virtual Machine (VM). **source Virtualization:** Server, Storage, Network, Virtual Machine (resource) provisioning and manageability, Storage as a service, Examples Applications: Amazon EC2, Google Drive, one drive, drop box. Developing applications Using IaaS.
Module 4	**tform as a Service (PaaS):** Introduction to PaaS: What is PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management, Computation, Storage, Examples, Google App Engine, Microsoft Azure, SalesForce.com's Force.com platforms. Developing applications using PaaS. **ftware as a Service (SaaS):** Introduction to SaaS, Web services, Web 2.0, Web OS, and Case Study on SaaS. Provisioning, scheduling and requesting VM that is identified with

	desired software packages. Development of Application software using the system software installed on the Virtual Machine. Developing Applications that use SaaS.

Reference Books:

S No	Title	Author(s)	Publisher	Year
1	Cloud Computing	Kris Jamsa	Wiley India Pvt Ltd	2012
2	Cloud Security: A comprehensive Guide to Secure Cloud Computing.	Krutz, Ronald L.; Vines, Russell Dean	Wiley India Pvt Ltd	2010
3	Cloud Computing Bible,	Barrie Sosinsky	Wiley India	2011

CYBER SECURITY AND ETHICAL HACKING

COURSE CODE	24CA52S1O	MODE	OL	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the need for cyber security	2	PO1
CO2	Analyse various types of security threats and electronic payment systems	4	PO3, PO4
CO3	Analyse the security issues involved in developing secure information systems	4	PO3, PO4
CO4	Compare different ethical hacking methods	5	PO3, PO4
CO5	Analyse various cyber security threats	4	PO4,PO5
CO6	Compare different ethical hacking methods and tools	5	PO4,PO5

Syllabus

Module 1	Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.
Module 2	Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce Electronic Payment System, e- Cash, Credit/Debit Cards.
Module 3	Digital Signature, public Key Cryptography. Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.
Module 4	Introduction to Ethical Hacking : Hacking Methodology, Process of Malicious Hacking, Foot printing and Scanning: Foot printing, Scanning. Enumeration: Enumeration. System Web and Network Hacking : SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms, Physical Security. Linux Hacking: Linux Hacking. Evading IDS and Firewalls: Evading IDS and Firewalls Report writing & Mitigation :Introduction to Report Writing & Mitigation, requirements for low level reporting & high level reporting of Penetration testing results, Demonstration of vulnerabilities and Mitigation of issues identified including tracking

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"Analysing Computer Security "	Charles P. Pfleeger, Shari Lawerance Pfleeger,	Pearson Education India.	2012
2	"Cryptography and information Security"	V.K. Pachghare	PHI Learning Private Limited, Delhi	2004
3	"Introduction to Information Security and Cyber Law"	Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla	Willey Dreamtech Press	2008
4	" Information Assurance for the Enterprise"	Schou, Shoemaker	Tata McGraw Hill	2006
5	Hacking Exposed 7th Edition	Stuart McClure, Joel Scambray, George Kurtz	Tata McGraw Hill	2009

PATTERN RECOGNITION (PR)

COURSE CODE	24CA52A2O	MODE	OL	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand basic concepts in pattern recognition.	2	PO2
CO2	Understanding Generative Learning Models.	2	PO3,PO2
CO3	Understand Structured pattern recognition and Neural pattern recognition.	2	P02
CO4	Apply pattern recognition techniques in practical problems.	3	PO2

Syllabus

Module 1	Introduction and general pattern recognition: Pattern Recognition (PR), Pattern Recognition Approaches, Examples of PR Applications, Pattern Recognition Extensions. Statistical pattern recognition: Introduction, Supervised, Parametric Approaches, Unsupervised Approaches
Module 2	Bayes Classifier: Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities Comparison with the NNC, Naive Bayes Classifier. Hidden Markov Models: Markov Models for Classification, Hidden Markov Models, HMM Parameters, Learning HMMs, Classification Using HMMs.
Module 3	classification of Test Patterns. Syntactic (structural) pattern recognition & NN Classifiers: Introduction, Structural Analysis Using Constraint Satisfaction and Structural Matching, The Formal Language-based Approach, Learning/Training in the Language- based Approach. Nearest Neighbour Based Classifiers: Nearest Neighbour Algorithm, Variants of the NN Algorithm, Use of the Nearest Neighbour Algorithm for Transaction Databases, Minimal Distance Classifier (MDC).
Module 4	Applications of Pattern Recognition: Fingerprinting, cursive characteristic recognition, Biometrics, Rice inspection, Food quality analysis.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Introduction to Statistical Pattern Recognition	Fukunaga	Academic Press	
2	Pattern Recognition and Machine learning”	M.Narasimha Murty, V. Susheela Dev	Universities Press (India) Pvt. Ltd	2011
3	“Pattern Classification”,	R. O. Duda, P. E. Hart, and D. G. Stork,	2nd edition, Wiley-Interscience.	2000
4	Pattern Recognition and Machine learning	. M. Bishop, 22	Springe	2006

HADOOP AND BIG DATA (HBD)

COURSE CODE	**24CA52D2O**	MODE	OL	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	understand how to store and maintain of Big Data	2	PO1
CO2	understand architecture and ecosystem of Hadoop & Outline Processing and Storage Layer of Hadoop, internal concept of Map Reduce , YARN	2,3	PO2
CO3	understand architecture of Spark and Outline Core components in Spark	2,3	PO2
CO4	Apply Hadoop plus Spark for achieving Big Data Analytics	4	PO3,PO4,PO5

Syllabus

Module 1	Understanding Big Data: Definition of Big Data, Types of Big Data, How Big data being Generated, Different source of Big Data Generation, Rate at which Big Data is being generated, Different V's, How single person is contributing towards Big Data, Significance for Big Data, Reason for Big Data, Understanding RDBMS and why it is failing to store Big Data, Future of Big Data, Maintenance/storage of Big data, Big Data use cases for major IT Industries
Module 2	Introduction to Hadoop: What is Hadoop, Apache Community, History of Hadoop, How is Hadoop Important, Apache Hadoop Ecosystem, Hadoop Architecture, Difference between Hadoop 1.x,2.x and 3.x Architecture, Master- Slave Architecture, Advantages of Hadoop. HDFS and its features, Map Reduce and its features, Map Reduce V1 vs Map Reduce V2, Hadoop YARN-job scheduling in YARN, storage options in HADOOP – File Formats & Compression Formats, Encryption, and User Authentication.
Module 3	Introduction to Spark: What is Spark, history of Spark, Theoretical concepts in Spark – Resilient distributed datasets, Directed acyclic graphs, Spark Context, Spark Data Frames, Actions and Transformations, Spark deployment options, Spark APIs. Core Components in Spark – Spark Core, Spark SQL, Spark Streaming, GraphX, MLib. The Architecture of Spark .
Module 4	Big Data Analytics with Hadoop plus Spark: Limitations of Hadoop, Overcoming limitations of Hadoop, Spark solutions, spark practical on big data analytics ,Hadoop Practical on Big data analytics , Hadoop vs Spark, Why Hadoop plus Spark – Hadoop features, Spark features. Installing Hadoop plus Spark Clusters.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Practical Big Data Analytics	Nataraj Dasgupta	Packt Publishing	2018
2	Big Data Analytics	Venkat Ankam	Packt Publishing	2016
3	Big Data Analytics with Hadoop 3.0	Sridhar Alla	Packt Publishing	2018
4	Hadoop: The Definitive Guide	Tom White	O'REILLY	2015
5	Hadoop for Dummies	Dirk deRoos, Paul C. Zikopoulos, Bruce Brown, Rafael Coss, and Roman B. Melnyk	A Wiley brand	2014

CLOUD INFORMATION SECURITY (CIS)

COURSE CODE	24CA52C2O	MODE	OL	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Explain the basic concepts of cloud computing, virtualization, and the importance of Information Security in the Cloud Context	2	PO1, PO2
CO2	Discuss various vulnerabilities, controls, and protocols in the cloud	2	PO3, PO1
CO3	Classify the cloud vulnerabilities and threats	3	PO1, PO3
CO4	Outline how cloud and Security works in a seamless model	3	PO1, PO3
CO5	Execute and perform cloud security measures	5	PO2, PO4

Syllabus

Module 1	Introduction to Virtualization & Cloud: Virtualization and Cloud computing concepts, Private cloud Vs Public cloud, IAAS, PAAS & SAAS concepts, Virtualization security concerns, Hypervisor Security, Host/Platform Security, Security communications, Security between Guest instances, Security between Hosts and Guests.
Module 2	Cloud Controls Matrix &Top Cloud Threats: Introduction to Cloud Controls Matrix & Top Cloud Threats, Cloud Controls Matrix, Trusted Cloud Initiative architecture and reference model, requirements of Security as a Service (Secaas) model and Top Security threats to the cloud model.
Module 3	Cloud Security: Cloud Security vulnerabilities and mitigating controls, Cloud Trust Protocol, Cloud Controls Matrix. Complete Certificate of Cloud Security Knowledge (CCSK).
Module 4	Cloud Trust Protocol &Transparency: Introduction to Cloud Trust Protocol & Transparency, Cloud Trust Protocol and Transparency, Transparency as a Service, Concepts, Security, Privacy & Compliance aspects of cloud.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"Cloud Security – A comprehensive Guide to Secure Cloud Computing"	Ronald L. Krutz and Russel Dean Vines	Wiley Publishing, Inc.	2010
2	"Cloud Computing Explained"	John Rhoton	Recursive Limited	2009

3	"Cloud Computing - A Practical Approach"	Anthony T Velte, Toby J Velte and Robert Elsenpeter	McGraw Hill	2010
4	"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"	Tim Mather, Subra Kumaraswamy, and Shahed Latif	O'Reilly Media	2009

CYBER FORENSICS < (CFS)>

COURSE CODE	24CA52S2O	MODE	OL	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand Forensic Science and Recovery methods	2	PO1, PO2
CO2	Analyse Digital Evidence, Network Forensics and Mobile Device Forensics	4	PO2, PO3
CO3	Analyse Web Forensics and Email Forensics	4	PO2,PO3, PO4
CO4	Analyse the security policies, standards and cyber laws	4	PO3, PO4

Syllabus

Module 1	Computer Forensics : Introduction to Computer Forensics, Forms of Cyber Crime, First Responder Procedure- Non-technical staff, Technical Staff, Forensics Expert and Computer Investigation procedure, Case Studies Storage Devices & Data Recover Methods : Data Acquisition, Data deletion and data recovery method and techniques, volatile data analysis, Case Studies
Module 2	Forensics Techniques I : Windows forensic, Linux Forensics, Network forensics – sources of network-based evidence, other basic technical fundamentals, Network forensic investigative strategies, technical aspects, statistical flow analysis, packet analysis, forensics of wireless networks, network intrusion detection analysis, event log aggregation and correlation analysis, switches, routers and firewalls, Case Studies, Mobile Forensics – data extraction & analysis, Steganography, Password cracking, Case Studies.
Module 3	Forensics Techniques II : Cross-drive analysis, Live analysis, deleted files, stochastic forensics, Dictionary attack, Rainbow attack, Email Tacking – Header option of SMTP, POP3, IMAP, examining browsers, Case Studies
Module 4	Cyber Law : Corporate espionage, digital evidences handling procedure, Chain of custody, Main features of Indian IT Act 2008 (Amendment), Case Studies, Incident specific procedures.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year

1	Computer Forensics: Computer Crime Scene Investigation	John Vacca	Laxmi Publications	2015
2	Digital Forensic: The Fascinating World of Digital Evidences	Nilakshi Jain	Wiley	2016
3	Hacking Exposed Computer Forensics	Aaron Philipp, David Cowen	McGraw Hill	2009
4	Mastering Mobile Forensics	SoufianeTahiri	Packt Publishing	2016
5	Computer Forensics: A Beginners Guide	David Cowen	McGraw Hill	2013

COMPUTER VISION (CV)

COURSE CODE	24CA61A3O	MODE	OL	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate the need for image transformations and modeling, different types of image transformation, and their properties.	2	PO1,PO4
CO2	Apply the techniques and transformation methods for image enhancement and image restoration.	3	PO1,PO2
CO3	Demonstrate image processing algorithms to perform feature detection, matching, segmentation and recognition.	4	PO1,PO2
CO4	Apply and analyze NN, ML, and DL algorithms for image transformation, pose consistency, and segmentation.	4	PO5,PO1
CO5	Analysis and study of image processing and machine learning algorithm for computer vision	5	PO5

Syllabus

Module 1	Introduction to Computer vision: 2D and 3D transformation, Co-vectors, Stretch/Squash, Planar surface flow, Bilinear Interpolant. 3D rotations, 3D to 2D projections :Orthography and para perspective, Pin hole Camera Model, Camera Intrinsic ,Image sensing pipeline, sampling, and aliasing.
Module 2	Linear Filtering: 1D and2D convolution, Separable altering, Examples off linear filters (Moving average/ Box filter, Bilinear, Gaussian, Sobel, Corner Filter), Bandpass and steerable filters: applicant of gaussian filter, Nonlinear filters: Median filter, Bilateral filter, Binary Image processing, Morphology, Fourier Transforms, DCT, Applications sharpening , blur and noise removal, interpolation, Decimation, multi resolution, Image pyramids.
Module 3	Boundary Detection: Fitting Lines and Curves, Active Contours, Hough Transform, Generalized Hough Transform, SIFT Detector: Interest Points, Detecting Blobs, SIFT Detector, SIFT Descriptor, SURF Features.

Module 4	Image Stitching: Image transformations (2x2 &3x3), Computing Holography, Dealing with Outliers: RANSAC, Face Detection: Uses of Face Detection, Haar Features for Face Detection, Integral Image, Nearest Neighbour Classifier, Support Vector Machines., Perception: Object tracking, Image Segmentation, Appearance Matching, Deep Learning Architecture for Computer Vision Applications: Convolutional neural networks, ImageNet Dataset, YOLO, VGG16/19, RESNET, EfficientNet, U-NET.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Perform basic Image Handling and Processing operations on the image.	Russell kirsch	Kickstarted Publications	2011
2	Geometric Transformation, compute homography matrix	Razavan	Klein	2013
3	Edge detection, Line Detection and Corner Detection	Mohamed AEi-sayed	Lambert	2012
4	Image classification using SVM	Ramon amayan	Rupa publications	2010
5	Image classification using SVM	Mario Amado	Bloomsbury	2019

DATA VISUALIZATION TECHNIQUES <DV>

COURSE CODE	24CA61D3O	MODE	OL	LTPS	**3-0-2-4**	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the brief history of data visualization, its importance, and the challenges involved in visualizing data	2	PO1
CO2	Apply static graphical techniques such as bar graphs to represent data, including grouping bars, customizing colors, sizes, titles, and axis units	3	PO2,PO4
CO3	Analyze multivariate statistical visual representations, such as dendrograms, scree plots, QQ plots, and PP plots.	4	PO2,PO3,PO4
CO4	Examine the visualizations by adding annotations such as text, mathematical expressions, lines, arrows, shaded shapes, and error bars.	4	PO4,PO5

CO5	Hands-on practice creating basic bar graphs, grouping bars, customizing color, size, and title, adding labels, and applying bar graphs in business scenarios.	3	PO1,PO2,PO5
CO6	Practicing annotation techniques such as adding text, mathematical expressions, lines, arrows, shaded shapes, and error bars. Modifying axes, including swapping x and y axes, changing scaling ratios, positioning tick marks and labels, adjusting the appearance of axis labels, creating circular graphs, using themes, and manipulating legends.	4	PO1,PO3,PO5

Syllabus

Module 1	Introduction to Data Visualization: Brief history of data visualization, scientific design choices in data visualization- choice of graphical form, grammar of graphical techniques of large amount of data, crucial need of visualization techniques, challenges in visualization techniques, classification of visualization techniques for qualitative and quantitative data, power of visualization techniques.
Module 2	Static Graphical Techniques – 1 :Introduction to bar graph, basic understanding of making basic bar graph, grouping bars together, bar graphs on counts, customization of bar graphs by changing colour, size, title, axis units, changing width and spacing of the bar chart, adding labels to bar graph, application of bar graph in business.
Module 3	Multivariate Graphical Techniques :Introduction to correlation matrix, application of correlation matrix in the multivariate analysis, network graph, basics of heat map, difference between heat map and tree map, introduction to higher dimensional scatter plot, axis adjustment in the higher dimensional scatter plot.
Module 4	Graphical Validation : Basics of multivariate statistical visual representations and its results, dendrogram, importance of dendrogram in grouping (cluster analysis), Scree Plot, importance of Scree Plot, application of Scree Plot in determining number of clusters and factors, QQ plot, importance of QQ plot in distribution of data for the further quantitative analysis, PP plot, applications and usage of PP Plot for distribution detection.Customization: Introduction to annotations – adding : text, mathematical expression , lines, arrows, shaded shapes, highlighting the texts and items, adding error bars, introduction to axis, swapping x and y axis, changing the scaling ration in the axis, positioning of axis and arranging tick marks and labels, changing the appearance of axis labels, circular graphs, using themes, changing the appearance of theme elements, creating the own themes, legends : removing the legends, position of legends, legend title, labels in legends.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Visualization Analysis and Design	Munzner	A K Peters/CRC Press	2014
2	Information Visualization: Perception for Design	Colin Ware	Morgan Kaufmann	2012
3	Visualizing Data.	Ben Fry	O'Reilly Media	2008

MALWARE ANALYSIS (MA)

COURSE CODE	24CA61S3O	MODE	OL	LTPS	3-0-2-4	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate the Goals of Malware Analysis and Creating fake networks	2	PO1,PO4
CO2	Demonstrate the usage of virtual machines in the context of malware analysis.	2	PO1,PO2
CO3	Apply the concept of exception handling in the context of malware analysis. How can it be used to identify and analyze malware activity	3	PO1,PO2
CO4	Develop a plan for analyzing malware persistence mechanisms	3	PO5,PO1
CO5	Evaluate malware analysis programs web servers and password cracking	5	PO5

Syllabus

Module 1	Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots, Creating fake networks
Module 2	X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Ari thematic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, The Structure of a Virtual Machine, Analysing Windows programs, Anti-static analysis techniques, obfuscate
Module 3	Live malware analysis, dead malware analysis, analysing traces of malware, system calls, Api calls, registries, network activities'-dynamic analysis techniques, VM detection techniques, Evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching
Module 4	Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, Coinfection, YARA rule based detection.

Reference Books:

Sly No	Title	Author(s)	Publisher	Year
1	“Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software"”	Michael Sikorski and Andrew Honig	No Starch Press	2017
2	"The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory"	Michael Hale Ligh, Andrew Case, Jamie Levy, and Aaron Walters	Willey	2012
3	"Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code"	Michael Hale Ligh, Steven Adair, Blake Hartstein, and Matthew Richard	Willey	2012
4	"Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation"	Bruce Dang, Alexandre Gazet, and Elias Bachaalany	Willey	2019
5	"Black Hat Python: Python Programming for Hackers and Pentesters"	Justin Seitz	No Starch Press	2011

APPLIED DEEP LEARNING (ADL)

COURSE CODE	24CA61A4O	MODE	OL	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Describe the fundamental concepts of deep learning, including neural networks, activation functions, loss functions, and optimization techniques.	3	PO1, PO2, PO5.
CO2	Apply deep learning frameworks such as TensorFlow or PyTorch to develop and implement deep learning models.	2	PO2, PO3,.
CO3	Apply deep learning techniques to image classification, object detection, and natural language processing tasks	3	PO1, PO2, PO5
CO4	Apply Generative Adversarial Networks (GANs) for image and text generation.	3	PO1, PO2, PO5

Syllabus

Module 1	Introduction to Deep Learning: Overview of machine learning and deep learning Neural networks and their components Activation functions, loss functions, and optimization Training deep neural networks

Module 2	Convolutional Neural Networks (CNNs): Fundamentals of image data and preprocessing Building and training CNNs Applications of CNNs (e.g., image classification, object detection) Recurrent Neural Networks (RNNs): Sequence data and time series analysis Building and training RNNs Applications of RNNs (e.g., natural language processing, speech recognition)
Module 3	Transfer Learning and Pretrained Models: Transfer learning techniques, Fine-tuning pretrained models, Reinforcement learning and its applications Explainable AI and model interpretability, Ethical considerations in deep learning. Natural Language Processing (NLP) and Transformers: Introduction to NLP Transformers architecture for NLP tasks Fine-tuning pre-trained language models
Module 4	Generative Adversarial Networks (GANs): Introduction to GANs Training GANs for image generation Applications of GANs (e.g., image synthesis) Deploying Deep Learning Models: Model deployment methods (e.g., cloud, edge devices) Model optimization and inference speed Model version control and updates

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"Deep Learning"	Ian Goodfellow, Yoshua Bengio, and Aaron Courville.	MIT press	2016
2	"Deep Learning for Computer Vision"	Rajalingappaa Shanmugamani.	Packt Publishing.	2018
3	"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow"	Aurélien Géron.	O'Reilly Media	2nd (2019)

STATISTICS FOR DATASCIENCE

COURSE CODE	24CA61D4O	MODE	OL	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Explain the basic concepts of statistics and explains the various methods of descriptive data collection and analysis	2	PO1,PO2,PO6
CO2	Show the probability distribution of a random variable, based on real-world situation, and use it to compute expectation and variance	2	PO1,PO2,PO6
CO3	Construct the linear and non-linear regression lines for the given data.	3	PO2,PO3,PO6
CO4	Apply basic concepts of statistics and explains the various methods of descriptive data collection and analysis	3	PO2,PO3,PO4,PO6,

Syllabus

Module 1	Basic Statistics: Importance of Statistics-Primary and secondary data-Data collection methods Presentation of numerical and categorical data. Concepts of central tendency and dispersion-Mean, median and mode-Partition Values-Quartiles for grouped and ungrouped data-Range-Quartile Deviation-Standard deviation and coefficient of variation for grouped and ungrouped data.

Module 2	Probability Distribution: Random Variable- Discrete Random and Continuous Random variable, Probability Distribution of a Random Variable, Mathematical Expectation Types: Binomial, Poisson, Normal Distribution, Mean and Variance of Binomial, Poisson, and Normal Distribution
Module 3	Correlation: Introduction, Types, Properties, Methods of Correlation: Karl Pearson's Coefficient of Correlation, concept of point biserial correlation, Rank Correlation and Phi-coefficient. Regression: Introduction, Aim of Regression Analysis, Types of Regression Analysis, Lines of Regression, Properties of Regression Coefficient and Regression Lines, Comparison with Correlation
Module 4	Working on Statistical data with Ms-Excel: Working with Data using MS-Excel, Importing Data Sort, Data Filter, Advance Filter, Data Validation, Data Consolidation, What-If Analysis, Data Grouping, Subtotal, Data regression, Working with function; statistical functions. Index numbers-Laspeyere-Passche-Fisher's price and quantity index numbers Time reversal and factor reversal tests.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Probability and Statistics for Engineers and Scientists	Ronald E. Walpole, Sharon L. Myers and Keying Ye,	Pearson-8ed	2017
2	Fundamentals of Business Statistics	Sharma J.k.	Vikas Publishing House	2019
3	A textbook of probability and statistics	B. Sooryanarayana :	S. Chand 2003	2003

CLOUD AND SERVERLESS COMPUTING(CSC)

COURSE CODE	23CA61C4O	MODE	OL	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the concepts of Cloud Serverless Computing	2	PO1, PO2, PO5
CO2	Organize the Serverless cloud Architecture	3	PO1, PO2, PO5
CO3	Experiment with the appropriate methodologies of testing and debugging serverless functions	3	PO1, PO2, PO5
CO4	Implement knowledge representation using Event-driven Programming in Serverless Architectures	3	PO1, PO2, PO5

Syllabus

Module 1	Introduction to Cloud Serverless Computing, Overview of serverless computing, Benefits and drawbacks of serverless architecture, Comparison with traditional server-based approaches, Serverless platforms and providers
Module 2	Serverless Architecture, Serverless design patterns, Microservices and serverless, Scalability and elasticity in serverless environments, Data storage and management in serverless applications
Module 3	Function-as-a-Service (FaaS),Introduction to FaaS platforms, Developing serverless functions, Managing dependencies and external integrations Testing and debugging serverless functions
Module 4	Event-driven Programming in Serverless Architectures, Understanding event-driven programming models, Event sources and triggers, Implementing event-driven workflows, Orchestration and choreography

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Serverless Architectures on AWS: With examples using AWS Lambda	Peter Sbarski	DT Editorial Services	1st edition (2017)
2	Building Serverless Web Applications Paperback	Diego Zanon	Packt Publishing Limited	1st edition (2017)
3	Serverless Applications with Node	Slobodan Stojanovic, Aleksandar Simovic, and Mladen Macanovic	Pearson Education	3rd edition (2017)
4	Practical AWS Lambda: Build and Deploy Event-Driven Serverless Applications	Yohan Wadia	Ingram short title	1st edition (2017)

SECURITY GOVERNANCE AND MANAGEMENT(SGM)

COURSE CODE	24CA61S4O	MODE	OL	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand basic security for the system.	2	PO1,PO2,PO3
CO2	Applying Security Governance Objectives to various organizations	3	PO3
CO3	Applying Security Strategy ,Strategy Constraints to various organizations	3	PO3
CO4	Applying Incident Management and Response Metrics to various organizations	3	PO4

Syllabus

Module 1	Governance Overview—How Do We Do It? What Do We, Why Governance?,: Benefits of Good Governance, A Management Problem, Legal and Regulatory Requirements: Security Governance and Regulation, Roles and Responsibilities: The Board of Directors ,Executive Management,Security Steering Committee, The CISO,CIA Model , User identity and Access Management: Authentication, Account Authorization, Validation, Access Control
Module 2	Strategic Metrics: Governance Objectives, Information Security Outcomes : Defining Outcomes , Security Governance Objectives: Security Architecture, CobiT ,Capability Maturity Model , ISO/IEC 27001/27002 63, Other Approaches, Risk Management Objectives: Risk Management Responsibilities, Managing Risk Appropriately ,Determining Risk Management Objectives
Module 3	Current State: Current State of Security, Current State of Risk Management , Gap Analysis—Unmitigated Risk , Developing a Security Strategy: Failures of Strategy ,Attributes of a Good Security Strategy Strategy Resources , Strategy Constraints, Sample Strategy Development: The Process, Implementing Strategy: Action Plan Intermediate Goals , Action Plan Metrics , Reengineering , Inadequate Performance , Elements of Strategy
Module 4	Security Program Development Metrics: Information Security Program Development Metrics ,Program Development Operational Metrics ,Information Security Management Metrics: Management Metrics ,Security Management Decision Support Metrics ,CISO Decisions , Incident Management and Response Metrics: Incident Management Decision Support Metrics

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	INFORMATION SECURITY Governance: A Practical Development and Implementation Approach	KRAG BROTBYA	WILEY	2009
2	Information Systems Security: Security Management, Metrics, Frameworks And Best Practices	Nina Godbole	2010	ISC2 Press

3	Information Security Risk Analysis	Thomas R. Peltier	3rd edition	Auerbach, 2012
4	Principles of Information Security	Michael E. Whitman	5 edition (2015)	Cengage Learning India Private Limited

APPLICATIONS OF NATURAL LANGUAGE **PROCESSING(ANLP)**

COURSE CODE	24CA61A5O	Mode	O L	LTP S	3-0-2-0	PRE-REQUISITE	NIL

CO. No	Course Outcome	PO/PSO	BTL
CO 1	Understand approaches to syntax and semantics in NLP	PO1	2
CO 2	Apply the statistical estimation and statistical alignment models P	PO2	3
CO 3	Analyze grammar formalism and context free grammars	PO2	3
CO 4	Apply Rule based Techniques, Statistical Machine translation (SMT), word alignment	PO1	3
CO 5	Evaluating NLP algorithms using python	PO5	5

Syllabus:

Module 1	"**Overview of NLP**. Statistical machine translation. Language models and their role in speech processing. The problem of ambiguity. NLP tasks in syntax, semantics, and pragmatics. Words: Structure, Semantics, Parts of Speech, Sentences: Basic ideas in compositional semantics, Classical Parsing (Bottom up, top down, Dynamic Programming: CYK parser). Sentences: Parsing using Probabilistic Context Free Grammars and EM based approaches for learning PCFG parameters. N-gram Language Models. "
Module 2	**Information Theory**: The role of language models. Simple N-gram models, Entropy, relative entropy, cross entropy. Statistical estimation and smoothing for language models. Part Of Speech Tagging and Sequence Labelling. Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training). n-gram models. Syntactic parsing: Grammar formalisms and treebanks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Top-down and bottom-up parsing, empty constituents, left recursion.
Module 3	**Modern Statistical Parsers Search methods in parsing**: Agenda-based chart, A*, and "best-first" parsing. Dependency parsing. Discriminative parsing. Semantic Analysis: Lexical semantics and word-sense disambiguation. Discourse: Reference resolution and phenomena, syntactic and semantic constraints on Coreference, pronoun resolution algorithm, text coherence, discourse structure. Semantic Role Labelling and Semantic Parsing.

Module 4	**Information Extraction (IE):** Named entity recognition and relation extraction. IE using sequence labelling. Information sources, rule-based methods, evaluation (recall, precision). Statistical Machine Translation (SMT), Alignment Models. Statistical Alignment Models and Expectation Maximization (EM) EM and its use in statistical MT alignment models. The EM algorithm. Machine Translation (MT): Basic issues in MT. Rule based Techniques, Statistical Machine translation (SMT), word alignment.
Module 5	Evaluating NLP algorithms using python

Textbooks:

1. An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition". Daniel Jurafsky and James H. Martin,

2. Natural language Understanding James A 2nd Edition Pearson Education.

3. Natural language processing: a Paninian perspective "Bharati A., Sangal R., Chaitanya V." 2000 Pearson Education.

Reference books:

1. Natural language processing and Information retrieval ". Siddiqui T., Tiwary U. S. " 2008

2. Foundations of Statistical Natural Language Processing Cambridge "Christopher D; Hinrich Schuetze" 1999 MIT Press

GRAPH AND WEB ANALYTICS> <(GWA)>

COURSE CODE	23CA61D5O	MODE	OL	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the importance of Bigdata on Graphs, Network basics and Social networks	2	PO1
CO2	Make use of Web Analytics – Data sources, tools, Web traffic data	3	PO1,PO5
CO3	Analysing Web Analytics Strategy- website traffic analysis, audience identification and segmentation analysis, Emerging Analytics	4	PO1
CO4	Compare Email Testing Analysis, competitive Intelligence Analysis, and Social, Mobile, Video Analysis	4	PO1

CO5	Implementing Python programming for graph and web analytics	4	PO4,PO5,PO6

Syllabus

Module 1	Graph Analytics: Origin of Graph Theory, Graph Basics, types of Graphs, Finding the best path, Dijkstra's Algorithm, operation on graphs. Network Basics: Types of Networks, Properties of Networks, Network Measures, Matrices: Adjacency matrix SocialNetworks:PropertiesofsocialnetworkscaleFreeNetwork,SmallworldNetworks,NetworkNavigation.Node_LevelAnalysis:Degree_centrality,closenesscentrality,betweenesscentrality,EigenvectorCentrality,pagerank,GroupLevelAnalysis:Cohesive subgroups,cliques,clusteringcoefficient,triaSlice,K-Cores.CommunityDetection:Graph partitioning, Hierarchical clustering
Module 2	Web Analytics: Introduction- State of the analytics union, state of the industry, Rethinking web analytics, clickstream, multiple outcomes analysis, experimentation, imperative, tactical shift. Strategy for choosing the optimal analytics tool- vendor selection analysis, running an effective tool pilot, checking SLA's for web-analytics vendor contract. Clickstream analysis- Critical web metrics, visits and visitors engagement, attributes of great metrics, strategically aligned tactics for impactful web metrics.
Module 3	Web Traffic Data: Practical solutions- Sources of traffic, outcomes, foundational analytical strategies, segmentation, benefits of and creating and app measuring the search quality, search engine optimization analysis, google example, content coverage, indexing by search engines, paid search analysis, direct traffic analysis, email campaign analysis, campaign response, website behaviour, data Testing, actionable testing ideas.
Module 4	Component of Web Analytics Strategy : Competitive Intelligence Analysis- Data Sources, website traffic analysis, search and keyword analysis, audience identification and segmentation analysis. Emerging Analysis of the performance of Videos.

Text Books:

Sl No	Title	Author(s)	Publisher	Year
1	Python for graph and Network Analysis	Mohammad Zuhair Al-Taie, Seifedine Kadry	Springer Publication	2017
2	Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity	Avinash Kaushik	Sybex	2009
3	Graph Analysis and Visualization	Richard Brath David Jonker	Willey publisher	2015
4	Advanced Web Metrics with Google Analytics	Brian Clifton	Syrex	2012
5	A textbook of Graph theory	R.Balakrishnan and K.Ranganathan	Universitext	2012

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Michael Beasley, "Practical Web Analytics for User Experience: How Analytics can help you Understand your Users"	Morgan Kaufmann, 2013 2. Justin Cutroni	O'Reilly	2010

CLOUD WEB SERVICES

COURSE CODE	24CA61C5O	MODE	OL	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Summarize the model of Cloud Computing As A Service	2	PO1,PO2,PO3
CO2	Illustrate the Networking Basics required for cloud services	2	PO1,PO2,PO3
CO3	Demonstrate the Control of workflow in cloud services	3	PO1,PO3
CO4	Explain the method of fault tolerance in cloud	3	PO1,PO3
CO5	Experiment with the AWS Cloud	3	PO1,PO3, PO5

Syllabus

Module 1	**Cloud Web concepts:** Search engine, Apache Hadoop, Grid Computing, Amazon Web Services, REST APIs, SOAP API, Query API, User Authentication, Connecting to the Cloud, Open SSH Keys, Tunnelling/ Port Forwarding, Image (glance), Object Storage (swift), ACL, Logging, Signed URI, Compute (nova), Cloud value proportion, Cloud economics, cloud architecture and design principles, AWS Cloud basic services
Module 2	**Networking & Storage:** Overview, Key pairs, Network Types, LAN, Gateways and Router, IP Classes and Subnets, CIDR, Utilities, Instances Management, Image Management, direct connect, hybrid deployments, VPN, Security groups, Block Storage (cinder), Ubuntu in the Cloud, Installation, Utilities, File system, basic concepts of storage and databases, various storage services, storage solutions, database services.
Module 3	**Global Infrastructure and Security:** Methods of deploying and operating cloud, global infrastructure, availability zone, benefits of CloudFront and Edge locations. AWS Corer services, resources for technology support, methods for provisioning services, Benefits of shared responsibility model, layers of security, Multi Factor Authentication, Identity Access Management Security levels, security policies, benefits of compliance, security services.

Module 4	**Monitoring & Pricing:** Approaches for monitoring, benefits of Cloud watch, CloudTrial, Trust Advisor, Pricing and support model, free tire, benefits of organization and consolidated billing, Budgets, Explorer, AWS pricing calculator, various AWS support plans, AWS market place.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Cloud Computing: Principles and Paradigms	RajkumarBuyya, James Broberg, Andrzej M. Goscinski	Wiley	2011
2	OpenStack Essentials	Dan Radez	Wiley	2009
3	Cloud Computing: Concepts, Technology and Architecture	Erl	Pearson Education	2009
4	Resource Management in Utility and Cloud Computing	Han Zhao,Xiaolin Li	Springer	2013

CLOUD SECURITY

COURSE CODE	24CA61S5O	MODE	OL	LTPS	3-0-2-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Explain Importance of Information Security in the Cloud Context	2	PO1, PO2
CO2	Identify various concepts of cloud security	2	PO1, PO2
CO3	Develop the cloud vulnerabilities and threats	3	PO3,PO4,PO7
CO4	Construct how cloud and Security works in a seamless model	3	PO3,PO4,PO5, PO7,
CO5	Practical	5	PO1, PO2, PO5

Syllabus

Module 1	**Introduction to Virtualization & Cloud**: Virtualization and Cloud computing concepts, Private cloud Vs Public cloud, IAAS, PAAS & SAAS concepts, Virtualization security concerns, Hypervisor Security, Host/Platform Security, Security communications, Security between Guest instances, Security between Hosts and Guests

Module 2	**Cloud Controls Matrix &Top Cloud Threats**: Introduction to Cloud Controls Matrix & Top Cloud Threats, Cloud Controls Matrix, Trusted Cloud Initiative architecture and reference model, requirements of Security as a Service (Secaas) model and Top Security threats to the cloud model
Module 3	**Cloud Security**: Cloud Security vulnerabilities and mitigating controls, Cloud Trust Protocol, Cloud Controls Matrix. Complete Certificate of Cloud Security Knowledge (CCSK).
Module 4	**Cloud Trust Protocol &Transparency**: Introduction to Cloud Trust Protocol & Transparency, Cloud Trust Protocol and Transparency, Transparency as a Service, Concepts, Security, Privacy & Compliance aspects of cloud.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Visible Ops Private Cloud – Andi Mann, Kurt Miline and Jeanne Morain, IT Process Institute.	John Rhoton 2009.	Visible Ops Private Cloud	2011
2	Cloud Computing Bible	Barrie Sosinsky	Wiley	2011
3	Cloud Computing Explained	John Rhoton		2011
4	Cloud Security and Privacy	Tim Mather, Subra Kumaraswamy, and Shahed Latif		2009
5	Cloud Security – A comprehensive Guide to Secure Cloud Computing	Ronald L. Krutz and Russel Dean Vines		2009