



RAMAIAH
Institute of Technology

CURRICULUM

(2024 – 2026 Batch)

DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

I - IV Semester MCA

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 18 UG programs and 13 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with 'A+' **grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute has also been conferred autonomous status for Ph.D. program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 70% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency Systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation. **Ramaiah Institute of Technology has obtained All India Rank 182 in "Scimago Institutions Rankings" for the year 2024.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. The Institute is a member of DELNET, CMTI and VTU E-Library Consortium. The Institute has a modern auditorium, recording studio, and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, Ramaiah Institute of Technology has achieved 75th rank among 1463 top Engineering Institutions & 21st Rank for School of Architecture in India among 115 Architecture Institutions, for the year 2024.

About the Department

The Department of Master of Computer Applications was established in 1997 with the objective of producing high quality professionals to meet the demands of the emerging field of Computer Applications. The department got academic autonomy in the year 2007 and is accredited by NBA. The department is recognized as a Research Centre under Visvesvaraya Technological University in 2012.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

1. Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
2. Establishing research clusters in emerging areas in collaboration with globally reputed organizations
3. Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at M. S. Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To be a nationally prominent and internationally recognized department in academics and research activities with the aim of developing competitive software professionals to serve the society and ever changing industry.

MISSION OF THE DEPARTMENT

- To enable the students to be knowledgeable and creative through state-of-the-art curriculum and innovative teaching methodologies
- To provide training programs that bridges the gap between academia and industry to produce competitive software professionals
- To inculcate ethical values in the students enabling them to become socially committed professionals
- To enhance the research quality and productivity, by providing required facilities

Program Educational Objectives (PEOs):

PEO1: Excel in professional career in the field of Computer Applications and contribute to research and development activities.

PEO2: Provide software solutions that are socially acceptable and adapt emerging technologies and tools.

PEO3: Exhibit ethical and communication skills and engage in lifelong learning.

Program Outcomes (POs):

1. **PO1 (Foundation Knowledge):** Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.
2. **PO2 (Problem Analysis):** Identify, review, formulate and analyse problems for primarily focusing on customer requirements using critical thinking frameworks.
3. **PO3 (Development of Solutions):** Design, develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.
4. **PO4 (Modern Tool Usage):** Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.
5. **PO5 (Individual and Teamwork):** Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
6. **PO6 (Project Management and Finance):** Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.
7. **PO7 (Ethics):** Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware.
8. **PO8 (Life-long learning):** Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

Curriculum Course Credits Distribution

Semester	Professional Core Course (PCC)	Integrated Professional Core Course (IPCC)	Professional Elective Course (PEC)	Professional Core Lab PCL	Internship (INT)	Project Work PCC (PB)	Technical Seminar (TS)	Total
First	6	8	-	4	-	-	-	18
Second	3	12	3	4	-	-	-	22
Third	3	4	9	-	-	6	-	22
Fourth	-	-	-	-	6	10	2	18
Total	12	24	12	8	6	16	2	80

Nomenclature: **PCC**: Professional Core Course, **IPCC**: Integrated Professional Core Course - Refers to Professional Theory Core Course Integrated with practical of the same course, **PEC** - Professional Elective Course, **PCL** - Professional Core Laboratory

SCHEME FOR 2024-2026 BATCH

I SEMESTER

S. No	Course Code	Course Name	Category	L	T	P	Total contact hours /week	Total Credits
1.	24MCA11	Programming with Python	IPCC	3	0	1	5	4
2.	24MCA12	Computational Mathematics	PCC	2	1	0	4	3
3.	24MCA13	Operating Systems and Shell Programming	IPCC	3	0	1	5	4
4.	24MCA14 [#]	Web Programming	PCCL	0	1	2	6	3
5.	24MCA15	Data Structures	PCC	3	0	0	3	3
6.	24MCA16	Data Structures Using 'C'	PCCL	0	0	1	2	1
7.	24MCABC***	Mathematical Foundation	BC				3	-
Total				11	2	5	28	18

II SEMESTER

S. No	Course Code	Course Name	Category	L	T	P	Total contact hours/week	Total Credits
1.	24MCA21	Object Oriented Programming Using Java	PCC	3	0	0	3	3
2.	24MCA22	Design and Analysis of Algorithms	IPCC	3	0	1	5	4
3.	24MCA23	Database Systems	IPCC	3	0	1	5	4
4.	24MCA24	Computer Networks	IPCC	3	0	1	5	4
5.	24MCA25*	Research Methodology	NCMC	-	-	-	2	-
6.	24MCA26 [#]	Full Stack Development	PCCL	0	1	2	6	3
7.	24MCA27	Programming in Java Laboratory	PCCL	0	0	1	2	1
8.	24MCAE1X	Elective Course	PEC					3
Total				12	1	6	28	22

ELECTIVE COURSES

S. No	Course Code	Course Name	L	T	P	Total contact hours/week	Total Credits
1.	24MCAE11	Data Analytics and Visualization	2	0	1	4	3
2.	24MCAE12	Introduction to Artificial Intelligence	2	0	1	4	3
3.	24MCAE13	Management Information System	3	0	0	3	3
4.	24MCAE14	Cyber Security	2	0	1	4	3

III SEMESTER

[illegible]

IV SEMESTER

4

S. No	Course Code	Course Name	Category	L	T	P	Total contact hours/week	Total Credits
1.	24MCAP2	Project Work - Phase II	PCC(PB)	0	0	10	20	10
2.	24MCAIN##	Industry Internship / Research Internship	INT	0	0	6	-	6
3.	24MCAS1	Technical Seminar	TS	0	0	2	4	2
4.	24MCAAEC**	Online Course (MOOC)/ Ideathon / Hackathon	NCMC				-	-
	Total							18

Specialization I – Artificial Intelligence and Data Science

S. No	Course Code	Course Name	L	T	P	Total contact hours/week	Total Credits
1.	24MCAAD1 [#]	Artificial Intelligence of Things	0	1	2	6	3
2.	24MCAAD2	Big Data Analytics	2	0	1	4	3
3.	24MCAAD3	Social Network Analysis	2	0	1	4	3
4.	24MCAAD4	Natural Language Processing	2	0	1	4	3
5.	24MCAAD5 [#]	Generative AI and Prompt Engineering	0	1	2	6	3

Specialization II - Web and Mobile Application Development

S. No	Course Code	Course Name	L	T	P	Total contact hours/week	Total Credits
1.	24MCAWM1 [#]	Mobile Application Development	0	1	2	6	3
2.	24MCAWM2 [#]	Software Testing and Automation	0	1	2	6	3
3.	24MCAWM3	Extended Reality	2	0	1	4	3
4.	24MCAWM4	Web Development with J2EE	2	0	1	4	3
5.	24MCAWM5	User Interface and User Experience	2	0	1	4	3

Specialization III – Software System and Security

S. No	Course Code	Course Name	L	T	P	Total contact hours/week	Total Credits
1.	24MCASS1	Software Project Management	3	0	0	3	3
2.	24MCASS2 [#]	DevOps	0	1	2	6	3
3.	24MCASS3 [#]	Cloud Computing	0	1	2	6	3
4.	24MCASS4	Information Security	3	0	0	3	3
5.	24MCASS5	Ethical Hacking	2	0	1	4	3

* Non Credit Mandatory Course (NCMC)

** NCMC, only Continuous Internal Evaluation will be conducted

*** Students who have not taken Mathematics at the 10+2 level or degree level are required to study and pass this course in the 1st semester. However, this course will not be considered for vertical progression.

Semester End Examination will be conducted only for Laboratory

Only Continuous Internal Evaluation will be conducted

L: Lecture T: Tutorial P: Practical

I SEMESTER

PROGRAMMING WITH PYTHON	
Subject Code: 24MCA11	Credits: 3:0:1
Pre requisites: Nil	Contact Hours: 42L 28P

Course Content

Unit I

Introduction to Python

Python Basics: Data Types, Operators, Input / Output Statements, Creating Python Programs.

Python Flow Control statements: Decision making statements, Indentation, Conditionals, loops, break, continue, and pass statements.

Unit II

Core Data Structures

Strings - Working with strings as single things, working with the parts of a string, length, traversal, slicing, strings are immutable, string operations, Tuples - Tuples are used for grouping data, tuple assignment, tuples as return values, Composability of Data Structures, Lists – list values, accessing elements, list length, list membership, list operations, list slices, list deletion, objects and references, lists and for loops, list parameters and methods, lists and functions, strings and lists, nested lists, Dictionaries - Dictionary operations, methods

NumPy: shape, slicing, masking, broadcasting, dtype

Unit III

Python Functions: Defining functions, DOC strings, Function parameters: default, keyword required and variable length arguments, key-word only parameters, local and global variables, pass by reference versus value, Recursion.

Functional Programming: Mapping, Filtering and Reduction, Lambda Functions, List Comprehensions.

Unit IV

Regular Expressions: Defining Regular Expressions and String Processing

Object Oriented Programming: Definition and defining a class, Constructor, Destructor, self and del keywords, Access to Attributes and Methods, getattr, setattr and hasattr attributes, Data Attributes and Class Attributes, Data Hiding, Inheritance, Static Members.

Unit V

Exceptions Handling: Catching exceptions, the finally clause of the try statement, Handling Exceptions, Built-in Exceptions and User defined Exceptions.

File I/O: File object attributes, Read and Write into the file, Rename and Delete a File.

Laboratory:

Sl. No	Topic
1.	Basic Constructs of Python
2.	Flow Control Statements
3.	Core Data Structures
4.	Arrays using Numpy
5.	Functions
6.	Functional Programming
7.	Regular expressions
8.	Classes and Objects
9.	Exception handlers
10.	File processing

Text Books:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers: “How to Think Like a Computer Scientist: Learning with Python 3”, 3rd Edition, Green Tea Press, 2020.
2. Timothy A. Budd: Exploring Python, Tata McGraw-Hill, 2011.

References:

1. Ascher, Lutz: Learning Python, 4th Edition, O'Reilly, 2009.
2. Jeff Forcier, Paul Bissex, Wesley Chun: Python Web Development with Django, Addison-Wesley (e-book), 2008.
3. Wesley J Chun: Core Python Applications Programming, Pearson Education, 3rd Edition, 2013.

Course Outcomes (COs):

1. Develop programs using basic concepts of Python programming. (PO-1, PO-2, PO-3, PO-4, PO-8)
2. Apply the methods to create and manipulate the core data structures strings, lists, tuples and dictionaries and arrays. (PO-1, PO-2, PO-3, PO-4, PO-8)
3. Construct modular programs using functions. (PO-1, PO-2, PO-3, PO-4, PO-8)
4. Implement object-oriented concepts and regular expressions. (PO-1, PO-2, PO-3, PO-4, PO-8)
5. Demonstrate exception handling and file processing. (PO-1, PO-2, PO-3, PO-4, PO-8)

Course Assessment and Evaluation:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Lab Test	10	CO1, CO2, CO3, CO4, CO5
Continuous Evaluation (Lab Record – 5 Marks + Viva – 5 Marks)	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

COMPUTATIONAL MATHEMATICS	
Subject Code: 24MCA12	Credits: 2:1:0
Pre requisites: Nil	Contact Hours: 28L 28T

Course Content

Unit I

Fundamentals of Logic: Propositional Logic – Propositions, Conditional Statements, Truth Tables of Compound Propositions, Precedence of Logical Operators, Propositional Equivalences – Logical Equivalences, Using De Morgan's Laws, Predicates and Quantifiers – Predicates, Quantifiers, Rules of Inference - Valid Arguments in Propositional Logic, Rules of Inference for Propositional Logic

Unit II

Basic Structures: Sets and Functions

Sets – Introduction, The Power Set, Cartesian Products, Set Operations - Set Identities, Generalized Unions and Intersections

Functions – Introduction, One-to-One and Onto Functions

Unit III

Counting:

The Basics of Counting – Basic Counting Principles, The Inclusion-Exclusion Principle, The Pigeonhole Principle – Introduction, The Generalized Pigeonhole Principle, Permutations and Combinations – Permutations, Combinations, Binomial Coefficients – The Binomial Theorem, Generalized Permutations and Combinations – Permutations with Repetition, Combinations with Repetitions, Permutations with Indistinguishable Objects

Unit IV

Relations:

Relations and Their Properties – Introduction, Functions as Relations, Properties of Relations, Combining Relations, Representing Relations - Representing Relations Using Matrices, Representing Relations Using Digraphs, Closures of Relations – Closures, Paths in Directed Graphs, Transitive Closures, Equivalence Relations – Equivalence Classes, Equivalence Classes and Partitions, Partial Orderings – Lexicographic Order, Hasse Diagrams, Maximal and Minimal Elements

Unit V

Graphs:

Graphs, Graph Terminology and Special Types of Graphs – Basic Terminology, Some Special Simple Graphs, Bipartite Graphs, Representing Graphs and Graph Isomorphism – Representing Graphs, Incidence Matrices, Isomorphism of Graphs, Euler and Hamilton Paths – Euler Paths and Circuits, Hamilton Paths and Circuits

Text Books:

1. Kenneth H Rosen: Discrete Mathematics and its Applications, 7th Edition, McGraw Hill publications.

Reference Books:

1. Ralph P Grimaldi, B V Ramana: Discrete and Combinatorial Mathematics, An Applied Introduction, 5th Edition, Pearson Education, 2007.
2. Douglas B. West, Introduction to Graph Theory, Second Edition, Prentice-Hall.

Course Outcomes (COs):

1. Apply the notion of mathematical logic and proof and be able to apply them in problem solving (PO-1, PO-2, PO-3)
2. Solve Problems which involve discrete data structure such as sets and functions and its associated properties. (PO-1, PO-2, PO-3)
3. Apply basic counting techniques and combinatorics in the context of discrete probability. (PO-1, PO-2, PO-3)
4. Solve problems which involve discrete data structures such as relations. (PO-1, PO-2, PO-3)
5. Evaluate the given problem by applying the concepts of graph theory (PO-1, PO-2, PO-3)

Course Assessment and Evaluation:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Quiz	10	CO1, CO2, CO3, CO4, CO5
Assignment	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

OPERATING SYSTEMS AND SHELL PROGRAMMING	
Subject Code: 24MCA13	Credits: 3:0:1
Pre requisites: Nil	Contact Hours: 42L 28P

Course Content

Unit I

Introduction to Operating Systems, System Structure What operating systems do, Operating System Operations, Computing Environments, Operating System Services, System Calls, Types of System Calls, System Programs, Operating System Structure, System Boot

Unit II

Process Concept

Process Concept, Process Scheduling, Interprocess Communication

Process Scheduling

Basic Concepts, Scheduling Criteria, Scheduling Algorithms

Synchronization

Background, The Critical Section Problem, Mutex Locks, Semaphores, Classic Problems of Synchronization: Readers-Writers Problem, Dining Philosopher's Problem using Semaphores

Unit III

Deadlocks Deadlocks: System model, Deadlock Characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

Unit IV

Memory Management Strategies Basic Hardware, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory Management Background, Demand Paging, Page Replacement

Unit V

General purpose utility commands, File Names, Path Name, type, locating commands, The file attributes. Filters and regular expression: grep: Searching for a pattern, Basic Regular Expression, Extended Regular Expression and egrep, types of grep. sed: stream editor, Line addressing, Context addressing, Text editing, Substitution. Introduction to Shell Script: Shell scripts, read, command line arguments, exit, variables, wildcards, escape characters' logical operators and conditional operators if conditional, case conditional, expr computations and string handling, while looping, for looping, set and shift, trap interrupting a program, debugging shell scripts with set command.

Laboratory:**Unix Laboratory covering the following topics:**

Sl. No	Topics covered
1.	General Purpose Utilities: Exploring basic Unix commands
2.	File and Directory Handling commands
3.	Understanding the Shell: Wild cards, Escaping, Quoting, Redirection, Pipes, tee, Command Substitution, Shell Variables
4	Simple Filters
5	Filters using Regular Expressions: grep, sed
6	The Process: Process and related commands.
7	Simple Shell scripts

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating Systems Principles, 9th Edition, Wiley – India, 2018. Chapters: 1.1, 1.5, 1.11, 2.1, 2.3, 2.4, 2.5, 2.10, 3.1, 3.2, 3.4, 5.1, 5.2, 5.3, 6.1, 6.2, 6.5, 6.6.1, 6.6.2, 6.6.3, 6.7.2, 6.7.3, 7, 8.1.1, 8.2, 8.3, 8.4, 8.5.1, 8.5.2, 9.1, 9.2.1, 9.4.1, 9.4.2, 9.4.3, 9.4.4, 10.1.1, 10.1.2, 10.1.3, 10.2, 10.3.2, 11.4.1, 11.4.2, 11.4.3, 11.5, 12.1, 12.4, 12.5, 12.6
2. Sumitabha Das: UNIX Concepts and Applications, 4th Edition, Tata McGraw Hill, 2017

Reference Books:

1. D M Dhamdhere: Operating Systems – A Concept Based Approach, 3rd Edition, Tata McGraw – Hill, 2017.
2. Harvey M Deital: Operating Systems, 3rd Edition, Addison Wesley, 1990.

Course Outcomes (COs):

1. Explain the elements and various functionalities of the operating system using different utilities in Unix
2. Apply the techniques of process management and demonstrate process synchronization
3. Demonstrate deadlock handling and process control.
4. Demonstrate various memory allocation strategies, virtual memory techniques
5. Develop shell scripts using basic commands and advanced filters.

Course Assessment and Evaluation:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1 CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Assignment	10	CO1, CO2, CO3, CO4, CO5
Lab test	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

WEB PROGRAMMING	
Subject Code: 24MCA14	Credits: 0:1:2
Pre requisites: Nil	Contact Hours: 28T 56P

Course Content

Topics to be covered in Tutorial

1.	Introduction to HTML5, Basic HTML Tags
2.	HTML Forms, Graphics and Media
3.	Designing HTML pages using CSS
4.	Basics of XML and DTD
5.	Introduction to JavaScript, JavaScript variables, operators
6.	Conditional and loop statements in JavaScript
7.	Functions and Arrays in JavaScript
8.	Event Handling and Document Object model in JavaScript
9.	Handling strings and working with window object
10.	New Features in ES6, Introduction to JSON
11.	Introduction to Bootstrap
12.	Developing web pages using Bootstrap

Laboratory:

1.	Design a simple Web Page to demonstrate the use of HTML tags.
2.	Design a Web Page to demonstrate hyperlinks.
3.	Design a Web Page to demonstrate the use of Table tags with rowspan and colspan attributes.
4.	Design a Web Page to demonstrate nested lists and Image tags.
5.	Design a Registration Form to demonstrate the input elements of text, email, password and submit.
6.	Design a Web Page to demonstrate field set element.
7.	Design a web form to collect feedback information from site visitors to demonstrate the use of radio buttons, checkbox, submit button, drop down box and a field set element.
8.	Design a Web Page to demonstrate the use of Frames and frame links.
9.	Demonstrate the use of inline CSS, Embedded/Internal CSS and External CSS
10.	Create a web page on "International yoga day celebrations which includes box model design of CSS
11.	Demonstrate the use of Class and ID Selectors for presenting the same HTML element differently.
12.	Demonstrate linking between sections and span tag.
13.	Design a Web Page to display a table of books and its details as given below using XML Code and CSS.
14.	Develop a javascript program to demonstrate the use of following input/output methods of javascript i)prompt ii)Alert iii) Confirm

15.	Develop a javascript program to demonstrate the window object methods of i) moveTo(), ii) moveBy(), iii) resize() and iv) resizeBy()
16	Develop a javascript program to demonstrate the concept of arrays and its following methods i)join(), reverse(), sort() and concat().
17	Develop a javascript program to demonstrate the concept of strings and its following methods: slice(), ii)substr(), replace() and replaceall(), trim() and split()
18.	Develop a javascript program to demonstrate the methods of getElementById(), getElementByClassname() and getElementsByTagName()
19.	Develop and design JavaScript code to Implement arithmetic operations using getElementByI
20.	Demonstrate creation of a JavaScript Object instance directly using new keyword and using constructor
21.	Demonstrate the basic structure of a Bootstrap Grid.
22.	Demonstrate bootstrap Alerts and Resize the responsive bootstrap page to see the effect
23.	Design a Contact Form i) Create a contact form with fields for name, email, subject, and message.ii) Add appropriate form validation to the input fields.iii) Customize the form elements, such as labels, placeholders, and button styles.
24.	Build a Pricing Table i)Create a pricing table with three different pricing plansii)Each plan sh include features,pricing details, and a call-to-action button.iii)Ensure that the pricing table is responsive and adjusts its layout on smaller screens.

Reference Books:

1. KOAGENT Learning Solutions Inc.: HTML5 BLACK BOOK, Dreamtech Press, 2011.
2. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008.
3. BOOTSTRAP Responsive Web Development by Tutorials Point.

Course Outcomes (COs):

1. Develop web pages using HTML5, CSS and XML. (PO-2, PO-3, PO-4, PO-7)
2. Develop interactive web pages using JavaScript. (PO-2, PO-3, PO-4, PO-7)
3. Develop web pages using Bootstrap framework. (PO-2, PO-3, PO-4, PO-6, PO-7)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes Addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II CIE-II)	30	CO2, CO3
Average of the two CIE shall be taken for 30 marks		
Other Components		
Component 1-Lab Record	10	CO1, CO2, CO3
Component 2-Application Development	10	CO1, CO2, CO3
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks + Marks scored in other components		
Semester End Examination (SEE)		
Course End Examination (Laboratory)	100	CO1, CO2, CO3

DATA STRUCTURES	
Subject Code: 24MCA15	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 42L

Course Contents

Unit I

Introduction to Data Structures: Definition, Need of Data Structures, Classification of Data Structures.

Recursion: Recursive definition and processes, Designing the recursive functions, Examples on recursion: Factorial of a number, Fibonacci numbers, Towers of Hanoi problem for 'n' disks.

Stack: Introduction to Stacks, Operations on a Stack and Applications of Stacks: Conversion from Infix to Postfix, evaluation of a postfix expression.

Unit II

Queues: Introduction to Queues, Definition, Array Representation of Queues, Primitive operations of queue and its implementation; Types of Queues: How to overcome the drawbacks of Linear Queue using Circular Queue, Representation of Circular Queues, Deques and Priority Queues.

Linked list: Introduction, Representation and implementation of operations (Insertion, Deletion and Search) of Singly, Doubly and Circular Linked Lists, Implementation of stack and queue using lists.

Unit III

Trees: Importance of Trees, Basic Tree Concepts and Terminologies: node, path, degree, internal nodes, height and subtree. Binary Tree: Binary Trees, Binary Tree Representations, Representing Lists as Binary trees, Minimum nodes, Maximum nodes, Nearly complete binary tree – Tree Traversals Depth First Traversal (Preorder, Inorder and Postorder), Breadth First Traversal, Construction of Expression Tree.

Binary Search Tree: Binary Search Trees – Basic Concepts, Operations (Insertion, Deletion, Find the smallest node, Find the largest node, and Find a requested node), Applications, Threaded Binary Trees.

Unit IV

Advanced concepts in Trees: AVL Search Trees: Need for AVL Search Trees, Definition, Balancing Trees (L-L Rotation, R-R Rotation, L-R Double Rotation, R-L Double Rotation)-, AVL tree Operations: Insertion, Deletion. Heaps – Definition, Heap Maintenance operations: insertion and deletion. Rheapup, Rheapdown algorithms and heap implementation, Applications.

Unit V

Multi-way trees: Introduction, Definition, features. B-trees – Introduction, Definition and features, Construction of B-trees of order 3, order 4 and order 5, Implementation, Simplified B-Trees: 2-3 tree, 2-3-4 tree.

Graphs: Basic concepts, Terminologies: vertices, edge, cycle, loop, graph vs tree, operations: insert vertex delete vertex, insert edge, delete edge. Graph traversals: Breadth-First- Search (BFS)

Traversal, Depth-First- Search (DFS) Traversal, storage structures (Adjacency Matrix and Adjacency List), graph algorithms.

Text Books:

1. Yedidyah Langsam and Moshe J. Augenstein and Aaron M Tenenbaum: Data Structures using C and C++ by, 2nd Edition, Pearson Education Asia, 2004.
2. Richard F Gilberg and Behrouz A Forouzan: Data Structures - A Pseudocode Approach with C, Cengage Learning, 6th Indian Reprint, 2009.

Reference Books:

1. Reema Thareja: Data Structures Using C, 2nd Edition, Oxford University Press, 2018.
2. Horowitz, Sahani, Anderson, Freed, Fundamentals of Data Structures in C, Second edition, 2014.

Course Outcomes (COs):

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

1. Apply the concepts of recursion and stack. (PO-1,2,3)
2. Implement the queue and list for real world applications. (PO-1,2,3)
3. Demonstrate the usage and operations of Binary Search trees. (PO-1,2,3)
4. Construct AVL tree, heap and apply operations on them. (PO-1,2,3)
5. Exhibit the construction of Multi way Trees and storage structures. (PO-1,2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course Outcomes (COs) addressed
Internal test-I (CIE-I)	30	CO1, CO2
Internal test-II (CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz	10	CO1, CO2, CO3, CO4, CO5
Case Study	10	CO1, CO2, CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks + Marks Scored in Quiz + Case Study.		
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DATA STRUCTURES USING 'C'	
Subject Code: 24MCA16	Credits: 0:0:1
Pre requisites: Nil	Contact Hours: 28P

Course Content

1.	Illustrating recursion using Example: Tower of Hanoi Problem.
2.	Implementation of STACK Operations: push(), pop(),display()
3.	Implementation of C program to convert infix expression to postfix expression.
4.	Implementation of C program to evaluate postfix expression.
5.	Implementation of Linear Queue.
6.	Implementation of Circular Queue.
7.	Implementation of Single Linked List Operations.
8.	Implementation of Circular Single Linked List Operations.
9.	Implementation of Doubly Linked List Operations.
10.	Implementation of Circular Doubly Linked List Operations.
11.	Implementation of STACK using Linked List.
12.	Implementation of Binary Tree.

Note: Each Lab Session is of two hours' duration/week.

Reference Books:

1. Data Structures using C and C++ by Yedidyah Langsam and Moshe J. Augenstein and Aaron M Tenenbaum, 2nd Edition, Pearson Education Asia, 2017.
2. Reema Thareja: Data Structures Using C, 2nd Edition, Oxford University Press, 2018.
3. Behrouz A Forouzan, Data Structures - A Pseudocode Approach with C, Richard F Gilbert and Cengage Learning, 6th Indian Reprint, 2009.

Course Outcomes (COs):

1. Simulate stack and queue operations and implement its applications. (PO-1, 2, 3)
2. Develop C programs on linked list and its variations. (PO-1, 2, 3)
3. Construct C programs on Binary tree and its applications. (PO-1, 2, 3)

Course Assessment and Evaluation:

Assessment Tool	Marks	Course Outcomes (COs) addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Lab Test	30	CO1, CO2, CO3
Weekly Evaluation-Lab Record + Viva	20 (10+10)	CO1, CO2, CO3
The Final CIE out of 50 Marks = Marks scored in Lab Test + Marks of Lab Record		
Semester End Examination (SEE) (One full question from the Lab Question Bank, Programs will be coded using C and executed).	50	CO1, CO2, CO3

MATHEMATICAL FOUNDATION	
Subject Code: 24MCABC	Credits: 0:0:0
Pre requisites: Nil	Contact Hours: 42L

Course Content

Unit I

Number System and Boolean Algebra: Introduction, Number Systems- Binary Number System, Octal Number System, Hexadecimal Number System, Binary Arithmetic, BCD Addition, Alphanumeric Codes

Boolean Algebra Operations, Basic Laws of Boolean Algebra, De-Morgan's Theorems

Unit II

Sequence and Series: Sequences, Series, Arithmetic Progression, Sum of finite number of terms in AP, Arithmetic Mean, Geometric Progression, Sum to n terms of GP, Geometric Mean, Relation between AM and GM

Unit III

Matrices and Determinants:

Introduction, Types of Matrices, Scalar Multiplication, Addition of Matrices, Product of Matrices, Transpose of a Matrix, Symmetric and Skew Symmetric Matrix, Rank of a Matrix, Determinant of a matrix, Singular Matrix

Unit IV

Induction and Recursion: Mathematical Induction – Introduction, Inductive Hypothesis, Strong Induction and Well Ordering, Recursive Definitions

Unit V

Probability: Introduction, Random Experiments, Sample Space, Events.

Definitions of Probability – Classical and Axiomatic. Conditional Probability, Laws of Addition and Multiplication, Independent Events, Theorem of Total Probability

Text Books:

1. Kenneth H Rosen: Discrete Mathematics and its Applications, 7th Edition, McGraw Hill publications.
2. Richard A Johnson and C B Gupta: Probability and Statistics for Engineers, Pearson Education

Course Outcomes (COs):

1. Apply the conversions in number system and Boolean algebra. (PO-1, PO-2, PO-3)
2. Solve the problems in sequences and series. (PO-1, PO-2, PO-3)
3. Apply basic concepts of matrices and formulate the problems in matrix expression. (PO-1, PO-2, PO-3)
4. Solve problems using induction and recursion. (PO-1, PO-2, PO-3)
5. Apply concepts of probability and solve problems. (PO-1, PO-2, PO-3)

II SEMESTER

OBJECT ORIENTED PROGRAMMING USING JAVA	
Subject Code: 24MCA21	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 42L

Course Content

Unit I

Introducing Classes: Introduction to Java, Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage, The finalize() Method, Exploring the String Class, Using Command-Line Arguments, Varargs, Scanner class.

Inheritance : Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

Unit II

Packages and Interfaces : Packages, Access Protection, An Access Example Importing Packages, Interfaces, Default Interface methods.

Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions Using try and catch, multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.

Unit III

Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Inter-thread Communication, Suspending, Resuming, and Stopping Threads, Obtaining thread state, Using Multithreading.

Enumeration and Auto boxing: Enumeration, Type Wrappers, Auto boxing.

Generics: What are Generics? A Simple Generics Example, A Generics Class with two Type Parameters, The General Form of a Generic Class.

Unit IV

The Collections Framework: Collections Overview, The Collection Interfaces, The List Interface, The ArrayList Class, The LinkedList Class.

Networking: Networking Basics, Client-server communication using TCP and UDP.

Lambda Expressions: Introducing Lambda Expressions, Block Lambda Expression.

Design Patterns : Introduction to common design patterns like Singleton, Factory, Observer, and Strategy.

Unit V

Event Handling: Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, The event class, The Key event, Class Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Adapter Classes, Inner Classes.

JavaFX: Introducing JavaFX GUI programming, Exploring JavaFX controls.

Web Development: Introduction to Servlets and JSP.

Database Programming: JDBC and Database Connectivity

Text Books:

1. Herbert Schildt: The Complete Reference JAVA, 9th Edition, TATA McGraw HILL, 2014.
Chapters: 1, 3, 4, 8, 9, 10, 11, 12,13,14, 15,18,22,24,34,35

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 6th Edition, Pearson Education, 2006.
2. Cay S Horstmann, Gary Cornell: Core Java 2 volume 1 and volume 2, 7th Edition, Pearson Education, 2005.
3. Paul Deitel and Harvey Deitel: Java How to Program, 9th Edition, PHI, 2012.

Course Outcomes (COs):

1. Understand and apply the fundamental concepts of classes and inheritance in Java, including object creation, method definition, and class hierarchy. (PO-1, 2, 3, 5)
2. Implement Java packages and interfaces effectively and handle exceptions using exception-handling mechanisms. (PO-1, 2, 3, 5)
3. Develop multi-threaded applications in Java, use enumerations and autoboxing, and create generic classes and methods. (PO-1, 2, 3, 5)
4. Utilize the Collections Framework, implement network communication, apply lambda expressions, and understand basic design patterns. (PO-1, 2, 3, 5)
5. Design and implement event-driven applications using JavaFX, handle web development tasks with Servlets and JSP, and connect to databases using JDBC. (PO-1, 2, 3, 5)

Course Assessment and Evaluation:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1(Quiz)	10	CO1, CO2, CO3,CO4,CO5
Component 2 (Assignment)	10	CO1, CO2, CO3,CO4,CO5
Semester End Examination (SEE)	100	

DESIGN AND ANALYSIS OF ALGORITHMS	
Subject Code: 24MCA22	Credits: 3:0:1
Pre requisites: MCA15	Contact Hours: 42L 28P

Course Content

Unit I

Introduction: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types

Fundamentals of the Analysis of Algorithm Efficiency: Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non recursive algorithms, Examples.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation

Lab Component/ Practical Topics : Implement simple non - recursive and recursive algorithms to analyze their time complexity.

Unit II

Brute Force: Selection Sort, Sequential Search, Brute-Force String Matching, Exhaustive Search.

Divide-and-Conquer: Merge Sort, Quick Sort, Binary Search

Principles of Parallel Algorithm Design: Preliminaries-Decomposition, Tasks and Dependency Graphs, Granularity, Concurrency and Task-Interaction, Decomposition Techniques.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation

Lab Component/ Practical Topics : Implement selection sort, string-matching, merge sort, quick sort and binary search algorithms to analyze their time complexity.

Unit III

Decrease-and-Conquer: Insertion Sort, Depth First Search and Breadth First Search, Topological sorting, Algorithms for Generating Combinatorial Objects-Generating Permutations, Generating Subsets.

Transform-and-Conquer: Presorting, Heaps-Notion of the Heap, Heapsort.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation

Lab Component/ Practical Topics : Implement insertion sort, dfs, bfs and heapsort algorithms to analyze their time complexity.

Unit IV

Space and Time Tradeoffs: Sorting by Counting, Hashing-Open Hashing, Closed Hashing.

Dynamic Programming: Warshall's Algorithm, Floyd's Algorithms for the All-Pairs Shortest-Paths Problem.

Greedy Technique: Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation

Lab Component / Practical Topics : Implement sorting by counting, hashing, warshalls and floyds algorithms to analyze their time complexity.

Unit V

Backtracking: n-Queens Problem, Hamiltonian Circuit Problem, Subset-Sum Problem.

Branch-and-Bound: Knapsack Problem, Traveling Salesman Problem.

P, NP-Completeness and Approximation Algorithms: P and NP Problems, NP-complete Problems, Approximation algorithms for the Traveling Salesman Problem, Approximation Algorithms for Knapsack Problem.

Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation

Lab Component / Practical Topics : Implement knapsack and travelling sales man algorithms to analyze their time complexity.

Text Books:

1. Anany Levitin: Introduction to the Design and Analysis of Algorithms, 2nd Edition, Pearson Education, 2009.
Chapters 1.1-1.3, 2.1-2.4, 3.1, 3.2, 3.4, 4.1-4.3, 5.1-5.4, 6.1, 6.4, 7.1, 7.3, 8.2, 9.1-9.4, 11.3, 12.1-12.3
2. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar: Introduction to Parallel Computing, 2nd Edition, Pearson Education, 2003.
Chapters 3.1.1, 3.1.2, 3.2

References:

1. Horowitz E., Sahani S., Rajasekharan S.: Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2007.
2. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 3rd Edition, PHI, 2010.

Laboratory:

Sl. No.	Program
1.	Design a program in C/C++ to find GCD of two numbers m and n using Eculid's Method. Design a program in C/C++ to find GCD of two numbers m and n using Consecutive Integer Checking Method. Design a program in C/C++ to find GCD of two numbers m and n using Middle School Method.
2.	Implement Linear search algorithms and determine the time required to search an element in a list of n numbers. Repeat the experiment for different values of n and plot a graph of the time taken versus n.
3.	Develop a program to Multiply two Matrices of order n by n. Repeat the experiment for different values of n and plot a graph of the time taken versus n.
4.	Develop a program to find the largest element in a list of n numbers and Repeat the experiment for different values of n and plot a graph of the time taken versus n.
5.	Develop a program to check the Uniqueness property of elements in a list and Repeat the experiment for different values of n and plot a graph of the time taken versus n.
6.	Develop a program to compute Factorial of n Using Recursion non-recursion procedure. Repeat the experiment for different values of n and plot a graph of the time taken versus n.
7.	Develop a program to perform String Matching using Brute Force Method.

8.	Sort a given set of elements using Selection Sort and determine the time required to sort n elements. Repeat the experiment for different values of n and plot a graph of the time taken versus n
9.	Sort a given set of elements using Insertion sort and determine the time required to sort n elements. Repeat the experiment for different values of n and plot a graph of the time taken versus n
10.	Sort a given set of elements using Merge sort and determine the time required to sort n elements. Repeat the experiment for different values of n and plot a graph of the time taken versus n
11.	Sort a given set of elements using Quick sort and determine the time required to sort n elements. Repeat the experiment for different values of n and plot a graph of the time taken versus n
12.	Develop a program to Implement Heap Sort for n number of elements.
13.	Develop a program to Implement Warshall's Algorithm for a graph of n nodes.
14.	Develop a program to Implement Floyd's Algorithm for a graph of n nodes.

Course Outcomes (COs):

1. Derive the time complexity of algorithms in terms of asymptotic notations. (PO-1, PO-2, PO-5)
2. Apply the brute force, divide and conquer and parallel algorithm approaches for designing algorithm and determining the order of growth. (PO-1, PO-2, PO-3, PO-5)
3. Implement the decrease and conquer and transform and conquer approach for designing and determining the order of growth of algorithms. (PO-1, PO-2, PO-3, PO-5)
4. Demonstrate the design techniques dynamic programming and greedy technique to solve problems and determine the time complexity. Describe the space and time tradeoffs for algorithms. (PO-1, PO-2, PO-3, PO-5)
5. Apply the branch and bound and backtracking approach for solving problem and describe the concepts of NP-hard problem. (PO-1, PO-2, PO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes Addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II (CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Component 1-Lab Test	10	CO1, CO2, CO3, CO4, CO5
Component 2- Lab Record(5) + Viva(5)	10	CO1, CO2, CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks + Marks scored in other component		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit)	100	CO1, CO2, CO3, CO4, CO5

DATABASE SYSTEMS	
Subject Code: 24MCA23	Credits: 3:0:1
Pre requisites: NIL	Contact Hours: 42L 28P

Course Content

Unit I

Introduction: Introduction, Characteristics of the Database Approach, Database Architecture: Data Models, Schemas and Instances, Three Schema Architecture and Data Independence, DBMS Component module.

Relational Model: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update operations, Transactions, and Dealing with Constraint Violations

SQL: SQL Data Definition and Data Types; Specifying constraints in SQL, Schema changing statements in SQL.

Unit II

SQL: Basic Retrieval Queries in SQL: The Select from where structure, Ambiguous Attribute Names and Aliasing, Use of asterisk, Tables as Sets and Pattern Matching, INSERT, DELETE and UPDATE statements in SQL; Additional features of SQL, Complex Queries: Handling Null values, Nested and Co-Related Nested queries.

PL/SQL: Introduction to PL/SQL, Procedures and Functions, Triggers

Unit III

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design, Entity Types, Entity Sets, Attributes and Keys; Relationship Types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams.

Database Design: Informal Design Guidelines, Functional Dependencies: Definition, Inference Rules, Equivalence and Minimal Sets of Functional Dependencies. Normal Forms Based on Primary Keys.

Unit IV

Advanced Database Concepts:

Object Oriented Databases: Object Database Concepts, Object Identity, Object Structure and Type Constructors.

Distributed Databases: Distributed Database Concepts, Types of Distributed Database Systems, Distributed Database Architectures, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design

Big Data: Introduction to big data, NoSQL Databases and their Benefits - MongoDB, CouchDB, HBase, Cassandra DB, Infinite Graph

Unit V

MongoDB: Introduction to Mongo Database Features, Database, Collection, Documents, Data Types.

CRUD Operations: Create, Read, Update, Delete, operations.

Bulk Write Aggregation: Aggregation Pipeline, Map Reduce, Single Purpose Aggregation Operations

Laboratory:

- Programs that supplement the theory concepts are to be implemented.

Text Book:

1. Ramez Elmasri and Shamkanth B Navathe: Fundamentals of Database Systems, 6th Edition, Pearson Education, 2011.
Chapters: 1.1, 1.2, 1.3, 2.1, 2.2, 2.4.1, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 5.1, 5.2, 5.3, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.9, 10.1, 10.2, 10.3, 20.1, 20.2, 25.1, 25.2, 25.3
2. Kristina Chodorow: MongoDB: The Definitive Guide: Powerful and Scalable Data Storage, 3rd Edition, O'Reilly, 2020

Reference Books:

1. Abraham Silberschatz, Henry F Korth and S Sudarshan: Data base System Concepts, 6th Edition, Mc-Graw Hill, 2011.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.
3. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson education, 2006.

Web Links:

1. <http://plsql-tutorial.com>
2. <http://k.web.umkc.edu/kumarv/cs471/oracle-arch.htm>
3. <https://docs.mongodb.com/>

Course Outcomes (COs):

1. Describe the basic architecture of the database management system and database schema with constraints. (PO-1, PO-3, PO-8)
2. Execute SQL queries to access data and implement triggers, PL/SQL procedures and functions. (PO-1, PO-2, PO-3, PO-4, PO-5, PO-8)
3. Design ER model and relational database schema for real world application. (PO-1, PO-2, PO-3, PO-4, PO-5, PO-8)
4. Explain different databases and Compare the significance of different NoSQL databases. (PO-1, PO-4)
5. Perform mongodb crude operations and aggregation. (PO-1, PO-2, PO-3, PO-4, PO-8)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes Addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II (CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Component 1-Lab Test	10	CO1, CO2, CO3, CO4, CO5
Component 2- Assignment	10	CO1, CO2, CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks + Marks scored in other component		
Semester End Examination (SEE)		
Course End Examination (Answer One full question from each Unit)	100	CO1, CO2, CO3, CO4, CO5

COMPUTER NETWORKS	
Subject Code: 24MCA24	Credits: 3:0:1
Pre requisites: Nil	Contact Hours: 42L 28P

Course Content

Unit I

Computer Networks and The Internet: Introduction to Internet, The Networks Edge, Network Core, Delay, Loss, and Throughput in Packet – Switched Networks, Protocol Layers and Their Service Models.

Unit II

Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications.

Unit III

Transport Layer: Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP.

Unit IV

Transport Layer: Principles of Congestion Control, TCP Congestion Control.

The Network Layer: Introduction, Virtual Circuit and Datagram Networks, What's Inside a Router? The Internet Protocol (IP): Forwarding and Addressing in the Internet, Routing Algorithms.

Unit V

The Network Layer: Routing in the Internet Broadcast and Multicast Routing.

The Link Layer and Local Area Networks: Link Layer: Introduction and Services, Error-Detection and Correction Techniques, Multiple Access Protocols, Link- Layer Addressing.

Laboratory:

1.	Basic Networking Devices
2.	Simulation of hub
3.	Simulation of repeater
4.	Simulation switch
5.	IP addressing –class full addressing
6.	Simulation of Router
7.	Simulation of DNS and web server
8.	Basic networking commands
9.	Configuration of DHCP:Server-DHCP
10.	Configuration of DHCP:Router-Single LAN
11.	Configuration of DHCP : Router-Different LANs
12.	HTTP message formats using Wireshark.

Text Books:

1. James F. Kurose, Keith W. Ross: Computer Networking: A Top-Down Approach, 5th Edition, Addison-Wesley, 2012. Chapters: 2.1 - 2.6, 3, 4.1- 4.7, 5.1 - 5.4.
2. Behrouz A. Forouzan: Data Communications and Networking, 5th Edition, Tata McGraw-Hill, 2006. Chapters: 1.1, 1.2, 1.3, 2.1,2.2,2.3, 3.6, 6.1.1, 6.1.3.

Reference Book:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks-Fundamental Concepts and Key architectures, 3rd Edition, Tata McGraw-Hill, 2004.

Course Outcomes (COs):

1. Describe basic terminologies used for computer networking. (PO-1, PO-2, PO-3, PO-4)
2. Demonstrate application layer protocols used for Process to Process Communication and illustrate using existing tools. (PO-1, PO-2, PO-3, PO-4, PO-5)
3. Describe the transport layer protocols and illustrate using existing tools. (PO-1, PO-2, PO-3, PO-4, PO-5)
4. Familiarize with network layer protocols and simulate using existing tools. (PO-1, PO-2, PO-3, PO-4, PO-5)
5. Explain link-layer functionalities. (PO-1, PO-2, PO-3, PO-4)

Course Assessment and Evaluation:

Assessment Tool	Marks	Course Outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I (CIE-I)	30	CO1, CO2
Internal test-II (CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Lab Test	10	CO1, CO2, CO3, CO4, CO5
Continuous Evaluation- Lab Record	10	CO1, CO2, CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks + Marks Scored in Lab Test + Marks of Lab Record.		
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

RESEARCH METHODOLOGY AND IPR	
Subject Code: 24MCA25	Credits:
Pre requisites: NIL	Contact Hours: 28L

Course Content

Unit I

Research Methodology: Introduction, meaning of research, Objectives of research, Types of research, Research approaches, Significance of research, Research methods versus methodology, Research and scientific method, Research process, Criteria of good research, Problems encountered by researchers in India.

Defining the Research Problem: What is research problem, Selecting the problem, Necessity of defining the problem, Technique involved in defining a problem, An illustration.

Unit II

Literature review: Primary and secondary sources, Reviews, Monograph, Patents, Research databases, Web as a source, Searching the web, Critical literature review, identifying gap areas from literature and research database, Development of working hypothesis.

Research Design: Meaning of research design, need for research design, features of a good design, Importance concepts relating to research design, Different research designs, Basic principles of experimental design.

Unit III

Design of Sample Surveys - Introduction, sample design, sampling and non-sampling errors, sample survey Vs Census survey.

Methods of Data Collection - Collection of primary data, Collection of data through questionnaires, Collection of data through schedules, Guidelines for constructing Questionnaire/Schedules, some other methods of data collection, Collection of secondary data, Selection of appropriate method for data collection, Case study method.

Unit IV

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Unit V

IPR: IPR- Intellectual property rights and Patent law, Commercialization, Copyright, Royalty, Trade related aspects of intellectual property rights (TRIPS); Scholarly publishing- IMRAD concept and design of research paper, Citation and acknowledgement, Plagiarism, Reproducibility and Accountability.

Text Books:

1. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg New Age International 4th Edition, 2018.
2. Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE Publications Ltd 3rd Edition
3. Wadhera BL. 2010. Law Relating to Intellectual Property: Patent, Trademarks, Designs and Geographical Indication, Universal Law Publishing

Reference Books:

1. Zikmund WG, Babin BJ, Carr JC and Griffin M. 2013. Business Research Methods, Ninth Edition, Cengage India Private Limited, ISBN (13): 978- 9353503260.
2. Panneerselvam R. 2013. Research Methodology, Second Edition, Prentice Hall India Learning Private Limited, ISBN (13): 978-8120349469

Course Outcomes (COs):

1. Explain the research methodology and define the problem for research.
2. Conduct literature review and apply the principles of research design.
3. Apply the knowledge of various sampling procedures and different methods of data collection in the research.
4. Interpret and write effective research reports.
5. Apply ethics and concepts of intellectual property in the research process.

Course Assessment and Evaluation:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2 and CO3
Internal test-II	30	CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Case Study	10	CO1, CO2 and CO3
Assignments	10	CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3 CO4 and CO5

FULL STACK DEVELOPMENT	
Subject Code: 24MCA26	Credits: 0:1:2
Pre requisites: MCA14	Contact Hours: 14T 28P

Course Content

Concepts to be covered in Tutorial

1. Introduction to ReactJS, Express JS and Node.js.
2. React features, components, keys, lists.
3. React CSS, React Props Validation.
4. React forms, events, React Conditional Rendering.
5. Node.js First Application, REPL Terminal, Package Manager(NPM).
6. Node.js Callbacks, Even Loop, Event Emitter.
7. Node.js Buffers, Streams and File System.
8. Express JS Routing, HTTP Methods.
9. Express JS URL Building, Templating, Static Files.
10. Express JS Cookies, Sessions and Authentication.
11. Connecting MongoDB, insert documents, update/delete documents, Query Database.
12. Introduction to GIT

Laboratory:

- Programs supplementing the concepts covered in Tutorial.
- Building of small applications using above Frameworks

References:

1. Mean Web Development Second Edition, PACKT
2. <http://www.tutorialpoint.com/reactjs/>
3. <http://www.tutorialpoint.com/nodejs/>
4. <http://www.tutorialpoint.com/expressjs/>
5. <https://www.w3schools.com/GIT/>

Course Outcomes (Cos):

1. Demonstrate and Develop simple programs using ReactJS. (PO-1, PO-2, PO-3, PO-5, PO-6, PO-8)
2. Demonstrate and Develop simple programs using Express JS. (PO-1, PO-2, PO-3, PO-5, PO-6, PO-8)
3. Demonstrate and Develop simple programs using Node JS. (PO-1, PO-2, PO-3, PO-5, PO-6, PO-8)

PROGRAMMING IN JAVA LABORATORY	
Subject Code: 24MCA27	Credits: 0:0:1
Pre requisites: Nil	Contact Hours: 28P

Course Content

No.	CONTENTS	CO
1.	Develop a Java program to demonstrate class fundamentals, including object creation, method implementation, and constructor usage. Utilize features like the this keyword and the finalize() method.	CO1
2.	Implement a Java program showcasing inheritance concepts, including creating a multilevel hierarchy, using the super keyword, method overriding, and dynamic method dispatch. Also, include the use of abstract classes and final with inheritance.	CO1
3.	Explore the String class and command-line arguments by developing a program that manipulates strings and processes arguments. Additionally, demonstrate the use of varargs and the Scanner class for input.	CO1
4.	Create a Java program that uses packages and interfaces, demonstrating access protection, importing packages, and implementing interface methods. Include default interface methods in your implementation.	CO2
5.	Develop a Java application to handle various exceptions using try, catch, throw, throws, and finally. Implement nested try statements and create custom exception subclasses.	CO2
6.	Implement a Java program to demonstrate exception handling fundamentals, including catching multiple exceptions and using Java's built-in exceptions.	CO2
7.	Create a Java program to illustrate multithreaded programming concepts, including creating and running multiple threads, using isAlive(), join(), thread priorities, synchronization, and inter-thread communication.	CO3
8.	Develop a Java program that uses enumerations and demonstrates autoboxing with type wrappers.	CO3
9.	Implement a generic class with multiple type parameters and create a simple example using generics to showcase their usage.	CO3
10.	Develop a Java program to demonstrate the Collections Framework, including the use of ArrayList and LinkedList. Showcase how these collections are used and manipulated.	CO4
11.	Create a Java application utilizing lambda expressions to simplify code and implement block lambda expressions.	CO4
12.	Implement a simple Java program to demonstrate common design patterns such as Singleton, Factory, Observer, and Strategy.	CO4
13.	Create a Java program to handle various types of events using the Delegation Event Model, including implementing event listener interfaces and adapter classes. Demonstrate event handling mechanisms with key and action events.	CO5
14.	Implement a Java program to connect to a database using JDBC, perform basic CRUD operations, and handle database connectivity.	CO5

Text Books:

1. Herbert Schildt: The Complete Reference JAVA, 9th Edition, TATA McGraw HILL, 2014.
Chapters: 1, 3, 4, 8, 9, 10, 11, 12,13,14, 15,18,22,24,34,35

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 6th Edition, Pearson Education, 2006
2. Cay S Horstmann, Gary Cornell: Core Java 2 volume 1 and volume 2, 7th Edition, Pearson Education, 2005
3. Paul Deitel and Harvey Deitel: Java How to Program, 9th Edition, PHI, 2012

Course Outcomes (COs):

1. Apply the fundamentals of object-oriented programming concepts including classes, objects, methods, constructors, and inheritance in Java.
2. Utilize Java packages and interfaces effectively, and implement robust exception handling mechanisms to create resilient Java applications.
3. Implement multithreaded programs, use enumerations and autoboxing, and apply generics to write efficient and type-safe Java code.
4. Employ the Collections Framework, leverage lambda expressions for functional programming, and implement common design patterns to create modular and maintainable code.
5. Develop Java applications with graphical user interfaces using JavaFX, handle events efficiently, and perform database operations using JDBC for comprehensive data management.

Course Assessment and Evaluation:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I		CO1, CO2
Internal test-II		CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1 (Record)		CO1,CO2,CO3,CO4,CO5
Component 2 (Surprise lab test and attendance)		CO1,CO2,CO3,CO4,CO5
Semester End Examination (SEE)		CO1,CO2,CO3,CO4,CO5

ELECTIVE COURSES

DATA ANALYTICS AND VISUALIZATION	
Subject Code: 24MCAE11	Credits: 2:0:1
Pre requisites: Programming with Python	Contact Hours: 28/0/14

COURSE CONTENT

Unit I

Introduction to Data: Statistical Data: Primary and Secondary data, Sources of Data, Types of Classification of data. **Frequency Distribution:** Discrete or Ungrouped Frequency distribution, Grouped Frequency Distribution, Continuous Frequency Distribution.

Unit II

Measures of Central Tendency: Average: Concept, Types.

Mathematical Averages: Arithmetic Mean, Geometric Mean, Harmonic Mean, Position or Locational Averages: Median, Mode,

Partition Values: Quartiles, Deciles and Percentiles, Comparison of the Various Measures of Central Tendencies.

Unit III

Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Variance, Coefficient of Variance, comparison of various measures of Dispersion. Skewness and kurtosis

Unit IV

Getting Started with Pandas: Introduction pandas Data Structures, Essential Functionality, Summarizing, Handling Missing Data.

NumPy Basics: Arrays and Vectorized Computation: The NumPy ndarray: A multidimensional Array Object, Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays

Unit V

Data Wrangling: Combining and Merging Data Sets Reshaping and Pivoting.

Data Visualization matplotlib: Basics of matplotlib, Plotting with Functions in pandas.

TEXT BOOK:

- Fundamentals of Statistics 7/e, S. C. Gupta, Himalaya Publishing House, 2019
- Python for Data Analysis, 2nd Edition by Wes McKinney 2017 Publisher(s): O'Reilly Media, Inc.

REFERENCE BOOKS:

1. "Data Science for Business" by Foster Provost and Tom Fawcett, O'Reilly Media, 2013.
2. "Practical Statistics for Data Scientists" by Peter Bruce and Andrew Bruce, 2nd Edition, O'Reilly Media, 2017.

COURSE OUTCOMES (COS):

1. Understand different types of data, sources of data collection, and methods of classifying data for effective analysis.
2. Apply mathematical and positional averages to summarize datasets and compare different measures of central tendency.
3. Analyze data variability using measures of dispersion, skewness, and kurtosis to understand data distribution.
4. Utilize Python libraries like Pandas and NumPy for data manipulation, summarization, and handling missing values efficiently.
5. Implement data wrangling techniques and visualize data using Matplotlib and Pandas to extract meaningful insights.

Course Assessment and Evaluation:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1(Lab Internals)	10	CO1,CO2,CO3,CO4,CO5
Component 2 (Project0029	10	CO1,CO2,CO3,CO4,CO5
Semester End Examination (SEE)	100	

INTRODUCTION TO ARTIFICIAL INTELLIGENCE	
Subject Code: 24MCAE12	Credits: 2:0:1
Pre requisites: NIL	Contact Hours: 28L 28P

COURSE CONTENT

Unit I

Artificial Intelligence: Introduction to artificial intelligence, Historical development and foundation areas of artificial intelligence, Tasks and application areas of artificial intelligence. Introduction, types and structure of intelligent agents, Computer Vision, Natural language processing. A brief history of AI.

Unit II

Searching Techniques: Introduction, Problem solving by searching, searching for solutions, Uniformed searching techniques, Informed searching techniques, Local search algorithms, Adversarial search methods, Search techniques used in games, Alpha-Beta pruning.

Unit III

Knowledge Representation and Reasoning: Propositional logic, Predicate logic, First order logic, Inference in first order logic, Clause form conversion, Resolution. Chaining- concept, forward chaining and backward chaining, Utility theory and Probabilistic reasoning, Hidden Markov model, Bayesian networks.

Unit IV

Introduction to AI and Ethics: Strong and weak AI, Types of ethics---Descriptive, Normative, Meta, Relationship between ethics and law, Machine ethics examples, Moral Diversity and Testing, Need of ethics, Normative Ethical Theories, Ethics and Empirical Evidence, Four Domains of Ethics: Self, Friend, Stranger, World, What Counts as Adequate Justification and Argument in Ethics

Unit V

AI Using Computer Vision, Handling files and images in computer vision involves understanding technical requirements, reading and writing image files, capturing frames from cameras and video files, writing video files, and adjusting video capture properties. Image processing techniques include splitting and merging channels, performing geometric transformations, applying image filtering, executing arithmetic operations on images, implementing morphological transformations,

TEXT BOOKS:

1. Russell S. and Norvig P., "Artificial Intelligence – A Modern Approach", Pearson Education. Chapters 1,2, 3,5, 6,9,10,11,12,15, 16,17,18,19
2. Villán, Alberto Fernández. Mastering OpenCV 4 with Python: a practical guide covering topics from image processing, augmented reality to deep learning with OpenCV 4 and Python 3.7. Packt Publishing Ltd, 2019

REFERENCE BOOKS:

1. Rich E. and Knight K., "Artificial Intelligence", McGraw Hill Publications.
2. Charnik E. and McDermott D., "Introduction to Artificial Intelligence", Pearson Education.
3. Patterson D. W., "Artificial Intelligence and Expert Systems", Prentice Hall of India Publications.

COURSE OUTCOMES (COS):

1. Explain AI concepts, its history, intelligent agents, and applications in computer vision and NLP.
2. Apply search algorithms (uniformed, informed, local search, adversarial, Alpha-Beta pruning) to solve real-world problems.
3. Represent and reason with knowledge using logic and probabilistic methods like Bayesian networks and Hidden Markov models.
4. Analyse AI ethics, including the relationship between ethics, law, and machine ethics.
5. Implement computer vision techniques for image processing, video analysis, and geometric transformations.

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1 (Laboratory)	10	CO1, CO2, CO3, CO4, CO5
Component 2 (Record)	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MANAGEMENT INFORMATION SYSTEM	
Subject Code: 24MCAE13	Credits: 3:0:0
Pre requisites: NIL	Contact Hours: 42L

COURSE CONTENTS

Unit I

Information Systems in Global Business Today

How Information Systems Are Transforming Business, What's New in Management Information Systems?, Globalization Challenges and Opportunities: A Flattened World, The Emerging Digital Firm, Strategic Business Objectives of Information Systems, What is an Information System?, Dimensions of Information Systems, Technical Approach, Behavioral Approach, Approach of This Text: Sociotechnical Systems, The Company, Position Description, Job Requirement, Interview Questions, Author Tips, Business Processes, How Information Technology Improves Business Processes, Systems for Different Management Groups, Systems for Linking the Enterprise, What is Collaboration, What is Social Business?, Business Benefits of Collaboration and Social Business, Business a Collaborative Culture and Business Processes, Tools and Technologies for Collaboration and Social Business.

Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, videos

Unit II

Information Technology Infrastructure

Defining IT Infrastructure, Evolution of IT Infrastructure, Technology Drivers of Infrastructure Evolution, Computer Hardware Platform, Operating System Platform, Enterprise Software Application, Data Management and Storage, Networking/Telecommunications Platforms, Internet Platforms, Consulting and System Integration Services, The Mobile Digital Platform.

Foundation of Business Intelligence: Databases and Information Management

File Organization Terms and Concepts, Problems with the Traditional File Environment, Database Management Systems, Capabilities of Database Management Systems, Designing Database, Non-relational Databases, Cloud Databases, and Blockchain, The Challenge of Big Data, Business Intelligence Infrastructure.

Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation

Unit III

Key system Applications for the Digital Age

What are Enterprise Systems?, Enterprise Software, Business value of Enterprise Systems, The Supply Chain, What is Customer Relationship Management?, Customer Relationship Management Software, Operational and Analytical CRM, Business Value of Customer Relationship Management Systems, Enterprise Application Challenges.

E-Commerce: Digital Markets, Digital Goods

E-Commerce Today, The New E-Commerce: Social, Mobile, Local, Why E-Commerce is Different, Key Concepts in E-Commerce: Digital Markets and Digital Goods in a Global Marketplace, Type of E-Commerce, E-Commerce Business Models, Behavioral Targeting, E-Commerce Business Models,

Behavioral Targeting, Social E-Commerce and Social Network Marketing.

Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, videos

Unit IV

Managing Knowledge

Importance Dimensions of Knowledge, The Knowledge Management Value Chain, Types of Knowledge Management Systems, Evolution of AI, Major Types of AI, Expert Systems, Machine Learning, Neural Networks, Genetic Algorithms, Natural Language Processing, Computer vision, Systems And Robotics, Intelligent Agents, Enterprise Content Management Systems, Locating and Sharing Expertise, Learning Management Systems.

Enhancing Decision Making

Business Value of Improved Decision Making, Types Of Decisions, The Decision – Making Process, What is Business Intelligence?, The Business Intelligence Environment, Business Intelligence and Analytics Capabilities.

Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation, videos

Unit V

Building and Managing Systems

Systems Development and Organizational Change, Business Process Redesign, Systems Analysis, Systems Design, Completing the systems Development Process, Structured Methodologies, Object-Oriented Development, Computer-Aided Software Engineering, Traditional Systems Life Cycle, Prototyping, End-User Development, Application Software Packages, Software Services, and Outsourcing, Rapid Application Development(RAD), Agile Development, and DevOps, Component-Based Development and Web Services, Mobile Application Development: Designing for a Multiscreen World.

Managing Projects

Runaway Projects and System Failure, Project Management Objectives, Management Structure for Information Systems Projects, Linking Systems Projects to the Business Plan, Portfolio Analysis, Scoring Models, Information Systems Costs and Benefits, Capital Budgeting for Information Systems, Limitations of Financial Models.

Pedagogy/ Course delivery tools: Chalk and talk, Power point presentation

TEXT BOOKS:

1. Kenneth C.Laudon, Jane P.Laudon: Management Information Systems Managing the Digital Firm, 12th Edition, Pearson Education, 2015.

REFERENCE BOOKS:

1. Kenneth C.Laudon, Jane P.Laudon: Management Information Systems Managing the Digital Firm, 1st Edition, Pearson Education, 2010.
2. Laudon & Laudon: Essentials of Management Information Systems, 8th Edition, Pearson Education, 2009.
3. McLeod & Schell: Management Information Systems, 10th Edition, Pearson Education, 2007.

COURSE OUTCOMES (COS):

1. Discuss the Role of Information Systems in Global Business Today.
2. Apply the foundations of Business in software Industry and describe the IT Infrastructure.
3. Describe the Enterprise Systems and Digital Marketing and managing knowledge in Industry.
4. Analyze the Decision Making concepts for building and managing information systems in an organization.
5. Apply the Project Management principles for managing the system.

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1,CO2
Internal test-II	30	CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1	10	CO1,CO2
Component 2	10	CO3,CO4,CO5
Semester End Examination (SEE)	100	CO1,CO2, CO3,CO4,CO5

CYBER SECURITY	
Subject Code: 24MCAE14	Credits: 2:0:1
Pre requisites: Nil	Contact Hours: 28L 14P

COURSE CONTENTS

Unit I

Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, who are Cybercriminals? Classifications of Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyber offenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector

Unit II

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones.

Unit III

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

Unit IV

Understanding Computer Forensics: Introduction, Historical Background of Cyber-forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber-forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti-forensics.

Unit V

Introduction to Security Policies and Cyber Laws: Need Introduction to Indian Cyber Law, Objective and Scope of the it Act, 2000, Intellectual Property Issues, Overview of 2008, 2020 / 23. Intellectual - Property - Related Legislation in India, Patent, Copyright,

TEXT BOOKS:

1. "Cyber Security" by Nina Godbole Sunit Belapure, latest edition, Wiley India.
2. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, Introduction to information security and cyber laws, Dreamtech Press 2015

REFERENCES BOOKS:

1. Thomas J. Mowbray, Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions John Wiley & Sons 2013
2. James Graham, Ryan Olson, Rick Howard, Cyber Security Essentials CRC Press 2010

COURSE OUTCOMES (Cos):

1. Identify and analyze the cyber security risks due to different cybercrimes and examine them from a legal perspective.
2. Illustrate the use of Cyber security and of cyber-forensics tools in investigating the given cybercrime.
3. Examine relevant network defense / web application tools to solve given cyber security problems/ case study
4. Analyze legal issues and socio-economic impact due to cybercrime and forensics investigation approach
5. Design the security policy for an organization in line with IT ACT 2000 and based on ISO standard.

PROGRAM LIST:

1. Foot printing and Reconnaissance
2. Vulnerability Analysis: Nmap
3. Vulnerability Analysis: Nessus
4. Social Engineering Attack
5. Password Cracking
6. Phishing attacks using Kali Linux
7. SQL Injection Attack
8. Dos and DDos attacks
9. Network Traffic Analysis
10. Trojan backdoor using Kali Linux/ Metasploit

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Case Study with demo and report in A4 sheet	10	CO1, CO2, CO3, CO4, CO5
Continuous Evaluation (Lab Record – 5 Marks + Viva – 5 Marks)	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

III SEMESTER

SOFTWARE ENGINEERING AND AGILE METHODOLOGIES	
Subject Code: 24MCA31	Credits: 3:0:0
Pre requisites: NIL	Contact Hours: 42L

COURSE CONTENT

Unit I

Requirements Engineering: Functional and Non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Socio-technical systems: Complex systems, System engineering, System procurement, System development, System operation

Unit II

System modelling: Context models, Interaction Models, Structural Models, Behavioural models, Model-driven engineering.

Software Design and Development, Architectural Design: Architectural design decisions, Architectural views, Architectural patterns, Application architectures.

Unit III

Agile Methodologies – Introduction: What is agile? The history of Agile, The Agile Manifesto, The Foundations of Agile, The Agile mind set, Delivery environments and Agile suitability, the lifecycle of product development, the ‘Iron Triangle’, Working with uncertainty and volatility, Empirical and defined processes.

Unit IV

Generic Agile Process: Agile operating model, Common Agile Roles, the customer, the team, The Agile lead, the stakeholders, Common Agile Techniques, Stories and backlog refinement, Agile estimation, Agile planning, Agile testing, Common Agile Practices, Short feedback loops, Face-to-face communication, Daily stand-ups, Show and tells, Retrospectives, Emergent documentation, Visual boards, Sustainable pace, Focus on quality, Major Agile technical practices.

Unit V

Major Agile Frameworks: eXtreme programming (XP), Values, Principles, Practices Scrum, Roles, Activities and Artefacts, Dynamic systems development method (DSDM), Philosophy and eight principles, Roles, DSDM process, Agile project management, Kanban, models, Difference between Scrum and Kanban, Lean software development, Lean software development principles, Lean start-up, Scaled Agile framework (SAFe), Safe Process model.

TEXT BOOKS:

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education Publications, 2013.
2. Peter Measey and Radtack: Agile Foundations: Principles, Practices and Frameworks, Viva Books Private Limited, 2015

REFERENCE BOOKS:

1. Roger. S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, McGraw-Hill, 2010.
2. Shari Lawrence Pfleeger, Joanne M. Atlee: Software Engineering Theory and Practice, 4th Edition, Pearson Education, 2009.
3. Robert C. Martin with contributions by James W. Newkirk and Robert S Koss: Agile Software Development: Principles, Patterns and Practices, Pearsons Education, 2002.

COURSE OUTCOMES (COS):

1. Articulate the software engineering process by developing the Software Requirements Documentation. (PO-1, PO-2, PO-5)
2. Model and design solutions for a given real life problem. (PO-1, PO-2, PO-3, PO-4, PO-5)
3. Describe the concepts Agile principles and Practices. (PO-2, PO-3, PO-4, PO-5, PO-8)
4. Discuss the process of Agile Software Development. (PO-2, PO-3, PO-5, PO-8)
5. Describe the different Agile Framework for software Development. (PO-2, PO-3, PO-5, PO-8)

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1,CO2
Internal test-II	30	CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1: Case - Study: To develop SRS in IEEE format	10	CO1,CO2
Component 2: Case study on Agile methods	10	CO3,CO4,CO5
Semester End Examination (SEE)	100	CO1,CO2, CO3,CO4,CO5

MACHINE LEARNING	
Subject Code: 24MCA32	Credits: 3:0:1
Pre requisites: NIL	Contact Hours: 42L 28P

COURSE CONTENT

Unit 1

Introduction to Machine Learning, Human Learning Versus Machine Learning, Types of Machine Learning, Applications of Machine Learning, Tools for Machine Learning, Model Preparation: Machine Learning Activities, Data Structures for Machine Learning, Data Pre-Processing

Unit II

Modelling and Evaluation: Selecting A Model, Training A Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of A Model
Feature Engineering, Introduction to Feature Engineering, Feature Transformation, Feature Subset Selection

Unit III

Brief Overview of Probability: Introduction, Importance of Statistical Tools in Machine Learning, Concept of Probability, Random Variables, Some Common Discrete Distributions - Bernoulli distributions, Binomial distribution, multinomial and multinoulli distributions, Poisson distribution
Bayesian Concept Learning Importance of Bayesian Methods, Bayes' Theorem, Concept Learning Through Bayes' Theorem, Bayesian Belief Network

Unit IV

Supervised Learning – Classification, Regression Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms - k-Nearest Neighbour (kNN), Decision tree, Example of Regression, Common Regression Algorithms - Simple Linear Regression, Multiple Linear Regression, Logistic Regression
Unsupervised Learning – Clustering, Pattern Finding Using Association Rules Unsupervised Learning Versus Supervised Learning, Applications of Unsupervised Learning, Clustering and Its Types, Apriori Algorithm for Association Rule Learning

Unit V

Neural Network- Understanding the Biological Neuron, Exploring Artificial Neuron, Types of Activation Functions, Early Implementation of Artificial Neural Network, Architectures of Neural Network, Learning Process in Artificial Neural Network, Backpropagation, Overview of Deep Learning.

Text Books:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Dos, "Machine Learning", 1st Edition, Pearson, 2019.

References:

1. Tom M. Mitchell, Machine Learning, India Edition, McGraw Hill Education, 2013.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd ed., Springer, 2009
3. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.

Course Outcomes (COs):

1. Explain the fundamentals of machine learning, its types, applications, tools, and data preparation techniques. (PO-1,2,3)
2. Apply model selection, evaluation, and feature engineering techniques to improve the performance of machine learning models. (PO-1,2,3)
3. Utilize probability concepts and Bayesian methods for concept learning and decision-making under uncertainty. (PO-1,2,3)
4. Implement supervised and unsupervised learning algorithms for classification, regression, clustering, and pattern discovery. (PO-1,2,3)
5. Construct and analyze artificial neural networks, explain their learning process, and explore deep learning concepts. (PO-1,2,3)

Course Assessment and Evaluation:

Assessment Tool	Marks	Course Outcomes (COs) addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I (CIE-I)	30	CO1, CO2
Internal test-II (CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Lab Internal	10	CO1, CO2, CO3, CO4, CO5
Lab Data Sheets	10	CO1, CO2, CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks + Marks Scored in Lab internal + Lab Data Sheets.		
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

SPECIALIZATION I
Artificial Intelligence and Data Science

ARTIFICIAL INTELLIGENCE OF THINGS	
Subject Code: 24MCAAD1	Credits: 0:1:2
Pre requisites: NIL	Contact Hours: 28T 56P

Course Contents

Topics to be covered in Tutorial:

- Introduction to AIoT: Concepts, Paradigm, and Applications
- AIoT Architecture and Functional Components
- Communication Protocols and Networking in AIoT
- Security Challenges in IoT and AIoT Networks
- Arduino Microcontrollers: Features, Boards, and Serial Communication
- Working with Arduino Sensors and Actuators; Introduction to TinyML on Arduino
- Configuring ESP8266: Setup, Wi-Fi Connectivity, and Cloud Integration
- Sending Sensor Data to Cloud for AI-based Inference using ESP8266
- Getting Started with ESP32: GPIO, Wi-Fi, and MQTT Communication
- Building an IoT Weather Monitoring System with ESP32
- Raspberry Pi Basics: Setup, Python Libraries, and AI Model Deployment
- Running AI/ML Models on Raspberry Pi: Image Classification, Voice Recognition, and Anomaly Detection

Laboratory:

- Based on the above tutorial concepts, students are required to design and demonstrate a project. The project should incorporate elements such as AIoT architecture, Arduino/ESP8266/ESP32 programming, communication protocols, cloud integration, security considerations, and Raspberry Pi-based AI/ML model deployment

Text Books:

1. Qureshi, Kashif Naseer, and Thomas Newe (Eds.). Artificial Intelligence of Things (AIoT): New Standards, Technologies and Communication Systems. CRC Press, 2024.
2. Staple, Danny. Robotics at Home with Raspberry Pi Pico: Build Autonomous Robots with the Versatile Low-Cost Raspberry Pi Pico Controller and Python. Packt Publishing Ltd, 2023.
3. Monk, Simon, and Michael McCabe. Programming Arduino: Getting Started with Sketches. Vol. 176. McGraw-Hill Education, New York, 2016.
4. Kurniawan, Agus. Internet of Things Projects with ESP32: Build Exciting and Powerful IoT Projects Using the All-New Espressif ESP32. Packt Publishing Ltd, 2019.

Reference Books:

1. Malý, M. (2024). The Ultimate Compendium of Sensor Projects: Developing projects using sensor-modules with Arduino Uno, Raspberry Pi, and ESP32 microcontroller development systems. Edici CZ.NIC.

2. Brahim, D. (2022). The Ultimate Compendium of Sensor Projects: Developing projects using sensor-modules with Arduino Uno, Raspberry Pi, and ESP32 microcontroller development systems. Elektor.
3. Kurniawan, A. (2019). Internet of Things Projects with ESP32: Build exciting and powerful IoT projects using the all-new Espressif ESP32. Packt Publishing.

Course Outcomes (COs):

1. Explain the fundamentals of AIoT, including architecture, communication, applications, and security aspects. (PO-1,2,7,8)
2. Demonstrate sensor and actuator interfacing using Arduino and ESP boards, and configure ESP8266/ESP32 for cloud connectivity and edge AI integration. (PO-1,3,4,5)
3. Implement AI/ML models on embedded platforms such as Raspberry Pi and develop AIoT applications for intelligent data analysis and automation. (PO-1,2,3,4,8)

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1	10	CO1,CO2,CO3,CO4,CO5
Component 2	10	CO1,CO2,CO3,CO4,CO5
Semester End Examination (SEE)	100	CO1,CO2,CO3,CO4,CO5

BIGDATA ANALYTICS	
Subject Code: 24MCAAD2	Credits: 2:0:1
Pre requisites: Object Oriented Programming	Contact Hours: 28L 28P

Course Content

Unit I

Meet Hadoop: Data, Data Storage and Analysis, Querying All Your Data, Beyond Batch, Comparison with Other Systems: Relational Database Management Systems, Grid Computing, Volunteer Computing Hadoop Fundamentals MapReduce a Weather Dataset: Data Format, Analysing the Data with Unix Tools

Unit II

Analysing the Data with Hadoop: Map and Reduce, Java MapReduce, Scaling Out: Data Flow, Combiner Functions, Running a Distributed MapReduce Job, Hadoop Streaming

Unit III

The Hadoop Distributed Filesystem the Design of HDFS, HDFS Concepts: Blocks, Namenodes and Datanodes, HDFS Federation, HDFS High-Availability, The Command-Line Interface, Basic Filesystem Operations, Hadoop Filesystems Interfaces

Unit IV

Pig Installing and Running: Pig, Execution Types, Running Pig Programs, Grunt, Pig Latin Editors, An Example: Generating Examples, Comparison with Databases, Pig Latin: Structure, Statements, Expressions, Types, Schemas, Functions, Data Processing Operators: Loading and Storing Data, Filtering Data, Grouping and Joining Data, Sorting Data, Combining and Splitting Data.

Unit V

Spark an Example: Spark Applications, Jobs, Stages and Tasks, A Python Example, Resilient Distributed Datasets: Creation, Transformations and Actions, Persistence, Serialization, Shared Variables, Broadcast Variables, Accumulators, Anatomy of a Spark Job Run, Job Submission, DAG Construction, Task Scheduling, Task Execution

TEXT BOOKS:

1. "Hadoop: The Definitive Guide" by Tom White (Chapters: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10), 4th Edition 2019.

REFERENCE BOOKS:

1. "Big Data: Concepts, Technologies, and Applications" by Karim Yaghmour
2. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" by Pramod J. Sadalage and Martin Fowler
3. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett

COURSE OUTCOMES (COS):

1. Understand and describe the core concepts of Hadoop and its ecosystem, including data storage, processing, and querying techniques.
2. Apply MapReduce techniques to analyze and process large datasets efficiently.
3. Apply HDFS techniques to analyze and process large datasets efficiently.
4. Implement data processing and transformation tasks using Pig Latin.
5. Develop and run Spark applications to perform advanced data analytics and machine learning.

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1 (Record)	10	CO1,CO2,CO3,CO4,CO5
Component 2 (Quiz)	10	CO1,CO2,CO3,CO4,CO5
Semester End Examination (SEE)	100	CO1,CO2,CO3,CO4,CO5

SOCIAL NETWORK ANALYSIS	
Subject Code: 24MCAAD3	Credits: 2:0:1
Pre requisites: Nil	Contact Hours: 28L 28P

Course Content

Unit I

Networks and Society: Social Network Analysis, Applications, Graph Preliminaries, Three Levels of Social Network Analysis, Graph Visualization Tools

Network Measures: Network Basics – Degree and Degree Distribution, Paths

Unit II

Network Measures: Network Basics – Clustering Coefficient, Connected Components, Node Centrality, Assortativity, Transitivity and Reciprocity, Similarity

Unit III

Link Analysis: Applications of Link Analysis, Signed Networks, Strong and Weak Ties, Link Analysis Algorithms, PageRank, SimRank

Link Prediction: Applications of Link Prediction, Temporal Changes in a Network, Problem Definition, Evaluating Link Prediction Methods

Unit IV

Community Structure in Networks: Applications of Community Detection, Types of Communities, Community Detection Methods, Disjoint Community Detection - Node-centric Community Detection, Modularity and Community Detection-Modularity, Fast Greedy Algorithm, Overlapping Community Detection - Clique Percolation, Link Partition, Evaluation of Community Detection Methods-Evaluation for Disjoint Communities.

Unit V

Anomaly Detection in Networks: Outliers and versus Network-based Anomalies, Challenges, Anomaly Detection in Static Networks, Anomaly Detection in Dynamic Networks – Preliminaries, Feature-based Approaches, Decomposition-based Approaches, Window-based Approaches

LABORATORY:

- The students have to work on simulated and publicly available real datasets. The project(s) will require students to develop a complete end-to-end solution requiring preprocessing, design of the graph algorithms, training and validation, testing and evaluation with quantitative performance comparisons.

TEXT BOOKS:

1. Tanmoy Chakraborty: Social Network Analysis, Wiley, 2021.
Chapters: 1.1 - 1.5, 1.7, 2.1 – 2.5, 4.1 – 4.5, 4.8, 5.1 – 5.3, 5.4.1, 5.4.2, 5.5.1, 5.5.2, 5.7, 5.8, 6.1 – 6.4, 8.1 – 8.3, 8.4.1, 8.4.2, 8.4.3, 8.4.5

REFERENCES:

1. Stanley Wasserman, Katherine Faust: Social Network Analysis: Methods and Applications, Cambridge University Press, 1994.
2. Charu C Aggarwal: Social Network Data Analytics, Springer, 2011.

COURSE OUTCOMES (COS):

1. Relate the physical society with the online social network and explain how one shapes the other. (PO-1, PO-2, PO-7, PO-8)
2. Apply network measures to real-world networks. (PO-1, PO-2, PO-3, PO-4, PO-8)
3. Analyze the edges in the network using link analysis algorithms and link prediction methods. (PO-1, PO-2, PO-3, PO-4, PO-5, PO-7, PO-8)
4. Formulate the community structures in networks and evaluate the community detection methods. (PO-1, PO-2, PO-3, PO-4, PO-5, PO-7, PO-8)
5. Design algorithms for efficient and cost-effective anomaly detection in social networks. (PO-1, PO-2, PO-3, PO-4, PO-5, PO-7, PO-8)

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1	10	CO1, CO2, CO3, CO4, CO5
Component 2	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

NATURAL LANGUAGE PROCESSING	
Subject Code: 24MCAAD4	Credits: 2:0:1
Pre requisites: NIL	Contact Hours: 28L 28P

Course Content

Unit I

Language Modelling: Introduction to Natural Language Processing, Language and Knowledge, The Challenges of NLP, Language and Grammar, NLP Applications, Various Grammar-based Language Models, Statistical Language Model.

Unit II

Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-of-Speech Tagging

Unit III

Syntactic Analysis: Context-Free Grammar, Constituency, Parsing, Probabilistic Parsing

Unit IV

Semantic Analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation.

Unit V

Machine Translation: Problems in Machine Translation, Machine Translation Approaches, Direct Machine Translation, Rule-based Machine Translation, Corpus-based Machine Translation, Semantic or Knowledge-based MT systems.

Lab: Students must practice use of libraries like NLTK or SpaCy to perform Word Analysis Word Generation, N-Grams, N-Grams Smoothing, Chunking and Building Chunker

TEXT BOOKS:

1. Tanveer Siddiqui and U.S Tiwary: Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
(Chapters: 1.1-1.5, 1.7, 2, 3, 4.1-4.5, 5, 8.1-8.2, 8.4-8.8)

REFERENCE BOOKS:

1. Daniel Jurafsky, James H. Martin: Speech and Language Processing - An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Anne Kao and Stephen R. Potee: Natural Language Processing and Text Mining, Springer Verlag, London, 2007.

3. Steven Bird, Ewan Klein, Edward Loper: Natural Language Processing with Python, O'Reilly Media, 2009.

COURSE OUTCOMES (COS):

1. Explain the importance of natural language applications and apply language modeling approaches. (PO-1, PO-2, PO-3, PO-4, PO-8)
2. Analyze the natural language text and parse the grammar. (PO-1, PO-2, PO-3, PO-4, PO-8)
3. Design a rule based system to tackle morphology/syntax of a language. (PO-1, PO-2, PO-3, PO-4, PO-8)
4. Develop the meaning of the given text. (PO-1, PO-2, PO-3, PO-4, PO-8)
5. Compare and contrast various machine translation approaches. (PO-1, PO-2, PO-3, PO-4, PO-8)

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1	10	CO1,CO2,CO3,CO4,CO5
Component 2	10	CO1,CO2,CO3,CO4,CO5
Semester End Examination (SEE)	100	CO1,CO2,CO3,CO4,CO5

GENERATIVE AI AND PROMPT ENGINEERING	
Course Code: 24MCAAD5	Credits: 0:1:2
Prerequisite: Nil	ContactHours:28T 56P

COURSE CONTENTS

- Introduction to Generative AI
- Image and Video Generation Tools
- Copilot, Claude, BRAD, Educational generative AI.
- Preliminary Project Based Learning
- Large Language Models Prompt Engineering
- DNNs Tensor Flow
- Word Embedding's
- Hugging Face Models
- LangChain - Basics of Chains
- LangChain Model IO, LangChain - RAG
- LangChain– Memory, LangChain - Agents
- Recurrent neural network, Long Short-Term Memory
- Transformers

Laboratory:

- Programs supplementing the concepts covered in tutorial.
- Students are expected to design and develop a mini-project using Generative AI tools.

Text Book:

1. Raghav Bali. Generative AI with Python and TensorFlow 2,1st Edition Packt Publishing,2021.
2. Ben Auffarth. Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT, and Other LLMs, 1st Edition. Packt Publishing, 2024.

Course Outcomes:

1. Apply fundamental concepts of Large Language Models (LLMs), Prompt Engineering, and Word Embedding to optimize AI-driven text processing tasks. (PO – 1, 2, 3, 4, 5)
2. Implement and evaluate Artificial Neural Networks (ANNs) and Deep Neural Networks (DNNs) using TensorFlow for efficient model training and performance tuning. (PO – 1, 2, 3,4,5)
3. Develop AI applications using Hugging Face Models, LangChain (Chains, Model IO, RAG, Memory, Agents), RNNs, LSTMs, and Transformers to enhance intelligent system capabilities. (PO – 1, 2, 3, 4, 5, 8)

SPECIALIZATION II

Web and Mobile Application Development

MOBILE APPLICATION DEVELOPMENT	
Subject Code: 24MCAWM1	Credits: 0:1:2
Pre requisites: MCA21	Contact Hours: 28T 56P

Course Content

Topics to be Covered in Tutorial

- Introduction to android, features, Android Architecture
- Exploring the Linear layout
- Exploring the Relative layout
- Exploring UI widgets
- Android activity life cycle
- Intents in Android
- Fragments in android
- Databases and content providers
- Services
- Location-based services
- Audio playback and image capture
- Introduction to Kotlin

Laboratory

- Programs supplement the tutorial concepts will be based on the latest version of Android.
- Mini Project

Reference Books:

1. Reto Meier: Professional Android 4 Application Development. Wiley India Edition, 2012.
2. Jerome (J.F.) Di Marzio: Android A Programmer's Guide, Tata McGraw-Hill, 2010.
3. B.M. Harwani: Android Programming, Pearson, 2013.
4. Jason Ostrander: Android UI Fundamentals Develop and Design, Pearson, 2014.
5. John Horton: Android Programming for Beginners, Packt publishing, 2015.
6. Web Reference: Any Google developer sites
7. <https://www.w3schools.com/KOTLIN/index.php>

Course Outcomes (Cos):

1. Describe the Android SDK, Development Framework and Demonstrate Android Application Life Cycle. (PO-1, PO-2, PO-3, PO-5)
2. Apply the Android UI and animations API for enhancing the user experience and developing advanced applications. (PO-1, PO-2, PO-3, PO-5, PO-7)
3. Develop the Android Applications using sensors, location based services, databases and Background services. (PO-1, PO-2, PO-3, PO-5, PO-7)

COURSE ASSESSMENT ANDEVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1	10	CO1,CO2,CO3,CO4,CO5
Component 2	10	CO1,CO2,CO3,CO4,CO5
Semester End Examination (SEE)	100	CO1,CO2,CO3,CO4,CO5

SOFTWARE TESTING AND AUTOMATION	
Subject Code: 24MCAWM2	Credits: 0:1:2
Pre requisites: MCA11	Contact Hours: 28T 56P

Course Content

Concepts to be Covered in Tutorial:

1. Articulate the basics of Software Testing Life Cycle using Manual Testing implementations.
2. Installation of Selenium IDE, Recording and running test cases using Selenium IDE
3. Selenese Commands
4. Installation of Selenium Webdriver in Pycharm and basics of python programming
5. Finding Elements by NAME, ID, CSS, XPATH, LINKTEXT. Understanding “By” class
6. Working with Web Elements; Useful Methods and Properties; Wait Types.
7. Construct the complete automation framework in selenium webdriver.
8. Concept of APIs- Working of API in modern applications (REST, SOAP), Types of APIs: REST, SOAP, and Web Services
9. Postman: Installation, setup, and usage for API testing.
10. Advanced Postman Usage: Creating Collections., Environment Variables in Postman.
11. Chaining Requests: Using previous API response as input for the next.
12. Automating API Tests in Postman.

LABORATORY:

- Students should demonstrate the working of manual testing, selenium IDE and should be able to test the given web page using selenium web driver and generate the necessary documents/tables
- **Project:** A team of 1 or 2 students must take up a Web Application and generate the necessary documents/tables using Manual Testing, Selenium IDE, Selenium Web Drivers and should run the complete test suite.

TEXT BOOKS:

1. Selenium with Python: A Beginners’ Guide, Pallavi R Sharma, BPB Publications.
2. David Burns: Selenium 2 Testing Tools: Beginner’s Guide, Packt Publishing, 2012.
3. API Testing and Development with Postman: Dave Westerveld, 1st Edition, 2019.

COURSE OUTCOMES (COS):

1. Explain the basics of the testing process and demonstrate the process of manual testing. (PO-1, PO-2, PO-3, PO-5, PO-8)
2. Demonstrate the basics of working with Selenium IDE. (PO-1, PO-2, PO-3, PO-4, PO-5, PO-8)
3. Demonstrate the basics of working with Selenium Web Driver. (PO-1, PO-2, PO-3, PO-4, PO-5, PO-8)

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1	10	CO1,CO2,CO3,CO4,CO5
Component 2	10	CO1,CO2,CO3,CO4,CO5
Semester End Examination (SEE)	100	CO1,CO2,CO3,CO4,CO5

EXTENDED REALITY	
Subject Code: 24MCAWM3	Credits:2:0:1
Pre Requisites: Nil	Contact Hours: 28L 28P

COURSE CONTENT

Unit I

Introduction to Virtual Reality: Defining Virtual Reality, Four Key Elements of Virtual Reality Experience, A History of VR

Programming with Unity: Unity Basics, Manipulating the Scene, Code blocks and Methods, Debugging Conditional and looping statements, working with objects, Working with Scripts

Unit II

Unity 3D Game engine: Working in Unity- Getting Around in Unity, working with Game Objects, working with Components, working with Prefabs, working with Scenes, Managing Assets, Building Unity Projects, Accessing Preferences, Installing Unity Packages, Physics materials, Mesh colliders, Box collider, Materials, Textures

Unit III

Animation and Object Behavior: Keyframe Animation, Physics based Animation of Rigid Bodies, Object Behavior, Behavior and Animation in Scene Graphs.

Unit IV

Light sources, Sound, Background, Special purpose systems- Virtual Humans, Particle Systems, Terrain, Vegetation

Unit V

VR/AR Input Devices and Tracking: Fundamentals of Input Devices, Basics of Visual Output, Camera based Tracking- Marker-based Methods, Tracking Using black and white markers, Marker Free tracking

REFERENCE BOOKS:

1. Ralf Doerner, Wolfgang Broll, Paul Grimm, Bernhard Jung, —Virtual and Augmented Reality (VR/AR)- Foundations and Methods of Extended Realities (XR)l, © Springer, ISBN 978-3-030-79061-5 ISBN 978-3-030-79062-2 (eBook)
2. Paris Buttfield-Addison, Jon Manning, Tim Nugent, —Unity Development Cookbook-Real Time Solutions from Game Development to AII, O'Reilly Media, Inc., August 2023, ISBN: 9781098113711
3. Suman Dutta, —Immersive Realm of Extended Realityl, bpb publications 2024 Edition, ISBN: 9789355517227 eISBN: 9789355519450

Web links and Video Lectures (e-Resources)

<https://learn.unity.com/pathway/unity-essentials>
<https://learn.unity.com/pathway/mobile-ar-development>
<https://learn.unity.com/pathway/vr-development>

COURSE OUTCOMES:

1. Apply Game objects and their representations for building XR world
2. Design the XR story board for the application requirements
3. Build and Analyze XR model components
4. Demonstrate knowledge of working with Game Engine

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course outcomes addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3,CO4,CO5
Average of the two internal tests shall be taken for 30 marks.		
Other Components		
Component 1 (Record)	10	CO1,CO2,CO3,CO4,CO5
Component 2 (Quiz)	10	CO1,CO2,CO3,CO4,CO5
Semester End Examination (SEE)	100	CO1,CO2,CO3,CO4,CO5

WEB DEVELOPMENT WITH J2EE	
Subject Code: 24MCAWM4	Credits: 2:0:1
Pre requisites: NIL	Contact Hours: 28L 28P

COURSE CONTENT

Unit I

Introduction to J2EE and Web Technologies: J2EE Architecture and Components, Containers and Services, Web Technologies Overview, HTTP Protocol, HTML Forms and Request Handling, MVC Architecture.

Unit II

Servlets: Servlet Lifecycle and Architecture, Handling GET and POST Requests, Session Management Techniques (Cookies, URL Rewriting, HttpSession), ServletConfig and ServletContext, Servlet Chaining and Filters.

Unit III

JavaServer Pages (JSP): JSP Syntax and Structure, JSP Lifecycle, Implicit Objects, Scriptlets, Expressions, and Declarations, JavaBeans in JSP, Error Handling in JSP.

Unit IV

Database Connectivity with JDBC: JDBC Architecture and Drivers, Database Connections, Executing SQL with Statement and PreparedStatement, ResultSet and Metadata, Transaction Management.

Unit V

Enterprise JavaBeans (EJB): EJB Architecture, Types of EJBs (Stateless, Stateful, Entity), Session Beans, Message-Driven Beans, EJB Deployment and Use Cases.

TEXT BOOK:

- J2EE: The Complete Reference, Jim Keogh, McGraw-Hill Education, 2002, ISBN: 978- 0072224726

REFERENCE BOOKS:

- Beginning Java EE 7, Antonio Goncalves, Apress
- HeadFirst Servlets and JSP, Kathy Sierra, Bryan Basham, O'Reilly Media
- Professional Java for Web Applications, Nicholas S. Williams, Wrox

COURSE OUTCOMES (COS):

1. Describe the architecture and core components of J2EE.
2. Develop dynamic web applications using Servlets and JSP.
3. Implement data access using JDBC.
4. Build enterprise applications using EJB.
5. Integrate various J2EE components in a modular enterprise solution.

COURSE ASSESSMENT AND EVALUATION

Assessment Tool	Marks	Course Outcomes Addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal Test I	30	CO1, CO2
Internal Test II	30	CO3, CO4, CO5
Average of two tests for 30 marks		
Other Components		
Component 1 (Lab Internals)	10	CO1–CO5
Component 2 (Mini Project)	10	CO1–CO5
Semester End Examination (SEE)	100	All COs

USER INTERFACE AND USER EXPERIENCE	
Subject Code: 24MCAWM5	Credits: 2:0:1
Pre requisites: NIL	Contact Hours: 28T 28P

Course Content

UNIT I

Usability of Interactive Systems: Introduction, Usability Goals and Measures, usability Motivations, Goals for Our Profession

Guidelines, Principles, and Theories: Introduction, Guidelines, Principles, Theories

UNIT II

Managing Design Processes: Introduction, Organizational Design to Support Usability, The Four Pillars of Design, Development Methodologies, Ethnographic Observation, Scenario Development, Legal Issues

Evaluating Interface Designs: Expert Reviews, Usability Testing and Laboratories, Surveys Instruments, Acceptance Tests, Evaluation during Active Use

UNIT III

Direct Manipulation and Virtual Environments: Introduction, Examples of Direct-Manipulation, 3D Interfaces, Virtual and Augmented Reality

Menu Selection, Form Fillin, and Dialog Boxes: Introduction, Task-Related Menu Organization, Single Menus, Combinations of Multiple Menus, Content Organization, Fast Movement through Menus, Data Entry with Menus: Form Fillin, Dialog Boxes and Alternatives.

UNIT IV

Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Displays- Small and Large

Collaboration and Social Media Participation: Introduction, Goals of Collaboration and Participation, Asynchronous Distributed Interfaces: Different Place, Different Time, Synchronous Distributed Interfaces: Different Place, Same Time, Face-to-Face Interfaces: Same Place, Same Time

UNIT V

Balancing Function and Fashion: Introduction, Error Messages, Display Design, Web Page Design, Window Design, Color

Information Search and Information Visualization:

Searching in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Search Interface, Challenges for Information Visualization.

LABORATORY:

Students have to design the User Interface Components based on the theory concepts.

TEXT BOOK:

1. Shneiderman Plaisant Cohen Jacobs: Designing the User Interface, 5th Edition, Pearson Education, 2010.

REFERENCE BOOKS:

1. Helen Sharp, Jennifer Preece, Yvonne Rogers- Interaction Design: Beyond Human–Computer Interaction, 5th edition, John Wiley & Sons; 2019
2. Wilbert O. Galitz - The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, 3rd editions, Wiley; 2007
3. Jenifer Tidwell- Designing Interfaces 2e Paperback, O'Reilly 2011
4. Brian Wood - "Adobe XD CC Classroom in a Book" Publisher: 1 edition, Publisher: Adobe Press, 2019
5. Gerardus Blokdyk - UX UI design A Complete Guide - Publisher: 5starcooks, 2019

COURSE OUTCOMES (COS):

1. Describe the fundamental knowledge on Usability of Interactive Systems and its Guidelines, Principles and theories. (PO-1,2,3)
2. Apply the techniques involved in designing real-time Interfaces and Managing Design Processes. (PO-1,2,3,5,9)
3. Apply a design process, Manipulation and data entries in web application navigation. (PO-1,2,3,10)
4. Describe the prominence of Interaction Devices, Collaboration and Social Media Participation. (PO-1,2,3)
5. Examine and design the Balancing Function and Fashion. (PO-1,2,3,5,10)

COURSE ASSESSMENT ANDEVALUATION:

Assessment Tool	Marks	Course Outcomes Addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal Test I	30	CO1, CO2
Internal Test II	30	CO3, CO4, CO5
Average of two tests for 30 marks		
Other Components		
Component 1 (Lab Internals)	10	CO1–CO5
Component 2 (Mini Project)	10	CO1–CO5
Semester End Examination (SEE)	100	All COs

SPECIALIZATION III

Software System and Security

SOFTWARE PROJECT MANAGEMENT	
Subject Code: 24MCASS1	Credits: 3:0:0
Pre requisites: NIL	Contact Hours: 42L

Course Content

Unit I

Introduction to Software Project Management and Project Evaluation: Importance of Software Project Management, Activities, Methodologies, Categorization of Software Projects, Setting objectives, Management Principles, Management Control, Project portfolio Management, Cost-benefit evaluation technology, Risk evaluation.

Unit II

Project Planning and Effort Estimation: Stepwise Project Planning, Basics of Software estimation, Effort estimation techniques, COSMIC Full function points, COCOMO II A Parametric Productivity Model.

Unit III

Project Approach Selection and Activity Planning: Software process and Process Models, Choice of Process models, Rapid Application development, Agile methods, Extreme Programming, SCRUM, Objectives of Activity planning, Project schedules, Activities, Sequencing and scheduling, Network Planning models, Forward Pass and Backward Pass techniques, Critical path (CRM) method.

Unit IV

Risk Management and Project Monitoring: Risk identification, Assessment, Monitoring, PERT technique, Framework for Management and control, Collection of data Project termination, visualizing progress, Cost monitoring, Earned Value Analysis-Project tracking, Change control - Software Configuration Management.

Unit V

Resource Allocation and Software Quality: Resource Allocation, Creation of critical paths, Software Quality in Project Planning, Software Quality Models, Product and Process Metrics and Quality Management, Quality Management Systems, Process Capability Models.

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management, 6th Edition, Tata McGraw Hill, New Delhi, 2018.

Chapters: 1.1 to 1.16, 2.1 to 2.6, 3, 4.1 to 4.5, 4.13 to 4.16, 5.1 to 5.13, 6, 7.1 to 7.12, 8.1 to 8.5, 9, 13.1 to 13.5, 13.7 to 13.10.2

REFERENCE BOOKS:

1. Robert K. Wysocki: Effective Software Project Management, Wiley Publication, 2011.
2. Walker Royce: Software Project Management, Addison-Wesley, 1998.
3. Gopalaswamy Ramesh: Managing Global Software Projects, McGraw Hill Education (India), Fourteenth Reprint, 2013.

COURSE OUTCOMES (COS):

1. Discuss the scope of software project management and adapt the software project evaluation principles. (PO-1, PO-2, PO-3, PO-5, PO-6, PO-7, PO-8)
2. Explain the project planning approach and apply the software effort estimation techniques. (PO-1, PO-2, PO-5, PO-6, PO-8)
3. Determine the appropriate process model and produce activities plan. (PO-1, PO-2, PO-4, PO-5, PO-6, PO-8)
4. Manage the risks, monitor the progress of projects and manage the change control. (PO-1, PO-5, PO-6)
5. Handle the resource allocation and practice the software quality standards. (PO-1, PO-2, PO-5, PO-6, PO-8)

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course Outcomes Addressed
Continuous Internal Evaluation (CIE): 50 Marks	50	
Internal Test I	30	CO1, CO2
Internal Test II	30	CO3, CO4, CO5
Average of two tests for 30 marks		
Other Components		
Component 1	10	CO1–CO5
Component 2	10	CO1–CO5
Semester End Examination (SEE)	100	CO1–CO5

DEVOPS	
Subject Code: 24MCASS2	Credits: 0:1:2
Pre requisites: MCA14	Contact Hours: 28T 56P

Course Content

CONCEPTS TO BE COVERED IN TUTORIAL

1. Introduction to Agile, Agile Phases.
2. Introduction to DevOps.
3. DevOps Life Cycle.
4. Agile vs DevOps
5. DevOps Work Flow and Principles.
6. Roles, Responsibilities and Skills of a DevOps Engineer.
7. overview of Git, GitHub.
8. Git Workflow.
9. Overview of Jenkins.
10. Introduction to Docker, Docker Architecture.
11. Introduction to Kubernetes, Cluster Architecture.
12. Container, Containerization vs Virtualization.

EXERCISES FOR LAB

- Git Installation, Environment Setup.
- Creating local repository using Git.
- Creating an Account in GitHub, Creating Remote Repository.
- Working in local repository using Basic Git commands.
- Working with remote repository using Git remote commands.
- Jenkins Master-Slave Installation on AWS
- Installing Jenkins Plugins.
- Creating Jenkins Builds, Creating Scheduled Builds
- Installing Docker, Running a Container.
- Pulling an Image from the Docker Registry.
- Running an Image, Stopping and Starting Containers.
- Pushing an Image to the Repository.
- Basic Docker Commands.
- Basic Kubernetes Commands.

REFERENCES:

1. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer Paperback – Import, 1st ed. Edition ,1
2. December 2019 by Mariot Tsitoara .
3. Continuous Delivery with Docker and Jenkins: Create secure applications by building complete CI/CD pipelines, 2nd Edition by Rafal Leszko.
4. <https://git-scm.com/book/en/v2>
5. <https://www.jenkins.io/doc/tutorials/>
6. <https://docs.docker.com/get-started/>
7. <https://kubernetes.io/docs/home/>

COURSE OUTCOMES (COS):

1. Exemplify the usage of DevOps and its life cycle. (PO-3, PO-6, PO-7, PO-8)
2. Demonstrate the basic commands and Source Control Management using Git. (PO-3, PO-5, PO-6, PO-8)
3. Implement the CI/CD Pipelines and Continuous Monitoring using Jenkins, Maven, Docker and Kubernetes. (PO-3, PO-5, PO-6)

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course Outcomes Addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal Test I	30	CO1, CO2
Internal Test II	30	CO3, CO4, CO5
Average of two tests for 30 marks		
Other Components		
Component 1	10	CO1–CO5
Component 2	10	CO1–CO5
Semester End Examination (SEE)	100	All COs

CLOUD COMPUTING	
Subject Code: 24MCASS3	Credits: 0:1:2
Pre requisites: NIL	Contact Hours: 28T 56P

CONCEPTS TO BE COVERED IN TUTORIAL

1. Introduction to Cloud Computing
2. Familiarity of different services provided by AWS
3. Setting of Private Cloud in AWS
4. Working with Amazon EC2, AMI and S3 services.
5. Back up and Launch a new instance using Back-up
6. Elastic IPs and AWS Identity and Access Management(IAM)
7. Hosting Static Website and Hosting Applications in AWS
8. Working with AWS RDS: MySQL Workbench and Dynamo DB
9. Resource management in cloud: Load Balancer and Auto Scaling Group
10. AWS-Eclipse Integration with Elastic Beanstalk
11. Connect RDS and Java Applications
12. Data Analytics, Security

LABORATORY

- Familiarize the services by AWS
- Creating user login
- Creating Linux, Windows virtual machines instance using EC2
- Run simple applications on EC2 Instance
- Creating Storage using S3
- Create a Backup using Image and launch new instance using Backup image
- Creating an RDS Instance with MySQL Workbench and Dynamo DB
- Demonstrate Database application on AWS
- Autoscaling the infrastructure based on the requirement
- Demonstrate Load balancing using different instance of EC2
- Launch a web application.
- Demonstrate Identity and Access management.

- Demonstrate Elastic bean stack
- Demonstrate AWS dynamic web application.
- Demonstrate Data Analytics using Elastic Map Reduce (EMR)

REFERENCES:

1. Rajkumar Buyya, ChristaianVecchiola, S. ThamaraiSelvi, Master Cloud Computing, TMH Education, 2013.
2. Arshdeep Bahga, Vijay Madiseti, Cloud Computing: A Hands-on Approach, Universities Press, 2014. 71
3. https://aws.amazon.com/training/intro_series/
4. <https://aws.amazon.com/getting-started/>
5. <https://aws.amazon.com/>
6. <https://aws.amazon.com/free/>
7. <https://blog.webspecia.com/cloud/iaas-paas-saas-explained-examples-comparison>
8. <http://aws.amazon.com/training/self-paced-labs/>
9. Instructor led AWS Training - <http://aws.amazon.com/training/>

COURSE OUTCOMES(COS):

1. Build private cloud and launch instances using AWS services. (PO-1, PO-2, PO-3, PO-5, PO-7)
2. Demonstrate database, EMR, Auto Scaling, Load Balancer and IAM services on AWS. (PO-1, PO-2, PO-3, PO-5, PO-7)
3. Develop AWS Dynamic Web Application and Migrate Applications on AWS. (PO-1, PO-2, PO-3, PO-5, PO-7)

COURSE ASSESSMENT ANDEVALUATION:

Assessment Tool	Marks	Course Outcomes Addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal Test I	30	CO1, CO2
Internal Test II	30	CO3, CO4, CO5
Average of two tests for 30 marks		
Other Components		
Component 1	10	CO1–CO5
Component 2	10	CO1–CO5
Semester End Examination (SEE)	100	All COs

INFORMATION SECURITY	
Subject Code : 24MCASS4	Course Credits : 3:0:0
Prerequisites: NIL	Contact Hours:42L

COURSE CONTENT

Unit I

Introduction to Information Security, What Is Security? Components of an Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, The Security Systems Development Life Cycle, The Need for Security, Threats, Attacks, Legal, Ethical, and Professional Issues in Information Security, Ethics and Information Security, Codes of Ethics and Professional Organizations

Unit II

Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies, selecting a Risk Control Strategy, Quantitative Versus Qualitative Risk Control Practices, Security Technology: Firewalls and VPNs, Access Control, Firewalls, Protecting Remote Connections

Unit III

Security Technology: Intrusion Detection and Prevention Systems, and Other Security Tools, Intrusion Detection and Prevention Systems, Honeypots, Honey nets, and Padded Cell Systems, Scanning and Analysis Tools Implementing Information Security, Information Security Project Management, Technical Aspects of Implementation, Nontechnical Aspects of Implementation.

Unit IV

Symmetric Ciphers: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography, Block Ciphers and the Data Encryption Standard, Block Cipher Principles, The Data Encryption Standard, The Strength of Des, Advanced Encryption Standard, Evaluation Criteria for AES, The AES Cipher

Unit V

Public-Key Encryption and Hash Functions, Public-Key Cryptography and RSA, Principles of Public-Key Cryptosystems The RSA Algorithm, Key Management; Other Public-Key Cryptosystems, Key Management, Diffie-Hellman Key Exchange, Message Authentication and Hash Functions, Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and Macs.

TEXT BOOKS:

1. Michael E. Whitman, Herbert J. Mattord: Principles of Information Security, 4th Edition, Cengage Learning, 2012. (Selected Portion from Chapters 1,2,3,4,5,6,7,9,10).
2. William Stallings: Cryptography and Network Security-Principles and Practices, 4th Edition, Prentice Hall, (Chapters 2.1 to 2.5, 3.1 to 3.3, 3.5, 5.1 to 5.2, 9.1 to 9.2, 10.1 to 10.2, 11.1 to 11.5).

REFERENCE BOOKS:

1. Behrouz A Forouzan: Cryptography & Network Security, 3rd Edition, 2015, Tata McGraw Hill.
2. R. Kelly Rainer, Casey G. Cegielski: Introduction to Information Systems, 4ed, Wiley India.
3. Mark Merkow, James Breithaupt: Information Security: Principles and Practices, Pearson Education.

COURSE OUTCOMES (COS):

1. Describe the basic concepts of information security, its need, legal, ethical and professional issues associated with it. (PO-1, PO-7)
2. Determine risks and its controlling mechanisms, and discuss the importance of firewalls and VPN in the context of network security. (PO-2, PO-7)
3. Discuss different security technologies and implementation of information security. (PO-2, PO-7)
4. Apply symmetric key cryptography and encryption standards. (PO-1, PO-2, PO-7)
5. Explain public-key cryptography and hash functions. (PO-1, PO-2, PO-7, PO-7, PO-10)

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course Outcomes Addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal Test I	30	CO1, CO2
Internal Test II	30	CO3, CO4, CO5
Average of two tests for 30 marks		
Other Components		
Component 1	10	CO1–CO5
Component 2	10	CO1–CO5
Semester End Examination (SEE)	100	All COs

ETHICAL HACKING	
Subject Code: 24MCASS5	Credits: 2:0:1
Pre requisites: Nil	Contact Hours: 28L 28P

Course Contents

Unit I

Introduction to Ethical Hacking, why do intrusions and attacks happen? Types and profiles of attackers and defenders, Attack targets and types, the anatomy of an attack, Ethical hacking and penetration testing, Defensive technologies, Lab – setting up the testing lab

Unit II

Ethical Hacking Footprinting and Reconnaissance: Ethical Hacking Footprinting and Reconnaissance, Technical requirements, what is footprinting and reconnaissance, Web searches and Google hacks, WHOIS database records

Ethical Hacking Scanning and Enumeration: Ethical Hacking Scanning and Enumeration, comparing scanning and enumeration, exploring scanning techniques, understanding service enumeration, Introducing the Nmap network scanning tool, Lab – Scanning and enumeration

Unit III

Hacking the Windows Operating System: Hacking the Windows Operating System Chevron down icon, Hacking the Windows Operating System, Technical requirements, Exploiting the Windows OS,

Hacking the Linux Operating System: Hacking the Linux Operating System, Exploiting the Linux operating system, Exploring the Linux file system, Exploiting Linux networking,

Unit IV

Web Application Hacking: Cross-Site Request Forgery, Deep linking, Man-in-the - Middle/sniffing attack, Cookie tampering, Cookie-based session attacks, SQL Injection, Cross- Site Scripting (XSS), Security Misconfigurations, Web Shells and Remote Code Execution, Web Application Firewalls (WAF) bypass techniques, Using Burp Suite and OWASP ZAP for web application testing.

Unit V

Hacking Databases: Hacking Databases, finding databases on the network, Exploring databases and database structures, Database threats and vulnerabilities,

Social Engineering: Introducing social engineering, Phases of a social engineering attack, **Mobile Hacking:** Mobile security fundamentals, Mobile OS security (Android and iOS), Common attack vectors, Understanding mobile vulnerabilities. Mobile Reconnaissance and Information Gathering: Extracting mobile app metadata, APK decompilation, Reverse engineering Android and iOS apps

LABORATORY: Students must practice network Scanning, password cracking, Authentication, analyze traffic using Tools Nmap, Hydra, Wireshark, APK Tool Metasploit and Burp Suite.

TEXT BOOKS:

1. Hartman, Shane. Hands-On Ethical Hacking Tactics: Strategies, tools, and techniques for effective cyber defense. Packt Publishing Ltd, 2024.
2. Simpson, Michael T., Nicholas Antill, and Rob Wilson. Hands-on ethical hacking and network defense. Vol. 3. Cengage Learning, 2017.
3. D Singh, Glen. "The Ultimate Kali Linux Book-: Harness Nmap, Metasploit, Aircracking, and Empire for cutting-edge pentesting." (2024).

REFERENCES BOOKS:

1. R. Baloch, Web Hacking Arsenal: A Practical Guide to Modern Web Pentesting. Boca Raton, FL, USA: CRC Press, 2024.
2. S. J. Shapiro, Fancy Bear Goes Phishing: The Dark History of the Information Age, in Five Extraordinary Hacks. New York, NY, USA: Farrar, Straus and Giroux, 2023.

COURSE OUTCOMES(COS):

- 1: Understand the fundamentals of **ethical hacking**, attack methodologies, types of hackers, and security measures to protect against cyber threats.
- 2: Perform **footprinting, reconnaissance, scanning, and enumeration** using various tools and techniques to gather intelligence about target systems.
- 3: Exploit vulnerabilities in **Windows, Linux, and database systems**, understanding operating system security weaknesses and attack methodologies.
4. Analyze web application architectures and traffic to identify, prioritize, and reproduce vulnerabilities using web security tools in a controlled lab environment.
- 5: Analyze and execute **social engineering attacks**, understanding attacker psychology, attack phases, and implementing defense mechanisms.

COURSE ASSESSMENT AND EVALUATION:

Assessment Tool	Marks	Course Outcomes Addressed
Continuous Internal Evaluation (CIE): 50 Marks		
Internal Test I	30	CO1, CO2
Internal Test II	30	CO3, CO4, CO5
Average of two tests for 30 marks		
Other Components		
Component 1	10	CO1–CO5
Component 2	10	CO1–CO5
Semester End Examination (SEE)	100	All COs

PROJECT WORK - PHASE I	
Subject Code: 24MCAP1	Credits: 0:0:6
Pre requisites: Nil	Contact Hours: 28 P

GUIDELINES:

- The students have to carry out the project work in 2 phases. Phase I includes selection of the project, requirement analysis and design.
- The topic and title of the project work shall be chosen by the candidate in consultation with the guide and co-guide if any. The subject and topic of project work shall be from the major field of studies of the candidate.
- The project work shall be carried out by each student independently under the guidance of one of the faculty members of the department.
- At the end of the semester each candidate shall submit a report of the project work duly approved by the guide and countersigned by the co-guide (if any) and Head of the Department.
- The project work – phase I is evaluated by a panel of internal faculty based on the report and presentation. Semester End Examination need not be conducted.

COURSE OUTCOMES (COS):

1. Gather and analyze the requirements of the given problem. (PO-1, PO-2, PO-5, PO-8)
2. Design solution for a given problem using software engineering approach ethically considering social issues. (PO-1, PO-3, PO-4, PO-5, PO-6, PO-7, PO-8)
3. Demonstrate and document the project work efficiently. (PO-1, PO-3, PO-4, PO-8)
4. Contribute as an individual or in a team in development of technical projects. (PO-1, PO-3, PO-4, PO-5, PO-6, PO-8)

SOCIETAL ACTIVITY	
Subject Code: 24MCASA	Credits: 0:0:0

GUIDELINES:

- The student shall take up an activity with a NGO / Professional body / NSS / NCC / Government School etc. for a minimum duration of 10 hours.
- This course does not have any CIE or SEE; however, the students are required to submit a Completion Certificate and a report.
- The result is declared either pass or fail, based on the completion of the course in the stipulated time.
- This course is a Non Credit Mandatory Course (NCMC).

COURSE OUTCOMES (COS):

1. Engage in independent learning in the chosen area/field. (PO-5, PO-8)
2. Discuss the legal, environmental, societal and health issues for the work carried out. (PO-5, PO-7, PO-8)
3. Function effectively as an individual or work in a team for the task undertaken. (PO-5, PO-7, PO-8)

IV SEMESTER

PROJECT WORK – PHASE II	
Subject Code : 24MCAP2	Credits: 10

GUIDELINES:

- During the phase-II, the students are required to carry out the implementation, testing and results part of their project work.
- The students are required to exhibit their working model module-wise to their guide every week.
- At the end of the semester each candidate shall submit a report of the dissertation work duly approved by the guide. The dissertation work shall be countersigned by the co-guide (if any) and Head of the Department.
- The candidate shall submit Two copies of the dissertation work to the Head of the Department. Duration of the dissertation work shall be 4 months. A separate calendar of events for submission of dissertation and viva-voce shall be fixed and will be notified by the Chairman of Board of Exam (BoE). The candidates who fail to submit the dissertation work within the stipulated time have to submit the same at the time of next ensuing examination.
- The dissertation shall be evaluated by two examiners-one internal and one external, appointed by the Chairman of BoE. The evaluation of the dissertation shall be made independently by each examiner. During the evaluation of the dissertation if anyone of the examiner/both/ feels that the candidate is not getting the minimum marks for passing, he/she/they shall notify to the Chairman of BoE stating specific reasons for rejection and suggestions for resubmission. The viva-voce examination of such candidates shall not be conducted. The resubmitted dissertation may preferably send to the same examiners for the re-examination.
- The candidate may also choose another topic of dissertation under a new guide, if necessary. In such case dissertation may be submitted within 4 years from the date of admission to the course. A different set of examiners shall be constituted for evaluation of dissertation under such circumstances by the Chairman of BoE.
- A copy of the dissertation shall be sent to both the examiners by the Chairman of BoE.
- Both the examiners shall evaluate the dissertation normally within a period of not more than 3 weeks from the date of receipt of the dissertation. The external examiner shall be contacted by the head of the department to arrive at a convenient date for the conduct of viva-voce of the batch students allotted to the external examiner.
- The relative weightage for the evaluation of dissertation and the performance of the viva-voce shall be as per the scheme.
- Both the examiners shall evaluate the dissertation independently and marks shall be awarded jointly at the time of viva-voce examination.
- The viva-voce examination will be conducted jointly by the internal and external examiners and marks shall be awarded jointly. The marks shall be sent to the Controller of Examinations immediately after examination.
- Student has to publish a research paper in indexed journal / conference. At the end of the semester each candidate has to submit the published paper with plagiarism copy duly approved by the guide.

Note: All the above guidelines are subjected to the approval by the Chairman of Board of Studies, from time to time.

Course Outcomes (COs):

1. Implement the design, verify, validate and analyze the results. (PO-1, PO-2, PO-3, PO-4, PO-5, PO-7, PO-8)
2. Demonstrate and document the project work efficiently. (PO-3, PO-4, PO-5, PO-7, PO-8)
3. Manage as an individual or in a team in development of technical projects. (PO-3, PO-4, PO-5, PO-7, PO-8)

INDUSTRY INTERNSHIP / RESEARCH INTERNSHIP	
Subject Code : 24MCAIN	Credits : 6

GUIDELINES:

- Students have to undergo the Internship in any Institute of National repute or any reputed/well-known industry for a period of 6 weeks
- They are required to submit a report and give a presentation.

TECHNICAL SEMINAR	
Subject Code : 24MCAS1	Credits : 2

COURSE CONTENT

Seminar Guidelines:

- The topic of the seminar shall be chosen by the candidate in consultation with the guide. The topic shall be from the emerging field of computer science / computer applications.
- The seminar shall be carried out by each candidate independently under the guidance of one of the faculty members of the department.
- At the end of the semester each candidate shall submit a report on the seminar presented.
- The seminar examination will be conducted jointly by the internal and external examiners and marks shall be awarded jointly. The marks shall be sent to the Controller of Examinations immediately after examination.

Course Outcomes (COs):

1. Gather information on emerging technologies and tools on a specific topic. (PO-1, PO-2, PO-4, PO-7, PO-8)
2. Prepare a concise article using ICT efficiently. (PO-1, PO-2, PO-4, PO-5, PO-7, PO-8)
3. Communicate professionally and develop the team spirit. (PO-1, PO-5, PO-7, PO-8)

ONLINE COURSE (MOOC)/IDEATHON/HACKATHON	
Subject Code: 24MCAAEC	Credits: Nil

GUIDELINES:

ONLINE COURSE (MOOC):

- Students are required to complete an On-line Certification Course in the field of Computer Science / computer applications for a minimum duration of 8 weeks
- Students have to select a course in NPTEL that the student has not studied in the regular programme
- They have to submit the Course Completion Certificate along with the scores obtained.

Ideathon / Hackathon

- Clearing one level in any of the recognized competitions
 - Students have to register for any recognized competitions and clear one level
 - The committee has to identify suitable competition and make the students to aware of that