Curriculum Structure and Curriculum Content for the Academic Bach 2024-26
Department of Computer Applications
Master of Computer Applications

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Vision and Mission of KLE Technological University

Vision

KLE Technological University will be a national leader in Higher Education–recognised globally for innovative culture, outstanding student experience, research excellence and social impact.

Mission

KLE Technological University is dedicated to teaching that meets highest standards of excellence, generation and application of new knowledge through research and creative endeavours.

The three-fold mission of the University is:

- To offer undergraduate and post-graduate programs with engaged and experiential learning environment enriched by high quality instruction that prepares students to succeed in their lives and professional careers.

- To enable and grow disciplinary and inter-disciplinary areas of research that build on present strengths and future opportunities aligning with areas of national strategic importance and priority.

- To actively engage in the Socio-economic development of the region by contributing our expertise, experience and leadership, to enhance competitiveness and quality of life.

As a unified community of faculty, staff and students, we work together with the spirit of collaboration and partnership to accomplish our mission.

Vision and Mission Statements of the Department

Vision

To be a premier center of integrated computer application studies and research towards developing competent professionals equipped with cutting-edge technological skills and knowledge to provide sustainable solutions for the evolving needs of society.

Mission

1. To provide high quality education through outstanding teaching and industry relevant curricula to enable students to accomplish a successful career in Computer Science and applications.

2. To contribute to advancing knowledge in both fundamentals and applied areas of Computer Science.

3. To provide a scholarly environment that enables faculty and students to achieve academic and professional growth.

4. To provide valuable services to society through education, research, and entrepreneurship, in the field of Computer Science and applications.

Program Educational Objectives/Program Outcomes and Program-Specific Objectives

Program Educational Objectives -PEO's
1. Have a strong foundation and ability to apply knowledge of Computer Science, Mathematics, and Humanities to conceive, analyse, design, and implement IT solutions to problems in real-life applications.
2. Have a comprehensive background to practice Software Engineering Principles in various domains that require software architecture, design, development, and testing practices.
3. Understand the professional and ethical obligations of a software engineer towards society and the need for lifelong learning.
4. Have the ability to participate in multi-disciplinary teams using ICT effectively.

Program Outcomes-PO's
1. **Computational knowledge**: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
2. **Problem analysis:** Identify, formulate research literature, and solve complex computing problems, reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
3. **Design/Development of Solutions:** Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, adapt, and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
6. **Professional Ethics**: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

7. **Life-long learning:** Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.
8. **Project management and finance:** Demonstrate knowledge and understanding of the computing and management principles and apply these to one's work as a member and leader in a team, to manage projects and in multidisciplinary environments.
9. **Communication Efficacy:** Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations and give and understand instructions clearly.
10. **Societal and Environmental Concern:** Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts and the consequential responsibilities relevant to professional computing practice.
11. **Individual and teamwork:** Function effectively as an individual and as a member or leader in diverse teams and multi-disciplinary environments.
12. **Innovation and Entrepreneurship:** Identify a timely opportunity and use of innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.
Program Specific Objectives -PSO's
1. **IT** skills: An ability and capacity acquired through deliberate, systematic, and sustained effort to carry out complex IT activities involving innovative ideas, technical skills, and interpersonal skills.
2. **Professional Competency:** Apply computing concepts, skills, and processes to produce a product/project in the domain, demonstrating professional knowledge and attitude.

Curriculum Structure-Overall 2024-26

	I	II	III	IV	Elective 1 & 2	Elective 3 (MOOC)
Course with course code	Data Structures using C 24ECAC701 (3-0-1.5)	OOPS using Java 24ECAC705 (3-0-0)	Machine Learning 24ECAC801 (3-0-1)	Capstone Project Work 24ECAP802 (0-0-18)	Linux Administration 23ECAE801 (3-0-0)	Modern Web Development Framework 23ECAP804 (0-0-2)
	Database Management System 24ECAC702 (3-0-1.5)	Data Mining 24ECAC706 (3-0-1)	Big Data Analytics 24ECAC802 (3-0-1)	Elective-3 (MOOC) 23ECAP8XX (0-0-2)	DevOps 23ECAE802 (2-0-1)	Data Modeling with SQL and NoSQL Databases 23ECAP805 (0-0-2)
	Computer Networks 24ECAC703 (3-0-1)	Software Engineering 24ECAC707 (3-0-0)	Advanced JAVA Programming 24ECAC804 (3-0-1)		User Interface Design 23ECAE803 (3-0-0)	Software Testing and Quality Assurance Practices 23ECAP806 (0-0-2)
	Operating Systems 24ECAC704 (3-0-1)	Cloud Computing 24ECAC708 (3-0-1)	Elective-1 23ECAE8XX (3-0-0)		Cyber Security 23ECAE804 (3-0-0)	Applications of Artificial Intelligence 23ECAP807 (0-0-2)
	Mathematical Thinking & Logical Reasoning 15EHSC701 (3-0-0)	Design and Analysis of Algorithms 24ECAC709 (3-0-1)	Elective-2 23ECAE8XX (3-0-0)		C# Programming with .Net 23ECAE806 (3-0-0)	Applied Data Science and Analytics 23ECAP808 (0-0-2)
	Web Technology 23ECAP704 (0-0-2)	Java Lab 24ECAP701 (0-0-2)	Mobile Application Development 24ECAP801 (0-0-2)		Statistical Foundation for Data Science 23ECAE807 (3-0-0)	Cloud Native Systems and Continuous Delivery 23ECAP809 (0-0-2)
		Mini Project-1 24ECAP702 (0-0-2)	Mini Project-2 23ECAP802 (0-0-2)		Full Stack Development with MERN 23ECAE808 (2-0-1)	Network Security and Ethical Hacking 23ECAP810 (0-0-2)
	Critical Thinking and Problem-Solving Skills 24EHSC701 (1-0-0)	Communication and Leadership Skills 24EHSC702 (1-0-0)			Natural Language Processing & Gen-AI 23ECAE817 (2-0-2)	Building Blockchain Applications 23ECAP811 (0-0-2)
Credits	23	23	22	20		

Curriculum Structure-Semester wise

Semester - I

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in Hrs)
1.	24ECAC701	Data Structures using C	PSC	3-0-1.5	4.5	6	50	50	100	3 hours
2.	24ECAC702	Database Management System	PSC	3-0-1.5	4.5	6	50	50	100	3 hours
3.	24ECAC703	Computer Networks	PSC	3-0-1	4	5	50	50	100	3 hours
4.	24ECAC704	Operating Systems	PSC	3-0-1	4	5	50	50	100	3 hours
5.	15EHSC701	Mathematical Thinking & Logical Reasonin	HSC	3-0-0	3	3	50	50	100	3 hours
6.	23ECAP704	Web Technology	PSC	0-0-2	2	4	80	20	100	3 hours
7.	24EHSC701	Critical Thinking and Problem Solving Skills	HSC	1-0-0	1	1	100	--	100	3 hours
		TOTAL		**16-0-7**	**23**	**30**	**430**	**270**	**700**	

Semester - II

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in Hrs)
1.	24ECAC705	OOPS using Java	PSC	3-0-0	3	3	50	50	100	3 hours
2.	24ECAC706	Data Mining	PSC	3-0-1	4	5	50	50	100	3 hours
3.	24ECAC707	Software Engineering	PSC	3-0-0	3	3	50	50	100	3 hours
4.	24ECAC708	Cloud Computing	PSC	3-0-1	4	5	50	50	100	3 hours
5.	24ECAC709	Design and Analysis of Algorithms	PSC	3-0-1	4	5	50	50	100	3 hours
6.	24ECAP701	Java Lab	PSC	0-0-2	2	4	80	20	100	3 hours
7.	24ECAP702	Mini Project-1	PSC	0-0-2	2	4	50	50	100	3 hours
8.	24EHSC702	Communication and Leadership Skills	HSC	1-0-0	1	1	100	--	100	3 hours
TOTAL				16-0-7	23	30	480	320	800	

Semester- III

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in Hrs)
1.	24ECAC801	Machine Learning	PSC	3-0-1	4	5	63	37	100	3 hours
2.	24ECAC802	Big Data Analytics	PSC	3-0-1	4	5	63	37	100	3 hours
3.	24ECAC804	Advanced JAVA Programming	PSC	3-0-1	4	5	63	37	100	3 hours
4.	23ECAE8XX	Elective-1	PSE	3-0-0	3	3	50	50	100	3 hours
5.	23ECAE8XX	Elective-2	PSE	3-0-0	3	3	50	50	100	3 hours
6.	24ECAP801	Mobile Application Development	PSC	0-0-2	2	4	80	20	100	3 hours
7.	23ECAP802	Mini Project-2	PSC	0-0-2	2	4	50	50	100	3 hours
TOTAL				**15-0-7**	**22**	**29**	**419**	**281**	**700**	

Semester- IV

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration (in Hrs)
1.	24ECAP802	Capstone Project Work	PW	0-0-18	18	36	100	150	250	3 hours
2.	23ECAP8XX	Elective-3 (MOOC)	PSE	0-0-2	2	2	100	--	100	3 hours
TOTAL				**0-0-20**	**20**	**38**	**200**	**150**	**350**	

Semester	I	II	III	IV	Total
Credits	**23**	**23**	**22**	**20**	**88**

List of Program Electives 1 &2 MCA III-Semester

Sr. No	Name of the Course	Course Code
1.	Linux Administration	23ECAE801
2.	DevOps	23ECAE802
3.	User Interface Design	23ECAE803
4.	Cyber Security	23ECAE804
5.	C# Programming with .Net	23ECAE806
6.	Statistical Foundation for Data Science	23ECAE807
7.	Full Stack Development with MERN	23ECAE808
8.	Natural Language Processing & GenAI	23ECAE817

List of Program Electives-3 **IV-Semester**

Sr. No	Name of the Course	Course Code
1.	Modern Web Development Framework	23ECAP804
2.	Data Modeling with SQL and NoSQL Databases	23ECAP805
3.	Software Testing and Quality Assurance Practices	23ECAP806
4.	Applications of Artificial Intelligence	23ECAP807
5.	Applied Data Science and Analytics	23ECAP808
6.	Cloud Native Systems and Continuous Delivery	23ECAP809
7.	Network Security and Ethical Hacking	23ECAP810
8.	Building Blockchain Applications	23ECAP811

Curriculum Content- Course wise

Semester - I

Program: Master of Computer Applications		Semester: I
Course Title: Data Structures using C		Course Code: 24ECAC701
L-T-P : 3-0-1.5	Credits: 4.5	Contact Hours: 6 hrs/week
ISA Marks: 50	ESA Marks:50	Total Marks: 100
Teaching Hours: 40	Practical:36	Examination Duration: 3 Hrs
Unit I		
1	**Overview of C** History of C, Features of C, Why to learn C Programming, Basic structure of a C program, Compilation Process in C, Compile time Vs Runtime, Variables, Constants, ASCII value, Data Types, Storage Classes, Operators, Decision Making, Loops, Functions, Scope Rules, Passing arrays to functions, Passing structures to Functions, Character arrays, Pointers, malloc(), calloc(), realloc() and free() functions in C	8 Hrs
2	**Stacks** Definition and examples, Primitive operations, Example, Representing stacks in C, Implementing the pop operation, Testing for exceptional conditions, Implementing the push operation, Examples for infix, postfix, and prefix expressions, Basic definition and examples, Program to evaluate a postfix expression, Converting an expression from infix to postfix, Program to convert an expression from infix to postfix.	4 Hrs
3	**Recursion** Recursive definition and processes, Factorial function, Multiplication of natural numbers, Fibonacci sequence, Binary search, Properties of recursive definition or algorithm. Recursion in C, Factorial in C, Fibonacci numbers in C, Binary search in C, Towers of Hanoi problem	4 Hrs
Unit II		
4	**Queues and Lists** The queue and its sequential representation, C implementation of queues, Insert operation, Priority queue, and array implementation of a priority queue. Linked lists, Inserting and removing nodes from a list, Linked implementation of stacks, get node and free node operations, Linked implementation of queues, Linked list as a data structure, Example of list operations, Header nodes, Lists in C, Array implementation of lists, Limitations of array implementation, allocating and freeing dynamic variables, Linked lists using dynamic variables, Queues as lists in C, Examples of list operations in C, Non integer and non- homogeneous lists, Other list structures: Circular lists, Stack as a circular list, Queue as a circular list, Primitive operations on circular lists, doubly linked lists	8 Hrs
5	**Trees and Graphs**	8 Hrs

	Binary trees, operations on binary trees, Applications of binary trees, Binary tree representation, Node representation of binary tree, Internal and external nodes, Implicit array representation of binary trees, Choosing a binary tree representation, Binary tree traversal in C, Threaded binary trees. Graphs: Definitions, Application of graphs, and C representation of graphs, Traversal methods for graphs, Depth first traversal, and Breadth first traversal.	
Unit III		
6	**Sorting** Bubble Sort, Quick Sort, Selection Sort, Tree Sorting: Binary Tree Sort, Heap Sort Insertion Sorts: Simple Insertion, Shell Sort, Address Calculation Sort, Merge and Radix Sort.	**4 Hrs**
7	**Searching** Basic Search Techniques: Algorithmic notation, Sequential searching, Searching an ordered table, Indexed sequential search, Binary search, Interpolation search, Tree searching: Inserting into a Binary Search Tree, Deleting from a Binary Search Tree, Hashing: Resolving hash clashes by open addressing, Choosing a hash function	**4 Hrs**

Text Books :

1. Yedidyah Langsam, Augenstein, M.J. and Tenanbaum, Data Structures using C and C++, Second Edition, Pearson Education Asia, 2006

Reference Books:

1. Weiss, M.A., Data Structures and Algorithm Analysis in C, 2, Pearson Education Asia, 1997
2. Gilberg, R.F. and Forouzan, B.A. , Data Structures A Pseudo code Approach with C, 3, Reprint,Thomson Course Technology, 2005
3. Reema Thareja, Data Structures using C , 2 nd Edition, 2014, Oxford University Press

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5	Any 2 questions are to be answered

III	2 Questions to be set of 20 Marks Each	6, 7	Any 1 question is to be answered

Lab Activities

Sl.no	Topics	Activity	Weightage
1	Arrays, functions, pointers, structures and dynamic memory allocation in C.	Program to demonstrate the following for a given set of elements: ● Array as a parameter ● Structure as a parameter ● Process of allocating memory during program execution	10
2	Stack data structure	Program to illustrate implementation of stack using the following: ● Array ● Structures ● Functions and pointers.	10
3	Applications of stack	Implement the two application of stack. ● Postfix expression evaluation ● Conversion of Infix expression to Postfix expression	10
4	Recursion	Write recursive functions in C program for the following: ● Simple recursive functions: Tower of Hanoi, factorial, Fibonacci series. ● Reverse a stack using recursion ● Sort a stack using recursion	10
5	Queue and Circular Queue concepts	Program to illustrate implementation of queue and circular queue using array	10
6	Queue.	Implementation of queue using Linked list	10
7	Singly Linked List and Circular Linked List.	Implementation of singly and circular linked list.	10
8	Doubly Linked List	Perform all the operations on doubly linked list	10
9	Searching and sorting techniques.	Implementation of the following searching and sorting techniques: Linear search, binary search, insertion sort, heap sort, quick sort.	10
10	Tree and graph traversal	● Construction and traversal of binary search tree ● Program to demonstrate the graph traversal.	10
Total			100

Program: Master of Computer Applications		Semester: I
Course Title: Database Management System		Course Code: 24ECAC702
L-T-P : 3-0-1.5	Credits: 4.5	Contact Hours: 6 hrs/week
ISA Marks: 50	ESA Marks:50	Total Marks: 100
Teaching Hours: 40	Practical:36	Examination Duration:3 Hrs

Chapter No.	Content	Hrs
	Unit I	
1	**Introduction to Databases** Introduction; An example; Characteristics of Database approach; Actors on the scene; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; When not to use a DBMS. Data models, schemas and instances; Three-schema Architecture and Data Independence; Database Languages and Interfaces.	5 Hrs
2	**Conceptual Data Modeling Using Entities and Relationships** Using High Level Conceptual Data Models for database Design; A Sample Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database, ER Diagram, Naming Conventions and Design Issues, Relationships Higher than Two.	5 Hrs
3	**The Basic (Flat) Relational Model and Relational Algebra** Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations. Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra. Relational Database Design using ER-to-Relational Mapping.	6 Hrs
	Unit II	
4	**SQL** SQL Data Definition and Data Types; Specifying Constraints in SQL; Basic Retrieval Queries in SQL; Insert, Delete and Update statements in SQL; More Complex SQL Retrieval Queries, Specifying Constraints as Assertions and Action as Triggers; Views (Virtual Tables) in SQL; Schema Change Statements in SQL; Database programming issues and techniques.	7 Hrs
5	**Database Design** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form.	6 Hrs
6	**Object and Object-Relational Databases** Overview of Object Database Concepts, Object-Relational Features: Object Database Extensions to SQL.	3 Hrs

	Unit III	
7	**Foundations of Database Transaction Processing and Concurrency Control** Introduction to Transaction Processing; Transaction and System Concepts; Desirable Properties of Transactions; Characterizing Schedules Based on Recoverability; Characterizing Schedules Based on Serializability; Transaction Support in SQL. Two-Phase Locking Techniques for Concurrency control; Concurrency control based on Timestamp Ordering; Multiversion Concurrency control Techniques; Validation Concurrency Control Techniques; Granularity of Data Items & Multiple Granularity Locking; Using Locks for Concurrency Control in Indexes; Other Concurrency Control Issues.	4 Hrs
8	**Introduction to Database Recovery Protocols** Recovery Concepts, NO-UNDO/REDO Recovery Based on Deferred update; Recovery Techniques based on Immediate update; Shadow paging; The ARIES Recovery Algorithm; Recovery in Multi database Systems; Database Backup and Recovery from Catastrophic Failures.	4 Hrs

Text Books :

1. Ramez Elmasri, Shamkant B. Navathe, Database Systems, Sixth Edition, PEARSON, 2013

Reference Books:

1. Carlos Coronel, Steven Morris, Database Systems, Design, Implementation & Management. Cengage 2017.
2. Elmasri and Navathe, Fundamentals of Database Systems, Fifth Edition, Addison- W, 2007.
3. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, Third Edition, McGraw-Hill, 2003
4. https://courses.cs.duke.edu/fall17/compsci316/lectures/03-design-notes.pdf

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

Lab Activities

Sl.no	Topics	Activity	Weightage
1	Conceptual Data Modeling Using Entities and Relationships	Draw the ER diagrams for the following databases* i) Student-Enrolment Data base ii) Insurance Database iii) Company Database Movie Database	15
2	The Basic (Flat) Relational Model and Relational Algebra	Convert the ER diagrams mentioned in activity 1 to Relational Schema diagrams.	15
3	SQL	SQL query implementation for following schemas * i) Student-Enrolment Data base ii) Insurance Database iii) Company Database iv) Movie Database	50
4	Database Design	Assignments on Normalization	10
5	Transaction Processing	Assignments on Transaction Processing	10
Total			100

[BACK](#)

Program: Master of Computer Applications	Semester: I

KLE Technological University
Creating Value, Leveraging Knowledge

Course Title: Computer Networks		Course Code: 24ECAC703
L-T-P : 3-0-1	Credits: 4	Contact Hours: 5 hrs/week
ISA Marks: 50	ESA Marks:50	Total Marks: 100
Teaching Hours: 40	Practical:24	Examination Duration: 3 Hrs

	Unit I	
1	**Computer Networks and the Internet** Internet, The Network Edge and Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layer and Service Models: OSI and TCP/IP, Networks Attacks.	5 Hrs
2	**Application Layer** Principles of Network Applications, HTTP, SMTP, DNS, DHCP, Peer-to-Peer Applications	5 Hrs
3	**Transport-Layer Services** Introduction, Multiplexing and Demultiplexing, Connectionless Transport, Principles of Reliable Data Transfer Protocol, Connection-Oriented and Connectionless Transport, Principle of Congestion Control, TCP Congestion Control.	6 Hrs
	Unit II	
4	**Network Layer – Data Plane** Introduction to Data and Control Plane, Virtual Circuit and Datagram Networks, Internet Protocol: Datagram Format, Fragmentation, IP Addressing, NAT, IPv6	6 Hrs
5	**Network Layer- Routing Algorithms** The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet ,intra-AS Routing in the Internet: RIP , Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP.	6 Hrs
6	**Data Link Layer** Introduction to the Link Layer, Error-Detection and -Correction Techniques : Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC),Hamming Code	4 Hrs
	Unit III	
7	**Data Link Layer (Continued..)** Multiple Access Links and Protocols: Channel Partitioning Protocols, Random Access Protocols: Aloha, Slotted Aloha, CSMA, CSMA/CD, CSMA/CA, Taking-Turns Protocols, The Link-Layer Protocol for Cable Internet Access, Link-Layer Addressing and ARP, Ethernet and LAN standards	4 Hrs
8	**Security In Computer Networks** What is Network Security, Principles of cryptography, Message Integrity and Digital Signatures, End point authentication, Securing E-Mail, Securing TCP Connections,Network Layer Security IPSec and VPN,Operational Security:Firewalls and Intrusion detection systems	4 Hrs

Text Books :

1. Computer Networking, A Top-Down Approach, by J.F.Kurose, K.W.Ross, 7th edition Pearson Education,2017.

Reference Books:
1. TCP/IP Protocol Suite ,4th MGH 2010 By B. A. Forouzan.

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

Lab Activities

Sl.no	Topics	Activity	Lab slots
1	**Introduction to Data Communications**	Overview of networks and layered communications	1
2	**Physical Layer:** Cable constructions and testing of different cable connectivity	1. Practice the cable construction for twisted pairs and fiber optics. 2. Test the configured cable connectivity.	1
3	**Physical Layer:** Analyzing the packet content using network monitoring tools	1. Understanding of packet capture using network interface. 2. Analyze the content of the packet using Wireshark tool correlated with OSI model.	2
4	**Physical Layer ,Data Link Layer:** Understanding of network devices and protocol simulation tool	1. Understanding of different network devices used for data communication. 2. Illustrate packet tracer simulation tool for design of the network.	2

5	**Data Link Layers:** ARQ Protocol implementation using C Program.	Implement the different supported ARQ protocols implementation using C Program.	2
6	**Network Layer:** Network Operations and troubleshooting	1. Outline the network properties and testing the network connectivity. 2. Explain the addressing protocols.	2
7	**Network Layer:**	Simulation and Implementation of Routing Protocols.	2

Program: Master of Computer Applications		Semester: I
Course Title: Operating Systems		Course Code: 24ECAC704
L-T-P : 3-0-1	Credits: 4	Contact Hours: 5 hrs/week
ISA Marks: 50	ESA Marks:50	Total Marks: 100
Teaching Hours: 40	Practical:24	Examination Duration:3 Hrs
Unit I		

1	**Introduction to Operating Systems, System structures**	6 Hrs
	What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Resource Management; Security and Protection; Virtualization, Distributed systems, Kernel data structures, Computing environments; Operating System Services; User - Operating System interface; System calls; System services; Linkers and Loaders; Operating System design and implementation; Operating System structure; Building and Booting an Operating System, Operating System Debugging	
2	**Process Management**	4 Hrs
	Process Concept, Process scheduling Operation on Processes, Interprocess communication, Multi-Threaded Programming: Overview; Multicore Programming, Multithreading models; Thread Libraries; Threading issues. CPU Scheduling: Basic concepts; Scheduling criteria Scheduling algorithms Multiple-Processor scheduling; Thread scheduling, Algorithm Evaluation.	
3	**Process Synchronization**	6 Hrs
	Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors	
	Unit II	
4	**Deadlocks**	6 Hrs
	Deadlocks: System model; Deadlock in Multithreaded application, Deadlock characterization; methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock	
5	**Memory Management**	6 Hrs
	Memory Management Strategies: Background; Swapping Contiguous memory allocation; Paging Structure of page table; Segmentation Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement Allocation of frames; Thrashing.	
6	**Implementation of File System**	4 Hrs
	File System: File concept; Access methods Directory structure, File system mounting File sharing; Protection. Implementing File System: File system structure File system implementation; Directory implementation; Allocation methods; Free space management	
	Unit III	
7	**Secondary Storage Structures, Protection**	4 Hrs
	Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection Domain of protection, Access matrix Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems	
8	**Case study – Linux operating system**	4 Hrs

	Design principles Kernel modules, Process management Scheduling, memory Management File systems, Input & output, Interprocess Communication.	

Text Books :

1. Abraham Silberschatz, Peter Galvin and Greg Gagne, Operating System Principles, 10, Wiley-India, 2018

Reference Books:

1. D.M.Dhamdhere': Operating systems-A concept based Approach 2nd Edition, Tata McGraw-Hill 2002
2. P.C.P. Bhatt: Operating systems, 2nd Edition, PHI, 2006.
3. Harvey M Deital ; Operating Systems 3rd Edition, Addison Wesley, 1990.

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

Sl.no	Topics	Activity	Lab slots
Activities : Implement the following programs using C programs			
1.	**UNIX Commands System Calls.**	Program to simulate Unix commands and System calls.	**1**
2.		Program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority	**1**
3.	**Process Synchronization**	Program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.	**1**
4.	**Process Synchronization**	Program to simulate and Producer Consumer Problem using semaphores	**1**
5.		Program to simulate Dining Philosopher's problem	**1**
6.	**Memory Management Techniques**	Program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit	**1**
7.		Program to simulate paging technique of memory management.	**1**
8.	**Deadlock Avoidance**	Program to implement Banker's algorithm.	**1**
9.	**Disk Scheduling**	Program to simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN	**2**
10.	**Page replacement algorithms**	Program to simulate Unix commands and System calls.	**2**

Program: Master of Computer Applications		Semester: I
Course Title: Mathematical Thinking & Logical Reasoning		Course Code:15EHSC701
L-T-P : 3-0-0	Credits: 3	Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks:50	Total Marks: 100
Teaching Hours: 40	Tutorial/Practical Hrs:--	Examination Duration: :1.5 Hrs

Chapter No.	Content	Hrs
1	Arithmetical Reasoning	10 Hrs
2	Analytical Thinking	4 Hrs
3	Syllogistic Logic	3 Hrs
4	Verbal Logic	9 Hrs
5	Non-Verbal Logic	6 Hrs
6	Lateral Thinking	8 Hrs

Text Books :

1. A Modern Approach to Verbal and Non – Verbal Reasoning – R. S. Aggarwal, Sultan Chand and Sons, New Delhi
2. Quantitative Aptitude – R. S. Aggarwal, Sultan Chand and Sons, New Delhi

Reference Books:

1. Verbal and Non – Verbal Reasoning – Dr. Ravi Chopra, MacMillan India
2. **Lateral Thinking** – Dr. Edward De Bono, Penguin Books, New Delhi

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

BACK

KLE Technological University
Creating Value, Leveraging Knowledge

Program: Master of Computer Applications		Semester: I
Course Title: Web Technology		Course Code:23ECAP704
L-T-P : 0-0-2	Credits: 2	Contact Hours: 4 hrs/week
ISA Marks: 80	ESA Marks:20	Total Marks: 100
Teaching Hours: --	Practical Hours:48	Examination Duration: 3 Hrs

Chapter No.	Content	Hrs
1	**Fundamentals of Web** Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Hypertext Transfer Protocol, Security, Web Programmer's Toolbox	4 Hrs
2	**HTML 5** HTML5 tags, Multimedia tags, Form attributes, Meter tag, Drag and drop, Image tags, Block & inline, Geo location, Location properties, Handling errors and rejections, Google map, Canvas, URL schemes, ASCII encoding	6 Hrs
3	**CSS and Bootstrap 5** Levels of Style Sheets, Style Specification Formats, Box Model, Basic layouts , Animations, Accordions, Progress bar, Validation , Borders, Fonts, Alerts, Toasts, Navbars, Card utilities, Pagination, Slideshow using carousel	8 Hrs
4	**Dynamic documents and JavaScript** JavaScript Execution Environment, Element Access in JavaScript, Event Handling, Button, Text Box and Password Elements, Positioning Elements, Dynamic Content, Stacking Elements, Dragging and Dropping Elements.	8 Hrs
5	**PHP Programming** History, Unique features, Basic development concepts, creating your first PHP script, Writing & running the script, Understanding the scripts, Handling script errors, storing data in variables, Understanding PHP's data types, Setting & checking variable data types, using constant and Manipulating variables with operators, Handling form input and conditional statements, Processing arrays with loops & iterators, creating user defined function, creating classes, Using Advanced OOP concepts.	10
6	**Working with databases & SQL** Introducing databases & SQL, Using PHP MySQLi extension, Adding or modifying data, handling errors, Building a Login form.	8
7	**Working with Cookies, Sessions & Headers** Working with Cookies, Cookie Basics, Cookie Attributes, Cookie Headers, Setting Cookies, Reading Cookies, Removing Cookies, Working with Sessions, Session Basics, Creating Sessions and Session Variables, Removing Sessions and Session Variables, Using HTTP headers.	4

Text Books :

1. Robert W Sebesta, Programming the World Wide Web, 8th Edition, Pearson education, 2015.

2. Vikram Vaswani, A Beginner's Guide PHP, Mc Graw Hill, 2009.

Reference Books:

1. Chris Bates, Web Programming: Building internet applications, John Wiley & Sons, 2007

2. Luke welling & Laura Thomson, PHP and MySQL Web Development 4th Edition, 2012

3. Steven Holzner, PHP Complete Reference, Mc Graw Hill, 2010

Evaluation Scheme

In Semester Assessment (80%)	Assessment	Weightage in Marks
	Exercise (Problem execution, Viva & Observation Book)	60
	Structured Enquiry	20
	Total (ISA)	**80**
End Semester Assessment (20%)	Exercise	**20**
	Total	**100**

Lab Experiments

Sl.no	Experiments	Lab Slots
1	Identify components of the web: URLs, web browsers, servers, HTTP/HTTPS protocols, and explore web security tools	1
2	Design static web pages using HTML5: semantic tags, multimedia elements, forms, drag-and-drop, and geolocation features	1
3	Implement HTML5 form controls with attributes like required, placeholder, autofocus, and range/meter inputs	1
4	Apply CSS styling (inline, internal, external), box model, and custom layouts to enhance HTML5 pages	1
5	Develop responsive designs using Bootstrap 5: containers, grid system, cards, navbars, modals, and carousels	1
6	Create dynamic web pages using JavaScript: event handling, DOM manipulation, form validation, and dynamic content	1
7	PHP scripts to demonstrate variables, constants, data types, operators, and control structures	1
8	Process HTML form inputs using PHP with conditional statements, loops, and user-defined functions	1
9	Connect PHP with MySQL using MySQLi and perform CRUD operations on a sample database	2
10	Develop a login form with session management, cookie handling, and error validation using PHP and MySQL	2

KLE Technological University
Creating Value, Leveraging Knowledge

Program: Master of Computer Applications		Semester: I
Course Title: Critical Thinking and Problem Solving Skills		Course Code:24EHSC701
L-T-P : 1-0-0	Credits: 1	Contact Hours: 1 hr/week
ISA Marks: 100	ESA Marks: ---	Total Marks: 100
Teaching Hours: 40	Practical Hrs:--	Examination Duration: :---

Chapter No.	Content	Hrs
1	**Communication Skills** ▪ Brain Storing ▪ Fractionation and Suspended Judgment ▪ Out of the box thinking and creativity activities	3 Hrs
2	**Perfect Presenter (PS)** ▪ The Zero Presentation ▪ Overcoming Living with Stage(any) Fear ▪ Feedback matters.	3 Hrs
3	**Analyze This! (AT)** ▪ Human Relations ▪ Number Series ▪ Decoding the Codes ▪ Logical Venn Diagrams ▪ Clocks and Calendars ▪ Direction Tests ▪ Visual Reasoning	3 Hrs
4	**The Verbal Impression (WE)** ▪ Are you shy? Linguistically? ▪ Get rooty! ▪ Opposites Attract? ▪ Error Detection & Correction	3 Hrs
5	**Mathematical Thinking (MT) (4 hours)** ▪ Numbers ▪ Factors and Multiples ▪ The God of Math ▪ Ratio, Proportion and Variation	4 Hrs
Text Books :		
Reference Books:		

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
Activities	100
Total	**100**

Semester-II

Program: Master of Computer Applications		Semester - II	
Course Title: OOPS Using Java		Course Code: 24ECAC705	
L-T-P: 3-0-0	Credits: 3	Contact Hours: 3 hrs/week	
ISA Marks: 50	ESA Marks: 50	Total Marks: 100	
Teaching Hrs: 40	Practical Hrs:--	Exam Duration: 03 Hrs	
Unit I			
1	**Introduction and Fundamental Programming Structures in Java** History of java, features of java, A simple java programming, Comments, Data Types, Variables, Constants, Operators, Control Flow, Big Numbers, Arrays		**4 hrs**
2	**Objects and Classes** Introduction to Object-Oriented Programming, Classes, Objects, Identifying Classes, Relationships between Classes, Using Predefined Classes, Objects and Object Variables, Mutator and Accessor Methods, First Steps with Constructors, Implicit and Explicit Parameters, Benefits of Encapsulation, Class-Based Access Privileges, Private Methods, Static Fields and Methods, Method Parameters, Object Construction, Overloading, Packages.		**6 hrs**
3	**Inheritance and Java Strings** Classes, Super classes, and Subclasses, Inheritance Hierarchies, Polymorphism, Dynamic Binding, Preventing Inheritance: Final Classes and Methods, Casting, Abstract Classes. Java String, Strings Are Immutable, String Buffer class, String Builder class, to String () method, String Tokenizer in Java.		**5 hrs**
Unit II			
4	**Interfaces and Inner Classes** Interfaces, Properties of Interfaces, Interfaces and Abstract Classes, Object Cloning, Interfaces and Callbacks, Inner Classes, Use of an Inner Class to Access Object State, Special Syntax Rules for Inner Classes, Local Inner Classes, Accessing final Variables from Outer Methods, Anonymous Inner Classes, Static Inner Classes.		**5 hrs**
5	**Exceptions and Multithreading** Dealing with Errors, The Classification of Exceptions, Declaring Checked Exceptions, How to Throw an Exception, Creating Exception Classes, Catching Exceptions, Catching Multiple Exceptions, Rethrowing and Chaining Exceptions, The finally Clause; Multithreading:- What Are Threads?, Interrupting Threads, Thread States, Thread Properties.		**6 hrs**
6	**Collections** Collection Interfaces, Collection and Iterator Interfaces in the Java Library, Linked Lists, Array Lists, Hash Sets, Tree Sets, Object Comparison, Queues and Dequeues, Priority Queues, Maps.		**4 hrs**
Unit – III			
7	**Servlets**		**5 hrs**

	Background; The life cycle of servlet, A simple servlet, The Servlet API, The javax.servlet Package ,The Servlet Interface, The Servlet Config Interface, Servlet Context Interface, Servlet Request Interface, Servlet Response Interface, The Cookies class.	
8	**JSP and Database Access** Overview of JSP, Invoking java code from JSP, JSP expressions, scriplet, page directive.	**5 hrs**

Text Books:

1. Core Java Volume-I Fundamentals 10th Edition, 2016, by Cay S.Horstmann, Gray Cornell.
2. Herbert Schildt, JAVA The Complete Reference 11th edition, Tata McGraw Hill 2019.

References Books:

1. Head First Java 2nd Edition by Kathy Sierra and Bert Bates, OREILLY.

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

Program: Master of Computer Applications		Semester: II
Course Title: Data Mining		Course Code: 24ECAC706
L-T-P : 3-0-1	Credits: 4	Contact Hours: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Practical:24	Examination Duration: 3 Hrs
Unit I		
1	**Introduction** Fundamentals of data mining, Kinds of pattern, technologies used, and technologies used, applications, issues, data objects and attribute types, Basic Statistical Descriptions of Data, Data Visualization.	**7 Hrs**
2	**Data Preprocessing** Need of preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization.	**4 Hrs**
3	**Data Warehousing and Online Analytical Processing** Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.	**5 Hrs**
Unit II		
4	**Mining Frequent Patterns, Associations, and Correlations** Basic Concepts, Frequent Itemset Mining Methods, Which Patterns Are Interesting?: Pattern Evaluation Methods, Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequent Pattern Mining.	**5 Hrs**
5	**Classification** Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Bayesian Belief Networks, Classification by Backpropagation.	**6 Hrs**
6	**Graph Mining, Social Network Analysis, and Multi-relational** **Data Mining** Methods for Mining Frequent Subgraphs, Mining Variant and Constrained Substructure Patterns, Characteristics of Social Networks, Mining on Social Networks, Multirelational mining, Multi Relational Classification, Multirelational Clustering with User Guidance.	**5 Hrs**
Unit III		
7	**Cluster Analysis** Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering	**4 Hrs**
8	**Mining Complex Types of Data** Multidimensional Analysis and Descriptive Mining of Complex, Data Objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time Series and Sequence Data, Mining Text Databases, Mining the World Wide Web.	**4 Hrs**

Text Books:

1. J. Han, M. Kamber., Data Mining Concepts and Techniques, 3rd edition, Kaufmann publishers, 2011

Reference Books:

1. Pujari, A.K, Datamining Techniques, 1, Universities Press, 2010.

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

Lab activities

Sl.no	List of Practices	Lab slots
1.	Demonstration of pre-processing on given dataset	**1**
2.	Demonstration of mining Discrimination between different Classes in given dataset	**1**
3.	Demonstration of Association rule process on given dataset using Apriori algorithm	**1**
4.	Demonstration of classification rule process on given dataset using Decision tree algorithm	**1**
5.	Demonstration of classification rule process on dataset using naïve Bayes algorithm	**1**
6.	Demonstration of prediction on given dataset using regression techniques	**1**
7.	Demonstration of data visualization on given dataset.	**1**
8.	Demonstration of quartiles using FIVE number summary on given dataset.	**1**

	Demonstration of Graph displays of statistical class description on given dataset using: 1. Histogram 2. A quantile plot 3. A quantile-quantile plot 4. A scatter plot 5. A loess curve	**2**
9.		
10.	Demonstration of web mining for a given portal.	**2**

Program: Master of Computer Applications		Semester: II	
Course Title: Software Engineering		Course Code: 24ECAC707	
L-T-P : 3-0-0	Credits: 3	Contact Hours: 3 hrs/week	
ISA Marks: 50	ESA Marks: 50	Total Marks: 100	
Teaching Hours: 40	Practical hrs:--	Examination Duration: 3 Hrs	

	Unit I	
1	**Introduction of Software Engineering process** Professional software development, Software engineering ethics, Case studies, Software processes: Software process models, Process activities, Coping with change, Process improvement	**6 Hrs.**
2	**Agile Software Development** Agile methods, Agile development techniques, Agile project management. Scaling agile methods	**6 Hrs.**
3	**Requirement Engineering** Functional and Non-functional requirements, Requirements Engineering processes, Requirements elicitation, Requirement specification, Requirements validation; Requirements change.	**4 Hrs.**
	Unit II	
4	**System Modelling** Context models, Interaction Models, Structural models, Behavioural models. model driven architectures	**6 Hrs.**
5	**Architectural Design** Architectural Design Decisions, Architectural views, Architectural patterns, Application Architectures	**6 Hrs.**
6	**Design and implementation** Object oriented design using UML, design patterns, Implementation Issues, Open source development.	**4 Hrs.**
	Unit III	
7	**Software Testing** Development Testing, Test Driven Development, Release Testing, User Testing.	**4 Hrs.**
8	**Configuration management** Change management, Version management, System building, Release management.	**4 Hrs.**

Text Books :
1. Ian Summerville, Software Engineering, 10th ed, Pearson Ed, 2018

Reference Books:
1. Roger S. Pressman, Software Engineering: A Practitioners Approach, 8th e, McGraw, 2015
2. Jalote, P, An Integrated Approach to Software Engineering, 6e, willy Publications, 2015

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

Lab Experiments

Activities			
No.	**Topics**	**Activity**	**Weightage**
1	Introduction, Parallel and distributed systems	Compare the three cloud computing delivery models, SaaS, PaaS, and IaaS, from the point of view of the application developers and users. Discuss the security and the reliability of each one of them. Analyze the differences between the PaaS and the IaaS. An IT company decides to provide free access to a public cloud dedicated to higher education. Which one of the three cloud computing delivery models, SaaS, PaaS, or IaaS should it embrace and why? What	15

Program: Master of Computer Applications		Semester: II
Course Title: Cloud Computing		Course Code: 24ECAC708
L-T-P : 3-0-1	Credits: 4	Contact Hours: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Practical:24	Examination Duration: 3 Hrs

	Unit I		
1	**Introduction, Parallel and distributed systems** Network-centric computing and network centric content, peer-to-peer systems, Cloud computing basics, delivery models and services, Ethical issues, cloud vulnerabilities, major challenges; parallel computing, parallel computer architecture, Distributed systems, communication protocol and process coordination, logical clocks, message delivery rules, casual delivery, Concurrency, atomic actions, consensus protocols, modularity: client-server paradigm.		6 Hrs
2	**Cloud Infrastructure** Cloud computing at Amazon, cloud computing: the Google perspective, Microsoft windows Azure and online services; open-source software platforms for private clouds; Cloud storage diversity and vendor lock-in; Cloud computing interoperability: the intercloud; Energy use and ecological impact of large-scale data centers; Service and compliance level agreements; User experience; Software licensing.		6 Hrs
3	**Cloud Computing: Applications and Paradigms** Challenges for cloud computing; Existing cloud applications and new application opportunities; Architectural styles for cloud applications; Workflows: Coordination of multiple activities; The MapReduce programming model; Case studies.		4 Hrs
	Unit II		
4	**Cloud Resource Virtualization** Virtualization; Layering and virtualization; Virtual machine monitors; Virtual machines; Performance and security isolation; Full virtualization and Para virtualization; Hardware support for virtualization; Case study; Optimization of network virtualization; vBlades; A performance comparison of virtual machines; Software fault isolation;		6 Hrs
5	**Cloud Resource Management and Scheduling** Policies and mechanisms for resource management; Applications of control theory to task scheduling on a cloud; Stability of a two-level resource allocation architecture; Feedback control based on dynamic thresholds; Coordination of specialized autonomic performance managers; A utility-based model for cloud-based web services; Resource bundling; Scheduling algorithms for computing clouds; Fair queuing; Resource management and dynamic application scaling.		6 Hrs
6	**Networking Support**		4 Hrs

Packet-switched networks; The Internet; Internet migration to IPV6; The transformation of the Internet; Web access and the TCP congestion control window; Network resource management; Interconnection networks for computer clouds; Content-delivery networks; Overlay networks and small-world networks.

	Unit III	
7	**Storage Systems** The evolution of storage technology; Storage models, file systems and databases; Distributed file systems: The precursors; General parallel file system; Google File System; Apache Hadoop; Locks and Chubby: A locking service; Transaction processing and NoSQL and databases; BigTable; Megastore.	**4 Hrs**
8	**Cloud Security** Cloud security risks; Security: The top concern for cloud users; Privacy and privacy impact assessment; Trust; Operating system security; Virtual machine security; Security of virtualization; Security risks posed by shared images; Security risks posed by a management OS; A trusted virtual machine monitor.	**4 Hrs**

Text Books :

1. Dan C. Marinescu, Cloud Computing: Theory and Practice, Morgan Kaufmann publishers, Second Edition, 2018.

Reference Books:

1. Michael Miller, Cloud Computing: Web-Based Applications that change the Way you work and collaborate Online, Pearson Publication, 2012.

2. Anthony T. Volte, Toby J. Volte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Fill, 2010.

3. Cloud Computing for Dummies: J. Hurwitz, ISBN 978-0-470-484-8

4. Dr. Kumar Sourabh, Cloud Computing, 2nd Edition, Wiley India, 2011.

		Applications would be most beneficial for the students? Will this solution have an impact on distance learning? Why? What is in your opinion the critical step in the development of a systematic approach to all-or-nothing atomicity? What does a systematic approach means? What are the advantages of a systematic versus an ad-hoc approach to atomicity?	
2	Cloud Infrastructure	Several desirable properties of a large-scale distributed system includes transparency of access, location, concurrency, replication, failure, migration, performance, and scaling. Analyze how each one of these properties applies to AWS.	15

		Demonstration Cloud services using AWS or Azure or Google Cloud. ● Compare the Oracle Cloud offerings (see https://cloud.oracle.com) with the cloud services provided by Amazon, Google, and Microsoft.	
3	Cloud Computing: Applications and Paradigms	Download and install the Zookeper from the site http://zookeeper.apache.org/. Use the API to create the basic workflow patterns or Use the AWS Cloud Formation service to create the basic workflow patterns. Search the web for reports of cloud system failures and discuss the causes of each incident. Research the power consumption of processors used in mobile devices and their energy efficiency. Rank the components of a mobile device in terms of power consumption. Establish a set of guidelines to minimize the power consumption of mobile applications.	10
4	Cloud Resource Virtualization	Virtualization simplifies the use of resources, isolates users from one another, supports replication and mobility, but exacts a price in terms of performance and cost. Analyze each one of these aspects for: (i) memory virtualization, (ii) processor virtualization, and (iii) virtualization of a communication channel. Virtualization of the processor combined with virtual memory management pose multiple challenges; analyze the interaction of interrupt handling and paging. ● In Section 5.6 we state that a VMM for a processor can be constructed if the set of sensitive instructions is a subset of the privileged instructions of that processor. Identify the set of sensitive instructions for the x86 architecture and discuss the problem each one of these instruction poses.	15
5	Cloud Resource Management and Scheduling	Analyze the benefits and the problems posed by the four approaches for the implementation of resource management policies: control theory, machine learning, utility based, market-oriented. Can optimal strategies for the five classes of policies, admission control, capacity allocation, load balancing,	15

		energy optimization, and QoS guarantees be actually implemented in a cloud? Support your answer with solid arguments. • Multiple controllers are probably necessary due to the scale of the cloud. Is it beneficial to have system and application controllers? Justify your answers.	
6	Networking Support	Implementation Simple IPC (Client Server Communication) Simple chat server • multi-threaded File Server	10
7	Storage Systems	Analyze the reasons for the introduction of storage area networks (SANs) and their properties. Block virtualization simplifies the storage management tasks in SANs. Provide solid arguments in support of this statement. The designers of the Google file system (GFS) have re-examined the traditional choices for a file system. Discuss observations regarding these choices that have guided the design of GFS.	10
8	Cloud Security	Write a survey paper on cloud computing security: Issues, threats, and solutions	10
Total			**100**

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Program: Master of Computer Applications		Semester: II
Course Title: Design & Analysis of Algorithms		Course Code: 24ECAC709
L-T-P : 3-0-1	Credits: 4	Contact Hours: 5 hrs/week
ISA Marks: 50	ESA Marks:50	Total Marks: 100
Teaching Hours: 40	Practical:24	Examination Duration: 3 Hrs
Unit I		
1.	**Introduction** Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental data Structures.	**5 Hrs**
2.	**Fundamentals of the Analysis of Algorithm Efficiency** Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms, Examples	**5 Hrs**
3.	**Brute Force** Selection Sort and Bubble Sort, Sequential Search and String Matching, Exhaustive Search	**3 Hrs**
4.	**Divide-and-Conquer** Mergesort, Quicksort, Binary Search, Binary tree Traversals and related properties.	**3 Hrs**
Unit II		
5.	**Decrease-and-Conquer** Insertion Sort, Depth First and Breadth First Search, Topological sorting.	**3 Hrs**
6.	**Transform-and-Conquer** Presorting, Balanced Search Trees, Heaps and Heapsort, Problem Reduction	**3 Hrs**
7.	**Space and Time Tradeoffs** Input Enhancement in String Matching, Hashing	**3 Hrs**
8.	**Dynamic Programming** Computing a binomial coefficient, Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions.	**3 Hrs**
9.	**Greedy Technique** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees	**4 Hrs**
Unit III		
10.	**Limitations of Algorithm Power** Lower-Bound Arguments, Decision Trees, P, NP and NP-Complete Problems	**4 Hrs**
11.	**Coping with the Limitations of Algorithm Power** Backtracking, Branch-and-Bound, Approximation Algorithm for NP-Hard problems.	**4 Hrs**

Text Books :

1. Anany Levitin: Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.

Reference Books:

1. Coremen T.H., Leiserson C.E., and Rivest R.L., Introduction to Algorithms, PHI,Third Edition 2009.

2. Horowitz E., Sahani S., Rajasekharan S.: Computer Algorithms, Galgotia Publications, Second Edition, 2008.

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3,4	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	5,6,7,8,9	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	10,11	Any 1 question is to be answered

Lab Activities

Sl.no	Topics	Activity	Weightage
1	Divide and Conquer	implement and analyze the following : ● Quick sort ● Merge sort	15
2	Decrease and Conquer	Implementation of the following : ● Insertion sort ● Depth first search ● Breadth First Search	15
3	Transform and Conquer	Implement the following: ● AVL Tree ● 2-3 tree	15
4	Dynamic Programming	Implement the following: ● Warshall's algorithm ● Floyd's Algorithm	20

5	Greedy method	Implementation of the following : ● Knapsack problem ● Kruskal's algorithm ● Prim's algorithm	25
6	Backtracking	● Program to implement 8-Queen's problem.	10
Total			**100**

Program: Master of Computer Applications		Semester - II
Course Title: Java Lab		Course Code: 24ECAP701
L-T-P: 0-0-2	Credits: 4	Contact Hours: 4 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs:--	Practical Hours:48	Exam Duration: 03 Hrs

Sl.no.	Lab Programs	Lab slots
1	Programs to demonstrate Java fundamentals like program structure, data types and variables, constants and operators, control flow statements, big numbers and Arrays.	1
2	Programs to demonstrate classes and objects including accessor and mutator methods, constructors, objects parameters, encapsulation, static methods, method overloading and packages.	1
3	Programs to demonstrate Inheritance: Class with overridden methods. Polymorphism – Base class reference pointing to subclass object. Abstract Classes –Final Class/Methods – Create final class/methods that can't be overridden. Type Casting (Up/Down Casting) – Cast subclass object to superclass and back.	1
4	Program to demonstrate packages and Access modifiers.	1
5	Programs to demonstrate String class, StringBuffer, StringBuilder and StringTokenizer.	1
6	Programs to demonstrate Interfaces and Abstract classes.	1
7	Programs to demonstrate different types of inner classes and lambda expressions to Simplify functional interface.	1
8	Program to demonstrate various types of Exception handling with try catch, throw And throws keyword.	1
9	Program to demonstrate custom exceptions.	1
10	Programs to demonstrate multithreading concept using Thread and Runnable Classes, Thread life cycle and their properties.	1
11	Programs to demonstrate a program on usage of various collection types like	1

	ArrayList, LinkedList, Maps, Sets etc. and iterators.	
12	Program to demonstrate a program on multi-threading concept.	1
13	Programs to demonstrate Servlets.	1
14	Programs to demonstrate JDBC concepts.	1

Text Books:
1. Core Java Volume-I Fundamentals 10thEdition, 2016, by Cay S. Horstmann, Gray Cornell.
2. Herbert Schildt, JAVA The Complete Reference 11th edition, Tata McGraw Hill 2019.

References Books:
1. Head First Java 2nd Edition by Kathy Sierra and Bert Bates, OREILLY.
2. Different websites on Java like Tutorialspoint.com, javatpoint.com etc.

Evaluation Scheme

Assessment	Weightage in Marks
Lab ISA	80
Lab ESA	20
Total	**80+20= 100**

Program: Master of Computer Applications		Semester: II
Course Title: Mini Project-1		Course Code: 24ECAP702
L-T-P : 0-0-2	Credits: 2	Contact Hours: 4 hrs/week
ISA Marks: 80	ESA Marks:20	Total Marks: 100
Teaching Hours: --	Practical Hours:56	Examination Duration: 3 Hrs

Students can design and develop web / mobile applications using the latest technology.

Objectives:

Help students to utilize and strengthen the knowledge Web Technology which they have learnt in previous semester.

Methodology:

Students are asked to make a team of 3-4 members and can choose the different categories of projects like desktop applications, web applications, mobile application and distributed application and work once it is approved by the coordinator.

Assessment:

Students Assessment through ISA (80%) + ESA (20%)

Continuous Internal Evaluation	Assessment	Marks
	Problem Definition, Literature Review	10
	Synopsis and SRS Deliverables	10
	Design (Module wise algorithmic design)	10
	Coding	20
	Integration and testing	10
	Report	10
	Presentation skills and Viva-voce	10
	Total	**80**
Semester End Examination	Presentation	15
	Viva-voce	05
	Total	**20**

The project assessment is done by an evaluation team as per the schedule.

Evaluation Scheme

In Semester Assessment

Assessment	Marks
Activities	100
Total	**100**

Program: Master of Computer Applications		Semester: II	
Course Title: Communication and Leadership Skills		Course Code:24EHSC702	
L-T-P : 1-0-0	Credits: 1	Contact Hours: 1 hr/week	
ISA Marks: 100	ESA Marks:--	Total Marks: 100	
Teaching Hours: 16	Tutorial/Practical Hours:--	Examination Duration:3 Hrs	
Content			
1	**Communication Skills** ▪ Brain Storing ▪ Fractionation and Suspended Judgment ▪ Out of the box thinking and creativity activities		5 Hrs
2	**Perfect Presenter (PS)** ▪ The Zero Presentation ▪ OvercomingLiving with Stage(any) Fear ▪ Feedback matters.		5 Hrs
3	**Analyze This! (AT)** ▪ Human Relations ▪ Number Series ▪ Decoding the Codes ▪ Logical Venn Diagrams ▪ Clocks and Calendars ▪ Direction Tests ▪ Visual Reasoning		6 Hrs
4	**The Verbal Impression (WE)** ▪ Are you shy? Linguistically? ▪ Get rooty! ▪ Opposites Attract? ▪ Error Detection & Correction		6 Hrs
5	**Mathematical Thinking (MT) (4 hours)** ▪ Numbers ▪ Factors and Multiples ▪ The God of Math ▪ Ratio, Proportion and Variation		6 Hrs
Text Books :			
Reference Books:			

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
Activities	100
Total	**100**

BACK

Semester-III

Program: Master of Computer Applications		Semester: III	
Course Title: Machine Learning		Course Code: 24ECAC801	
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week	
ISA Marks: 63	ESA Marks: 37	Total Marks: 100	
Teaching Hrs: 40	Practical: 24	ESA Exam Duration: 3 hrs	
Unit –I			
1	**Introduction to Machine Learning** Introduction to Machine Learning, Applications of Machine Learning, Types of Machine Learning: Supervised, Unsupervised and Reinforcement learning, Dataset formats, Features and observations.		**6 hrs**
2	**Supervised Learning: Linear Regression, Logistic Regression** Linear Regression, Logistic Regression: Single and Multiple variables, Sum of squares error function, The Gradient descent algorithm: Application, The cost function, Classification using logistic regression, Regularization.		**10 hrs**
Unit –II			
3	**Supervised Learning: Classification** Introduction to Neural Network, Model representation, Gradient checking, Back propagation algorithm, Multi-class classification, Support vector machine, Applications & Use-cases.		**7 hrs**
4	**Unsupervised Learning: Clustering** Introduction to Clustering, K means Clustering Algorithm, Cost function, Application.		**5 hrs**
5	**Dimensionality Reduction** LDA-Linear Discriminant Analysis, Supervised Learning and LDA; PCA-Principal Component Analysis, Unsupervised Learning and PCA.		**4 hrs**
Unit –III			
6	**Introduction to Deep Learning & CNN** What is deep learning? Difference between Machine Learning and Deep Learning, When to use Deep Learning? Deep Feedforward Networks, Example: Learning XOR, Convolution Neural Networks (CNN) – Convolutional Layer: Filters, Stacking Multiple Feature Maps, TensorFlow Implementation, Pooling Layer, CNN Architectures.		**5 hrs**
7	**Recurrent Neural Networks** Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Sequence Modeling.		**3 hrs**

Text Book:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Media,Inc. 2019.

Reference Books:

1. Python Machine Learning, Third Edition, Packt Publishing, Sebastian, RaschkaVahidMirjalili, December 2019.
2. The Hundred-Page Machine Learning Book, AndriyBurkov, January 13, 2019.

Evaluation Scheme

1. **In Semester Assessment (ISA)**

Assessment	Weightage in Marks
ISA- 1	15
ISA- 2	15
Assignment/Activities	20
ISA	**50**
ESA	**50**
Total	**100**

2. **End Semester Assessment (ESA)**

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	3,4, 5	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	6, 7	Any 1 question is to be answered

Integrated Lab Practices

SI No.	Activities	Lab slots
1	Introduction to Scikit, Numpy, Scipy and TensorFlow	1
2	Linear Regression – Single Variable Linear Regression	1
3	Linear Regression – Multi Variable Linear Regression	1

4	Classification – Logistic Regression	1
5	Classification – Support Vector Machines (SVM)	1
6	Classification using Neural Networks	1
7	Unsupervised Learning – Principal Component Analysis (PCA)	2
8	Unsupervised Learning – K-Means Clustering	2
9	Deep Learning – Convolution Neural Networks Application	2

BACK

Program: Master of Computer Applications		Semester: III
Course Title: Big Data Analytics		Course Code: 24ECAC802
L-T-P : 3-0-1	Credits: 4	Contact Hours: 5 hrs/week
ISA Marks: 63	ESA Marks:37	Total Marks: 100
Teaching Hrs: 40	Practical : 24	Exam Duration: 3 Hrs

		Unit I	
1	**Introduction**: What is Big Data? Data Analytics, Data Analytics Life Cycle, Big Data Characteristics, Different Types of Data.		5 Hrs
2	**Big Data Storage**: Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, Combining Sharding and Replication. On Disk Storage Devices, In-memory Storage Devices.		5 Hrs
3	**Big Data Processing**: Parallel Data Processing, Distributed Data Processing, Hadoop, Map Reduce.		6 Hrs
		Unit II	
4	**Big Data Modeling:** Data Model Structures, Data Model Operations, Processing Workloads, Processing in Batch Mode, Processing in Real-time Mode.		8 Hrs
5	**Big Data Technologies:** MongoDB - What is MongoDB? Why MongoDB? Terms Used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.		8 Hrs
		Unit III	
6	**Hive:** What is Hive?, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, User-Defined Function (UDF).		4 Hrs
7	**Big Data Visualization:** Big Data Visualization and Interpretation, Data visualization techniques, Tools for Big Data visualization, Interpretation and analysis of visualized data, Case studies and real-world applications		4 Hrs

Text Books:

1. Big Data Fundamentals Concepts, Drivers & Techniques by Thomas Erl, Wajid Khattak and Paul Buhler, Prentice Hall, 2015

2. Big Data and Analytics by Seema Acharya, Subhashini Chellappan, Wiley India Pvt Ltd 2014.

Reference Books:

1. Big Data and Analytics: Turning Big Data into Big Money " by Frank J Ohlhorst, Wiley and SAS Business Series, 2012

2. Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis by Colleen Mccue , Elsevier.

Evaluation Scheme

1. In Semester Assessment (ISA)

Assessment	Weightage in Marks
Theory ISA- 1	20
Theory ISA- 2	20
Assignment/Quiz	10
Theory ISA Total	**50(Scaled down to 38)**
Lab ISA	**25**
Theory ESA	**100 (Scaled down to 37)**
Total	**38+25+37= 100**

2. End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2,3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	6, 7	Any 1 question is to be answered

Integrated Lab Practices

Sl.no	Topics	Activity	Lab slots
1	Types of digital data and concept of big data	• Identify the various types of data, such as, SD, USD and SSD present in any given business and also justify its importance for business growth. Prepare technical report for the same.	1
2	Big Data Analytics	• Prepare survey paper on BDA with issues, challenges and applications.	2
3	Big data technology landscape	• Demonstration of graph database management system using Neo4j and Cypher query language. • Data set: Movie database, Twitter followers database, Twitter Sentiment Graph Data, Graph dataset in Kaggle.	3
4	Hadoop distributed file system	• Demonstration of HDFS commands • Hadoop Implementation of MapReduce programming for Word count problem, Totals sales and Max temperature problem.	2

5	MongoDB and query language	• Demonstration of CRUD operations in MongoDB. • MongoDB built-in functions and UDF • Implementation of MapReduce functions in MongoDB for log data analysis. • Integration of JavaScript with MongoDB, Loading of large data into MongoDB	2
6	Hive and query language	• Hive CRUD operations • Hive – Partitioning • Hive - View and Indexes • HiveQL operations • Hive Function: Built-in & UDF (User Defined Functions) • Hive ETL: Loading JSON, XML, Text Data Examples	2

Program: Master of Computer Applications		Semester - III	
Course Title: Advanced JAVA Programming		Course Code: 24ECAC803	
L-T-P: 3-0-1	Credits: 4	Contact Hours: 3 hrs/week	
ISA Marks: 63	ESA Marks: 37	Total Marks: 100	
Teaching Hrs: 40	Practical: 24	Exam Duration: 03 Hrs	

	Unit I	
1	**Java Server Pages** JSP Technologies, Understanding the Client-Server Model, Understanding Web server software, Configuring the JSP Server, Handling JSP Errors, JSP Translation Time Errors, JSP Request Time Errors, Creating a JSP Error Page	**8 hrs**
2	**Session Management** HTTP as a stateless protocol, Hidden form fields, Cookies, session tracking, Http Session, Exception handling and error pages, Directives.	**3 hrs**
3	**Java Beans** Concepts of Java Beans, Developing Java Beans, Controls and Properties of a Bean, Types of Properties.	**4 hrs**
	Unit II	
4	**Spring Framework** Introduction to spring 3.0, Spring Architecture and configuration, IOC and DI, Spring HelloWorld program, Introduction to MVC Architecture	**5 hrs**
5	**Spring Framework Advanced** Spring MVC Architecture, Aspect oriented programming, Data Access using JDBC template, Spring Security and Spring integration	**5 hrs**
6	**Spring Boot** Introduction to Spring Boot, Bootstrapping, tomcat Deployment, Building RESTFUL Web Services, Exception Handling, Database Handling, Unit Testing in Spring Boot	**7 hrs**
	Unit – III	
7	**RMI** RMI Architecture, Designing RMI application, Executing RMI application	**4 hrs**
8	**Maven (Project Management Tool).** What is Maven, Ant Vs Maven, Install Maven, Maven Repository (Local, Central, and Remote), Maven pom.xml, Maven web App, Maven plugin.	**4 hrs**

Text Books

1. Spring Boot 3 and Spring Framework 6, Christian Ullenboom, Rheinwerk Computing 2023
2. Jakarta EE Recipes by Josh Juneau, Apress 2022

Reference Books:

1. 'Pro Spring 6' by Clarence Ho and Rob Harrop, Apress 2023
2. 'Learning Spring Boot 3.0' – 3rd Edition by Greg L. Turnquist, Packt Publishing 2022

Sl.no	Integrated Lab Practices	Lab Slots
1	Program to demonstrate JDBC connection using Statement and Prepared Statement.**Note** Use Scanner class,Perform CRUD operations	1
2	Program to demonstrate JDBC connection using Prepared Statement with Scrollable result sets and row sets.**Note** Use Scanner class, Perform CRUD operations	1
3	Program to demonstrate dynamic page rending using JSP, Servlet and JDBC connection **Note**: Use maven as build tool	2
4	Program to demonstrate usage of scripting elements, page and taglib directives in JSP	2
5	Program to demonstrate Cookies and HttpSession Session tracking techniques using JSP and Servlets **Note**: Use maven as build tool	2
6	Program to demonstrate Exception handling in JSP using page attributes and deployment descriptor file	1
7	Write a java bean program to validate username and password using JSP usebean action tag	1
8	Program to demonstrate Spring DI and MVC framework.**Note**: Use maven as build tool	2
9	**Structured Query:** • Program to develop a web application using Servlets, JSP, JDBC and Session management technique. Like TODO application or Employee Management System using Maven as build tool • Program to develop a web application using spring MVC framework along with DAO, AOP techniques. Like Student management system, Restaurant management system etc using Maven as build tool	

Evaluation Scheme

Assessment	Marks
ISA- 1	15
ISA- 2	15
Assignment/ Activities	10
Lab practices	23
Total ISA Marks	**63**
ESA	**37**
Total	100

End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

Program: Master of Computer Applications		Semester: III
Course Title: Mobile Application Development		Course Code: 24ECAP801
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4 Hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: --	Practical: 48	Exam Duration: 3 Hrs

<table>
<tr><td colspan="3" align="center">Unit I</td></tr>
<tr><td>1</td><td>Introduction to Dart
Getting started with Dart, The evolution of Dart, How Dart works, Hands-on Dart, Dart operators, Dart types and variables, control flow and looping, Functions, Data structures, collections, introduction to OOP in Dart.</td><td>6 Hrs</td></tr>
<tr><td>2</td><td>Intermediate Dart Programming
Dart classes and constructors, Interfaces, abstract classes, and mixins, Understanding Dart libraries and packages.</td><td>7 Hrs</td></tr>
<tr><td>3</td><td>An Introduction to Flutter
Comparisons with other mobile app development frameworks, Flutter compilation (Dart), Flutter rendering, Widgets introduction. Widgets: Building Layouts in Flutter: Stateful versus stateless widgets, Built-in widgets, understanding built-in layout widgets, creating a UI with widgets (favor manager app), Creating custom widgets.</td><td>6 Hrs</td></tr>
<tr><td>4</td><td>Handling User Input and Gestures
Handling user gestures, Input widgets, Validating Input (Forms), Custom input and FormField. Theming and Styling: Theme widgets, Material Design, iOS Cupertino, Using custom fonts, Dynamic styling with MediaQuery and LayoutBuilder.</td><td>6 Hrs</td></tr>
<tr><td>5</td><td>Routing: Navigating between Screens
Understanding the Navigator widget, named routes, Screen transitions. Firebase Plugins: Firebase overview, Firebase authentication, NoSQL database with Cloud Firestore.</td><td>6 Hrs</td></tr>
<tr><td>6</td><td>Platform Views and Map Integration
Displaying a map, Adding markers to the map, Adding map interactions, Using the Google Places API</td><td>7 Hrs</td></tr>
<tr><td>7</td><td>Testing, Debugging, and Deployment
Flutter testing – unit and widget testing, Debugging Flutter apps, Profiling Flutter apps, Preparing apps for deployment.</td><td>5 Hrs</td></tr>
<tr><td>8</td><td>Improving User Experience
Accessibility in Flutter and adding translations to apps, Communication between native and Flutter with platform channels, Creating background processes, Adding Android-specific code to run Dart code in the background.</td><td>5 Hrs</td></tr>
</table>

Text Book:

1. Flutter for Beginners- An introductory guide to building cross-platform mobile applications with Flutter and Dart 2, September 2019 1st Education by Alessandro Biessek,

Reference Books:

1. Flutter- A Hands On Guide To App Development by Marco L. Napoli
2. Beginning App Development with Flutter: Create Cross-Platform Mobile Apps, 1st Edition, by Rap Payne.

Evaluation Scheme

In Semester Assessment (80%)	Assessment	Weightage in Marks
	Exercise (Problem execution, Viva & Observation Book)	60
	Structured Enquiry	20
	Total (ISA)	**80**
End Semester Assessment (20%)	Exercise	**20**
	Total	**100**

List of Experiments

Sl.No	Experiments	Lab Slots
1	Write Dart functions to implement various mathematical operations	1
2	Write dart program to implement control flow statements.	1
3	Create a UI layout using built-in widgets such as Column, Row, Container using both stateless and stateful widgets	1
4	Create custom widgets in Flutter for reusable UI components.	1
5	Create a flutter layout to handle user input and gestures.	2
6	Create a login screen layout using flutter with validations	2
7	Develop a Flutter app with a navigation drawer.	1
8	Create a flutter app and use Firebase authentication.	1
9	Create a flutter app to display and interact with Google Maps.	1
10	Develop a mobile app having features such as Launch screen, Login with validations, home screen with navigation drawer and a screen having Google maps.	1

Program: Master of Computer Applications		Semester: III
Course Title: Mini Project-2		Course Code: 23ECAP802
L-T-P : 0-0-2	Credits: 2	Contact Hours: 4 hrs/week
ISA Marks: 50	ESA Marks:50	Total Marks: 100
Teaching Hrs: --	Practical:56	Examination Duration:3 Hrs

Students can use the following tools in web and mobile applications as well as product developments:

- Struts, Spring, Hibernate and JPA
- Machine Learning & Deep Learning
- JAXB and Apache Axis 2/Java
- JSP, Servlets, JDBC, EJB, JMS, JTA and JUnit
- Apache Tomcat, JBoss and GlassFish
- JavaScript, JSF, GWT and jQuery
- Eclipse, Netbeans and JBoss tools
- TestNG
- jBPM and Drools
- JCR

Objectives:

Help students to utilize and strengthen the knowledge of java which they have learnt in previous semester.

Methodology:

Students are asked to make a team of 3-4 members and can choose the different categories of projects like desktop applications, web applications, mobile application and distributed application and work once it is approved by the coordinator.

1.1 Course Objectives:

The Mini Project being part of the course work is not only a mechanism to demonstrate the abilities and specialization but also provides the opportunity to demonstrate originality, teamwork, inspiration, planning and organization in a software project. One can put into practice the techniques that have been taught throughout the previous courses. Mini-projects develop practical skills in students. The idea is to propose a problem that one might encounter in future career (be it in academia, industry, or government). Then propose a solution and implement it.

E-commerce Objectives:

Most business houses are shifting their operations to the online world. Right from buying apparels to computers to booking tickets and renting out apartments, everything can be done through the Internet now. It is a win-win formula for both the customers and the business houses. Digital India aims to boost E-business and the E-commerce industry with the vision that it would in turn boost the economy is a whole.

Multilingual Objectives:

Language is an essential driver of enterprise growth. The user interface is the key component of any application that needs to support various language speaking audiences. Making an app that appeals to and is available for more users broadens the market and brings more revenue in the app sales and there will be more exposure to the business.

- *Evaluation*: The project assessment is done by an evaluation team as per the schedule.

In-Semester Assessment	Assessment	Marks
	Problem Definition, Literature Review	05
	Synopsis and Software Requirement Specification(SRS)	05
	Design (Block Diagram, Data Flow Diagram [DFD], Entity-Relationship [ER] Diagram, and Use-case Diagrams)	10
	Coding and Implementation	10
	Integration and testing	05
	Project Report	10
	Presentation skills and Viva-voce	05
	Total	**50**
End-Semester Assessment	Presentation, Demonstration	30
	Modification	10
	Viva-voce	10
	Total	**50**

Elective – 1 and 2

Program: Master of Computer Applications		Semester: III
Course Title: Linux Administration		Course Code: 23ECAE801
L-T-P:3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Practical: --	Exam Duration: 3 Hours
Unit I		
1	**Basic System Configuration** Opening Graphical Applications, System Locale and Keyboard Configuration: Setting the System Locale, Changing the Keyboard Layout**,** Managing Users and Groups; Introduction to Users and Groups, Managing Users in a Graphical Environment..	**4 Hrs**
2	**Package Management, Services and Daemons** Yum: Checking For and Updating Packages, Packages and Package Groups, Configuring Yum and Yum Repositories. Configuring Services, Running Services OpenSSH: The SSH Protocol, An Open SSH Configuration, Open SSH Clients	**6 Hrs**
3	**Web & Mail Servers :** Web Servers: The Apache HTTP Server Updating the Configuration, Running the httpd Service, Editing the Configuration Files, Working with Modules , Setting Up Virtual Hosts, Setting Up an SSL Server. Mail Servers- Email Protocols, Email Program Classifications, Mail Transport Agents, Mail Delivery Agents, Mail User Agents	**6 Hrs**
Unit II		
4	**File & Directory Servers :** FTP Servers : The File Transfer Protocol, FTP Servers, Files Installed with vsftpd, Starting and Stopping vsftpd,vsftpd Configuration Options.Runing FTP Server Samba Server : Introduction to Samba, Samba Daemons and Related Services, Connecting to a Samba Share, Configuring a Samba Server ,Starting and Stopping Samba, Samba Server Types and the smbconf File, Samba Security Modes, Samba Account Information Databases, Samba Network Browsing , Samba with CUPS Printing Support, Samba Distribution Programs Directory Servers -OpenLDAP, Introduction to LDAP, Installing the OpenLDAP Suite , Configuring an OpenLDAP Server , SELinux Policy for Applications Using LDAP, Running an OpenLDAP Server, Configuring a System to Authenticate Using OpenLDAP	**10 Hrs**
5	**Viewing and Managing Log Files -** Locating Log Files, Basic Configuration of Rsyslog, Working with Queues in Rsyslog , Using Rsyslog Modules , Interaction of Rsyslog and Journal, Structured Logging with Rsyslog , Debugging Rsyslog, Using the Journal, Managing Log Files in a Graphical Environment.	**6 hrs**

	Unit – III	
6	**Working with the GRUB 2 Boot Loader** Configuring the GRUB 2 Boot Loader, Customizing GRUB Menu, GRUB 2 Password Protection, Reinstalling GRUB , GRUB 2 over Serial Console, Terminal Menu Editing During Boot, UEFI Secure Boot	**4 Hrs**
7	**Automating System Tasks** -Cron and Anacron- Installing Cron and Anacron, Running the Crond Services, Configuring Anacron Jobs, Configuring Cron Jobs, Controlling Access to Cron,Black and White Listing of Cron Jobs At and Batch-Installing At and Batch,Running the At Service, Configuring an At Job, Configuring a Batch Job, Viewing Pending Jobs, Additional Command Line Options, Controlling Access to At and Batch.	**4 Hrs**

Textbook:

1. Fedora 21 System Administrator's Guide: Deployment, Configuration, and Administration of Fedora 21 by Jaromír Hradílek, Douglas Silas, Martin Prpič, Publisher: Red Hat, Release Date: 2014.

Reference Books:

1. Linux System Administration Recipes: A Problem-Solution Approach by Juliet Kemp, Publisher: Apress, Release Date: October 2009.
2. IT Infrastructure Management by Anita Sengar, Publisher: S.K. Kataria & Sons, Release Date: 2010(Reprint2020).
3. IT Infrastructure Architecture: Infrastructure Building Blocks and Concepts by Sjaak Laan, Publisher: Lulu Press Inc., Release Date: February 2013.

Evaluation Scheme:

1. In Semester Assessment (ISA)

Assessment	Marks
ISA-1	25
ISA-2	25
ISA	50
ESA	50
Total	100

2. End Semester Assessment (ESA) Pattern:

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4,5	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	6,7	Any 1 question is to be answered

BACK

Program: Master of Computer Applications		Semester: III
Course Title: DevOps		Course Code: 23ECAE802
L-T-P: 2-0-1	Credits: 3	Contact Hrs: 4 hrs/week
ISA Marks: 66	ESA Marks: 34	Total Marks: 100
Teaching Hrs: 30	Practical: 24	Exam Duration: 2 Hrs

	Unit I	
1	**Introduction to DevOps and Revision Control System** DevOps Principles and Practices, Agile Wheel of Wheels, DevOps and ITIL Alignment, Git Overview, Build Servers, Artifact Repositories, Package Managers, Test Environments, Staging vs. Production, Release Management, Scrum, Kanban, Delivery Pipeline Walkthrough, Identifying Bottlenecks in Software Delivery.	4 Hrs
2	**Everything is Code** Roles and Code Responsibilities, Selecting SCM Tools, Source Code Migration Considerations, Branching Strategies and Pitfalls, Artifact Version Naming Best Practices, Setting Up a Basic Git Server, Shared Authentication, Git Hosting Platforms, Handling Large Binary Files, Exploring Alternative Git Server Implementations.	5 Hrs
3	**Git Workflows, Gerrit, Docker, and GitLab CI** Docker Basics and Usage, Introduction to Gerrit, Installing git-review Package, History Revisionism, Pull Request Models, Peer Reviews, GitLab Overview, CI/CD Pipelines.	6 Hrs
	Unit II	
4	**Building the Code** Why we build code, build systems and CI/CD, Jenkins setup and plugin ecosystem, dependency management in Jenkins, Jenkins architecture: host server and build slaves, Jenkins job triggers, pipelines, and job chaining, Jenkins filesystem layout and infrastructure as code, build order and phases.	5 Hrs
5	**Testing the Code** Manual vs. automated testing, unit testing with JUnit (including examples), mocking and code coverage tools, integration testing strategies, automated testing in Jenkins pipelines.	5 Hrs
6	**Deploying the Code** OS-Level Configuration for Deployment, Cluster and Environment Setup, Package Delivery and Versioned Releases, Docker Deployment Workflow, Introduction to Kubernetes, Pods, Deployments, Services, Containerization Principles, Orchestration Principles	5 Hrs
Textbook:		
1. Practical DevOps by Joakim Verona Publisher: Packt Publishing, Release Date:February 2018.		
Reference Books:		

1. Effective DevOps: Building a Culture of Collaboration, Affinity and Tooling at Scale by Jennifer Davis and Ryn Daniels, Publisher: O'Reilly Media, Release Date: June 2016.

2. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations by Gene Kim, Patrick Debois, John Willis, Jez Humble, and Nicole Forsgren, Publisher: IT Revolution Press, Release Date: November 2021.

Evaluation Scheme

1. **In Semester Assessment (ISA)**

Assessment	Marks
ISA- 1	15
ISA- 2	15
ISA- Lab	36
ISA	66
ESA	34
Total	100

2. **End Semester Assessment (ESA)**

UNIT	6 Questions to be set of 15 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 15 Marks Each	1, 2, 3	Any 2 full questions are to be answered
II	3 Questions to be set of 15 Marks Each	4,5,6	Any 2 questions are to be answered

Lab Activities

Sl.no	Practices	Lab slots
1	**Git Basics & Version Control Setup** Initialize a Git repository, create branches, push/pull changes from GitHub, and simulate version history.	1
2	**Agile & Scrum Simulation** Use a Kanban board (Trello/Jira) to create and manage a mini sprint backlog and simulate task progress.	1
3	**Build Server & Artifact Management** Set up a mock build server (using scripts or Jenkins) and simulate artifact generation/storage in a local repo (like Nexus/Artifactory).	1
4	**Source Code Management & Git Server Setup** Install and configure a local Git server (e.g., Gitea), create users with shared authentication, and clone repositories.	1
5	**Branching Strategy & Merge Conflicts** Practice Git branching (feature/release/hotfix) and resolve simulated merge conflicts between branches.	1
6	**Code Review using Gerrit**	1

		Install Gerrit, configure `git-review`, and conduct a sample peer code review process.	
7	**Docker Image Build & Containerization** Write a simple Dockerfile, build a custom Docker image, and run a containerized app (e.g., a simple Node.js or Python app).		1
8	**CI/CD Pipeline with GitLab CI** Create a `.gitlab-ci.yml` file to automate testing and deployment stages on GitLab.		1
9	**Jenkins CI Job Configuration** Install Jenkins, configure a freestyle or pipeline job, manage build triggers, and integrate Git repository.		2
10	**Automated Testing & Kubernetes Deployment** Write and run unit tests using JUnit, configure Jenkins to trigger tests, then deploy a Dockerized app to a Kubernetes cluster using `kubectl`.		2

KLE Technological University
Creating Value, Leveraging Knowledge

Program: Master of Computer Applications		Semester: III
Course Title: User Interface Design		Course Code: 23ECAE803
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Practical:--	Exam Duration:3 Hrs

	Unit I	
1	**What Users Do** The Basics of User Research ,Users' Motivation to Learn, The Patterns.	5 Hrs
2	**Organizing the Content: Information Architecture and Application Structure** The Big Picture, The Patterns:- Feature, Search, and Browse, News Stream, Picture Manager, Dashboard, Canvas Plus Palette, Wizard.	5 Hrs
3	**Getting Around: Navigation, Signposts, and Wayfinding** Staying Found, The Cost of Navigation, Navigational Models, Design Conventions for Websites, The Patterns:- Clear Entry Points, Menu Page, Pyramid, Modal Panel, Deep-linked State, Escape Hatch, Fat Menus, Sitemap Footer, Sign-in Tools, Sequence Map, Breadcrumbs, Annotated Scrollbar, Animated Transition.	6 Hrs
	Unit II	
4	**Organizing the Page: Layout of Page Elements** The Basics of Page Layout, The Patterns:- Visual Framework, Center Stage, Grid of Equals, Titled Sections, Module Tabs, Collapsible Panels, Movable Panels, Right/Left Alignment, Diagonal Balance.	5 Hrs
5	**Lists of Things** Use Cases for Lists, Back to Information Architecture, The Patterns:- Two-Panel Selector, One-Window Drilldown, List Inlay, Thumbnail Grid, Row Striping, Jump to Item, Cascading Lists, Tree Table.	5 Hrs
6	**Doing Things: Actions and Commands** Pushing the Boundaries, The Patterns:- Button Groups, Hover Tools, Action Panel, Smart Menu Items, Preview, Progress Indicator, Macros.	6 Hrs
	Unit – III	
7	**Showing Complex Data: Trees, Charts, and Other Information Graphics** The Basics of Information Graphics, The Patterns:- Overview Plus Detail, Datatips, Data Spotlight, Dynamic Queries, Data Brushing, Local Zooming, Sortable Table, Radial Table, Multi-Y Graph, Small Multiples, Treemap.	4 Hrs
8	**Getting Input from Users: Forms and Controls** The Basics of Form Design, Control Choice, The Patterns:- Forgiving Format, Structured Format, Fill-in-the-Blanks, Input Hints, Input Prompt, Password Strength Meter, Autocompletion, Dropdown Chooser, Same-Page Error Messages.	4 Hrs

Text Book:
1. Jenifer Tidwell, Designing Interfaces, 2nd Edition, O'Reilly ,2010

Reference Books:
1. Laws of UX, Jon Yablonski, O'Reilly, April 2020.
2. 100 Things Every Designer Needs to Know About People, Susan Weinschenk, New Riders, 2011.
3. Jodie Moule., Killer UX Design, SitePoint,2012

Evaluation scheme

1. In Semester Assessment (ISA)

Assessment	Marks
ISA1	15
ISA2	15
Activity	20
ESA	50
Total	100

2. End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2,3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4, 5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

Program: Master of Computer Applications		Semester: III
Course Title: Cyber Security		Course Code: 23ECAE804
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Practical : --	Exam Duration:3 Hrs

	Unit I	
1	**Introduction to Cybercrime, Cyber offences & Cybercrime** Cybercrime definition and origins of the word, Cybercrime and information security, Classifications of cybercrime, A global Perspective on cybercrimes. Cyber-attack plans, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets, Proliferation of Mobile and Wireless Devices, Credit Card Frauds in Mobile and Wireless Computing Era. Security challenges posed by mobile devices.	6 Hrs
2	**Tools and Methods used in Cybercrime, Phishing and identity theft** Proxy servers, Phishing, Password cracking, key loggers and spyware, Virus and worms, Trojan horses and backdoors, steganography, DoS and DDoS, SQL Injection, Buffer Overflow, Attack on wireless Networks, Phishing and Identity theft.	6 Hrs
	Unit II	
3	**Cybercrimes and Cybersecurity: The Legal Perspectives, Organizational implications.** Cybercrime and the legal landscape around world, Why do we need Cyberlaw: The Indian Context, The Indian IT Act, Digital Signature and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cost of cybercrime and IPR issues, Web threats for organization, cloud computing threats; security and privacy implications, social computing issues; Guidelines for internet usage and safe computing; incident handling	7 Hrs
4	**Understanding computer Forensics, Forensics of Hand-held devices** Historical background of forensics; Digital forensics science; need for computer forensics; cyber forensics and digital evidence; Analysis E-mail; Digital forensics life cycle; chain of custody concepts; network forensics; Forensics and social networking; challenges in computer forensics; Hand-held devices and digital forensics; Toolkits for Hand-held device forensics; Techno-legal challenges form hand-held devices; Guidelines8	7 Hrs
5	**Doing Things: Actions and Commands** Pushing the Boundaries, The Patterns:- Button Groups, Hover Tools, Action Panel, Smart Menu Items, Preview, Progress Indicator, Macros.	6 Hrs
	Unit – III	
6	**Social, Political, Ethical and Psychological Dimensions** Intellectual property in the cyberspace; Ethical dimension of cybercrimes; Psychology, mindset and skills of hackers and other cyber criminals; Sociology of cybercriminals.	4 Hrs
7	**Cybercrime: Illustrations, Examples and Case studies**	4 Hrs

	Introduction, Real-Life Examples, Case Studies: Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Digital forensics case illustrations Online Scams.	

Text Book:

    1.Nina Godbole & Sunit Belapur, "Cyber Security", Wiley India, 2011 and Reprint 2018.

Reference Books:

1. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata McGraw -Hill, New Delhi, 2006.
2. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.

Evaluation Scheme

1 . **In Semester Assessment (ISA)**

Assessment	Marks
ISA	50
ESA	50
Total	100

2. **End Semester Assessment (ESA)**

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	3,4,5	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	6,7	Any 1 question is to be answered

BACK

Program: Master of Computer Applications		Semester: III
Course Title: C# Programming with .Net		Course Code: 23ECAE806
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Practical:--	Exam Duration:3 Hrs

	Unit I	
1.	**The Philosophy of .NET** Understanding the Previous State of Affairs, The .NET Solution, Introducing the Building Blocks of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Assemblies, The Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifest, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime, The Assembly/Namespace/Type Distinction, Using ildasm.exe, Deploying the .NET Runtime, The Platform independent nature of .NET, Installing the .NET Framework, C# Command-Line Compiler, Building C# Applications using csc.exe, Working with csc.exe Response Files.	**08 Hrs**
2.	**C# Language Fundamentals.** The Anatomy of a Simple C# Class, An Interesting Aside : The System.Environment Class, Defining Classes and Creating objects, The System.Console Class, Establishing Member Visibility, Default Values of Class Member Variables, Member Variable Initialization Syntax, Defining Constant Data, Defining Read-only fields, Understanding the static keyword, Method Parameter Modifiers, Iteration Constructs, Decision Constructs and the Relational/Equality Operators, Understanding Value Types and Reference Types, Understanding Boxing and Unboxing Operations, Working with .NET Enumerations, The Master Class: System.Object, Overridding some default behaviours of System.Object, The System Data types(and C# Shorthand notation), The System.String data types, The role of System.Text.StringBuilder, .NET Array Types, Understanding C# Nullable Types, Defining Custom Namespaces	**04 Hrs**
3.	**Object-Oriented Programming with C#** Understanding the C# Class Type, Reviewing the Pillars of OOP, The First Pillar: C#'s Encapsulation Services, The Second Pillar: C#'s Inheritance Support, Programming for Containment/Delegation, The Third Pillar: C #'s Polymorphic Support, C# Casting rules, Understanding C# Partial types, Documenting C# Source Code via XML	**04 Hrs**
	Unit II	
4.	**Object Lifetime and Exceptions Handling.** Classes, Objects and References, the basics of Object Lifetime, The role of Application Roots, Understanding Object Generations, System.GC type, Building Finalizable Objects, Building Disposable Objects, Building Finalizable and Disposable types. Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handing, The Simplest possible example, Configuring the state of an exception, System – Level Exception	**8 Hrs**

	(System. System Exception), Application-Level Exception (System.ApplicationException), Processing Multiple Exception, The Finally Block, The result of unhandled exceptions, Debugging Unhandled exceptions using VS. NET.	
5.	**Interfaces and Collections** Defining Interfaces in C#, Implementing an Interface in C#, Contrasting Interfaces to Abstract Base Classes, Invoking Interface Members at the Object Level, Interfaces As Parameters, Interfaces As Return Values, Arrays of Interfaces Types, Understanding Explicit Interface Implementation, Building Interface Hierarchies, Implementing Interfaces Using Visual Studio 2005, Building Enumerable Types(IEnumerable and IEnumerator), Building CloneableObjects(IConeable), Building Comparable Objects(IComparable), The Interfaces of the System.Collections Namespace, The Class Types of System.Collections.	4 Hrs
6.	**Callback Interfaces, Delegates, and Events, Advanced C# Techniques** Understanding Callback Interfaces, Understanding the .NET Delegate type, Defining a Delegate in C#, The System.multicastDelegate and System.Delegate Base Classes, Investigating a Delegate Object, Delegates as Parameters, Understanding C# Events Building a Custom Indexer, Internal Representations of Type Indexers: Final Details, Understanding Operator Overloading Binary Operators, Unary Operators, Equality Operators, Comparison Operators, Understanding Custom Type Conversions, The Advanced Key words of C#, C# Preprocessor Directives.	4 Hrs
	Unit – III	
7.	**Records** Background, Defining a Record, Nondestructive Mutation, Property Validation, Calculated Fields and Lazy Evaluation, Primary Constructors, Records and Equality Comparison	04 Hrs
8.	**Programming with Windows Forms and Database Access with MS SQL Server** Controls, Building Custom Windows Forms Controls, Defining Custom Events, Defining Custom Properties, Overview of Data Access, Creating database connections, connecting to MSSQL Server,Dataset and Data table features, using inline SQL Statements, using stored procedures , Executing select commands, SQL transaction	04 Hrs

Text Book:
1. Pro C# 9 with .NET 5, Foundational Principles and Practices in Programming, Apress, Troelsen, Andrew, Japikse, Philip, 10 edition .
2. C# 9.0 in a Nutshell by Joseph Albahari, O'Reilly Media Inc 2021

Reference Books:
1. .NET 4.0 Programming (6-in-1),Black Book,Kogent Learning Solutions Inc.Wiely-Dream Tech Press
2. Tom Archer: Inside C#, WP Publishers, 2001.
3. Herbert Schildt: The Complete Reference C#,Tata McGraw Hill, 2004

Evaluation Scheme

1 . In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	50
Total	100

2. End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2, 3	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	4,5,6	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	7,8	Any 1 question is to be answered

Program: Master of Computer Applications		Semester: III
Course Title: Statistical Foundation for Data Science		Course Code: 23ECAE807
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Practical:--	Exam Duration:3 Hrs

	Unit I		
1	**Statistical Analytics and Basics in Probability** Knowledge discovery: finding structure in data, Data quality versus data quantity, Statistical modelling versus statistical description. Concepts in Probability, Bayes Theorem, Random Variables, Means, variances, and expected values; Standard Distributions- Binomial, Poisson, Geometric, Uniform, Exponential and Normal (Gaussian) distribution.		08 hrs
2	**Data manipulation** Data types, Data summarization, Means, medians, and central tendency, summarizing variation, summarizing (bivariate) correlation, Data diagnostics and data transformation, Outlier analysis, Entropy, Data transformation Simple smoothing techniques, Binning, Moving averages, Exponential smoothing. Introduction to SPSS (IBM's) statistical tool.		07 hrs
	Unit II		
3	**Data visualization and statistical graphics** Univariate visualization, Strip charts and dot plots, Boxplots, Stem-and-leaf plots, Histograms and density estimators, Quantile plots, Bivariate and multivariate visualization, Pie charts and bar charts, Multiple boxplots and QQ plots, Scatterplots and bubble plots, Heatmaps, Time series plots. Visualization in SPSS tool.		08 hrs
4	**Techniques for supervised learning** What is "supervised learning?", Simple linear regression The simple linear model, Multiple inferences and simultaneous confidence bands, Regression diagnostics, Weighted least squares (WLS) regression Correlation analysis, The correlation coefficient and Rank correlation.		07 hrs
	Unit – III		
5	**Techniques for unsupervised learning and Case study** Unsupervised versus supervised learning, Principal component analysis, Principal components, implementing a PCA, Exploratory factor analysis the factor analytic model, Principal factor estimation, Maximum likelihood estimation, Selecting the number of factors, Factor rotation, Implementing an EFA, Canonical correlation analysis. Case study on Data Analytics on Real world datasets		10 hrs

Text Books:

1. Piegorsch, Walter W. Statistical data analytics: foundations for data mining, informatics, and knowledge discovery. John Wiley & Sons, 2015.
2. Hinton, Perry R., Isabella McMurray, and Charlotte Brownlow. SPSS explained. Routledge, 2023.

Reference Books:

1. Wu, James, and Stephen Coggeshall. Foundations of predictive analytics. Chapman and Hall/CRC, 2012.
2. Marcoulides, George A., and Scott L. Hershberger. Multivariate statistical methods: A first course. Psychology Press, 2014.
3. Morgan, George A., et al. IBM SPSS for introductory statistics: Use and interpretation. Routledge, 2016

Evaluation Scheme

1. **In Semester Assessment (ISA)**

Assessment	Marks
ISA	50
ESA	50
Total	100

2. **End Semester Assessment (ESA)**

UNIT	8 Questions to be set of 20 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2	Any 2 questions are to be answered
II	3 Questions to be set of 20 Marks Each	3,4	Any 2 questions are to be answered
III	2 Questions to be set of 20 Marks Each	5	Any 1 question is to be answered

Program: Master of Computer Applications		Semester: III
Course Title: Full Stack Development with MERN		Course Code: 23ECAE808
L-T-P: 2-0-1	Credits: 3	Contact Hrs: 4 hrs/week
ISA Marks: 66	ESA Marks: 34	Total Marks: 100
Teaching Hrs: 30	Practical:24	Exam Duration: 2 Hrs

	Unit I	
1	**JavaScript & TypeScript Fundamentals** JavaScript Essentials (ES6+ Features): Variables (let, const), Functions, Template Literals, Destructuring, Spread & Rest Operators, Promises & Async/Await . Advanced JavaScript : Closures, Hoisting, Scope, Event Loop, Modules & Import/Export in ES6.	**5 Hrs**
2	**Introduction to MERN ,React.js Development & State Management** Overview of MERN (MongoDB, Express.js, React.js, Node.js),Client-Server Architecture,Creating a Basic "Hello World" App in MERN,Introduction to React.js & JSX, Components (Functional vs Class), Props & State ,Handling Events & Forms in React , React Router (Private & Public Routes) , State Management: Context API & Redux Toolkit.	**6 Hrs**
3	**Backend Development with Node.js & Express.js** Building a REST API with Express.js, Middleware in Express.js (Logging, Authentication, Error Handling), Rate Limiting & Security Headers (Helmet.js, CORS, Express Rate Limit), Authentication with JWT (Login, Register, Logout, Role-Based Access).	**5 Hrs**
	Unit II	
4	**MongoDB & Database Management** Introduction to NoSQL Databases (MongoDB vs. SQL) ,CRUD Operations in MongoDB using Mongoose, Schema Design & Relationships, Query Optimization (Indexing, Aggregation Pipeline).	**6 Hrs**
5	**API Integration & File Handling** API Calls using Fetch & Axios , CRUD Operations in React (GET, POST, PUT, DELETE) , Handling File Uploads using Multer for Express.js , REST API vs. GraphQL.	**4 Hrs**
6	**Advanced Authentication & Real-Time Communication** OAuth Authentication (Google, GitHub Login), WebSockets & Real-Time Communication (Socket.io - Live Chat, Notifications), Preventing Security Threats (XSS, CSRF, CORS, SQL Injection, OWASP Basics)	**4 Hrs**

Text Book:

1. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node by Vasan Subramanian, Publisher: Apress, Release Date: May 2019.

Reference Books:

1. MEAN Web Development by Amos Q. Haviv, Publisher: Packt Publishing, Release Date: September 2014.

2. Full Stack JavaScript Development with MEAN by Adam Bretz and Colin J. Ihrig, Publisher: SitePoint, Release Date: 2015.
3. JavaScript: The Good Parts by Douglas Crockford, Publisher: O'Reilly Media, Release Date: May 2008.
4. TypeScript in 50 Lessons by Stefan Baumgartner, Publisher: Smashing Magazine, Release Date: 2020.

Evaluation Scheme

1.   **In Semester Assessment (ISA)**

Assessment	Marks
ISA- 1	15
ISA- 2	15
ISA- Lab	36
ISA	66
ESA	34
Total	100

2.   **End Semester Assessment (ESA)**

UNIT	6 Questions to be set of 15 Marks Each	Chapter Nos.	Instructions
I	3 Questions to be set of 15 Marks Each	1, 2, 3	Any 2 full questions are to be answered
II	3 Questions to be set of 15 Marks Each	4, 5, 6	Any 2 questions are to be answered

Lab Activities

Sl.no	Practices	Lab slots
1	**JavaScript & TypeScript Practice** Develop small programs using ES6+ features and demonstrate closures, callbacks,promises and async/await.	1
2	**React Component Design** Build a React-based user profile card that uses props and state to display and toggle user information.	1
3	**Form Handling & Routing in React** Create a multi-step form in React with validation and navigation using React Router.	1
4	**Global State Management** Implement a theme toggler app using Context API and manage user authentication state using Redux Toolkit.	1
5	**RESTful API with Express.js**	1

	Design a basic CRUD API for product management using Express.js, including middleware for logging and error handling.	
6	**JWT Authentication** Create a secure login system using JWT for user authentication and protect backend routes.	1
7	**MongoDB CRUD with Mongoose** Build a backend to manage student records with MongoDB and Mongoose including schema validation.	2
8	**Review Submission with File Upload** Develop a feedback form in React and use Multer in Express.js to handle file/image uploads to the server.	1
9	**GraphQL API Development** Create a GraphQL server with schema for books and implement basic queries and mutations. Fetch data in React using Apollo Client.	1
10	**Real-Time Chat App** Implement a live chat feature using Socket.io in Node.js and React, enabling real-time user interaction.	2

Program: Master of Computer Applications		Semester: III
Course Title: Natural Language Processing with Gen AI		Course Code: 23ECAE817
L-T-P: 2-0-2	Credits: 4	Contact Hrs: 6 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30	Practical : 30	Exam Duration:3 Hrs

	Unit I	
1	**Introduction to NLP & Preprocessing** NLP overview & applications, Challenges in language understanding, Basic components of NLP systems, Text preprocessing: Tokenization, Stop word removal, Stemming, Lemmatization, POS tagging, Bag of Words, Introduction to word embeddings	**5 hrs**
2	**Parsing and Syntax Analysis** Grammar rules in NLP, Dependency and Constituency Parsing, Parsing techniques and algorithms, Introduction to neural dependency parsing	**4 hrs**
3	**Language Models & Transformers** N-grams and statistical models, Neural language models: Word2Vec, GloVe, Transformers for text understanding and generation, Sequence-to-sequence models, Attention mechanisms	**6 hrs**
	Unit II	
4	**Machine Translation & Generation** Overview of Machine Translation, Statistical vs Neural Machine Translation, Seq2Seq with attention, Text generation techniques: LSTM, Transformers, Role of Autoencoders & Decoders	**5 hrs**
5	**Generative AI and Advanced Architectures** Discriminative vs Generative models, Generative Adversarial Networks (GANs) in NLP, Types of GANs, Diffusion models: concepts & types, Introduction to Chatbots and Dialogue Systems	**5 hrs**
6	**Large Language Models (LLMs)** Introduction to LLMs: GPT, BERT, Prompting techniques for GenAI, Adapters and LoRA (Low-Rank Adaptation), Applications and limitations of LLMs	**5 hrs**

Text Books:
1. Yoav Goldberg. A Primer on Neural Network Models for Natural Language Processing, 2022.
2. "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" by David Foster.
3. "Hands-On Generative Adversarial Networks with Keras: Create Beguiling Image Generation Projects to Extend Your Generative AI Skills" by Rafael Valle

Reference Books:
1. Daniel Jurafsky and James H. Martin, Speech and Language Processing (3rd Edition – Draft), Stanford University, 2023.
2. S. K. Dwivedi, R. K. Dwivedi, Natural Language Processing: A Textbook with Python Implementation, Springer, 2024.

Program: Master of Computer Applications		Semester: IV
Course Title: Capstone Project Work		Course Code: 24ECAP802
L-T-P: 0-0-18	Credits: 18	Contact Hrs: 34
ISA Marks: 100	ESA Marks: 100+50	Total Marks: 250
Teaching Hrs: Full Time	Practical:--	Exam Duration:3 Hrs
A student must carry out a project on any domain using cutting edge technologies and demonstrates the same at the end of the semester.		

Internal Semester Assessment (50%)	Assessment	Weightage in marks
	Periodic reviews by Project Guide	25
	Periodic reviews by committee	25
End Semester Assessment (50%)	Final Review	50
	Total	**100**

Program: Masters of Computer Applications		Semester - IV
Course Title: Deep Learning		Course Code: 23ECAE809
L-T-P: 2-0-1	Credits: 3	Contact Hours: 4 hrs/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs : 30	Practical: 24	Exam Duration: --

	Unit –I		
1	**Deep Learning Intuition** Introduction to deep learning, Neural Network Basics, Multilayer Perceptron, Gradient-Based Learning, Hidden Units, Back-Propagation and Other Differentiation Algorithms, Batch Normalization in Neural Networks.		5 hrs
2	**Training and Improving Deep Neural Networks** Building Deep Neural Networks: Step-by-Step, Deep Neural Network Applications, Initialization Techniques, Regularization Techniques, Optimization Algorithms, Gradient Checking, Hyper parameter Tuning, Practical Aspects of Deep Learning, Deep Learning Programming Frameworks		7 hrs
	Unit –II		
3	**Convolutional Neural Networks** Foundations of CNNs- A Guide to Convolution for Deep Learning, The Basics of ConvNets, Deep Convolutional Models, Advanced CNN Architectures-Residual Networks (ResNet), Dense Net: Densely Connected Convolutional Networks, Dropout: A Simple Way to Prevent Neural Networks from Over fitting CNN Implementation-Convolutional Model: Applications, Keras		7 hrs
4	**Interpretability and Applications of Neural Networks- Visualizing** Understanding Neural Networks, Visualizing and Understanding Convolutional Networks, Deep Inside Convolutional Networks: Visualizing Image Classification Models, Understanding Neural Networks Through Deep Visualization.		6 hrs
	Unit –III		
5	**Recurrent Neural Networks and LSTM** Introduction to Recurrent Neural Networks- What are Recurrent Neural Networks, Building a Recurrent Neural Network – Step by Step, Core RNN Architectures, Long Short-Term Memory (LSTM) Networks, Character-Level Language Modelling.		5 hrs

Text Book:

1. Deep Learning with Python,Ian Goodfellow,Yoshua Bengio and Aaroncour,2025.

Reference Books:

1. Deep Learning Foundation and Concepts, Christopher M Bishop, 2023.

Evaluation Scheme

1. In Semester Assessment (ISA)

Assessment	Marks
ISA	100
ESA	---

Lab Activities

Sl. NO	TOPICS	ACTIVITY	Lab slots
1	Deep Learning Intuition	• Building and Implementation of basic neural networks	2
2	Improving Deep Neural Networks	• Apply Initialization, Regularization • Use Optimizers like SGD and Adam • Hyperparameter Tuning • Implement Batch Normalization	2
3	Convolutional Neural Networks	• Build a CNN Model • Experiment with Dropout • Visualize CNN Filters and Feature Maps • Implement ResNet Model	2
4	Interpretability & CNN Applications	• Neural Style Transfer using VGG16 Model • Car Detection using YOLO	3
5	Recurrent Neural Networks: Deep Reinforcement Learning	• Build a Character-Level RNN for text generation • LSTM for Text Generation • Word Embedding Operations & Debiasing	3

Program: Master of Computer Applications		Semester - IV
Course Title: Blockchain Technologies		Course Code: 23ECAE810
L-T-P: 0-0-2	Credits: 2	Contact Hours: 3 hrs/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs : 40	Practical: --	Exam Duration: --

	Unit I	
1	**Introduction** What blockchain is, What blockchain isn't, Blockchain definitions, How are blockchains different from databases? History of blockchain, Blockchain 2.0, The motivations behind blockchain, Characteristics of blockchain, Background of DLT, The different types of blockchain, Overview of blocks, Influence of Moore's law on blockchain technology.	**5 hrs**
2	**A Bit of Cryptography** Cryptography in blockchain, Classical cryptography, Cryptographic primitives, Symmetric key cryptography, Asymmetric key cryptography, Elliptic-curve cryptography, Digital signatures, Cryptographic hashing.	**5 hrs**
3	**Cryptography in Blockchain** Hashing in blockchain, Linking blocks in a blockchain, Linking blocks using an SHA256 hashing algorithm, Block structure, Blockchain functionality, Creating a blockchain, Byzantine failure problem in blockchain, Digital signatures in blockchain, Creating an identity, Signatures in transaction, Asset ownership in blockchain, Transferring an asset, Transmitting the transaction, Claiming the asset, Blockchain wallets.	**6 hrs**
	Unit II	
4	**Networking in Blockchain** Peer-to-peer (P2P) networking, Network discovery, Block synchronization, Building a simple blockchain in a P2P network, Validating a new block, Selecting the longest chain, Conflict resolution, Block exchange between peers, Initial block synchronization, Broadcasting scenarios, Application interfaces.	**6 hrs**
5	**Cryptocurrency** Bitcoin basics, Getting started with Bitcoin Core, Keys and addresses, Transactions, Mining and consensus, Blockchain, Blockchain networks, Bitcoin hard forks and altcoins, A simple cryptocurrency application: Transactions, Wallet, Transaction management.	**5 hrs**
6	**Diving into Blockchain - Proof of Existence** MultiChain blockchain platform, Setting up a blockchain environment, Getting started with MultiChain, Proof of Existence architecture, Building the Proof of Existence application, Executing and deploying the application.	**5 hrs**
	Unit – III	
7	**Diving into Blockchain - Proof of Ownership** Digital assets and identity, Proof of ownership, Smart contracts, Choosing the smart contract platform, NEO blockchain: Building blocks of a NEO	**4 hrs**

	blockchain, NEO technology, NEO nodes, NEO network, NEO transactions, Ethereum blockchain: Ethereum nodes, Getting started, Creating a decentralized application.	
8	**Blockchain Security.** Transaction security model, Decentralized security model, Attacks on the blockchain, Threats of quantum computing.	**4 hrs**
Text Book:		
1. Foundations of Blockchain, O'REILLY publications, 2019.		
References Books:		
1. Master in Blockchain,4th edition,Packt publishing,2023.		

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	100
ESA	---

BACK

Program: Master of Computer Applications			Semester: IV	
Course Title: Big Data Analysis with PySpark			Course Code: 23ECAE811	
L-T-P: 3-0-0		Credits: 3	Contact Hrs: 3 hrs/week	
ISA Marks: 100		ESA Marks:--	Total Marks: 100	
Teaching Hrs: 40		Practical:--	Exam Duration:--	

<table>
<tr><td colspan="3" align="center">Unit I</td></tr>
<tr>
<td>1</td>
<td>Getting Started – Introduction
Introduction to Apache Spark, Installing softwares, Scala Basics, Flow Control in Scala, Functions in Scala, Data Structures in Scala</td>
<td>4 Hrs</td>
</tr>
<tr>
<td>2</td>
<td>Using Resilient Distributed Datasets (RDDs)
The Resilient Distributed Dataset, Ratings Histogram Example, Preview, Key / Value RDD's, and the Average Friends by Age example, Running the Average Friends by Age Example, Filtering RDD's, and the Minimum Temperature by Location Example, Running the Minimum Temperature Example, and Modifying it for Maximum, Counting Word Occurrences using Flatmap(), Improving the Word Count Script with Regular Expressions, Sorting Word Count Results – Find the Total Amount Spent by Customer.</td>
<td>7 Hrs</td>
</tr>
<tr>
<td>3</td>
<td>SparkSQL, Datasets and Dataframes
Introduction to SparkSQL, Using SparkSQL, Using DataSets, Implement the "Friends by Age" example using DataSets, Exercise Solution: Friends by Age, with Datasets, Word Count example, using Datasets, Revisiting the Minimum Temperature example, with Datasets, Implement the "Total Spent by Customer" problem with Datasets</td>
<td>5 Hrs</td>
</tr>
<tr><td colspan="3" align="center">Unit II</td></tr>
<tr>
<td>4</td>
<td>Spark Programs Examples
Find the Most Popular Movie, Use Broadcast Variables to Display Movie Names, Find the Most Popular Superhero in a Social Graph, Find the Most Obscure Superheroes, Solution: Find the Most Obscure Superheroes, Superhero Degrees of Separation: Introducing Breadth-First Search, Superhero Degrees of Separation: Accumulators, and Implementing BFS in Spark, Superhero Degrees of Separation: Review the code, and run it. Item-Based Collaborative Filtering in Spark, cache(), and persist()</td>
<td>5 Hrs</td>
</tr>
<tr>
<td>5</td>
<td>Running Spark on a Cluster
Using spark-submit to run Spark driver scripts, Packaging driver scripts with SBT, Package a Script with SBT and Run it Locally with spark-submit, Introducing Amazon Elastic MapReduce, Partitioning, Best Practices for Running on a Cluster, Troubleshooting, and Managing Dependencies</td>
<td>5 Hrs</td>
</tr>
<tr>
<td>6</td>
<td>Machine Learning with Spark ML
Introducing MLLib, Using MLLib to Produce Movie Recommendations, Linear Regression with MLLib, Predict Real Estate Values with Decision Trees in Spark</td>
<td>6 Hrs</td>
</tr>
<tr><td colspan="3" align="center">Unit – III</td></tr>
<tr>
<td>7</td>
<td>Introduction to Spark Streaming</td>
<td>4 Hrs</td>
</tr>
</table>

	The DStream API for Spark Streaming, Real-time Monitoring of the Most Popular Hashtags on Twitter, Structured Streaming, Using Structured Streaming for real-time log analysis, Windowed Operations with Structured Streaming	
8	**Introduction to GraphX** GraphX, Pregel, Breadth-First-Search with Pregel, Using the Pregel API with Spark GraphX, Superhero Degrees of Separation using GraphX.	**4 Hrs**

Text Book:

Reference Books:

1. Spark: The Definitive Guide: Big Data Processing Made Simple 1st Edition, Publisher: **O'Reilly Media ;8 February2018.**

2. Apache Spark in 24 Hours, Sams Teach Yourself, Publisher : **Sams Publishing; 1st edition)7 November2016(**

3. Beginning Apache Spark 2: With Resilient Distributed Datasets, Spark SQL, Structured Streaming and Spark Machine Learning library, Publisher : **Apress; 1st ed .edition)16 August 2018(**

4. https://www.coursera.org/learn/scala-spark-big-data

5. https://www.udemy.com/course/apache-spark-with-scala-hands-on-with-big-data/

Evaluation Scheme

1. **In Semester Assessment (ISA)**

Assessment	Marks
ISA	100
ESA	---
Total	100

Program : Master of Computer Applications		Semester - IV	
Course Title: Software Practices and Testing		Course Code: 23ECAE812	
L-T-P: 2-0-1	Credits: 3	Contact Hours: 4 hrs/week	
ISA Marks: 100	ESA Marks: --	Total Marks: 100	
Teaching Hrs: 30	Practical: 24	Exam Duration: --	
Unit I			
1	**Software Testing Fundamentals** Testing and need of testing, Objectives of software Testing, Software Testing Types, STLC (Software Testing Life Cycle), Quality assurance.		4 hrs
2	**Levels of testing** Unit Testing, Integration Testing, Functional Testing, System Testing Types, Test environment.		5 hrs
3	**Test Case Development** Test Documentation, Test Scenario, Write Test Cases, Test Analysis, Requirements Traceability Matrix, Test Data Generation.		5 hrs
Unit II			
4	**Selenium** Introduction to Selenium, selenium Components & Brief Introduction to each component, Selenium Web Driver, Synchronization in Web Driver, Handling Alerts & Windows, configuring other Browsers, Data Driven Testing		8 hrs
5	**TestNG** Overview of TestNG, Annotation of TestNG, Creating Test Suite, Execution of Test Suite, creating groups, Execution of test case with groups, Creating TestNG.xml file, Parallel of Test Cases, understanding of test results, Running only failed test cases		8 hrs

Text Books:

1. Software Testing –A Craftsman's Approach 4th Edition – Paul C Jorgensen
2. Software Testing – A Self Teaching Introduction – Rajeev Chopra PHD
3. Test Automation using Selenium WebDriver with Java-Navneesh Garg

Reference Books:

1.Software Testing and quality Assurance ,Theory and Practice – Kshirasagar Naik and Priyadarshini Tripathy

Evaluation Scheme

Assessment	Marks
ISA	100
ESA	---

Lab Activities

Sl.No	Activities	Lab Slots
1	Writing test plan	1
2	Writing test cases	1
3	Execution of test cases	1
	Exercises	
4	Write the test plan and test cases for the below scenarios **Flipkart Ecommerce Site.** • Test Scenario: Check Login Functionality. • Test Scenario: Check the Search Functionality • Test Scenario: Check the Product Description Page • Test Scenario: Check the Order History	1
5	**Banking Site** • Test Scenario: Check the Login and Authentication Functionality • Test Scenario: Check Money Transfer can be done • Test Scenario: Check Account Statement can be viewed • Test Scenario: Check Fixed Deposit/Recurring Deposit can be created.	1
6	**Food delivery app** • User registration • Ordering food • Delivery tracking • Payment processing • User Feedback	1
7	Using Selenium and TestNG execute test cases for the above scenarios	1
More exercise on Selenium and TestNG		

1	Design and execute a selenium-based automation solution to display web page using browser.	1
2	Create a selenium automation testing to verify the login functionality of a web page with valid credentials and redirect to the expected landing page.	1
3	Implement a selenium automation testing for search functionality of any web application.	1
4	Design and implement a selenium automation testing to verify the webpage title, ensuring that they match predefined expected title and actual title across different web pages	1
5	Develop a TestNG test suite to validate the functionality and sequencing of TestNG annotations.	1
6	Create a TestNG test suite to verify the login functionality of a web application, validating different sets of login credentials including correct and incorrect.	1
7	Implement a TestNG test class to navigate through different webpages of a website, validating page transitions and displaying the name of visited current page for verification.	1

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Program: Master of Computer Applications		Semester: IV	
Course Title: Virtual Reality Systems		Course Code: 23ECAE813	
L-T-P: 3-0-0	Credits: 3		Contact Hours: 3 hrs/week
ISA Marks: 50	ESA Marks: --		Total Marks: 100
Teaching Hrs: 40	Practical:--		Exam Duration:--

	Unit I	
1	**Introduction to Virtual Reality** Definition and scope of VR, Modern VR experiences, Historical evolution of VR technologies.	4 hrs
2	**Bird's Eye View** Overview of hardware, sensors, displays, Software components, Virtual world generators, Game engines, Human senses and perceptual psychology	4 hrs
3	**A generic VR System** Introduction, The virtual environment, The computer Environment, VR technology, Modes of Interaction, VR systems.	4 hrs
	Unit II	
4	**Geometry in Virtual Worlds** Geometric modelling technique, Coordinate transformations and axis-angle representations, Viewing transformations and their applications Light and Optics Light propagation, Lenses and optical systems, Visual displays.	8 hrs
5	**The Physiology of Human Vision** Eye anatomy**,** Photoreceptors**,** Eye movements**,** Neural vision structures. Visual Perception, Depth and motion perception, Color perception, Multisensory integration.	8 hrs
	Unit – III	
6	**Rendering and Motion** Visual Rendering, Graphical rendering techniques, Ray tracing, Shading, Rasterization VR-specific rendering challenges. Motion in Real and Virtual Worlds, Velocities and acceleration, Vestibular system, Virtual world physics, Simulation and collision detection	6 hrs
7	**Tracking and Interaction** Tracking, Tracking systems, IMU integration, Sensor fusion, Eye tracking, SLAM (Simultaneous Localization and Mapping), Interaction, Locomotion, Manipulation, Social interaction, Specialized interaction mechanisms	6 hrs

Text Books:

1. VIRTUAL REALITY, By Steven M. LaValle. Cambridge University Press, 2023.
2. John Vince, Virtual Reality Systems, Pearson, 2002
3. William R. Sherman, Alan B. Craig, Understanding Virtual Reality, Inteface, Application and Design, MORGAN KAUFMANN PUBLISHERS, 2003

Reference Books:

1. Virtual Reality Technology by Grigore C. Burdea and Philippe Coiffet, Wiley,2017
2. Designing Virtual Reality Systems: The Structured Approach by Gerard Jounghyun Kim,

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	50
ESA	--
Total	100

BACK

Program: Master of Computer Applications		Semester - IV	
Course Title: Internet of Things		Course Code: 23ECAE814	
L-T-P: 3-0-0	Credits: 3	Contact Hours: 4 hrs/week	
ISA Marks: 100	ESA Marks: --	Total Marks: 100	
Teaching Hrs: 40	Practical:--	Exam Duration: --	

	Unit I	
1	**Basics of Networking** Introduction, Network Types, layered network models, Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components.	**8 Hrs**
2	**IoT Sensing and Actuation** Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.	**8 Hrs**
	Unit II	
3	**IoT Processing Topologies and Types** Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.	**8 Hrs**
4	**IoT Connectivity Technologies** Introduction , IEEE 802.15.4 ,Zigbee , Thread , ISA100.11A , WirelessHART ,RFID ,NFC ,DASH7, Z-Wave , Weightless ,Sigfox,LoRa ,NB-IoT ,Wi-Fi , Bluetooth	**8 Hrs**
	Unit – III	
5	**ASSOCIATED IOT TECHNOLOGIES** Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service.	**4 Hrs**
6	**Case Studies Illustrating IoT Design** IOT CASE STUDIES Agricultural IoT – Introduction and Case Studies. Home Automation- smart lighting, home intrusion detection, Cities-smart parking.	**4 Hrs**

Text Books

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, Cambridge University Press 2021.

References Books:

1. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press

Evaluation Scheme

In Semester Assessment (ISA)

Assessment	Marks
ISA	100
ESA	---

BACK

Program: Master of Computer Applications		Semester: IV
Course Title: Wireless Mobile Computing		Course Code: 23ECAE815
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 100	ESA Marks:--	Total Marks: 100
Teaching Hrs: 40	Practical:--	Exam Duration:--

	Unit I	
1	**Introduction** Mobility Of Bits & Bytes, Wireless-The Beginning, Mobile Computing, Dialog Control, Networks, Middleware & Gateways, Applications & Services, Developing Mobile Computing Applications, Security In Mobile Computing, Standard And Standard Bodies And Players In The Wireless Space	3 Hrs
2	**Wireless LAN.** Introduction, Wireless LAN advantages, IEEE 802.11 standards, Wireless LAN architectures, Mobility in Wireless LAN, Deploying Wireless LAN, Mobile adhoc Networks and Sensor Networks. Wireless LAN security, WiFi versus 3G.	3 Hrs
3	**Mobile Computing Architecture.** History of computers, History of Internet, Internet-the ubiquities networks, Architecture for mobile computing, The three-tier architectures, Design consideration for mobile computing, Mobile computing through internet, Making existing applications mobile enable.	5 Hrs
4	**Mobile Computing through Telephony.** Evaluation of telephony, Multiple access procedure, Mobile computing through telephone, Developing an IVR application, Voice XML, Telephony application Programming Interphase (TAPI).	5 Hrs
	Unit II	
5	**Emerging Technologies.** Introduction, Blue-tooth, Radio Frequency Identification (RFID), Wireless Broad Band (WiMAX), Mobile IP, Internet protocol Ver 6 (IP v6), Java card.	4 Hrs
6	**Global System for Mobile Communication** (GSM) Introduction, GSM architectures, GSM entities, Call routing in GSM, PLMN interface, GSM address and identifiers, Network aspect in GSM, GSM frequency allocation, Authentication and security,	4 Hrs
7	**Short Message Services (SMS)** Mobile Computing over SMS, Short Message Services (SMS), Value Added Services through SMS, Accessing the SMS Bearer.	4 Hrs
8	**General Packet Radio Service (GPRS)** Introduction, GPRS and packet data network, GPRS network architecture, GPRS network operation, Data services in GPRS, Application for GPRS, Limitation of GPRS, Billing and Charging in GPRS.	4 Hrs
	Unit – III	
9	**Wireless Application Protocol (WAP)** Introduction, WAP, MMS, GPRS, Application	4 Hrs

10	CDMA & 3G	4 Hrs
	Introduction, Spread Spectrum technology, IS-95, CDMA vs GSM, Wireless Data, 3rd generation network, Application on 3G.	

Text Book:

1. Asoke K Talukder & Roopa R Yavagal . Mobile Computing, Tata McGraw Hill Education Private Limited, New Delhi. Second Edition, 2010.

Reference Books:

1. Raj Kamal , Mobile Computing, Oxford University Press.

Evaluation Scheme

1. **In Semester Assessment (ISA)**

Assessment	Marks
ISA	100
ESA	---
Total	100

BACK

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Program: Master of Computer Applications		Semester: IV
Course Title: Web Content Management		Course Code: 23ECAE816
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 100	ESA Marks: --	Total Marks: 100
Teaching Hrs: 40	Practical:--	Exam Duration:--

	Unit I	
1	**What Content Management Is (and Isn't)** What Is Content?, What Is a Content Management System?, Types of Content Management Systems, What a CMS Does, What a CMS Doesn't Do	4 Hrs
2	**Points of Comparison** Target Site Type, Systems Versus Implementations, Platform Versus Product, Open Source Versus Commercial, Technology Stack, Management Versus Delivery, Coupled Versus Decoupled, Installed Versus Software-as-a-Service (SaaS), Code Versus Content, Code Versus Configuration, Uni- Versus Bidirectional Publishing, Practicality Versus Elegance, and the Problem of Technical Debt	6 Hrs
3	**Acquiring a CMS** Open Source CMSs, Commercial CMSs, Software-as-a-Service, Build Your Own, Questions to Ask	6 Hrs
	Unit II	
4	**The Content Management Team** Editors, Site Planners, Developers, Administrators, Stakeholders	6 Hrs
5	**CMS Feature Analysis** The Difficulties of Feature Analysis, An Overview of CMS Features	4 Hrs
6	**Content Modeling** Data Modeling 101, Data Modeling and Content Management, Separating Content and Presentation, Defining a Content Model, Relationships, Content Composition, Content Model Manageability, A Summary of Content Modeling Features	6 Hrs
	Unit – III	
7	**Content Aggregation** The Shape of Content, Content Geography, Aggregation Models: Implicit and Explicit, Aggregation Functionality, By Configuration or by Code, A Summary of Content Aggregation Features	4 Hrs
8	**Editorial Tools and Workflow** The Content Lifecycle, The Editing Interface, Versioning, Version Control, and Version Labels, Dependency Management, Content Scheduling and Expiration, Workflow and Approvals, Collaboration, Content File Management, Permissions, A Summary of Editorial Tools	4 Hrs

Text Book:
1. Web Content Management, Systems, Features, and Best Practices, Deane Barker, Publisher: O'Reilly Media, March 2016.

WEB CONTENT MANAGEMENT SYSTEM – COURSE PROJECT

COURSE DESCRIPTION:

Today, many web publishers use content management systems (CMS) to allow them to instantly and dynamically update web pages and properties as new content becomes available so that every visit to a site is engaging, informative, and meaningful. The course project shall explore any one of the three most popular open source web-based content management systems—WordPress, Joomla, and Drupal—to create dynamic and flexible websites and landing pages. Students shall explore the fundamentals of planning dynamic websites, CMS database management, developing CSS-controlled site templates, and creating database-driven websites through the planning and creation of their own topic-based sites.

OBJECTIVES

- Introduce learners to any one of the three most popular open source content management systems (CMS) such as WordPress, Drupal, or Joomla.
- Create, deploy and Maintain websites using CMS, including creating and editing content, adding functionality, and creating custom templates and themes.

COURSE PROJECT TITLE: BUILDING WEBSITE USING CMS

(JOOMLA / WORDPRESS OR DRUPAL)

To build website for any real world examples such as Corporate web sites or portals, Online magazines, newspapers, and publications, E-commerce and online reservations, Government applications, Small business web sites, Community-based portals, School, religious web sites or Personal or family homepages using popular Web Content Management System. The website shall facilitate to create, manage, store and deploy content on the Web, including text, graphics, video or audio as a part of Enterprise Content Management.

EXECUTION PLAN:

Sl.No	Demonstration	Implementation	Weightage
1.	**Introducing Content Management Systems** o An overview of some of the different tools and methods that today's web publishers are using to create highly-tailored dynamic web content. o Purchasing and configuring a domain name and web hosting.	1. Introduction to Joomla & Installation 2. Domain Name Registration & Configuration and Hosting 3. Create a Database 4. Content Preparation and Planning	20
2.	**Introduction to Joomla** o Explore the CAM model (Categories, Articles, and	1. Write an article & put your articles in order with categories. 2. Customize Administrator's Panel	20

	Menus) approach to creating content for Joomla environments. ○ Administration and management of users and media. ○ Installing Joomla ○ Exploring the Admin Interface ○ Content creation using the CAM model ○ Content customization: images, video, audio, tags, formats, etc.	3. Change your website's look with Templates. 4. Expand your website's functionality with different extensions. 5. Content creation & Customization using the CAM model	
3.	**Joomla Menus** ○ Creating and controlling menus for Joomla site. ○ To link to articles and create special menu items. ○ Adding and displaying menus ○ Linking menus to articles and other features	1. Categorize the articles which allow grouping your content better. 2. Create menu items for website.	20
4.	**Extending Joomla –Plug-ins, Modules** ○ Use of Joomla, Plug-ins, Modules, Components and other extensions. ○ Installation of extensions, Finding and adding Joomla extensions ○ Adding and setting up 2 "big" extensions (choose blog, calendar, image gallery, Paypal-based shopping cart, or portfolio. Other extensions on approval)	Select Create Joomla Modules for the website such as Feed Display Module, Footer Module, Latest News Module, Search Module, Random Image Module, Who's Online Module etc.	20
5.	**Custom Templates** ○ Explore the addition of creation and uses of customized Joomla templates ○ Modifying templates using CSS and HTML tricks.	Select and Customize template for website.	20

| 6. | **User management and permissions**

 o Explore how to manage users in Joomla site, including managing who sees what based on login, as well as who can do what based on permissions assigned. | Control the use of Captcha, registration allowed and type of registration, default user group new users, reset password, and new user registration email notice to administration. | 20 | |

Evaluation Scheme

1.   **In Semester Assessment (ISA)**

Assessment	Marks
ISA	100
ESA	---
Total	100

BACK