

Curriculum Structure and Curriculum Content for the Academic year: 2025-27

Department: Computer Science and Engineering

Program: M.Tech - Computer Science and Engineering

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Vision and Mission Statements of the 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 endeavors.

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/School

Department Vision

The KLE Tech- School of Computer Science will excel and lead in education, research and innovation in computing and information technology, contributing to the evolving needs of the world we live in.

Department Mission

- To foster a dynamic academic environment with cutting edge curriculum and innovative educational experience to prepare graduates to succeed and lead in a wide range of computing and information technology businesses and occupations.
- To be at the forefront of research through new and exciting innovations leading to the future of computing technologies.
- To collaborate within and beyond discipline to create solutions that benefit humanity and society.

Consolidated View of Program Educational Objectives (PEOs) /Program Outcomes (POs) and Program-Specific Objectives (PSOs)

Program Educational Objectives (PEO)	Program Outcomes (PO)
PEO: 1. Gain in depth knowledge of Computer Science and Engineering and acquire capabilities to compete at global level with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge to conduct research in theoretical, practical and policy context.	PO1: An ability to independently carry out research and development work to solve practical problems.
PEO: 2. Have in depth knowledge and research skills to professionally practice in a variety of fields including databases, computer network, system software and Embedded Systems.	PO2: An ability to write and present a substantial technical report/document.
PEO: 3. Acquire strengths and skills to work in a collaborative and multidisciplinary work and learn techniques to use modern tools required for simulation, modeling and measuring.	PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
PEO: 4. Have knowledge and understanding of managing projects and finance efficiently as a member and leader in a team with greater communication skills preferred by the profession.	PO4: An ability to use modern computational tools in modeling, simulation and analysis with effective participation in multidisciplinary teams and contribute towards achieving the common goals of the team.
PEO: 5. Acquire professional and intellectual integrity and ethics, learn independently and continuously to upgrade the knowledge and competence with enthusiasm.	PO5: An ability to work with integrity and ethics in their professional practice having an understanding of responsibility towards society with sustainable development for life time.

Curriculum Structure-Overall

Semester			Total Program Credit: 88	Year: 2025-27
Courses Semester wise	I	II	III	IV
	Linear Algebra and its Applications 25ECSC701 (2-0-1)	Calculus for Machine Learning and Data Science 25ECSC707 (2-0-1)	Industrial Training / In-House Training 24ECSW801 (0-0-8)	Project Work 24ECSW803(0-0-20)
	Machine Learning 25ECSC702 (3-0-1)	NLP and Gen AI 25ECSC708 (3-0-1)	Minor Project 24ECSW802(0-0-10)	
	Advanced DBMS 25ECSC703 (3-0-1)	Big Data Analytics 25ECSC709 (2-0-1)		
	Wireless Networks 25ECSC704 (3-0-1)	Computer Vision and Image Processing 25ECSC710 (3-0-1)		
	Advanced Operating Systems 25ECSC705 (3-0-1)	Distributed and Cloud Computing 25ECSC711 (3-0-1)		
	Cryptography and Network Security 25ECSC706 (3-0-1)	Professional Elective-1 (3-0-0)		
	Mini Project 25ECSW701 (0-0-3)	Professional Elective-2 (3-0-0)		
Credits	26	24	18	20

Curriculum Scheme - Semester wise
Semester: I

No.	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	25ECSC701	Linear Algebra and its Applications	PC	2-0-1	3	4	67	33	100	2 Hours
2	25ECSC702	Machine Learning	PC	3-0-1	4	5	63	37	100	3 Hours
3	25ECSC703	Advanced DBMS	PC	3-0-1	4	5	63	37	100	3 Hours
4	25ECSC704	Wireless Networks	PC	3-0-1	4	5	63	37	100	3 Hours
5	25ECSC705	Advanced Operating Systems	PC	3-0-1	4	5	63	37	100	3 Hours
6	25ECSC706	Cryptography and Network Security	PC	3-0-1	4	5	63	37	100	3 Hours
7	25ECSW701	Mini Project	PC	0-0-3	3	6	50	50	100	3 Hours
TOTAL				(17-0-9)	26	35	432	268	700	

Note: L: Lecture T: Tutorials P: Practical, ISA: In Semester Assessment ESA: End Semester Assessment

Date:

P G Coordinator

HoD, CSE

Semester - II

No.	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	25ECSC707	Calculus for Machine Learning and Data Science	PC	2-0-1	3	4	67	33	100	2 Hours
2	25ECSC708	NLP and Gen AI	PC	3-0-1	4	5	63	37	100	3 Hours
3	25ECSC709	Big Data Analytics	PC	2-0-1	3	4	67	33	100	2 Hours
4	25ECSC710	Computer Vision and Image Processing	PC	3-0-1	4	5	63	37	100	3 Hours
5	25ECSC711	Distributed and Cloud Computing	PC	3-0-1	4	5	63	37	100	3 Hours
Elective 1 & 2										
6	25ECSE701	Internet of Things	PE	3-0-0	3	3	50	50	100	3 Hours
	25ECSE702	Web Security								
	25ECSE703	Security Operations								
7	25ECSE704	Cyber Security	PC	3-0-0	3	6	50	50	100	3 Hours
	25ECSE705	Augmented Reality and Virtual Reality								
	25ECSE706	Multimedia Processing								
TOTAL				(19-0-5)	24	32	423	277	700	

Note: L: Lecture T: Tutorials P: Practical, ISA: In Semester Assessment ESA: End Semester Assessment PJ-Project, PC-Programme Core, PE-Programme Elective

Date

P G Coordinator

HoD, CSE

Semester: III

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24ECSW801	Industrial Training / In-House Training	PJ	0-0-8	08	16	50	50	100	3 hours
2	24ECSW802	Minor Project	PJ	0-0-10	10	20	50	50	100	3 hours
TOTAL				18 (0-0-18)	18	36	100	100	200	

Note: L: Lecture T: Tutorials P: Practical, ISA: In Semester Assessment ESA: End Semester Assessment PJ-Project

Date:

P G Coordinator

HoD, CSE

Semester: IV

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	24ECSW803	Project Work	PJ	0-0-20	20	40	50	50	100	3 hours
TOTAL				0-0-20	20	40				

Note: L: Lecture T: Tutorials P: Practical, ISA: In Semester Assessment ESA: End Semester Assessment PJ-Project, PC-Programme Core, PE-Programme Elective

Date:

P G Coordinator

HoD, CSE

Consolidated Credits of all semesters:

Semester	I	II	III	IV	Total
Credits	26	24	18	20	88

List of Program Electives

Sr. No	Name of the Course	Course Code
1.	Internet of Things	25ECSE701
2.	Web Security	25ECSE702
3.	Security Operations	25ECSE703
4.	Cyber Security	25ECSE704
5.	Augmented Reality and Virtual Reality	25ECSE705
6.	Multimedia Processing	25ECSE706

Curriculum Content- Course wise

I SEMESTER

Program: Master of Technology		Semester I
Course Title: Linear Algebra and its Applications		Course Code: 25ECSC701
L-T-P: 2-0-1	Credits: 3	Contact Hrs: 4 hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hrs: 28	Lab: 28hrs	Exam Duration: 2 hrs

1	Chapter 1: Vectors and Matrices Introduction, Scalars, Vectors, Matrices, Tensors; Vector operations: addition, scalar multiplication, dot product, cross product Matrix operations: addition, multiplication, transpose Matrix types: Identity, diagonal, symmetric, orthogonal Practical: Vector operations with NumPy	6 hrs
2	Chapter 2: Systems of Linear Equations Solving linear equations using matrix algebra, Row echelon form and Gaussian elimination, Matrix inversion and rank Application: Linear regression using the Normal Equation	6 hrs
3	Chapter 3: Vector Spaces and Subspaces Vector spaces, bases, dimension Linear independence and span Column space, null space Practical: Basis transformations and feature spaces in ML	6 hrs
4	Chapter 4: Eigenvalues and Eigenvectors Characteristic polynomial Diagonalization Difference Equations and Powers Application: Principal Component Analysis (PCA), PageRank	6 hrs
5	Chapter 5: Norms and Distance Metrics Vector norms (L1, L2, etc.) Distance measures: Euclidean, Cosine Application: KNN, clustering, regularization in ML (Lasso, Ridge)	4 hrs
Text Books: 1. <i>Linear Algebra and Its Applications</i> by Gilbert Strang, <i>Fourth Edition</i>, CENGAGE Learning, 2012 2. Introduction to Linear Algebra, Gilbert Strang, Wellesley-Cambridge Press 5th Edition (2016)		
Reference Books: 1. Deep Learning , Ian Goodfellow, Yoshua Bengio, Aaron Courville, The MIT Press November 2016		

Evaluation Scheme:

ISA Scheme

Assessment	Conducted for marks	Weightage
ISA-1 (Theory)	15	33
ISA-2 (Theory)	15	
Laboratory Assessment	20	34
Total	50	67

ESA Scheme

Parts	Questions	Chapter numbers	Instructions
A	6 questions of 5 marks	Whole Syllabus	Answer all questions
B	5 questions of 10 marks		Answer all questions
C	2 questions of 20 marks		Answer any one

List of Experiments for the Linear Algebra and its Applications

1. Image Transformation and Compression

- Use linear transformations like rotations, scaling, and shearing to manipulate images.
- Apply Singular Value Decomposition (SVD) for image compression—reduce image size while maintaining quality.

2. Google PageRank Algorithm

- Implement the PageRank algorithm using Markov Chains and Eigenvalues.
- Understand how Google's search engine ranks pages based on link structures.

3. Facial Recognition Using Eigenfaces

- Use Principal Component Analysis (PCA) to represent faces in a lower-dimensional space.
- Experiment with face recognition by reconstructing images from their principal components.

4. Cryptography with Hill Cipher

- Explore the Hill Cipher for encryption and decryption.
- Understand how matrix multiplication is used for secure communication.

5. Network Flow Analysis

- Apply linear algebra to model and solve network flow problems, such as optimizing traffic flow or data packets.

6. Machine Learning: Linear Regression and Classification

- Use linear algebra for gradient descent and optimization in machine learning models.
- Implement linear classifiers like Support Vector Machines (SVM) or Logistic Regression.

7. Robotics: Kinematics and Path Planning

- Model robot movement using transformation matrices and vector spaces.
- Simulate arm movement or pathfinding using linear algebra concepts.

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Program: Master of Technology		Semester I
Course Title: Machine Learning		Course Code: 25ECSC702
L-T-P : 3-0-1	Credits: 4	Contact Hrs: 5hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 42	Lab: 28 hrs	Exam Duration: 3 Hrs

	Content	Hrs
1	Chapter 1: Introduction to Machine Learning Definition of Machine Learning, Types of Learning: Supervised, Unsupervised, Semi-supervised, Reinforcement Learning Applications of Machine Learning Basic concepts: Hypothesis Space, Inductive Bias, Overfitting vs. Underfitting Evaluation Metrics: Accuracy, Precision, Recall, F1 Score, ROC, AUC	5 hrs
2	Chapter 2: Supervised and Unsupervised Learning Linear Regression, Polynomial Regression Logistic Regression Decision Trees and Random Forests Support Vector Machines (SVM) k-Nearest Neighbors (k-NN) Naive Bayes Classifier Clustering: K-Means, Hierarchical Clustering, DBSCAN Dimensionality Reduction: PCA, LDA, t-SNE Anomaly Detection	5hrs
3	Chapter 3: Understanding Deep Learning and its application: Introduction to Deep Learning (DL), DL Applications in various domains, Supervised and unsupervised learning, Model training, over fitting, model deployment, inferencing. Convolution Neural Networks (CNN): Convolution & Pooling, Dropout, Deep Learning Architectures: INCEPTION-V3, VGG-16, and RESNET-50.	6 hrs
4	Chapter 4: Transfer Learning: Transfer Learning Scenarios, Applications of Transfer Learning, Transfer Learning Methods, Fine Tuning and Data Augmentation, Related Research Areas. Variants of CNN: DenseNet, PixelNet.	5 hrs
5	Chapter 5: Deep Learning Applications in Image Processing: Image Classification: Image representation & preprocessing, Convolution layers and pooling operations, Case studies on Image Classification.	5 hrs
6	Chapter 6: Sequence Modelling – Recurrent Neural Networks Introduction to sequence modeling, Recurrent Neural Networks, Bidirectional RNNs, applications of RNN in Natural Language Processing.	6 hrs
7	Chapter 7: Generative Network: Understanding Generative Adversarial Networks, Architecture, Loss functions, Training challenges, Variants DCGAN, CGAN, WGAN, Style GAN	5 hrs

8	Chapter 8: Applications of Generative Network Image In painting, Image Super Resolution, Colorization of Black and White Images, Human Face Generation, Text2Image.	5 hrs
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TextBooks

1. Pattern Recognition and Machine Learning, Christopher M. Bishop Springer, August, 2006
2. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy The MIT Press, August 24, 2012

References

1. Deep Learning , Ian Goodfellow, Yoshua Bengio, Aaron Courville, The MIT Press November 2016

Evaluation Scheme:
ISA Scheme

Assessment	Conducted for marks	Weightage
ISA-1 (Theory)	15	37
ISA-2 (Theory)	15	
Laboratory Assessment	20	26
Total	50	63

ESA Scheme

Parts	Questions	Chapter numbers	Instructions
A	6 questions of 5 marks	Whole Syllabus	Answer all questions
B	5 questions of 10 marks		Answer all questions
C	2 questions of 20 marks		Answer any one

List of Experiments for Machine Learning

Supervised Learning

1. **Linear Regression:** Simple and multiple linear regression, performance metrics (MSE, R^2).
2. **Logistic Regression:** Binary and multi-class classification, decision boundary visualization.
3. **Decision Trees & Random Forests:** Construction, pruning, feature importance, and visualization.
4. **Support Vector Machines (SVM):** Hyperplane visualization, kernel tricks, and margin optimization.
5. **K-Nearest Neighbors (KNN):** Distance metrics, choice of K, and performance analysis.
6. **Naive Bayes Classification:** Gaussian, Multinomial, and Bernoulli Naive Bayes.
7. **Gradient Boosting & XGBoost:** Boosted decision trees, parameter tuning, and evaluation.

Unsupervised Learning

1. **K-Means Clustering:** Centroid selection, inertia, and elbow method.
2. **Hierarchical Clustering:** Agglomerative vs. divisive, dendrogram visualization.
3. **Principal Component Analysis (PCA):** Dimensionality reduction, eigenvalues, and variance explained.
4. **t-SNE and UMAP:** High-dimensional data visualization.
5. **DBSCAN (Density-Based Spatial Clustering):** Handling noise and arbitrary-shaped clusters.
6. **Association Rule Mining:** Apriori and FP-Growth algorithms for market basket analysis.

Deep Learning

1. **Neural Networks (NN):** Architecture design, activation functions, and backpropagation.
2. **Convolutional Neural Networks (CNN):** Image classification, feature extraction, and visualization.
3. **Recurrent Neural Networks (RNN) & LSTM:** Sequence prediction, time-series analysis, and text processing.
4. **Autoencoders:** Dimensionality reduction and anomaly detection.
5. **Generative Adversarial Networks (GANs):** Image generation and style transfer.

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Program: Master of Technology		Semester I
Course Title: Advanced Database Management System		Course Code: 25ECSC703
L-T-P-Self Study: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 42hrs.	Lab: 28 hrs.	Exam Duration: 3 hrs.

1	Chapter 1: Advanced Relational Concepts: Review of relational databases: schemas, keys, integrity constraints Advanced SQL: nested queries, triggers, stored procedures, indexing Query optimization: cost estimation, join algorithms, query rewriting	7 hrs
2	Chapter 2: Distributed Databases: Architecture and design of distributed DBMS Data fragmentation, replication, and allocation strategies Distributed query processing and optimization Concurrency control and recovery in distributed systems.	7 hrs
3	Chapter 3: Object-Oriented and Object-Relational Databases Object-oriented database concepts: classes, inheritance, encapsulation Object-relational features: user-defined types, inheritance, polymorphism Query languages for object databases	7 hrs
4	Chapter 4: Data Warehousing and OLAP Data warehouse architecture and design ETL processes and data cleaning OLAP operations: roll-up, drill-down, slicing, dicing Materialized views and query optimization in OLAP	7 hrs
5	Chapter 5: Data Mining and Information Retrieval Introduction to data mining: association rules, clustering, classification Information retrieval models and indexing techniques Text mining and web mining basics	7 hrs
6	Chapter 6: Big Data Technologies NoSQL databases: key-value stores, document databases, column-family stores Big data technologies: Hadoop, MapReduce, Spark Cloud databases and database-as-a-service (DBaaS) Security and privacy in databases	7 hrs

Text Books:

1. *Database Management Systems*, Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, McGraw-Hill Education, 2003
2. *Advanced Database Management System*, Preeti Gupta, Notion Press
3. *Advanced Database Management Systems*, Dr. R. Krishnamurthy, Wiley India

Reference Books:

1. *Advanced Database Management System (ADBMS)* Dr. S. B. Navathe, Publisher: Pearson 7th Edition, 2015

Evaluation Scheme:ISA Scheme

Assessment	Conducted for marks	Weightage
ISA-1 (Theory)	50	37
ISA-2 (Theory)	50	
Laboratory Assessment	60	26
Total		63

ESA Scheme

Parts	Questions	Chapter numbers	Instructions
A	6 questions of 5 marks	Whole Syllabus	Answer all questions
B	5 questions of 10 marks		Answer all questions
C	2 questions of 20 marks		Answer any one

List of Experiments:

1. Implementation of advanced SQL queries and PL/SQL procedures
2. Design and development of distributed databases
3. Data warehouse creation and OLAP operations using tools like Pentaho or Microsoft SSAS
4. Basic data mining tasks using Weka or RapidMiner
5. Working with NoSQL databases like MongoDB or Cassandra
6. Star and Snowflake Schema Design: Implement dimensional modeling for data warehouses.
7. ETL (Extract, Transform, Load) Process: Perform data extraction, transformation, and loading.
8. OLAP Operations: Execute roll-up, drill-down, slicing, and dicing.
9. NoSQL Databases
10. Document-oriented Databases: Experiment with MongoDB CRUD operations.
11. Key-Value Stores: Use Redis or DynamoDB for key-value data storage.
12. Column-family Stores: Work with Cassandra for column-oriented storage.

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Program: Master of Technology		Semester I
Course Title: Wireless Networks		Course Code: 25ECSC704
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 42	Lab: 28hrs	Exam Duration: 3 hrs

1	Chapter 1: Overview of Computer Networks: Transmission Fundamentals: Signals for Conveying Information, Analog and Digital Data Transmission, Channel Capacity, Transmission Media, Multiplexing ; Communication networks: LANs, MANs, and WANs, Switching Techniques, Circuit Switching, Packet Switching, Quality of Service; Protocols and TCP/IP : The Need for a Protocol Architecture, The TCP/IP Protocol Architecture, The OSI Model Internetworking.	8 hrs
2	Chapter 2 : Wireless communications Technology: Wireless signal : Spectrum Considerations, Line- of-Sight Transmission, Fading in the Mobile Environment, Channel Correction Mechanisms, Digital Signal Encoding Techniques, Coding and Error Control, Orthogonal Frequency Division Multiplexing (OFDM), Spread Spectrum; Wireless LAN: IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control.	8 hrs
3	Chapter 3: Wireless Mobile Networks Cellular wireless networks : Principles of Cellular Networks, First-Generation Analog, Second-Generation TDMA, CDMA, Third-Generation Systems; Fourth-generation systems and Long Term Evolution (LTE): Purpose, Motivation, and Approach to 4G, LTE Architecture, Evolved Packet Core, LTE Resource Management, LTE Channel Structure and Protocols , LTE Radio Access Network, LTE-Advanced.	8 hrs
4	Chapter 4: Mobile applications : Mobile Application Platforms : Resource Constraints, The Interaction Layer, Two Example Hardware Stacks; Mobile IP : Operation of Mobile IP, Discovery, Registration, Tunneling; Long range communication: Satellite Parameters and Configurations, Satellite Capacity Allocation, Satellite Applications, Fixed Broadband Wireless Access, WiMAX/IEEE 802.16 IEEE 802.16 Architecture and MAC Layer, Smart Grid.	8 hrs
5	Chapter 5: 5G Use Cases and Architecture: NGMN 5G Architecture Framework: Layered Functionality, Network Slicing; 3GPP 5G Architecture. 5G Core Network Architecture, Radio Access Network Architecture, Session Establishment.	5 hrs

6	Chapter 6: MEC and 5G: MEC Architectural Concepts, MEC Support for Network Slicing, MEC Use Cases: Consumer-Oriented Services , Operator and Third-Party Services , Network Performance and QoS Improvements	5 hrs
Text Books: 1. Cory Beard and William Stallings, “Wireless Communication Networks and Systems” , Global Edition(Edition 1), Pearson, 5 January 2016 2. William Stallings, “5G Wireless A Comprehensive Introduction”, 1st Edition, Addison-Wesley, 2021.		
Reference Books: 1. Kaveh Pahlavan & Prashant Krishnamurthy, “Wireless and Mobile Networks”, Prentice Hall, January 1, 2001 2. Erik Dahlman, Stefan Parkvall, Johan Skold, “5G NR: The next generation wireless access technology”, 2nd Edition, Academic Press Inc, 2020. 3. Jochen Schiller , Mobile Communications (2nd Edition), Addison-Wesley (Pearson Education), August 7, 2003		

Evaluation Scheme:

ISA Scheme

Assessment	Conducted for marks	Weightage
ISA-1 (Theory)	50	37
ISA-2 (Theory)	50	
Laboratory Assessment	60	26
Total		63

ESA Scheme

Parts	Questions	Chapter numbers	Instructions
A	6 questions of 5 marks	Whole Syllabus	Answer all questions
B	5 questions of 10 marks		Answer all questions
C	2 questions of 20 marks		Answer any one

Lab experiments

Expt./Job No.	Brief description about the experiment/job	No. of Lab. Slots per batch (estimate)
1	Simulation of Wireless Networks Using NS2/NS3 - Creating a simple wireless topology - Throughput and packet loss analysis under different conditions	02
2	IoT-Based Wireless Communication (ESP8266/ESP32 + Arduino) - Sending sensor data over Wi-Fi to cloud - Mobile app integration (e.g., Blynk, MQTT)	02
3	Set Up and Configuration of Ad-hoc Network - Peer-to-peer wireless communication - File and data transfer in absence of a central access point	02
4	5G Use Case Simulation - Simulate eMBB, mMTC, and URLLC traffic scenarios using NS-3 or MATLAB. - Measure latency, throughput, and packet loss.	02
5	Network Slicing - Create virtual network slices using Mininet or Kubernetes for isolated services. - Demonstrate how slices are used for different use cases (e.g., IoT, video streaming).	02
6	Simulate Mobile Edge Compute with Network Slicing Combine MEC and network slicing: assign slices to different edge applications and analyze performance.	02
7	Field Work: Testing Network Coverage in a Campus Environment - Site survey with heatmap generation - Reporting blackspots and suggesting AP placement	02

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Program: Master of Technology		Semester I
Course Title: Advanced Operating Systems		Course Code: 25ECSC705
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 42	Lab: 28hrs	Exam Duration: 3 hrs

1	Chapter 1. Operating System Overview Operating System objectives and functions. The evolution of OS, Major achievements, Developments leading to modern OS, Virtual machines, Overview of Linux.	5 hrs.
2	Chapter 2. Processes Management Processes -Definition, ProcessStates, ProcessDescription, ProcessControl, Security issues.ProcessThreads, Types of threads, Symmetric multiprocessing support. Linux process and thread management. Concurrency -Principles of concurrency, Mutual exclusion, Semaphores, Message passing, Reader's problem, Deadlock- Prevention, Avoidance and Detection. Scheduling -Uniprocessor scheduling- Types of processor scheduling, Scheduling algorithms, Multiprocessor scheduling, Unix scheduling.	10hrs.
3	Chapter 3. Memory Management and Virtual Memory Memory managementRequirements: Relocation, Protection, Sharing, Logical organization, and Physical organization.Memory Partitioning:Fixed portioning, Dynamic portioning, Buddy system, Relocation. Paging, Segmentation, Security issues: Buffer overflow attacks, defending against buffer overflow. Virtual memory - Hardware and Control Structures, Operating System software, Linux memory management.	8 hrs.
4	Chapter 4.File Management Overview, File Organization and Access, B-Tree , File Directories, File Sharing, Record blocking, File system security, Linux virtual file management, Window file management.	7 hrs.
5	Chapter 5. Distributed Operating Systems Distributed System Goals, Types of Distributed Systems, and Styles & Architecture of Distributed Systems, Threads, Virtualization, Clients/Servers computing, Code Migration, and Communication in Distributed Systems.	7 hrs.
6	Chapter 6. Distributed Systems & Synchronization Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning of Nodes, Data-Centric Consistency Models, Client-Centric Consistency Models, Consistency Protocols.	5 hrs.

Text Books:

1. William Stallings: Operating Systems- Internals and Design Principles, 10th Edition, Prentice Hall, 2018.
2. Gary Nutt, Nabendu Chaki, Sarmistha Neogy: Operating Systems, 3rd Edition, Pearson Education, 2021.
3. Distributed Systems, Second edition, Andrew Tanenbaum, Maarten Van teen. W. Richard Stevens, Stephen A. Rago, Advanced Programming in the UNIX Environment, 3rd Edition, Addison Wesley Professional, 2013.
4. Terrence Chan, Unix System Programming Using C++, 1 ed., Prentice Hall India, 2007.

Reference Books:

1. Abraham Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008.
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2022.
3. Charles Crowley: Operating System, design-oriented approach, 2017.

Evaluation Scheme:
ISA Scheme

Assessment	Conducted for Marks	Weightage
ISA-1	20	37
ISA-2	20	
Laboratory Assessment	10	26
Total	50	63

ESA Scheme

Parts	Questions	Chapter numbers	Instructions
A	6 questions of 5 marks	Whole Syllabus	Answer all questions
B	5 questions of 10 marks		Answer all questions
C	2 questions of 20 marks		Answer any one

List of Experiments

Expt/ Job No	Experiment/ Job details	No. of Lab sessions/batch
1	Implementation and use of operating system functions such as process management, inter-process communication.	2
2	Implementation of Primitive and non-primitive Scheduling Algorithms.	2
3	Implementation and use of operating system functions Process synchronization and deadlock	2
4	Implementation of Memory management - Paging Algorithms	2
5	Implementation of File system and its operations.	2
6	Implementation of Race Condition and Inter Process Communication (IPC): Pipes and FIFO	2
7	Implementation of Multi-threading, File and record Locking	2

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Program: Master of Technology		Semester I
Course Title: Cryptography & Network Security		Course Code: 25ECSC706
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 42	Lab: 28hrs	Exam Duration: 3 hrs

1	Chapter 1: Introduction: Cyber security, Information Security, and Network Security, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Cryptography, and Network Security	5hrs
2	Chapter 2 : Cryptographic Algorithms: Symmetric cipher : Symmetric Cipher Model Substitution Techniques, Transposition Techniques Traditional Block Cipher Structure, The Data Encryption Standard, Block Cipher Operation : Electronic Codebook. Cipher Block Chaining Mode, Cipher Feedback Mode. Output Feedback Mode. Counter Mode, AES Structure, AES Transformation Functions, AES Key Expansion	6hrs
3	Chapter 3: Cryptographic Algorithms: ASymmetric cipher : Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie–Hellman Key Exchange, ElGamal Cryptographic System; Elliptic Curve Arithmetic. Elliptic Curve Cryptography; Cryptographic Key Management and Distribution : Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption	10hrs
4	Chapter 4: Cryptographic data integrity algorithms: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Security Requirements for Cryptographic Hash Functions, Secure Hash Algorithm (SHA), Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Secure Hash Algorithm (SHA), Message Authentication Requirements, Message Authentication Functions, MACs Based on Hash Functions: HMAC, Digital Signatures, NIST Digital Signature Algorithm	8hrs
5	Chapter 5: Network Security Protocols: Introduction Pretty Good Privacy and S/MIME, Secure Sockets Layer, HTTPs, Kerberos, SSH, DomainKeys Identified Mail (DKIM), IPsec overview, Encapsulating security payload, combining security associations, Internet key exchange; IEEE 802.11i Wireless Lan Security: Services and phases of operation, WPA and WPA2	8hrs



6	Chapter 6: Internet of Things (IoT) Security: IoT Security Concepts and Objectives , An Open-Source IoT Security Module	5hrs
Text Books: 1. William Stallings, Cryptography and Network Security Principles and Practices, 8th Edition, Pearson, June 6, 2022.		
Reference Books: 1. Behrouz A. Forouzan, Debdeep Mukhopadhyay, " Cryptography and Network Security" , 3rd Edition (SIE) McGraw Hill Education (India) Private Limited, 2015, ISBN: 9339220943 2. Mark Stamp, "Information Security: Principles and Practices", 3rd Edition, John Wiley & Sons, 2021, ISBN-13: 978-1119505907		

Evaluation Scheme:

ISA Scheme

Assessment	Conducted for marks	Weightage
ISA-1 (Theory)	50	37
ISA-2 (Theory)	50	
Laboratory Assessment	60	26
Total		63

ESA Scheme

Parts	Questions	Chapter numbers	Instructions
A	6 questions of 5 marks	Whole Syllabus	Answer all questions
B	5 questions of 10 marks		Answer all questions
C	2 questions of 20 marks		Answer any one

List of Experiments

Expt./Job No.	Brief description about the experiment/job	No. of Lab. Slots
1.	Demo and practice on Crypto Library	1
2.	Implementation of substitution cipher	2
3.	Implementation of symmetric key algorithm	2
4.	Implementation of asymmetric key algorithm	2
5.	Implementation Hash algorithms	2
6.	Implementation of Applications of SSH, SSL, HTTPS, IPSC	2
7.	Seminar on research papers : Advanced topics of cryptography and network security	3

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Program: Master of Technology		Semester I
Course Title: Mini Project		Course Code: 25ECSW701
L-T-P: 0-0-3	Credits: 3	Contact Hrs: 6 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: --	Lab: 84hrs	Exam Duration: 3 hrs

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Conduct the survey and formulate the problem statement in selected area of research
2. Explore domain knowledge to collect the requirements to develop the project
3. Design the methodology for implementing project
4. Measure the performance of the research by analyzing the results
5. Acquire soft and technical writing skills

Evaluation:

ISA Scheme and ESA

	Assessment	Weightage in Marks
ISA (50)	Review 1	10
	Review 2	15
	Review 3	20
	Report review	05
ESA (50)	--	50
Total		100

Laboratory Plan

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions (3 hrs/session)
1.	Literature Survey, defining the Problem statement and objectives	09
2.	Review 1	01
3.	High level & Low level design, Methodology and Implementation	08
4.	Review 2	01
5.	Result discussion and report writing	08
6.	Review 3	01

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II SEMSTER

Program: Master of Technology		Semester II
Course Title: Calculus for Machine Learning and Data Science		Course Code: 25ECSC707
L-T-P: 2-0-1	Credits: 3	Contact Hrs: 4 hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hrs: 28 hrs	Lab: 28hrs	Exam Duration: 2 hrs

1	Chapter 1: Functions and Limits Types of functions (linear, exponential, sigmoid, etc.), Domain, range, and graph interpretation, Limits and continuity, Application: Activation functions in neural networks (ReLU, sigmoid, tanh)	5 hrs
2	Chapter 2: Differential Calculus Derivatives and rules (product, quotient, chain rule) Higher-order derivatives, Partial derivatives and gradients, Directional derivatives and Jacobians, Application: Gradient descent algorithm, optimization in ML	5 hrs
3	Chapter 3: Multivariable Calculus Functions of several variables, Partial derivatives and gradient vectors, Hessian matrix and its significance in convexity, Taylor series expansion (1D & multivariate), Application: Cost functions in neural networks, curvature analysis	6 hrs
4	Chapter 4: Optimization Techniques Maxima, minima, saddle points, Constrained optimization: Lagrange multipliers, Convex functions and convex optimization, Application: Logistic regression, loss function minimization	6 hrs
5	Chapter 5: Integral Calculus Indefinite and definite integrals, Area under curves and probability density, Multiple integrals and volume interpretation, Application: Expectation in probabilistic ML models, marginal probabilities	6 hrs

Text Books:

1. *Calculus: Early Transcendentals*, James Stewart, Cengage Learning 8th Edition, February 4, 2015

Reference Books:

1. *Deep Learning*, Ian Goodfellow, Yoshua Bengio, Aaron Courville, The MIT Press November 2016



Evaluation Scheme:

ISA Scheme

Assessment	Conducted for marks	Weightage
ISA-1 (Theory)	15	33
ISA-2 (Theory)	15	
Laboratory Assessment	20	34
Total	50	67

ESA Scheme

Parts	Questions	Chapter numbers	Instructions
A	6 questions of 5 marks	Whole Syllabus	Answer all questions
B	5 questions of 10 marks		Answer all questions
C	2 questions of 20 marks		Answer any one

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Program: Master of Technology		Semester II
Course Title: Natural language processing and Gen AI		Course Code: 25ECSC708
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: : 42	Lab: 28hrs	Exam Duration: 3 hrs

1	Foundational concepts of Natural Language Processing (NLP): Text Preprocessing, Text representation, Word Embeddings, Syntax and Semantics, Language Modeling, Evaluation Metrics for NLP	6 hrs
2	Machine Translation, Auto encoders and decoders Machine Translation, Seq2Seq and Attention, Autoencoder and decoders.	6 hrs
3	Transformer Networks & Diffusion models Transformer Networks, transformers for text generation, Diffusion models – continuous vs discrete, deterministic vs stochastic models.	6 hrs
4	Generative Adversarial Networks Generative vs. Discriminative models, Generative Adversarial Networks and Language Models, types of GANs.	8 hrs
5	Large Language Models Introductions to LLM's, LLM - BERT and GPT models, prompting techniques, Adapters and low rank adoption (LoRA).	8 hrs
6	NLP Applications: Machine translation, Text summarization, Information extraction, Speech recognition.	8 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

References:

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft).
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning. MIT Press.

Evaluation Scheme (ISA)

SL. No.	Section	Conducted for marks	Weightage in Marks
i.	ISA -I	15	37
ii.	ISA – II	15	
iii.	Lab Evaluation	20	26
Total		50	63

List of Experiments

1. Text Preprocessing and Representation

Tokenization and Normalization:

- Sentence splitting, word tokenization, lemmatization, stemming, and stopword removal.
- Case conversion, removing punctuation, and handling special characters.

Vector Representations:

- One-hot encoding, Bag of Words (BoW), TF-IDF (Term Frequency-Inverse Document Frequency).
- Word embeddings: Word2Vec, GloVe, and FastText.

Named Entity Recognition (NER):

- Identifying entities (e.g., person, location, date) using NLTK or spaCy.

2. Syntactic and Semantic Analysis

Part-of-Speech (POS) Tagging:

- Implementing POS tagging with rule-based, statistical, and neural methods.

Parsing Techniques:

- Dependency parsing and constituency parsing to understand grammatical structure.

Word Sense Disambiguation:

- Using context to resolve the meaning of ambiguous words.

Coreference Resolution:

- Linking pronouns to the correct entities in a sentence.

3. Language Modeling and Text Generation

N-gram Language Models:

- Building n-gram models for sequence prediction.

Recurrent Neural Networks (RNNs) and LSTMs:

- Implementing RNNs and LSTMs for text generation tasks.



Transformer Models:

- Hands-on with Transformer-based models (BERT, GPT).
- Fine-tuning pre-trained models for specific NLP tasks.

4. Machine Translation and Summarization

Neural Machine Translation (NMT):

- Building models for translating text between languages.

Text Summarization:

- Implementing extractive and abstractive summarization techniques.

5. Information Retrieval and Chatbots

Search and Ranking Algorithms:

- Building search engines with relevance ranking using TF-IDF and BM25.

Question Answering Systems:

- Creating models to extract answers from documents.

Chatbot Development:

- Developing rule-based and neural chatbot systems with intent detection.

6. Generative AI Techniques

Autoencoders:

- Building basic and variational autoencoders for feature learning and image generation.

Generative Adversarial Networks (GANs):

- Implementing GANs for synthetic data generation, image synthesis, and domain adaptation.

Prompt Engineering:

- Experimenting with prompts for large language models like GPT-4 for creative and structured outputs.

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Program: Master of Technology		Semester II
Course Title: Big Data Analytics		Course Code: 25ECSC709
L-T-P : 2-0-1	Credits: 3	Contact Hrs: 04 hrs/week
ISA Marks: 67	ESA Marks: 33	Total Marks: 100
Teaching Hrs: 28	Lab: 28hrs	Exam Duration: 3 Hrs
	Content	Hrs
1.	Chapter 1. Introduction to Big Data Analytics: Big Data Overview - Data Structures, Analyst Perspective on Data Repositories, State of the Practice in Analytic - BI Versus Data Science, Current Analytical Architecture, Drivers of Big Data, Emerging Big Data Ecosystem and a New Approach to Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics.	6 hrs
2	Chapter 2. Data Analytics Lifecycle : Data Analytics Lifecycle Overview - Key Roles for a Successful Analytics Project, Background and Overview of Data Analytics Lifecycle, Phase 1 - Discovery, Phase 2 - Data Preparation, Phase 3 - Model Planning, Phase 4 - Model Building, Common Tools for the Model Building Phase.	6 hrs
3	Chapter 3. Big Data Storage Concepts : Clusters , File Systems and Distributed File Systems, NoSQL, Sharding, Replication, Combining Sharding and Replication.	5 hrs
4	Chapter 4. Big Data Processing Concepts : Parallel Data Processing, Distributed Data Processing, Hadoop, Processing Workloads, Cluster, Processing in Batch Mode, Processing in Real-time Mode.Map Reduce, Algorithms using Map Reduce - Matrix-Vector Multiplication by MapReduce , Computing Selections by MapReduce,	5 hrs
5	Chapter 5. Advanced Analytical Theory and Methods: Time Series Analysis - Overview of Time Series Analysis, Box-Jenkins Methodology, ARIMA Model, Autocorrelation Function (ACF), Autoregressive Models, Moving Average Models, ARMA and ARIMA Models, Building and Evaluating an ARIMA Model. Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency—Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments.	6 hrs
Text Books: 1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publications. 2. Thomas Erl, WajidKhattak, and Paul Buhler, "Big Data Fundamentals Concepts, Drivers & Techniques", Prentice Hall, 2015.		

3. AnandRajaraman and Jeff Ullman, "Mining of Massive Datasets", Cambridge Press, <http://infolab.stanford.edu/~ullman/mmds/book.pdf>.

Reference Books:

1. Frank J Ohlhorst, "Big Data and Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series, 2012.
2. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Elsevier, 2007.

Evaluation Scheme:
ISA Scheme

Assessment	Conducted for marks	Weightage
ISA-1 (Theory)	15	33
ISA-2 (Theory)	15	
Laboratory Assessment	20	34
Total	50	67

ESA Scheme

Parts	Questions	Chapter numbers	Instructions
A	6 questions of 5 marks	Whole Syllabus	Answer all questions
B	5 questions of 10 marks		Answer all questions
C	2 questions of 20 marks		Answer any one

List of Experiments:

Exp No	Experiments	Lab slots
1	Install, configure and run Hadoop and HDFS.	2
2	Implement word count / frequency programs using MapReduce.	2
3	Implement sharding in big data using HDFS.	2
4	Prepare data set using big data sandbox tools.	2
5	Implement a MapReduce program that processes a dataset.	2
6	Implement NoSQL Database Operations: CRUD operations, Arrays and Functions using MongoDB	2
7	Process real time data using spark.	2

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Program: Master of Technology		Semester II
CourseTitle: Computer Vision and Image Processing		CourseCode: 25ECSC710
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 42	Lab: 28hrs	Exam Duration: 3 hrs

1	Chapter 1: Introduction to Computer Vision Distinction between image processing and computer vision, Applications: object recognition, medical imaging, surveillance, robotics	5 hrs
2	Chapter 2 Image Formation and Camera Models Pinhole camera model, perspective projection, Camera calibration, lens distortion, Color spaces and image representation	5 hrs
3	Chapter 3: Image Processing Techniques Filtering: convolution, Gaussian filters, edge detection (Sobel, Canny), Histogram equalization, noise reduction	5 hrs
4	Chapter 4: Image Segmentation Thresholding, region growing, clustering methods, Graph-based segmentation, Mean-Shift, MRFs	5 hrs
5	Chapter 5: 3D Vision and Geometry Stereo vision, depth estimation, Epipolar geometry, fundamental matrix, Structure from motion, 3D reconstruction	5 hrs
6	Chapter 6: Motion Analysis and Tracking Optical flow estimation, Kalman and particle filters, Object tracking algorithms	5 hrs
7	Chapter 7: Object Recognition and Classification Template matching, bag-of-words model, Support Vector Machines (SVM), k-NN classifiers, Deep learning approaches: CNNs	6 hrs
8	Chapter 8: Advanced Topics Scene understanding, semantic segmentation, Facial recognition systems, Augmented reality applications	6 hrs

Text Books:

1. William Stallings, "Cryptography and Network Security Principles And Practices", 7th Edition, Pearson, 2017. Willi

Reference Books:

1. *Multiple View Geometry in Computer Vision*, Richard Hartley & Andrew Zisserman
Second Edition, Cambridge University Press, April 19, 2004

Evaluation Scheme:

ISA Scheme

Assessment	Conducted for marks	Weightage
ISA-1 (Theory)	15	37
ISA-2 (Theory)	15	
Laboratory Assessment	20	26
Total	50	63

ESA Scheme

Parts	Questions	Chapter numbers	Instructions
A	6 questions of 5 marks	Whole Syllabus	Answer all questions
B	5 questions of 10 marks		Answer all questions
C	2 questions of 20 marks		Answer any one

List of Experiments

Expt./Job No.	Experiments	No. of Lab. Slots
1.	Implementation using Python and OpenCV: Object Detection	2
2.	Implementation using Python and OpenCV: surveillance	2
3.	Experiments on on real-world datasets	2
4.	Experiment on on real-world datasets of Medical Image Processing	2
5.		2
6.	Research paper reviews and presentations	2
7.	Evaluation	2

Scheme for Semester End Examination (ESA)

SL. No	Questions	Chapter numbers	Instructions
1	PART A 5 Marks X 6 Question	All	Answer All the Questions
2	PART B 10 Marks X 5 Questions	All	Answer All the Questions
3	PART C Two Questions to be set, any one Question of 20 Marks Each to be Answered.	All	Answer anyone Question

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Program: Master of Technology		Semester II
Course Title: Distributed and Cloud Computing		Course Code: 25ECSC711
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 63	ESA Marks: 37	Total Marks: 100
Teaching Hrs: 42	Lab: 28hrs	Exam Duration: 3 hrs
1	Chapter No. 1. Distributed System Models and Enabling Technologies Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing	6 hrs
2	Chapter No. 2. Virtual Machines and Virtualization of Clusters Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resources Management.	6 hrs
3	Chapter No. 3. Cloud Platform Architecture over Virtualized Data Centers Cloud Computing and Service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms.	6 hrs
4	Chapter No. 4. Cloud Programming and Software Environments Challenges and Opportunities in cloud application, architectural styles, workflows: co-ordination of multiple activities, MapReduce programming model.	6 hrs
5	Chapter No. 5. Cloud Resource Management 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.	6 hrs
6	Chapter No. 6. Cloud Resource Scheduling Resource bundling; combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds. Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines.	6 hrs
7	Chapter No. 7. Cloud Security Cloud security risks, Security; the top concern for cloud users, Privacy; privacy impact assessment, Trust, Operating system security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, Xoar - breaking the monolithic design of the TCB, A trusted virtual machine monitor.	6 hrs
Text Books: 1. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing from Parallel Processing to the Internet of Things, Elsevier, 2013. 2. Dan C. Marinescu, Cloud Computing Theory and Practice, Elsevier, 2013.		

3. Nigel Poulton, The Kubernetes Book, Packt Publishing, 2019.

References:

1. RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, Mastering Cloud Computing, McGraw Hil, 2013.
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hil, 2010.

Evaluation Scheme

ISA Scheme:

Assessment	Weightage in Marks	Weightage
ISA-1	15	37
ISA-2	15	
Lab activity	20	26
Total	50	63

Lab experiments:

Expt./Job No.	Brief description about the experiment/job	No. of Lab. Slots
1	Hypervisors (Type-I and Type-II). Virtual machines with Para/Full Virtualization	02
2	Implementation of cloud service models (IaaS, PaaS, SaaS)	03
3	Implementation of Task Model, Thread model Application using Aneka Management cloud	03
4	Private Cloud Setup	03
5	Implementation of Cloud resource scheduling and security mechanisms	03

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Electives-1

Program: Master of Technology		Semester II
Course Title: Internet of Things		Course Code: 25ECSE701
L-T-P : 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42	Lab: --	Exam Duration: 02 Hrs
Content		Hrs
Chapter No 1. Introduction to Internet of Things (IoT): Definition & Characteristics of IoT, Physical Design of IoT: IoT protocols, Logical Design of IoT: IoT functional blocks, communication models and APIs.		4
Chapter No 2. IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Deployment Templates.		6
Chapter No 3. Domain specific IoTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.		6
Chapter No 4. IoT Platforms Design Methodology: IoT Design Methodology, Case Study on IoT System for Weather Monitoring.		4
Chapter No 5. IoT systems – Logical design using Python: Introduction to Python, Data types, data structures, Control of flow, functions modules, packages, file handling, data/time operations, classes, Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib.		6
Chapter No 6. IoT Physical Devices and Endpoints: Basic building blocks of an IoT device, Exemplary device: Raspberry Pi, interface (serial, SPI, I2C), Programming Raspberry Pi with Python.		6
Chapter No 7. IoT Physical Servers & Cloud Offerings: Introduction to Cloud Storage models and communication APIs ,Webserver – Web server for IoT, Cloud for IoT, Python web application framework, Designing a RESTful web API		5
Chapter No 8. Case Studies Illustrating IoT Design: Home Automation-smart lighting, home intrusion detection, Cities-smart parking.		5
Text Books		
1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547		

References:

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
2. *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things*, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, Cisco Press June 2017

**Evaluation Scheme
ISA Scheme**

Assessment	Weightage in Marks
Minor-I	15
Minor-II	15
Course Project	20
Total	50

Intelligent Internet of Things Laboratory Plan

Sl. No.	List of Experiments	No. of Lab sessions/batch
1	Understanding Hardware Details of Arduino Installation of Integrated Development Environment for Arduino Blinking an LED using Arduino Uno	2
2	Basic Instructions used for Programming Arduino Basic Sensors used while Programming Arduino	2
3	Switching on and off of 230V, 50Hz Bulb Switching on and off of 230V, 50Hz Fan Switching on and off of 50 Volts DC Motor	1
4	Working with Servo Motor Working with a Stepper Motor Bidirectional Rotation of a DC Motor	1
5	Infra Red Sensors Passive Infra Red Sensors Ultra-Sonic Sensor	1
6	Temperature and Humidity Sensor Heart Rate Sensor Rain Sensor	1
7	Light Dependent Register Soil Moisture Sensor Smoke Sensor	1

8	Working with Raspberry Pi Installation of an Operating system Remote Login	1
9	Conducting all the experiments from S. No. 1 to S.No. 7	1
10	Developing MIT App / Working with website / Controlling devices and Sensors through website using NODE MCU / Raspberry Pi	3

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Program: Master of Technology		Semester II
CourseTitle: Security Operations		Course Code: 25ECSE703
L-T-P: 3-0-0	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42	Lab:	Exam Duration: 3 hrs
1	Introduction to Security Operations: Security Operations Centre (SOC) Fundamentals, Key SOC Roles and Responsibilities, SOC Components (People, Processes, Technology), Cyberthreats and the impact of a Breach, Investing in Security and Establishing a Baseline, Fundamental Security Capabilities and Industry Threat Models, Standards, Guidelines, and Frameworks, Vulnerabilities, Risk & Business Challenges.	9 hrs
2	Development of SOC: SOC Maturity Model, Key SOC Functions: Threat Detection, Incident Response, Forensics, Planning and Designing a SOC Facility, Network Considerations for SOC, Disaster Recovery & Business Continuity in SOC, Security Considerations, Guidelines and Recommendations for Securing SOC.	8 hrs
3	Security Information and Event Management (SIEM): Key SIEM Components, Introduction to SIEM solutions, Overview and Key Features, SIEM Architecture, Log collection methods, Security Event Correlation and Rule Writing.	9 hrs
4	Incident Detection and Response : Incident Detection in SIEM: Detecting Malware, Phishing, Insider Threats, Detecting Lateral Movement (MITRE ATT&CK Framework), Incident Response: Automated Incident Response with SIEM and SOAR, Generating and Managing SIEM Alerts.	8 hrs
5	Threat Intelligence and Management Types of threat intelligence: strategic, tactical, operational, and technical, Threat intelligence lifecycle: collection, analysis, dissemination, Integration of threat intelligence into security operations, Utilizing threat intelligence platforms and feeds	7hrs

Text Books :

1. **Muniz, J., Lakhani, A., Santos, O., & Frost, M.** (2015). *The Modern Security Operations Centre*. Cisco Press
2. **Muniz, J., McIntyre, G., & AlFardan, N.** (2015). *Security Operations Center: Building, Operating, and Maintaining Your SOC* (1st ed.). Cisco Press. ISBN: 978-0-13-405201-4.

References:

1. R. MacDougall and R. Lain, *The Security Operations Handbook: Managing a SOC and Detecting Threats*, Packt Publishing, 2021.
2. E. Al-Shaer, *Automated Security Operations: Threat Hunting, Detection, and Response at Scale*, Pearson, 2020.

Evaluation Scheme
ISA Scheme

Assessment	Weightage in Marks	Marks Reduced
ISA-1	30	33
ISA-2	30	
Lab Activity	40	33
Total	100	66

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Semester III

Program: Master of Technology		Semester III
Course Title: Industrial/ In-House Training		Course Code: 24ECSW801
L-T-P: 0-0-8	Credits: 8	Contact Hrs: 18 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
	Lab:	Exam Duration: 3 hrs

Course Outcomes (COs):

1. Explore the tools assigned by the industry or university by applying the concepts of computer science and engineering.
2. Demonstrate the facilities available in the chosen tool/s by conducting the experiments
3. Apply Constructors/Methods/APIs of the chosen tool/s to develop the applications
4. Develop the report using technical report writing tool
5. Impart self-confidence, communication skills responsibility, commitment, teamwork spirit and trustworthy during the training.

Evaluation:

Students Assessment through ISA and ESA

	Assessment	Weightage in Marks
ISA (50)	Review 1	10
	Review 2	15
	Review 3	20
	Report review	05
ESA (50)	--	50
Total		100

Laboratory Plan

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions (3 hrs/session)
1.	Defining Objectives of the training , State of art of the tools and Usage of concepts in computer science and engineering	18
2.	Review 1	01
3.	Identify the tool/s, Study of Tool/s and conduction of experiments	08
4.	Review 2	01
5.	Development of Application with Result Discussion	07
6.	Review 3	01

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Program: Master of Technology		Semester: III
Course Title: Minor Project		Course Code: 24ECW802
L-T-P: 0-0-10	Credits: 10	Contact Hrs: 24 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
	Lab:	Exam Duration: 3 hrs

Course Outcomes:

1. Explore the tools assigned by the industry or university by applying the concepts of computer science and engineering.
2. Demonstrate the facilities available in the chosen tool/s by conducting the experiments
3. Apply Constructors/Methods/APIs of the chosen tool/s to develop the applications
4. Develop the report using technical report writing tool
5. Impart self-confidence, communication skills responsibility, commitment, teamwork spirit and trustworthy during the training.

Evaluation:

ISA Scheme and ESA

	Assessment	Weightage in Marks
ISA (50)	Review 1	15
	Review 2	15
	Review 3	20
ESA (50)	--	50
	Total	100

Laboratory Plan

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions (3 hrs/session)
1.	Requirement Gathering and Analysis, Literature Survey, defining the Problem statement and objectives	38
2.	Review 1	01
3.	High level & Low level design, Methodology and Implementation	36
4.	Review 2	01
5.	Result discussion, report and paper writing	36
6.	Review 3	01

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Semester IV

Program: Master of Technology		Semester IV
Course Title: Project Work		Course Code: 24ECSW803
L-T-P: 0-0-20	Credits:20	Contact Hrs: 40hrs/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
	Lab:	Exam Duration: 3hrs

Course Outcomes:

1. Apply the knowledge gained to identify a problem and recognize the need of a solution for the identified problem.
2. Ability to create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools to complex problems with an understanding of their limitations.
3. Ability to participate effectively in multidisciplinary teams and contribute towards achieving the common goals of the teams.
4. Ability to manage projects as a member and as a leader of a team efficiently in their field and multidisciplinary environments by considering economical and financial factors.
5. Ability to communicate effectively with engineering community and society at large, regarding complex engineering activities in oral, written and presentation forms.

Evaluation: ISA Scheme and ESA

	Assessment	Weightage in Marks
ISA (50)	Review 1	20
	Review 2	15
	Review 3	15
ESA (50)	--	50
Total		100

Laboratory Plan

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions (3 hrs/session)
1.	Innovation and Originality, Requirement Gathering and Analysis, Literature Survey, defining the Problem statement and objectives	75
2.	Review 1	01
3.	High level & Low level design, Methodology and Implementation	54
4.	Review 2	01
5.	Result discussion, report and paper writing	54
6.	Review 3	01

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