KLE Technological University | Creating Value, Leveraging Knowledge

Curriculum Structure and Curriculum Content for the Academic year: **2023-25**
School: **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.

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

Program Educational Objectives (PEO)	Program Outcomes (PO)	Program Specific Objectives (PSO)
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 tosolve 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 asper the specialization of the program. The mastery should be at a levelhigher 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 andanalysis 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 practicehaving an understanding of responsibility towards society with sustainabledevelopment for life time.	

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Curriculum Structure-Overall

Semester			Total Program Credit: 88	Year: 2023-25
Courses Semester wise	I	II	III	IV
	Applied Mathematics 19ECSC701 (3-0-1)	Design and Analysis of Algorithms 21ECSC709 (3-0-1)	Industrial/ In-House Training 21ECSW801(0-0-8)	Project Work 21ECSW803 (0-0-20)
	Data Mining and Machine Learning 21ECSC702 (3-0-1)	Distributed & Cloud Computing 20ECSC710 (2-0-1)	Minor Project 21ECSW802(0-0-12)	
	Computer Networks 21ECSC703(3-0-1)	Big Data and Analytics 20ECSC711(2-0-1)		
	Internet of Things 20ECSC704(3-0-1)	Cryptography and Network Security 21ECSC701(3-0-1)		
	Operating Systems 20ECSC705(3-0-1)	Image and Video Processing 21ECSC713(2-0-1)		
	Problem Solving Laboratory 21ECSP706(0-0-1.5)	Professional Elective-1 XXECSE7XX (2-0-1)		
	Python Programming Laboratory 21ECSP707(0-0-1.5)	Mini Project 21ECSW718(0-0-3)		
		Web Technology Laboratory 21ECSP708(0-0-2)		
Credits	**23**	**25**	**20**	**20**

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Curriculum Scheme - Semester wise

Semester: I

No.	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	19ECSC701	Applied Mathematics	PC	3-0-1	4	5	50	50	100	3 Hours
2	21ECSC702	Data Mining and Machine Learning	PC	3-0-1	4	5	50	50	100	3 Hours
3	21ECSC703	Computer Networks	PC	3-0-1	4	5	50	50	100	3 Hours
4	20ECSC704	Internet of Things	PC	3-0-1	4	5	50	50	100	3 Hours
5	20ECSC705	Operating Systems	PC	3-0-1	4	5	50	50	100	3 Hours
6	21ECSP706	Problem Solving Laboratory	PC	0-0-1.5	1.5	3	80	20	100	3 Hours
7	21ECSP707	Python Programming Laboratory	PC	0-0-1.5	1.5	3	80	20	100	3 Hours
TOTAL				**23 (15-0-8)**	**23**	**31**	**410**	**290**	**700**	

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

Date: **P G Coordinator** **Head, SoCSE**

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Semester - II

No.	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	21ECSC709	Design and Analysis of Algorithms	PC	3-0-1	4	5	50	50	100	3 Hours
2	20ECSC710	Distributed & Cloud Computing	PC	2-0-1	3	4	50	50	100	3 Hours
3	20ECSC711	Big Data and Analytics	PC	2-0-1	3	4	50	50	100	3 Hours
4	21ECSC701	Cryptography and Network Security	PC	3-0-1	4	5	50	50	100	3 Hours
5	21ECSC713	Image and Video Processing	PC	2-0-1	3	4	50	50	100	3 Hours
Elective 1										
6	21ECSE715	Deep Learning	PE	2-0-1	3	4	50	50	100	3 Hours
	23ECSE701	Block-chain and Distributed Ledgers								
	21ECSE717	High Performance Computing								
7	21ECSW718	Mini Project	PC	0-0-3	3	6	50	50	100	3 Hours
8	21ECSP708	Web Technology Laboratory	PC	0-0-2	2	4	80	20	100	3 Hours
TOTAL				**25(14-0-11)**	**25**	**36**	**430**	**370**	**800**	

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** **Head, SoCSE**

Semester: III

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	21ECSW801	Industrial / In-House Training	PJ	0-0-8	08	16	50	50	100	3 hours
2	21ECSW802	Minor Project	PJ	0-0-12	12	24	50	50	100	3 hours
TOTAL				**20 (0-0-20)**	**20**	**40**	**100**	**100**	**200**	

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

Date: **P G Coordinator** **Head SoCSE**

Semester: IV

No	Code	Course	Category	L-T-P	Credits	Contact Hours	ISA	ESA	Total	Exam Duration
1	21ECSW803	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** **Head, SoCSE**

Consolidated Credits of all semesters:

Semester	I	II	III	IV	Total
Credits	23	25	20	20	88

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List of Program Electives

Sr. No	Name of the Course	Course Code
1.	Deep Learning	21ECSE715
2.	Block-chain and Distributed Ledgers	23ECSE701
3.	High Performance Computing	21ECSE717

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Curriculum Content- Course wise

I SEMSETER

Program: Master of Technology		Semester I
Course Title: Applied Mathematics		Course Code: 19ECSC701
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42	Lab: 24hrs(12 Slots of 2hrs)	Exam Duration: 3 hrs

1	**Introduction to Statistics** Statistical Thinking, Collecting data, Statistical Modeling Framework, Measure of Central Tendency and Variance, Importance of Data symmetry and Display, Graphical and Tabular Display.	**04 hrs**
2	**Discrete Random Variables and Probability Distribution** Discrete Random variables, Probability distributions and Probability mass function, Cumulative distribution function, Mean and Variance of a discrete random variable, Discrete Uniform distribution, Binomial distribution, Geometric distribution, Poisson distribution, Applications.	**07 hrs**
3	**Continuous Random Variables and Probability Distributions** Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, Uniform distribution, Normal Distribution, Normal approximation to Binomial and Poisson distribution, Exponential distribution.	**07 hrs**
4	**Testing of Hypothesis** Estimation theory, Hypothesis testing, Inference on the mean of population (variance known and unknown) Inference on the variance of a normal population, Inference on a population proportion, Testing for Goodness of fit, Inference for a difference in Means(variances known), Inference for a difference in means of two normal distributions (variances unknown), Inference on the Variances of two normal populations, Inference on two population proportions.	**08 hrs**
5	**Simple Linear Regression and Correlation** Simple Linear Regression, Properties of Least square Estimators and	**06 hrs**

	Estimation of Variances, Transformations to a Straight line, Correlation, Multiple linear regression model, Least square Estimation of parameters, Matrix approach to multiple linear regression, Properties of least square estimators and estimation of variance.	
6	**Queuing Theory 1 :** Basics of queuing models, Model I (M /M/ 1): (∞/FIFO), Single Server with Infinite Capacity, Model II (M/M/s): (∞/FIFO), Multiple Server with Infinite Capacity	**05 hrs**
7	**Queuing Theory 2:** Model III (M/M/1): (k/FIFO), Single Server with Finite Capacity, Model IV (M/M/s): (k/FIFO), Multiple Server with Finite Capacity.	**05 hrs**

Text Books:

1. Douglas C Montgomery, George C Runger, Applied Statistics for Engineers, 2nd Edition,John Wiley and Sons, ISBN-0-471-170027-5.

References:

1. Richard I Levin, David S Rubin, Statistics for Management, 6th Edition, Prentice Hall India.
2. Willian W Hines, Douglas C Montgomery, Probability and Statistics in Engineering, 2nd Edition, John Wiley and Sons.
3. V. Sundarapandian, Probability, Statistics and Queuing theory, PHI, 2009.
4. Arnold Oral Allen, Probability, statistics, and queuing theory: with computer science applications, Gulf Professional Publishing, Edition: 2 ,28-Aug-1990

Laboratory Plan

ExptNo.	Experiment/ Job details	No. of Lab sessions/batch
1.	Basics of R and R studio	02
2.	Graphical Representation	01
3.	Measures of central tendency and dispersion	01
4.	Discrete probability distributions	01
5.	Continuous probability distributions	01
6.	Testing of hypothesis: One sample problem	01
7.	Testing of hypothesis: Two sample problem	02
8.	Simple linear regression and polynomial regression	02
9.	Multiple linear regression	01
10.	Hands-on activity on Data analysis	02

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Program: Master of Technology		Semester I
Course Title: Data Mining and Machine Learning		Course Code: 21ECSC702
L-T-P : 3-0-1	Credits: 4	Contact Hrs: 5hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42	Lab: 24hrs(12 Slots of 2hrs)	Exam Duration: 3 Hrs

	Content	Hrs
1	**Chapter- 1: Introduction & Data Pre-Preprocessing** Introduction to data mining, Introduction to Machine Learning, Applications of Data mining/Machine Learning. Major tasks in data preprocessing - data reduction, data transformation and data Discretization, data cleaning and data integration.	6 hrs
2	**Chapter - 2:** **Mining Frequent Patterns, Associations and Correlations: Concepts and Methods** Basic Concepts, Efficient and Scalable Frequent Item set mining methods, finding interesting Patterns, Pattern Evaluation Methods, Applications of frequent pattern and associations, Advanced Frequent Pattern Mining- Frequent Pattern and Association Mining: A Road Map, Mining Various Kinds of Association Rules. Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequent Pattern Mining, Mining High-Dimensional Data and Colossal Patterns.	8 hrs
3	**Chapter- 3: Supervised Learning: Classification** Model Evaluation and Selection; Techniques to Improve Classification Accuracy: ensemble methods; Bayesian belief networks; Introduction to perceptron learning, Model representation, Gradient checking, Back propagation algorithm, Multi-class classification, and Application- classifying digits. Support vector machines.	8 hrs
4	**Chapter- 4: Regression Analysis** ANOVA, Linear Regression: Single and Multiple variables, Sum of squares error function, Logistic Regression: The cost function, Classification using logistic regression.	6 hrs
5	**Chapter- 5: Unsupervised Learning: Cluster Analysis** Partitioning methods, Hierarchical Methods, Density based methods, Outlier Detection.	8 hrs

	Chapter- 6: Social Network Analysis Graph mining, Mining Variant and Constrained Substructure Patterns, Social networks: Characteristics, Tasks and Challenges.	6 hrs

Text Books (List of books as mentioned in the approved syllabus)

1. Jiawei Han, MichelineKamber, and Jian Pei, Data Mining: Concepts and Techniques, 3rd, Morgan Kaufmann, 2011
2. Pang-Ning, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2007

References

1. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining - Practical Machine Learning Tools and Techniques, 3rd, Elsevier Inc, 2011
2. M. H. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education. 2008.

Laboratory Plan

Expt./Job No.	Brief description about the experiment/job	No. of Lab. Slots
1.	Data cleaning , data integration, and data reduction for given dataset	2
2.	Analysis of Apriori algorithm and FP growth algorithm	2
3.	Apply CNN and other classification algorithms and compute the evaluation parameters	2
4.	Analysis of linear and logistic regression	2
5.	Implement K-mean and k-modes etc. algorithms	2
6.	Seminar on Advanced topics of data mining and machine learning.	2

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Program: Master of Technology		Semester I
Course Title: Computer Networks		Course Code: 21ECSC703
L-T-P-Self Study: 3-0-1	Credits: 4	Contact Hrs: 5 hr/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42	Lab: 24hrs(12 Slots of 2hrs)	Exam Duration: 3 hrs

Content	Hrs
Chapter 1: Fundamental Concepts of computer Networks: Basic Definitions in Data Networks, Applications, Requirements, Network Architecture, Packet Size and Optimizations, Performance.	**6 hrs**
Chapter 2: Data Link Layer Perspectives on Connecting, Encoding (NRZ, NRZI, Manchester), Framing, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks.	**8 hrs**
Chapter 3: The Network Layer Overview of Network Layer, Router Architecture, The Internet Protocol (IP): IPv4, Addressing, NAT, Routing Algorithms, Intra-AS Routing in the Internet: OSPF, Routing Among the ISPs: BGP, ICMP: The Internet Control Message Protocol,	**8 hrs**
Chapter 4: Transport and Application Layer : Introduction and Transport-Layer Services, connectionless Transport: UDP, Connection-Oriented Transport: TCP , TCP Congestion Control , The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service,	**8 hrs**
Chapter 5: Multicasting Techniques and Protocols: Intra domain and Inter domain multicast protocols, node level multicast algorithms	**6 hrs**
Chapter 6: Wireless networks and mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP	**6 hrs**

Text Books:

1. Nader F. Mir, Computer and Communication Networks, 2nd Edition, Pearson Prentice-Hall, 2015.
2. J. F. Kurose and K. W. Ross, Computer Networking, A Top-Down Approach, 8th Ed, , Pearson , 2020.
3. Larry L Peterson & Bruce S Davien, Computer Networks A System Approach, 5th Ed Morgan Kaufmann (Elsevier), 2011.

References:

1. Behrouz Forouzan, Data Communications and Networking, 5th Ed, McGraw Hill, 2012.
2. A S Tanenbaum, D J Wetherall, Computer Networks, 5th Ed., Prentice-Ha

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
ISA-1	15
ISA-2	15
Tutorial	20
Total	**50**

Laboratory Plan

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions/batch
1.	Demonstration of Cisco Packet Tracer network tool: usage of hub, switch, and a router using a simple topology	02
2.	Application layer protocol implementation – DHCP and DNS	01
3.	Application layer protocol implementation – FTP, SMTP and HTTP	01
4.	Demonstration of static routing using Cisco Packet Tracer	01
5.	Assessment – 1 Demonstration of a given topology using Cisco Packet Tracer	01
6.	Demonstration of socket programming using a simple message board application - Connection oriented and connectionless.	01
7.	Demonstration of simple banking application using connection oriented socket programming.	01
8.	Demonstration of a simple calculator application using connectionless socket programming.	01
9.	Practice session for socket programming	01
10.	Exercise on usage of Wireshark tool to capture packets in the network.	01
11.	Assessment – 2	01

	i. Implementation of a given application using socket programming ii. Demonstration of packet captures and network performance analysis using the wireshark tool.	
12.	Develop a mobile application for Bluetooth Client – Server communication using Mit app inventor.	02

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Program: Master of Technology		Semester I
Course Title: Internet Of Things		Course Code: 20ECSC704
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42	Lab: 24hrs(12 Slots of 2hrs)	Exam Duration: 3 hrs

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.	**04 hrs**
2	**IoT Enabling Technologies:** Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Deployment Templates.	**06 hrs**
3	**Domain specific IoTs:** Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.	**06 hrs**
4	**IoT Platforms Design Methodology:** IoT Design Methodology, Case Study on IoT System for Weather Monitoring.	**04 hrs**
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.	**06 hrs**
6	**IoT Physical Devices and Endpoints:** Basic building blocks of an IoT device, Exemplary device: Rasyberry Pi, interface (serial, SPI, I2C), Programming Rasyberry Pi with Python.	**06 hrs**
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	**05 hrs**
8	**Case Studies Illustrating IoT Design:** Home Automation-smart lighting, home intrusion detection, Cities-smart parking.	**05 hrs**

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

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
ISA-1	15
ISA-2	15
Lab Activity	20
Total	**50**

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 I
Course Title: Operating Systems		Course Code: 20ECSC705
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42	Lab: 24hrs(12 Slots of 2hrs)	Exam Duration: 3 hrs

1	**Operating System Overview** Operating System objectives and functions, Evolution of OS, Major achievements, Developments leading to modern OS, Overview of Linux	**02 hrs**
2	**Processes Management** Processes- Definition, States, Description, Control, Security issues, Threads, Symmetric multiprocessing. **Concurrency** Principles of concurrency, Mutual exclusion, Semaphores, Monitors, Message passing, Readers problem, Deadlock- Prevention, Avoidance and Detection. **Scheduling** Uniprocessor scheduling- Types of processor scheduling, Scheduling algorithms, Multiprocessor scheduling,	**8 hrs**
3	**Memory Management and Virtual Memory** Memory management- Requirements, Partitioning, Paging, Segmentation, Security issues. Virtual memory - Hardware and control structures, Operating System software	**5 hrs**
4	**File Management of Linux** Overview, Organization, Directories, Sharing, Record blocking, File system security Linux file management	**7 hrs**
5	**Distributed Operating Systems** Distributed System Goals, Types Of Distributed Systems, and Styles & Architecture Of Distributed Systems, Threads, Virtualization, Clients, Servers, Code Migration, and Communication in Distributed Systems.	**7 hrs**
6	**Distributed Systems & Synchronization** Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning Of Nodes, Data-Centric Consistency Models, Client-Centric Consistency Models, Consistency Protocols.	**7 hrs**

7	**Fault Tolerance, Security:** Introduction To Fault Tolerance, Process Resilience,, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, Recovery, Secure Channels, Access Control, Security Management	**6 hrs**

Text Books:

1. William Stallings: Operating Systems- Internals and Design Principles, 6th Edition, Prentice Hall, 2008.
2. Gary Nutt, Nabendu Chaki, Sarmistha Neogy: Operating Systems, 3rd Edition, Pearson Education, 2004.
3. "DISTRIBUTED SYSTEMS", Second edition, Andrew S.Tanenbaum, Maarten Van teen.
4. W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX Environment", 3rd Edition, Addison Wesley Professional, 2013.
5. Terrence Chan, "Unix System Programming Using C++", 1 ed., Prentice Hall India, 2007.

References:

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, 2006.
3. Charles Crowley: Operating System, design oriented approach, 2004.

Evaluation Scheme - CIE Scheme

Assessment	Weight age in Marks
ISA-1	15
ISA-2	15
Lab Activity	20
Total	50

Laboratory Plan

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions/batch
1.	Demonstration of UNIX commands related to processes, files and memory	2
2.	Implementation of Process control activities (fork,wait,exit,vfork)	2
3.	Race Condition	2
4.	Inter Process Communication (IPC): Pipes and FIFO	2
5.	Implementation of Multi-threading, File and record Locking	2
6.	Process synchronization and deadlock	2
7.	Memory management	2

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Program: Master of Technology		Semester I
Course Title: Problem Solving Laboratory		Course Code: 21ECSP706
L-T-P: 0-0-1.5	Credits: 1.5	Contact Hrs: 3 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 36	Lab: 12 Slots of 3hrs	Exam Duration: 3 hrs

1	**Introduction:** Basic concept of problem solving with frame work, applying the frame work to applications.
2	**Creation and Manipulation of Data Structures** Introduction to data structures, abstract data types, Linked Lists: Singly linked list, doubly linked list. Circular Singly and doubly Linked lists and Applications of linked list. Stacks and Queues : Implementation using different linked list and Applications of stacks and queues. Trees : Introduction to trees, Binary search trees, binary tree and tree traversals, Applications of trees
3	**Variants of Tree Data Structures: (Advanced Data structures)** Dictionaries, Skip lists, Priority queues, Heaps, Leftist trees, AVL, Red Black, B-Trees, Alternative decision tree, Radix trees and Applications.

Reference Books:

1.Hemant Jain, Problem Solving in Data structures and Algorithms Using C,
Taran Technologies Private Limited, 2016
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
2009. Introduction to Algorithms, Third Edition (3rd ed.). The MIT Press
3. Data Structures Using C and C++ -- Langsam and Tanenbaum, PHI Publication.

***Evaluation*:**

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

ISA (80%)	Assessment	Weightage in Marks
	Exercises (4-Evaluation)	50
	Structured Enquiry(1-evaluations)	30
ESA (20%)	-	20
	Total	100

Experiment wise Plan

List of experiments/jobs planned to meet the requirements of the course.

Category: Demonstration		**Total Weightage: 0**		**No. of lab sessions: 11**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
1	Illustration of problem-solving framework	1	0	
	Learning Outcomes: The students should be able to: • Explain problem solving frame work • Apply problem solving frame work to solve problem			Chapter 1
2	Demonstration of linked lists	1	0	
	Learning Outcomes: The students should be able to: • Discuss different type of liked lists • Identify the suitable linked list to solve a given problem			Chapter 2
5	Demonstration of data structures	1	0	
	Learning Outcomes: The students should be able to: • Describe stack, queue and binary tree data structures • Apply suitable data structures to implement application			Chapter 2
8	Demonstration of Advanced data structures	8	0	
	Learning Outcomes: The students should be able to: • Explain skip list, red and black trees and other advanced data structures • Recognize suitable advanced data structure to implement course project			Chapter 3
Category: Exercise		**Total Weightage: 20**		**No. of lab**

				sessions: 2
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
17	Implementation of linked list	1	8	
	Learning Outcomes: The students should be able to: • Design problem solving frame work with suitable linked list. • Implement the given application using the identified linked list			Chapter2
18	Implementation of basic data structures	1	12	
	Learning Outcomes: The students should be able to: • Design problem solving frame work with suitable data structure • Implement the given application using the identified data structure			Chapter 2
Category: Structured Enquiry		**Total Weightage: 30**		**No. of lab sessions: 2**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
19	Implement of given application on online coding platform using stack and queue data structures	1	15	
	Learning Outcomes: The students should be able to: • Design problem solving frame work to implement the application • Execute the application on Hanker rank platform			Chapter 2

20	Implement of given application on online coding platform using binary tree data structure	1	15	
	Learning Outcomes: The students should be able to: • Design problem solving frame work to implement the application using binary search tree. • Execute the application on Hanker rank platform			Chapter 2
Category: Course project		**Total Weightage: 30**		**No. of lab sessions: 2**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
21	Course project using advanced data structures	1	10	
	Learning Outcomes: The students should be able to: • Explain the features of identified advanced data structure • Implement the basic operations of identified advanced data structure			Chapter 3
23	Course project using advanced data structures	1	20	
	Learning Outcomes: The students should be able to: • Implement the course project using identified advanced data structure • Articulate a technical report of course project			Chapter 3

Back

Program: Master of Technology		Semester I
Course Title: Python Programming Laboratory		Course Code: 21ECSP707
L-T-P: 0-0-1.5	Credits: 1.5	Contact Hrs: 3 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 3 hrs

1	**Introduction** Review of HTML5 basics and CSS3, Javascript basics
2	**Python libraries :** Data manipulation and processing using numpy, scipy and pandas. Data visualization using matplotlib.
3	**Machine Learning using Phyton** Design and evaluate Machine learning model

Reference Books

1. Jeff Forcier, "Python Web Development with Django", 1st edition, Pearson Education, 2008.
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly, 2010.
3. Michael Dawson, Python Programing for the Absolute Beginner, Premier Press, 3rd Edition 2010

***Evaluation*:**

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

ISA (80%)	Assessment	Weightage in Marks
	Exercises (4-Evaluation)	50
	Structured Enquiry(1-evaluations)	30
ESA (20%)		20
	Total	100

Experiment wise Plan

List of experiments/jobs planned to meet the requirements of the course.

Category: Demonstration		**Total Weightage: 10**		**No. of lab sessions: 6**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
1	Exploring python basics	6	0	
	Learning Outcomes: The students should be able to: 1. Develop simple Python programs for solving problems.. 2. Use functions and represent Compound data using Lists, Tuples and Dictionaries 3. Demonstrate python programs using control structures, functions, and arrays 4. Use exception handling in Python applications for error handling.			Chapter 1
Category: Exercise		**Total Weightage: 40**		**No. of lab sessions: 6**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
2	Python libraries: Numpy, Pandas	4	40	

	Learning Outcomes: The students should be able to: 1. Install python libraries. 2. Create basic programs using NumPy to solve numerical problem 3. Load the data from the data source into Pandas Data Frames. 4. Use Pandas libraries and work on data preparation , data manipulation and data explorations. 5. Formulate solutions to a broad range of queries on a given database			Chapter1
3	Data Visualization: Matplotlib	2	10	
	Learning Outcomes: The students should be able to: 1. Learn the fundamentals of Python's Matplotlib library and its main features. 2. Create various plots in Matplotlib.			Chapter 2
Category: Structured Enquiry		**Total Weight age: 20**		**No. of lab sessions: 2**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
4	Design and evaluate Machine learning model	2	30	
	Learning Outcomes: The students should be able to: 1. Given a task, derive a machine learning model 2. Analyse and compare models and algorithms with respect to their complexity, performance and applicability.			

Back

II SEMSTER

Program: Master of Technology		Semester II
Course Title: Design and Analysis of Algorithms		Course Code: 21ECSC709
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42	Lab: 24hrs(12 Slots of 2hrs)	Exam Duration: 3 hrs

1	**Introduction** Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-Recursive Algorithms and Mathematical Analysis of Recursive Algorithms.	**06 hrs**
2	**Hashing Technique** Direct Address Table, Hash Table, Hash Function and Collision Resolution Techniques.	**06 hrs**
3	**Algorithm design techniques:** **Divide and conquer:** General Method, Merge sort, quick sort, Matrix Computations **Greedy Technique:** General Method, Huffmann Coding, knapsack problem, Task Scheduling and minimum spanning tree. **Dynamic Programming:** General Method, Floyd-Warshall algorithm, String Editing, Longest Common Subsequence and shortest paths	**15 hrs**
4	**Combinatorial Problem solving Techniques:** **Backtracking Method**: General Method, Sum of subsets, knapsack Problem and Game strategies **Branch and Bound method:** General Method, knapsack Problem, Approximation algorithms and Randomized algorithms. **NP- Hard and NP Complete:** Examples, proof of NP-hardness and NP-completeness.	**15hrs**

Reference Books:

1. Introduction to Design and Analysis of Algorithms – Anany Levitin 3rd Edition, Pearson, 2012
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest, C. Stein, Introduction to Algorithms, 3nd edition, MIT, 2009.
3. Michael T. Goodrich, Roberto Tamassia, Algorithm Design and Applications, Wiley Publications, 2015

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
ISA-1	15
ISA-2	15
Lab activity	20
Total	**50**

Laboratory Plan

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions/batch
1.	Analysis of Non-Recursive Algorithms.	1
2.	Analysis of Recursive Algorithms.	1
3.	Implementation of hashing techniques	2
4.	Divide and conquer: Quick sort and Merge sort	2
5.	Greedy Technique: Minimum Spanning tree.	2
6.	Dynamic Programming: Longest Common Subsequence	2
7.	Backtracking Method: Sum of subsets	2
8.	Design, implement and analyze the algorithm for given problem	2

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KLE Technological University | Creating Value, Leveraging Knowledge

Program: Master of Technology		Semester II
Course Title: **Distributed and Cloud Computing**		Course Code: **20ECSC710**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **32**	Exam Duration: **3 hrs**	

1	**Distributed System Models and Enabling Technologies** Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing	**04hrs**
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.	**04hrs**
3	**Cloud Platform Architecture over Virtualized Data Centers** Cloud Computing and Service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms.	**04hrs**
4	**Cloud Programming and Software Environments** Challenges and Opportunities in cloud application, architectural styles, workflows: co-ordination of multiple activities, MapReduce programming model.	**04hrs**
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.	**06hrs**
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.	**05hrs**
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	**05hrs**

	posed by a management OS, Xoar - breaking the monolithic design of the TCB, A trusted virtual machine monitor.	

Text Books:

1. 1. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing from Parallel Processing to the Internet of Things, 1, Elsevier, 2012
2. Dan C. Marinescu , Cloud Computing Theory and Practice, 1, Elsevier, 2013

References:

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

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
ISA-1	15
ISA-2	15
Lab activity	20
Total	**50**

Laboratory Plan

Expt./Job No.	Experiment/ Job details	No. of Lab sessions/batch
1	Hypervisors (Type-I and Type-II). Virtual machines with Para/Full Virtualization	02
2	Implementation of cloud service models (IaaS, PaaS, SaaS)	02
3	Implementation of AWS core services: S3, EC2, DynamoDB, RDS, VPC, IAM.	02
4	Building containerized application - Dockers	02
5	Implementation of Cloud resource scheduling and security mechanisms	04

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KLE Technological University | Creating Value, Leveraging Knowledge

Program: Master of Technology		**Semester II**
Course Title: Big Data Analytics		**Course Code: 20ECSC711**
L-T-P : 2-0-1	**Credits: 3**	**Contact Hrs: 04 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
Teaching Hrs: 32	**Lab: 24hrs**	**Exam Duration: 3 Hrs**

Content	**Hrs**
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.	**04hrs**
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.	**04hrs**
3. **Big Data Storage Concepts : Clusters , File Systems and Distributed File Systems, NoSQL, Sharding, Replication, Combining Sharding and Replication.**	**06hrs**
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,	**10hrs**
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.	**04hrs**
6. **Advanced Analytical Theory and Methods:** Text Analysis - Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency—Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments.	**04hrs**

Text Books (List of books as mentioned in the approved syllabus)

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publications.
2. Thomas Erl, Wajid Khattak, and Paul Buhler, "Big Data Fundamentals Concepts, Drivers & Techniques", Prentice Hall, 2015.
3. Anand Rajaraman and Jeff Ullman, "Mining of Massive Datasets", Cambridge Press, http://infolab.stanford.edu/~ullman/mmds/book.pdf.

References

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	Weightage in Marks
ISA-1	15
ISA-2	15
Lab Activity	20
Total	50

Laboratory Plan

Sl. No.	**Experiments**	**No. of Lab sessions/ batch**
1.	Hadoop Installation	2
2.	Problem Identification (10 M) a) Learning the domain (2M) b) Assessment of resources available(2M): i. Data ii. People	2

	iii. Technology iv. Time c) Framing the Problem(Identifying Issue to be addressed)(2M) d) Developing Initial Hypothesis (2M) Identifying potential Data sources(2M)	
3.	Data Preparation: (10M) a) Preparing the Analytic Sandbox (2M) b) Performing ETLT(2M) c) Data Conditioning(3M) Data Visualization(3M)	2
4.	Design and Model Selection	2
5.	Implementation	4
6.	Presentation and Report	2

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Program: Master of Technology		Semester II
Course Title: Cryptography and Network Security		Course Code: 21ECSC701
L-T-P: 3-0-1	Credits: 4	Contact Hrs: 5 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42	Lab: 24hrs(12 Slots of 2hrs)	Exam Duration: 3 hrs

1	**Chapter No. 1. Network Security Overview** Computer Security Principles, The OSI Security architecture: Security attacks, services and mechanisms, A model for Network Security, Classical Encryption techniques: Substitution ciphers- Caesar, Monoalphabetic, Playfair and Hill ciphers, Substitution ciphers, Taxonomy of Cryptography and Cryptanalysis.	**08 hrs**
2	**Chapter No. 2. Data Encryption Algorithms** Traditional block cipher structure, Data Encryption Standard, DES example, strength of DES, Multiple DES, block cipher design principles, Advanced Encryption Standard, block-cipher modes of operation, Stream Ciphers: RC4 and A5/1.	**08 hrs**
3	**Chapter No. 3. Public-Key Cryptography and Key Management** Elementary Concepts and Theorems In Number Theory, principles of public-key cryptosystems, The RSA algorithm, Diffie-Hellman Key Exchange, Elliptic curve arithmetic, Elliptic key cryptography, Key Distributions and Management, X.509 certificates, public key infrastructure	**08 hrs**
4	**Chapter No. 4. Data Authentication** Cryptographic Hash Functions: applications and requirements, Hash functions based on cipher block chaining, Secure Hash algorithm, SHA3, Message authentication codes: requirements and functions, HMAC, Digital Signatures, and Digital Signature Standard.	**06 hrs**
5	**Chapter No. 5. Application, Transport and Network layer Security** Web security considerations, Pretty Good Privacy and S/MIME, Secure Sockets Layer, HTTPs, Kerberos, SSH, IPSec overview, Encapsulating security payload, combining security associations, Internet key exchange	**06 hrs.**
6	**Wireless Network Security** Wireless security threats and measures, mobile device security, IEEE 802.11 WLAN Standard, IEEE 802.11i Wireless Lan Security: Services and phases of operation, WPA and WPA2	**06 hrs**

Text Books:

1. William Stallings, “Cryptography and Network Security Principles And Practices”, 7th

Edition, Pearson, 2017.
Reference Books: 1. Jonathan Katz and Yehuda Lindell, "Introduction to Modern Cryptography", 3rd edition, CRC Press, 2020. 2. Behrouz A. Forouzan, "Cryptography and Network Security**",** 6th Edition, Tata McGraw-Hill, 2014. 3. Mark Stamp, "Information Security: Principles and Practices", 2nd Edition, John Wiley and Sons, 2011

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
ISA 1	15
ISA 2	15
Lab activity	20
Total	50

Laboratory Plan

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

Back

Program: Master of Technology		Semester II	
Course Title: Image and Video Processing		Course Code: 21ECSC713	
L-T-P: 2-0-1	Credits: 3	Contact Hrs: 4 hrs/week	
ISA Marks: 50	ESA Marks: 50	Total Marks: 100	
Teaching Hrs: 32	Lab: 24hrs(12 Slots of 2hrs)	Exam Duration: 3 hrs	
1	**Fundamentals of Image processing and Image Transforms:** Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels. Image Transforms: 2 D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms.		**06hrs**
2	**Image Enhancement:** Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters. Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering.		**06hrs**
3	**Image Analysis:** Spatial feature extraction, Transform features, Edge detection Boundary Extraction, Boundary representation, Region representation, Moment representation, Structure, Shape features, Texture, Scene matching & detection, Image segmentation and Classification Techniques.		**06hrs**
4	**Basics of Video Processing**: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations		**05hrs**
5	**2-D Motion Estimation:** Optical flow, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation.		**05hrs**
6	**Video Segmentation and Tracking :** Change detection, Spatiotemporal change detection, Motion segmentation, Motion tracking in video : Rigid object tracking and articulated object tracking		**04hrs**

Text Books:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing," 3rd edition, Pearson Education(Asia) Pte. Ltd/Prentice Hall of India, 2009.
2. M. Tekalp, "Digital Video Processing", 2nd edition, Prentice Hall, USA, 2015.

References:

1. Anil K. Jain, "Fundamentals of Digital Image Processing," Pearson Education (Asia) Pte. Ltd./Prentice Hall of India, 2004.
2. Alan C Bovik " Essential Guide to Video Processing", AP Elsevier publication, 2009
3. Z. Li and M.S. Drew**,** "Fundamentals of Multimedia," Pearson Education (Asia) Pte. Ltd., 2004.

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
Minor Exam-1	15
Minor Exam-2	15
Lab activity	20
Total	50

Laboratory Plan

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions
1.	Basics of python programming with OPENCV library	02
2.	Apply Image Transforms: 2 D Discrete Fourier Transform, Discrete Cosine Transform (DCT)	02
3.	Image Enhancement in spatial domain	02
4.	Low pass and high pass filters for image enhancement.	02
5.	Image segmentation Course project allocation	02
6.	Motion estimation using optical flow and block matching algorithm. Video segmentation	02
7.	Course project reviews	02

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Program: Master of Technology		Semester II
Course Code: 21ECSE715	Course Title: Deep Learning	
L-T-P : 2-0-1	Credits: 3	Contact Hrs: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 32	Lab: 24hrs(12 Slots of 2hrs)	Exam Duration: 03

Content	Hrs
1. Introduction to Deep Learning: Overview of deep learning & its applications. Historical background and key milestones. Introduction to Neural Networks : Linear & Non-systems, Biological Neurons, Perceptron learning, Neural models, Learning AND, OR, NOT, XOR	**06 Hrs**
2. Neural Network Basics: Perceptrons and activation functions. Forward Propagation, Back Propagation, Loss Functions, Gradient descent.	**05 Hrs**
3. Convolution Neural Networks: The Convolution Operation, Motivation, Pooling, Padding, Fully Connected Layers. Deep Learning Architectures : INCEPTION-V3, VGG-16, RESNET-50	**06 Hrs**
4. Training Neural Networks: Weight Initialization Techniques: Zero Initialization, Random Initialization, Xavier & Normalized Xavier Initialization. Regularization Methods: Dropout, L1, L2, L3 regularization. Optimization Algorithms: SGD, Adam, Rmsprop.	**05 Hrs**
5. Deep Learning Applications: Image Classification: Image representation & preprocessing, Convolution layers and pooling operations, Case studies on Image Classification.	**05 Hrs**
6. Recurrent Neural Networks: Introduction to sequence modeling, Long short-term memory networks, applications of RNN in Natural Language Processing.	**05 Hrs**

Text Books

1. Ian Goodfellow,Yoshua Bengio, Aaron Courville, “Deep Learning,” MIT Press

References

4. NPTEL Course Materials.

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
ISA 1	15
ISA 2	15
Lab activity	20
Total	50

Laboratory Plan

Expt/ Job No.	Experiment/ Job details	No. of Lab sessions
1.	Introduction to basics	02
2.	Comparison of activation functions	01
3.	Training a neural network	01
4.	Training a DL model	01
5.	Implementation of CNN	01
6.	Image Classification using DL	01
7.	Compare DNN architectures performance for a task	01
8.	Sentiment analysis using RNN	02
9.	Course Project	04

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Program: Master of Technology		Semester II
Course Title: Blockchain and Distributed Ledgers		Course Code: 23ECSE701
L-T-P: 2-0-1	Credits: 3	Contact Hrs: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 32	Lab: 24hrs(12 Slots of 2hrs)	Exam Duration: 3 hrs

1	**Chapter No. 1. Introduction** Overview of blockchain, Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy, Types of blockchain, blockchain platforms, Blockchain Architecture and use cases, Introduction to Bitcoin	**6 hrs**
2	**Chapter No. 2. Consensus Mechanisms** Basic consensus mechanisms, Requirements for the consensus protocols, Proof of Work, Proof of State, Proof of Activity, Practical Byzantine Fault Tolerance (PBFT), Federated PBFT, Consensus protocols in Blockchain platforms, Scalability issues of consensus protocols.	**6 hrs**
3	**Chapter No. 3. Ethereum** Ethereum transactions, accounts, smart contracts, smart contract development, Solidity basics, basic contracts, DApps using Ethereum, distributed storage and IPFS, Ethereum scaling	**6 hrs**
4	**Chapter No. 4. Permissioned Blockchain Platforms- Hyperledger** Introduction, architecture and components of Hyperledger, transactions, orderer and channels, projects and tools, Fabric membership and identity management, DApps with Hyperledger Fabric, chaincode as a smart contract	**6 hrs**
5	**Chapter No. 5. Permissioned Blockchain Platforms- Corda and Multichain** Overview Corda ledger, states, contracts, Dapp using Corda, Overview of Multichain platform, Dapp using Multichain	**4 hrs**
6	**Chapter No. 6. Blockchain Applications** Blockchain in Financial Software and Systems: Settlements, KYC, Insurance Government: Digital identity, land records, public distribution system, social welfare systems, Blockchain for cyber security: Cloud forensics, Identity management, Intrusion detection.	**4 hrs**

Reference Books:

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.
2. Rogen Wattenhofer, “Blockchain Science : Distributed Ledger Technologies”, 1st Edition, Inverted Forest Publishing, 2019
3. Andreas A, Gavin Wood, "Mastering Etherium: Building smart contracts and DApp", 1st Edition, O'Reilly Media, 2018.
4. Matt Zand, Xun Wu, Mark Anthony Morris, “Hands-On Smart Contract Development with Hyperledger Fabric V2”, 1st Edition, O'Reilly Media, 2018.

Evaluation Parameters for Course Project

Assessment	Rubrics parameters	Marks	BL	PI
Review 1	Problem statement, scope and Objectives	**5**	**L3**	3.2.1 5.3.1
Review 2	System Design	**5**	**L3**	3.2.1, 5.3.1
Review 3	Implementation and result analysis	**10**	**L3**	4.2.1 5.3.1

Laboratory Plan

Expt./No.	Brief description about the experiment/job	No. of Lab. Slots
1.	Demonstration of Ethereum smart contracts	1
2.	Solidity programming- Data types, control structures and functions	1
3.	Deploying contract using external blockchainusing Metamask/Myetherwallet	1
4.	Creating custom Ethereum blockchain using Geth	2
5.	Connecting to Geth node using Web3	1
6.	IPFS with Ethereum for data storage	1
7.	Hyperledger Fabric Demo	1
8.	Course Project	6

Back

Program: Master of Technology		Semester II
Course Title: Mini Project		Course Code: 21ECSW718
L-T-P: 0-0-3	Credits: 3	Contact Hrs: 3 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Lab: 24hrs(12 Slots of 2hrs)	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

ISA (50)	Assessment	Weightage in Marks
	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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Program: Master of Technology		Semester II
Course Title: Web Technology Laboratory		Course Code: 21ECSP708
L-T-P: 0-0-2	Credits: 2	Contact Hrs: 4 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 56	Lab: 56 hrs	Exam Duration: 3 hrs

Content

1	**Introduction** Review of HTML5 basics and CSS3, Javascript basics
2	**MEAN Stack Framework:** **Angular2:** Introduction, Navigation: Angular router, Dependency injection, Bindings, observables, and pipes, component communications, forms, Interacting with servers using HTTP and WebSockets, Bundling and deploying applications. Node.js Introduction to Node.js Building servers using the http and net modules, Node modules and events, Express, Accessing Data.
3	**Building Enterprise Web Applications.** Ruby on Rails: An Overview Of Ruby on Rails, Rails and HTML Forms, Form Helpers andValidation, Databases and Rails, Adding Style to an Application, Sessions.

References:

1. Pam Selle, Tim Ruffles, Christopher Hiller, Jamie, “Choosing a JavaScript Framework”, 7th Edition, Addison Wesley, 2012.
2. Yakov Fain, Anton Moiseev, "Angular 2 Development with TypeScript", Manning Publications Company, 2016.
3. AzatMardan, "Practical Node.js: Building Real-World Scalable Web Apps", Apress, 2014.
4. Michael Hartl, “Ruby on Rails Tutorial: Learn Web Development with Rails (2nd Edition) (Addison-Wesley Professional Ruby)”.

Evaluation:

ISA and ESA Schemes

ISA (80%)	Assessment	Weightage in Marks
	Exercises (4-Evaluation)	40
	Structured Enquiry(1-evaluations)	40
ESA (20%)	-	20
	Total	**100**

Experiment wise Plan

List of experiments/jobs planned to meet the requirements of the course.

Category: Demonstration		**Total Weightage: 0.00**		**No. of lab sessions: 8**
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
1	Exploring JavaScript and HTML5 basics	2	0.00	
	Learning Outcomes: The students should be able to: 5. Use HTML tags attributes and CSS3 to build a web page. 6. Write JavaScript programs.			Chapter 1
3	Angular2	2	0.00	
	Learning Outcomes: The students should be able to: 1. Use basic building blocks of Angular apps – Models, Views, Controllers, Services and Filters			Chapter2
6	NodeJS	2	0.00	
	Learning Outcomes: The students should be able to: 1. Handle HTTP requests with Node's API 2. Accept user input from forms			Chapter2
10	Ruby on Rails	2	0.00	
	Learning Outcomes: The students should be able to: 1. Describe core principles of Ruby on Rails. 2. Use basic building blocks of Rails framework– Models, Views, Controllers			Chapter 3

Category: Exercise		Total Weightage: 40.00		No. of lab sessions: 4
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
2	JavaScript HTML5,CSS	1	10.00	Chapter 1
	Learning outcomes The students should be able to: 1. Use HTML5,Javascript,and CSS3 2. Create Forms and Data validations			
5	Angular2	1	10.00	
	Learning Outcomes: The students should be able to: 1. Use basic building blocks of Angular apps – Models, Views, Controllers, Services and Filters. 2. Structure sites with routes services and Filters. 3. Create Forms and data validations s and Filters.			Chapter 2
8	NodeJS	1	10.00	
	Learning Outcomes: The students should be able to: 1. Handle HTTP requests with Node's API. 2. Build RESTful web service and Filters. 3. Accept user input from forms and Filters .			Chapter 2
12	Ruby on Rails	1	10.00	
	Learning Outcomes: The students should be able to: 1. Develop web applications using core principles of Ruby on Rails. 2. Use basic building blocks of Rails framework– Models, Views, Controllers			Chapter 3

Category: Structured Enquiry		Total Weightage: 40.00		No. of lab sessions: 2
Expt./ Job No.	**Experiment / Job Details**	**No. of Lab Session(s) per batch (estimate)**	**Marks / Experiment**	**Correlation of Experiment with the theory**
9	NodeJS, Angular2	1	20.00	
	Learning Outcomes: The students should be able to: 1. Develop a web application using framework 2. Identify their own learning issues and to work on those issues 3. Analyze and adopt appropriate client-side and server-side framework.			Chapter 2
13	Ruby on Rails	1	20.00	
	Learning Outcomes: The students should be able to: 1. Develop a web application using framework 2. Identify their own learning issues and to work on those issues.			Chapter 3

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Semester III

Program: Master of Technology		Semester III
Course Title : Industrial/ In-House Training		Course Code: 21ECSW801
L-T-P: 0-0-6	Credits: 6	Contact Hrs: 18hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
	Lab: 108 hrs	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:

ISA and ESA Schemes

ISA (50)	Assessment	Weightage in Marks
	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: 21ECSW802
L-T-P: 0-0-8	Credits: 08	Contact Hrs: 24 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
	Lab : 336 hrs	Exam Duration: 3 hrs

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 and 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

ISA (50)	Assessment	Weightage in Marks
	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: 21ECSW803**
L-T-P: 0-0-20	**Credits: 20**	**Contact Hrs: 40 hrs/week**
ISA Marks: 50	**ESA Marks: 50**	**Total Marks: 100**
	Lab: 560 hrs	**Exam Duration: 3 hrs**

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

ISA (50)	**Assessment**	**Weightage in Marks**
	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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