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UNIVERSITY
RAMRAO ADIK
INSTITUTE OF TECHNOLOGY
NAVI MUMBAI

Credit, Evaluation Scheme and Syllabus for B. Tech. in Computer Engineering

Department of Computer Engineering

Final Year , Academic Year 2024-25

Ramrao Adik Institute of Technology

Credit structure -Semester-VII

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CEC701	Distributed Computing	03			03		-	03
CECDLO705X	DLO5	03		-	03		-	03
CECDLO706X	DLO6	03		-	03		-	03
ILON702X	Institute Level Open Elective Non-Technical ILON2	03	-	-	03	-	-	03
CEL701	Distributed Computing Lab		02			01		01
CElDLO705X	DLO5 Lab		02			01		01
CElDLO706X	DLO6 Lab		02			01		01
CESL701	Skill Based Lab V-Cloud Computing Lab	-	04	-	-	02	-	02
CEMP701	Mini-Project V	-	04	-	-	02	-	02
	Total	**12**	**14**	**-**	**12**	**07**	**-**	**19**

Semester VII Elective List

Department Level Electives (DLO)	
ElectiveCourseCode	**Coursename**
CECDLO7051	**Software Testing and Analysis**
CECDLO7052	**Soft Computing**
CECDLO7053	**Digital Forensics**
CECDLO7054	**IoT and Security**
CECDLO7061	**High Performance Computing**
CECDLO7062	**BigDataAnalytics**
CECDLO7063	**Human Computer Interaction**
CECDLO7064	**Intrusion Detection System**

Institute Level Open Elective Non-Technical II	
Course Code	**Course Name**
ILON7021	Disaster Management & Mitigation Measures
ILON7022	Cyber & Data Laws
ILON7023	Design of Experiments
ILON7024	Financial Management
ILON7025	Design Thinking

Credit structure -Semester-VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CEP801	Major Project/Internship	-	30	-	-	15	-	15

Evaluation Scheme: Semester-VII

Course Code	Course Name	IA1	IA2	AVG	MSE	ESE	Exam Hrs	TW	OR	PR & OR	Total
CEC701	**Distributed Computing**	20	20	20	20	60	02				100
CECDLO705X	**DLO5**	20	20	20	20	60	02				100
CECDLO706X	**DLO6**	20	20	20	20	60	02				100
ILON702X	**Institute Level Open Elective Non- Technical ILON2**	20	20	20	20	60	02				100
CEL701	**Distributed Computing Lab**							25	25		50
CELDLO705X	**DLO5 Lab**							25	25		50
CELDLO706X	**DLO6 Lab**							25	25		50
CESL701	**Skill Based Lab V –Cloud Computing Lab**							25		25	50
CEMP701	**Mini-Project V**							25	25		50
	Total	-	-	80	80	240	-	125	125	125	**650**

Evaluation Scheme: Semester-VIII

		Internal Assessment(150 Marks)				End Sem Oral	Total
Course Code	**Course Name**	**Evaluation 1**	**Evaluation 2**	**Report**	Attendance		
CEP801	Major Project / Internship	50	50	30	20	100	250
	Total Marks					100	**250**

Semester VII

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical / Oral Credit	Tutorial Credits	Total Credits
CEC701	**Distributed Computing**	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations								
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam	End Sem Exam				
CEC701	**Distributed Computing**	20	20	20	20	60	--	--	--	100

Course objectives:
1. To provide students with contemporary knowledge in distributed systems
2. To equip students with skills to analyze and design distributed applications.
3. To provide master skills to measure the performance of distributed synchronization algorithms

Course outcomes: On successful completion of course learner will be able to:
1. Demonstrate knowledge of the basic elements and concepts related to distributed system technologies;
2. Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.
3. Analyze the various techniques used for clock synchronization and mutual exclusion
4. Demonstrate the concepts of Resource and Process management and synchronization algorithms
5. Demonstrate the concepts of Consistency and Replication Management
6. Apply the knowledge of Distributed File System to analyze various file systems like NFS, AFS and the experience in building large-scale distributed applications

Prerequisites: Operating System, Computer Network

Sr. No.	Module	Detailed Content	Hours	CO
1	Introduction to Distributed System	Characterization of Distributed Systems: Issues, Goals, and Types of distributed systems, Distributed System Models, Hardware concepts, Software Concept. 1.2 Middleware: Models of Middleware, Services offered by middleware, Client Server model	7	CO1
2	Communication	Layered Protocols, Interprocess communication (IPC): MPI, Remote Procedure Call (RPC), Remote Object Invocation, Remote Method Invocation (RMI) 2.2 Message Oriented Communication, Stream Oriented Communication, Group Communication	7	CO2
3	Synchronization	Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, Performance measure.	7	CO3
4	Non Token based Algorithms	Non Token based Algorithms: Lamport Algorithm, Ricart–Agrawala‘s Algorithm, Maekawa‘s Algorithm Token Based Algorithms: Suzuki-Kasami‘sBroardcast Algorithms, Singhal‘sHeurastic Algorithm, Raymond‘s Tree based Algorithm, Comparative Performance Analysis.	7	CO4
5	Resource Management	Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach	6	CO5
6	Process Management	Introduction to process management, process migration, Threads , Virtualization, Clients, Servers, Code Migration	5	CO6

Text Books:

1. Andrew S. Tanenbaum and Maarten Van Steen, ―Distributed Systems: Principles and Paradigms, 2nd edition, Pearson Education.
2. George Coulouris, Jean Dollimore, Tim Kindberg, , "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education, 2005.

Reference Books:

1. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.
2. M. L. Liu, ―Distributed Computing Principles and Applications‖, Pearson Addison Wesley, 2004.

In-Semester Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 40-50% of the syllabus.

End-Semester Examination:

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
CECDLO7051	Software Testing & Analysis	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
CECDLO7051	Software Testing & Analysis	20	20	20	20	60	--	--	--	100

Course Objectives:

1. To build a foundation knowledge of software testing & detail the software testing process
2. To provide in-depth of various software verification and validation testing methods and explore software Quality assurance.
3. To introduce the concepts and methods required for the construction of large software intensive system.
4. To prepare with technical competencies to get growing career as software tester or Software Development Engineer.

Course Outcomes: At the end of the course learner will able to

1. To understand the fundamentals of software testing and analysis.
2. To understand key strategies of software testing.
3. To explain the concepts of various software testing methods and levels.
4. To explain the quality management & different types of metrics used in software development.
5. To explain the need for software management to monitor & control the software
6. To explore scope, advantages and limitations of test automation.

Prerequisites:

1) CSE-TC406 Web Programming
2) CSE-TC501 Software Engineering

Sr. No.	Module	Detailed Content	Hours	CO
1	Introduction to Software Testing	**Software Testing Fundamentals:** Basic concept and terminologies of software Testing, Need for software Testing, various approaches to Software Testing. Testing Characteristics, Software Testing Principles, The tester's role in a software development organization, Origins of Defects, Cost of defects, Defect classes, Defect Repository and Test Design Defect classes, Defect Examples, defect distribution, Defect Prevention strategies.	6	CO1
2	Software Testing Strategies	**Testing Strategies & Test case design:** Introduction to Testing Design Strategies, Black box approaches, Equivalence Class Partitioning, Boundary Value Analysis, White box approach, Control Flow Graphs, Covering Code Logic, Control Path, basic concept of verification and validation, criteria for completionof testing and debugging process. DEF-USE testing, Black Box Testing-BVA Integration	12	CO2
3	Testing methods & Levels	**Different types of testing:** Unit testing, Designing the unit tests, Integration testing, Designing integration tests, System testing & its types, Regression testing, Alpha, beta and acceptance testing, Class Testing, Interclass testing Performance testing, Regression Testing, Ad-hoc testing, A OO testing methods, Configuration testing , Compatibility testing, Testing the documentation, Website testing.	8	CO3
4	Software Quality Measurement & Metrics	**Software quality and software quality assurance:** Introduction to software quality and softwarequality assurance, basic principles about the software quality and software quality assurance. Planning for SQA, Composition of SQA plan and organizational initiatives required for a SQA.	4	CO4
5	Test Management	Test planning, cost-benefit analysis of testing, Test organization, Test strategies, Test progress monitoring and control, test reporting, test control, Specialized testing.	4	CO5
6	Test Automation	Software test automation, skill needed for automation, scope of automation, design and architecture for automation, requirements for a test tool, frameworks, challenges in automation, Test metrics and measurement project, progress and productivity metrics.	4	CO6

Text Books:

1. Roger S. Pressman, Software Engineering A Practitioner's Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Ian Somerville, Software Engineering‖, 9th Edition, Pearson Education Asia, 2011.

Reference Books:

1. Aditya P Mathur, “Foundationsof Software Testing”, (2e), Pearson Education 2008.
2. Paul C. Jorgensen, “Software Testing A Craftsman's Approach”, (3e), 2013.
3. Mauro Pezze, Michal Young, “Software Testing and Analysis: Process, Principles and Techniques”, John Wiley & Sons, 2008.

In-Semester Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 40-50% of the syllabus.

End-Semester Examination:

5. Question paper will comprise of total six question.
6. All question carry equal marks
7. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
8. Only Four question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical / Oral Credit	Tutorial Credits	Total Credits
CECDLO7052	Soft Computing	03	-	-	03	-	-	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg	MSE					
CECDLO7052	Soft Computing	20	20	20	20	60	-	-	--	100

Course Objectives:

1. To learn the basic concepts of soft computing
2. To understand the concepts of data analysis solutions
3. To understand the concepts and techniques for designing intelligent systems

Course Outcomes: Students will be able to

1. Understand the concepts of fundamentals of soft computing.
2. Understand the concepts of neural network.
3. Understand the concepts of Fuzzy Systems.
4. Apply for the solution of multi-level optimization.
5. Create hybrid systems.
6. Evaluate and understand Backpropagation Networks.

Prerequisites:

1. Analysis of Algorithms

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Fundamentals of soft Computing	Introduction of Soft Computing, Soft Computing vs. Hard Computing, requirement of soft computing, Major areas of Soft Computing, Various Types of Soft Computing Techniques, Applications of Soft Computing.	06	CO1
2	Artificial Neural Networks	What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons , Back Propagation networks,	07	CO2

		Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.		
3	Fuzzy Logic	Introduction, Fuzzy sets and Fuzzy reasoning, Basic functions on fuzzy sets, relations, rule based models and linguistic variables, fuzzy controls, Fuzzy Classifications, Fuzzy decision making, applications of fuzzy logic	07	CO3
4	Genetic Algorithms	Introduction, Genetic Algorithm, Fitness Computations, Genetic Algorithm Operations, Evolutionary Programming, Classifier Systems, Genetic Programming Parse Trees, Variants of GA, Applications.	07	CO4
5	Hybrid Systems:	Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.	06	CO5
6	Backpropagation Networks	GA based Weight Determination, K - factor determination in Columns. Fuzzy Backpropagation Networks: LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of Fuzzy BP Networks.	06	CO6

Text Books:

1. Samir Roy and Udit Chakraborty, “Introduction to Soft Computing, Pearson 1st Edition.
2. Simon S. Haykin, Neural Networks, Prentice Hall, 2nd edition.
3. Zimmermann, “Fuzzy Set Theory and its Application”, 3rd Edition.

Reference Books:

1. Xin-She Yang, “Recent Advances in Swarm Intelligence and Evolutionary Computation, Springer International Publishing, Switzerland, 2015.
2. Kalyanmoy Deb, Multi-Objective Optimization using Evolutionary Algorithms, John Wiley & Sons, 2001.
3. James Kennedy and Russel E Eberheart, Swarm Intelligence, The Morgan Kaufmann Series in Evolutionary Computation, 2001.
4. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications,
5. S.Rajasekaran, G. A. Vijayalakshami, PHI.
6. Genetic Algorithms: Search and Optimization, E. Goldberg.
7. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.
8. Build_Neural_Network_With_MS_Excel_sample by Joe choong.

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End-Semester Examination:

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical / Oral Credit	Tutorial Credits	Total Credits
CECDLO7053	Digital Forensic	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg IA	MSE					
CECDLO7053	Digital Forensic	20	20	20	20	60	--	--	--	100

Course Objectives:
provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security.

1. To discuss the need and process of digital forensics.
2. To explore the procedures for identification, preservation, and acquisition of digital evidence.
3. To provide the ability to examine and analyze real life security cases.

Course Outcomes: At the end of the course learner will able to

1. Understand the concept of "cybercrime" and its effects of digital world.
2. Discuss the phases of Digital Forensics, apply digital forensic process model.
3. To explore techniques and tools used for forensic duplication
4. Describe the process of collection, preservation of the digital evidence
5. Acquire adequate perspectives of digital forensic investigation in windows and Unix system
6. To explore techniques and tools used for email forensics and understand the process of forensic investigation reporting

Prerequisites: Computer Networks, Cryptography and Network Security

Sr. No.	**Module**	**Detailed Content**	**Hours**	**CO**
1	Introduction to Cyber Crimes	Introduction to cybercrimes, categories of cybercrime, Type of cyber-crimes, The Internet spawn's crime, Worms versus viruses, Computers' roles in crimes, prevention of cybercrime	4	CO1
2	Introduction to Digital Forensics	Digital Forensics Definition, Phases of digital Forensic, Goals of Digital Forensics investigation, Categories of digital forensic, Incident Response Methodology	6	CO2
3	Forensic Duplication	Forensic duplication: Forensic Duplicates as Admissible Evidence, creating a Forensic image, Analysis of forensic images using open-source	8	CO3

		tools, Duplicate/Qualified Forensic Duplicate of a Hard Drive		
4	Evidence Collection and Preservation	Digital Evidence? Types of Evidence, The Rules of Evidence, characteristics of digital evidence, Volatile Evidence, evidence handling procedure, Challenges in evidence handling, Admissibility of evidence, Chain of Custody	8	CO4
5	Windows and Unix Forensics Investigation	Investigating Windows Systems - File Recovery, Windows Recycle Bin Forensics, Data Carving, Windows Registry Analysis, Windows Features Forensics Analysis, Investigating Unix Systems - Reviewing Pertinent Logs, Performing Keyword Searches	8	CO5
6	Email Forensics & Forensic Investigation Reporting	Email Forensics analysis steps, email tracing, E-mail forensic tools, Goal of report, Layout of an Investigative Report, Guidelines for Writing a Report,	5	CO6

TexBooks:

1. Principles of Information Security‖, Michael E Whitman and Herbert J Mattord, Vikas Publishing House, New Delhi, 2003

Reference Books:

1. Handbook of Information Security Management‖, Vol 1-3 CRC Press LLC 2004.
2. Hacking Exposed - Stuart McClure, Joel Scrambray, George Kurtz, Tata McGraw- Hill, 2003

In-Semester Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid-semester Examination on 40-50% of the syllabus.

End-Semester Examination:

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical / Oral Credit	Tutorial Credits	Total Credits
CECDLO7054	IoT& Security	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations								
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam	End Sem Exam				
CECDLO7054	IoT& Security	20	20	20	20	60	--	--	--	100

Course Objectives:

1. To learn the concepts of IOT.
2. To identify the different technology.
3. To learn different applications in IOT.
4. To learn different protocols used in IOT.
5. To learn the concepts of smart city development in IOT.
6. To learn how to analysis the data in IOT.

Course Outcomes: At the end of the course learner will able to

1. Apply the concepts of IOT.
2. Identify the different technology.
3. Apply IOT to different applications.
4. Analysis and evaluate protocols used in IOT.
5. Design and develop smart city in IOT.
6. Analysis and evaluate the data received through sensors in IOT.

Prerequisites:

1. Wireless Networks
2. Cryptography, Network Security

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Prerequisites and Introduction	What are sensors, Sensor family, Architecture of single node sensor Introduction, History of IOT, Objects in IOT, Identifier in the IOT, Technologies in IOT	6	CO1
2	RFID	principle of RFID, components of RFID	8	CO2

	Technology	system: RFID tag, Reader, RFID middleware		
3	RFID Applications	RFID, transponder, RFID architecture, RFID Applications	8	CO3
4	Wireless Sensor Networks	Node, connecting nodes, networking nodes, securing communication, Networking and the Internet -IP Addressing, Protocols - MQTT, CoAP, REST Transferring data	8	CO4
5	Mobility	Localization, mobility management, localization and handover management, technology considerations, performance evaluation,	8	CO5
6	IOT Identification	Identification of IOT , data formats IPV6, identifiers and locators, and tag	4	CO6

Text Books:

1. Internet of Things connecting objects to the web, by HakimaChaouchi, Wiley.
2. Internet of Things (A Hands-on-Approach) by ArshdeepBhaga and Vijay Madisetti

Reference Books:

1. The Internet of Things (MIT Press) by Samuel Greengard.
2. The Internet of Things (Connecting objects to the web) by HakimaChaouchi (Wiley Publications).
3. RFID and the Internet of Things, by Hervechabanne, Wiley

In-Semester Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 40-50% of the syllabus.

End-Semester Examination:

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical / Oral Credit	Tutorial Credits	Total Credits
CECDLO7061	High Performance Computing	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
CECDLO7061	High Performance Computing	20	20	20	20	60	--	--	--	100

Course Objectives:

1. Learn the concepts of parallel processing as it pertains to high-performance computing.
2. Learn to design parallel programs on high performance computing.
3. Discuss issues of parallel programming.
4. Learn the concepts of message passing paradigm using open source APIs.
5. Learn different open source tools.
6. Learn the concepts of Multi-core processor.

Course Outcomes: At the end of the course learner will able to

1. Explain and classify different architectures of parallel systems.
2. Describe parallel algorithms and evaluate the performance of various Parallel Algorithms.
3. Analyse various message passing paradigms.
4. Use different Parallel Programming models and Parallel Programming tools.
5. Analyze and optimize performance parameters.
6. Demonstrate parallel programming for different applications using CUDA.

Prerequisites:

Data Structures, Computer Organization and Architecture, Operating System

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Parallel Processing	Introduction to Parallel Computing, Motivating Parallelism, Scope of Parallel	6	CO1

	Concepts	Computing, Levels of parallelism (instruction, transaction, task, thread, memory, function), Architectural Schemes (Flynn's, Shore's), Distributed Memory, Shared Memory, Hybrid Distributed Shared Memory, different Models Multiprocessor Architectures.		
2	Parallel Programming	Principles of Parallel Algorithm Design, Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models.	6	CO2
3	Message Passing Programming	Principles of Message Passing Programming, The Building Blocks Operations, Message Passing Interface, Topology and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations	6	CO3
4	Programming Shared Address Space Platforms	Thread Basics, The POSIX Thread API, Thread Basics Thread Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs. Share memory Architecture, Multi-core processors and Hyperthreading, Fork and join model. OpenMP directives, Processes, Multiprocessor programming model, Distributed system programming model, Inter-process communication using message passing: Asynchronous and Synchronous, MPI Programming, Message passing vs Share memory communication: Advantages and disadvantage	10	CO4
5	Performance Measures	Performance Measures: Speedup, execution time, efficiency, cost, scalability, Effect of granularity on performance, Scalability of Parallel Systems, Amdahl's Law, Gustavson's Law, Performance Bottlenecks	6	CO5
6	General Purpose Graphic	An Overview of GPGPUs, GPGPU architecture, Introduction to CUDA, CUDA enabled GPGPU, An Overview of OpenCL	5	CO6

	Processing Unit (GPGPU)	API		

Text Books:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing", Pearson Education, Second Edition, 2007.
2. Kai Hwang,Naresh Jotwani, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw Hill,Second Edition, 2010.
3. Edward Kandrot and Jason Sanders, "CUDA by Example – An Introduction to General Purpose GPU Programming",Addison-Wesley Professional, 2010.
4. Shane Cook, Morgan Kaufmann ―CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, 2012.

Reference Books:

1. Michael J. Quinn, ―Parallel Programming in C with MPI and OpenMP‖, McGraw-Hill International Editions, Computer Science Series, 2008.
2. Kai Hwang, Zhiwei Xu, ―Scalable Parallel Computing: Technology, Architecture, Programming McGraw Hill, 1998.
3. M. R. Bhujade ―Parallel Computing‖,2nd edition, New Age International Publishers, 2009.
4. Georg Hager, Gerhard Wellein, Chapman ―Introduction to High Performance Computing for Scientists and Engineers‖ Hall/CRC Computational Science Series, 2011.
5. Laurence T. Yang, Minyi Guo, ―High-Performance Computing: Paradigm and Infrastructure, Wiley, 2006.

In-Semester Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid-semester Examination on 40-50% of the syllabus.

End-Semester Examination:

1. Question paper will comprise of total six question.
2. All question carries equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical / Oral Credit	Tutorial Credits	Total Credits
CECDLO7062	Big Data Analytics	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
CECDLO7062	Big Data Analytics	20	20	20	20	60	--	--	--	100

Course Objectives:

1. Understand big data challenges in different domains including social media, transportation, finance and medicine
2. Analyze scalability and performance of relational model, SQL and emergent systems.
3. Comprehend machine learning and algorithms for data analytics.
4. Understand the capability of No-SQL systems
5. Analyze Map-Reduce programming model for better optimization

Course Outcomes: At the end of the course learner will able to

1. Understand the concept of Big data Analytics
2. Apply techniques like Hadoop and MapReduce in solving real world problems
3. Understand different NoSQL systems to handle big data
4. Apply advance techniques for mining data streams
5. Understand need of big data analytics in various applications like recommender systems, social media applications, etc
6. Apply visulalization techniques for analyzing big data.

Prerequisites:

1. Data Base Management System 2. Data mining

Sr. No.	Module	Detailed Content	Hours	CO Mapping
1	Big Data Introduction	Definition and overview of Big Data, Big Data Characteristics, Issues and challenges of Big Data, Case study of Big Data Solutions, Concept of Hadoop, Components of Hadoop,	04	CO1

		Hadoop Ecosystem		
2	Big Data Processing Algorithms	Distributed File System, MapReduce Framework and MapReduce Programming, Algorithms using Map Reduce: Matrix Vector Multiplication using mapreduce, Relational Algebra Operations using mapreduce, Hadoop Limitations	10	CO2
3	NoSQL Databases	Review of traditional Databases, Need for NoSQL Databases, NoSQL Data Architecture Patterns: Key-value stores, Graph stores, Column family (Bigtable)stores, Document stores, Variations of NoSQL architectural patterns, NoSQL Case Study	05	CO3
4	Mining Data Streams	The Stream Data Model: A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing, Filtering Streams: Bloom Filter with Analysis, Counting Distinct Elements in a Stream, Flajolet-Martin Algorithm, Counting Ones in a Window	08	CO4
5	Real Time Big Data Models	Distance Measures: Definition of a Distance Measure, Euclidean Distances, Jaccard Distance, Cosine Distance, Edit Distance, Hamming Distance A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering. Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities in a social graph.	08	CO5
6	Data Visualization	Data Visualization: Types, Applications Exploring Basic features of R, Exploring RGUI, Exploring RStudio, Handling Basic Expressions in R, Variables in R, Working with Vectors, Storing and Calculating Values in R, Creating and using Objects, Interacting with users, Handling data in R workspace, Executing Scripts, Creating Plots, Reading datasets and Exporting data from R	04	CO6

Text Books:

1. Big Data – A Primer, H. Mohanty, P. Bhuyan, D. Chenthati (Eds.), Springer, Studies in Big Data, vol. 11, 2015.
2. Mining of Massive Datasets, Jure Leskovec, AnandRajaraman, Jeffrey D. Ullman, Cambridge Universities Press, 2012.
3. EMC Education Services, Data Science and Big Data Analytics‖,Wiley

Reference Books:

1. Hadoop, VigneshPrajapati, PACKT Publishing 4. Bill Franks, Taming The Big Data Tidal Wave, 1st Edition, Wiley, 2012.

In-Semester Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 40-50% of the syllabus.

End-Semester Examination:

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
CECDLO7063	Human Computer Interaction	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
CECDLO7063	Human Computer Interaction	20	20	20	20	60	--	--	--	100

Course Objective: At the end of the course, students will be able to

1. Learn the foundation of human-machine interaction.
2. Understand the importance of human psychology in designing good interfaces.
3. Be aware of mobile interaction design and its usage in day – to – day activities.
4. Understand various design technologies to meet user requirements.
5. Encourage to indulge into research in Machine Interaction Design.

Course Outcomes: At the end of the course learner will able to

1. Identify User Interface (UI) design principles.
2. Analysis of effective user-friendly interfaces.
3. Apply the Interactive Design process in real-world applications.
4. Evaluate UI design and justify.
5. Create applications for social and technical task

Prerquisites: Web Technologies; Software Engineering; Experience in designing interfaces forapplications and web sites. Basic knowledge of designing tools and languages like HTML, Java, etc

Sr. No.	**Module**	**Detailed Content**	**Hours**	**CO**
1	FOUNDATIONS OF HMI	The Human: History of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday	08	CO1

		Things, Psychology of everyday actions, Reasoning and problem solving. The computer: Devices, Memory, processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms.		
2	DESIGN & SOFTWARE PROCESS	Mistakes performed while designing a computer system, Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds. Interactive Design basics, process, scenarios, navigation, Iteration and prototyping. HMI in software process: software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules: principles, standards, guidelines, rules. Recognize the goals, Goal directed design process. Evaluation Techniques: Universal Design	08	CO2
3	GRAPHICAL USER INTERFACE	The Graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical systems, Characteristics. Web user Interface: Interface popularity, characteristics. The merging of graphical Business systems and the Web. Principles of user interface design.	08	CO3
4	SCREEN DESIGNING:	Design goals, Screen planning, and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation of information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design	06	CO4
5	INTERFACE DESIGN FOR MOBILE DEVICES:	Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	05	CO5
6	INTERACTION STYLES AND COMMUNICATION:	Windows: Characteristics, Components, Presentation styles, Types of Windows, Management, operations. Text messages: Words, Sentences, messages and text words, Text for web pages. Icons, Multimedia and colors	04	CO6

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction‖, 3rdEdition, Pearson Education, 2004.
2. Wilbert O. Galitz, —The Essential Guide to User Interface Design, Wiley publication.

3. Alan Cooper, Robert Reimann, David Cronin, —About Face3: Essentials of Interaction design, Wiley publication.

4. Jeff Johnson, —Designing with the mind in mind, Morgan Kaufmann Publication. 5. Donald A. Normann, — Design of everyday things, Basic Books; Reprint edition 2002.

5. Brian Fling, —Mobile Design and Development‖, First Edition, O'Reilly Media Inc., 2009.

Reference Books:

1. Rogers Sharp Preece, Interaction Design: Beyond Human Computer Interaction, Wiley.

2. Guy A. Boy —The Handbook of Human Machine Interaction, Ashgate publishing Ltd.

3. Kalbnde, Kanade, Iyer, Galitz's Human Machine Interaction, Wiley Publications.

In-Semester Assessment: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project. There will be a mid semester Examination on 40-50% of the syllabus.

End-Semester Examination:

1. Question paper will comprise of total six question.
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
CECDLO7064	**Intrusion Detection System**	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical & Oral	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA 1	IA 2	Avg. of 2 IAs	Mid Sem Exam					
CECDLO7064	**Intrusion Detection System**	20	20	20	20	60	-	-	-	100

Course Objectives:

1. Compare alternative tools and approaches for Intrusion Detection through quantitative analysis to determine the best tool or approach to reduce risk from intrusion.
2. Identify and describe the parts of all intrusion detection systems and characterize new and emerging IDS technologies according to the basic capabilities all intrusion detection systems share.

Course Outcomes: At the Possess a fundamental knowledge of Cyber Security.

3. Understand the vulnerability in network andaddress common vulnerabilities.
4. Know basic and fundamental risk management principles as it relates to IDPS
5. Analysed the network behaviour and prevention techniques
6. Understand and analysed host based IDPS
7. Understand and analysedMultiple IDPS Technologies
8. Analysed various IDPS Products

Prerequisites:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
	IDPS Technologies	Components & Architecture – Network architecture, Securities capabilities- information gathering, logging, detection, prevention capabilities, Management- Implementation, operation & maintenance, building & maintaining skills	05	CO1
2	Network-Based IDPS	Networking Overview- Application Layer, Transport Layer, Network Layer,	07	CO2

		Hardware Layer, Components and Architecture, Typical Components, Network Architectures and Sensor Locations, Security Capabilities, Information Gathering Capabilities Logging Capabilities, Detection Capabilities, Prevention Capabilities, Management- Implementation, Operation and Maintenance		
3	Network Behaviour Analysis	Components and Architecture,Typical Components, Network Architecture Sensor Locations, Security Capabilities- Information Gathering Capabilities, Logging Capabilities, Detection Capabilities , Prevention Capabilities, Management- Implementation, Operation and Maintenance	07	CO3
4	Host-Based IDPS	Components and Architecture, Typical Components, Network Architectures, Agent Locations, Host Architectures, Security Capabilities, Logging Capabilities, Detection Capabilities, Prevention Capabilities, Other Capabilities.	07	CO4
5	Integrating Multiple IDPS Technologies	The Need for Multiple IDPS Technologies, Integrating Different IDPS Technologies, Direct IDPS Integration, Indirect IDPS, Integration Other Technologies with IDPS Capabilities, Network Forensic Analysis Tool (NFAT) Software, Anti-Malware Technologies, Firewalls and Routers, Honeypots	06	CO5
6	IDPS Product Selection	General Requirements, Security Capability Requirements, Performance Requirements, Life Cycle Costs, Evaluating Products, IDPS Testing Challenges, Recommendations for IDPS Evaluations	06	CO6

Text Books:

1. Guide to Intrusion Detection and Prevention Systems- Karen Scarfone Peter Mell- Computer Security Division Information Technology Laboratory National Institute of Standards and Technology Gaithersburg, **National Institute of Standards and Technology Special Publication 800-94**

Reference Books:

1. Tim Crothers, Implementing Intrusion Detection Systems: A Hands–On Guide for Securingthe Network, John Wiley and Sons.
2. Christopher Kruegel, FedrickValeur, Intrusion Detection and Correlation: Challenges and

Solutions, Springer.

Evaluation Scheme:

1. **In-Semester Assessment:**

- Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

1. **End-Semester Examination:**

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
CEL701	**Distributed Computing Lab**	**-**	**02**	**-**	**-**	**01**	**-**	**01**

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical & Oral	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	AVG	Mid Sem Exam					
CEL701	**Distributed Computing Lab**	-	-	-	-	-	25	-	25	50

Lab Objectives:

1 To provide students with contemporary knowledge in distributed systems.
2. To learn the concept of clock synchronization.
3. To provide master skills to measure the performance of distributed mutual exclusion algorithms.
4. To study resource allocation.
5. To understand process management.

Lab Outcomes: At the end of the course, the students will be able to

CO1: Demonstrate knowledge of the basic elements and concepts related to distributed system technologies.
CO2: Develop test and debug using Message-Oriented Communication or RPC/RMI based client-server programs.
CO3: Implement techniques for Clock Synchronization and Election Algorithms.
CO4: Demonstrate mutual exclusion algorithms in distributed system.
CO5: Implement techniques of resource management.
CO6: Implement techniques of process management.

Prerequisite: Operating System, Computer Network

Suggested List of Experiments

Experiment No.	Experiments Name	CO Mapping
1	Program to demonstrate datagram Socket for Chat Application using Java.	CO1
2	Program to implement RMI Application using Java.	CO2
3	Program to demonstrate Berkeley Clock Synchronization Algorithm.	CO3
4	Program to demonstrate Bully Election Algorithm.	CO3
5	Program to implement Token based algorithm for distributed mutual exclusion.	CO4
6	Program to implement Non-Token based Algorithm for distributed mutual exclusion.	CO4
7	Program to Simulate Load Balancing Algorithm.	CO5
8	Program to implement Deadlock management in distributed system.	CO6

Text Books:

1. Andrew S. Tanenbaum and Maarten Van Steen, ―Distributed Systems: Principles and Paradigms, 2nd edition, Pearson Education.
2. George Coulouris, Jean Dollimore, Tim Kindberg, , "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education, 2005.

Reference Books:

1. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.
2. M. L. Liu, ―Distributed Computing Principles and Applications‖, Pearson Addison Wesley, 2004..

Term Work:

The Term work Marks are based on the weekly experimental performance of the students and case study, oral performance and regularity in the lab.

Students are expected to be prepared for the lab ahead of time by referring the manual and perform the experiment under the guidance and discussion. Next week the experiment write- up to be corrected along with oral examination.

End Semester Examination:

End of the semester, there will be Oral evaluation based on the laboratory work and the corresponding theory syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
CELDLO7051	Software Testing & Analysis Lab.	-	02	-	-	01	-	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
CECDLO7051	Software Testing & Analysis Lab.						25	--	25	50

Course Objectives Lab.:

1. To explore and apply of the basic concepts and techniques used in software testing, including test planning, test cases, test coverage, and test automation.
2. Understanding of software quality and the importance of testing in ensuring qualitysoftware
3. To develop practical testing skills by working on real-world testing projects
4. To develop skills in software test automation and management using latesttools.

Course Outcomes Lab.: At the end of the course learner will able to

1. To develop effective test plans and test cases.
2. To explore and use various testing tools and techniques.
3. To apply testing approaches for each level of software testing.
4. To apply different types of software development metrics and quality management tools.
5. To apply software management tool to monitor & control the software development.
6. To develop and implement automated test scripts for a software application

List of Experiment

Sr. No.	Title	CO mapping
1	Develop a test plan and test cases for a given software application/case study	CO1
2	Black-Box Testing: Perform black-box testing on a software application/case study	CO2
3	White-Box Testing: Perform white-box testing on a software application/case study	CO2
4	To develop and execute unit tests for a given software component	CO3
5	To develop and execute alpha, beta testing for a given software component	CO3
6	To develop and implement a software quality assurance plan for a given software system	CO4
7	To select and apply a tool to monitor the progress of the software development. (eg. Jira)	CO5
8	Test Automation: Develop and implement automated test scripts for a software application using an industry-standard test automation framework, such as Selenium.	CO6

Text Books:

3. Roger S. Pressman, Software Engineering A Practitioner's Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010.
4. Ian Somerville, Software Engineering‖, 9th Edition, Pearson Education Asia, 2011.

Reference Books:

4. Aditya P Mathur, "Foundationsof Software Testing", (2e), Pearson Education 2008.
5. Paul C. Jorgensen, "Software Testing A Craftsman's Approach", (3e), 2013.

Mauro Pezze, Michal Young, "Software Testing and Analysis: Process, Principles and Techniques", John Wiley & Sons, 2008.

Term Work:

The Term work Marks are based on the weekly experimental performance of the students, Oral performance and regularity in the lab.

Students are expected to be prepared for the lab ahead of time by referring the manual and perform the experiment under the guidance and discussion. Next week the experiment write-up to be corrected along with oral examination.

End Semester Examination:

End of the semester, there will be Oral examination based on the laboratory work and the corresponding theory syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical / Oral Credit	Tutorial Credits	Total Credits
CELDLO7052	Soft Computing Lab	-	02	-	-	01	-	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg	MSE					
CELDLO7052	Soft Computing Lab	-	-	-	-	-	25	-	25	50

Lab Objectives:
1. To implement the basic concepts of soft computing
2. To implement Fuzzy logic systems
3. To implement GA systems

Lab Outcomes: Students will be able to
1. Understand the implementation of fundamentals of soft computing.
2. Understand the Implementation of concepts of neural network.
3. Understand the implementation of concepts of Fuzzy Systems.
4. Apply for the solution of multi-level optimization.
5. Create hybrid systems.
6. Evaluate and understand Backpropagation Networks.

Suggested Experiments:

Experiment No.	Experiments Name	CO Mapping
1	Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.	CO1
2	Create a simple ADALINE network with appropriate no. of input and output nodes. Train it using delta learning rule until no change in weights is required. Output the final weights	CO2
3	Implement Union, Intersection, Complement and Difference operations on fuzzy sets.Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform maxmin composition on any two fuzzy relations.	CO3

4	Solve Greg Viot's fuzzy cruise controller using MATLAB Fuzzy logic toolbox.	CO3
5	Implement Genetic algorithm for any machine learning application.	CO4
6	Solve Air Conditioner Controller using MATLAB Fuzzy logic toolbox	CO5
7	Implement TSP using GA.	CO6

Term Work:

The Term work Marks are based on the weekly experimental performance of the students, Oral performance and regularity in the lab. Students are expected to be prepared for the lab ahead of time by referring the manual and perform the experiment under the guidance and discussion. Next week the experiment write-up to be corrected along with oral examination.

End Semester Examination:

End of the semester, there will be Oral examination based on the laboratory work and the corresponding theory syllabus.

Course Code	Course Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
CELDLO7053	Digital Forensic Lab	-	02	-	-	01	-	01

Course Code	Course Name	Examination Scheme								
		Theory Marks					Term Work	Practical & Oral	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	AVG	Mid Sem Exam					
CELDLO7053	Digital Forensic Lab	-	-	-	-	-	25	--	25	50

Lab Objectives:

1. To demonstrate the procedures for identification, preservation, and acquisition of digital evidence
2. To demonstrate techniques and tools used in digital forensics for operating systems
3. To provide the ability to examine and analyze real life security cases**.**

Course Outcomes:

1. Understand and Design models of data warehouse.
2. Apply OLAP operations on multidimensional data model.
3. Apply steps of data pre-processing, data mining tasks using appropriate tools.
4. Identify and implement association mining algorithms in real world scenario.
5. Apply various classification and clustering algorithms in real world scenario.
6. Evaluate new technologies to determine their potential impact on your information resource for multimedia and web data mining.

Prerequisites:

Sr No.	Name of Experiment	CO Meet	Weightage (in marks)
1.	Implementation of Phishing	CO1	10
2.	Study of digital Forensics and different tools used for forensic investigation	CO2	10
3.	Analysis of forensic images using open-source tools (FTK imager/Autopsy)	CO3	05
4.	Creation of Forensic image duplication using open-source forensic tool	CO3	05
5.	Windows Recycle Bin Forensics	CO4	10
6.	To implement how to use Command Prompt to hide and extract any text file hidden behind an image or audio file.	CO5	05
7.	Recovery of Deleted Files using Forensics Tools	CO5	05
8.	Email Analysis using open-source forensic tool	CO6	05
9.	Generate a Timeline Report Using Autopsy	CO6	05

TexBooks:

1. Principles of Information Security‖, Michael E Whitman and Herbert J Mattord, Vikas Publishing House, New Delhi, 2003

Reference Books:

2. Handbook of Information Security Management‖, Vol 1-3 CRC Press LLC 2004.
3. Hacking Exposed - Stuart McClure, Joel Scrambray, George Kurtz, Tata McGraw- Hill, 2003

Term Work:

The Term work Marks are based on the weekly experimental performance of the students, Oral performance and regularity in the lab. Students are expected to be prepared for the lab ahead of time by referring the manual and perform the experiment under the guidance and discussion. Next week the experiment write-up to be corrected along with oral examination.

End Semester Examination:

End of the semester, there will be Oral examination based on the laboratory work and the corresponding theory syllabus.

Course Code	Course Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
CELDLO7054	IoT and Security Lab	-	02	-	-	01	-	01

Course Code	Course Name	Examination Scheme								
		Theory Marks					Term Work	Practical & Oral	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	AVG	Mid Sem Exam					
CELDLO7054	IoT and Security Lab	-	-	-	-	-	25		25	50

Ten (10) Experiment will be conducted on the basis of above syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical / Oral Credit	Tutorial Credits	Total Credits
CELDLO7061	High Performance Computing Lab		02	--		01	--	01

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	Avg. of 2 IAs	Mid Sem Exam					
CELDLO7061	High Performance Computing Lab						25	--	25	50

Prerequisite: C Programming	
Lab Objectives: The objective of the course is to:	
1	Enable students to build the logic to parallelize the programming task.
2	Give insight about performance of parallel computing systems.
3	Provide hands-on experience on parallel programming platforms/frameworks
Lab Outcomes: After learning the course, the students will be able to:	
1	Perform Linux based commands on remote machine
2	Compare the performance of sequential algorithms with parallel algorithm in terms of execution time, speedup and throughput.
3	Implement parallel program using OpenMP libraryand analyze its performance
4	Implement parallel program using MPIplatform and analyze its performance
5	Implement parallel program using OpenCL framework and analyze its performance
6	Implement parallel program using CUDA framework on GPU and analyze its performance

Suggested Experiments: Students are required to complete at least 8 experiments.	
Star (*) marked experiments are compulsory.	
Sr. No.	**Name of the Experiment**
1	To setup SSH passwordless logins for two or more Linux based machines and execute commands on a remote machine. **Hardware/Software Requirement:** Linux Operating System, Multi-core computer systems
2	Write a program in C to multiply two matrices of size 10000 x 10000 each and find it's execution-time using "time" command. Try to run this program on two or more machines having different configurations and compare execution-times obtained in each run. Comment on which factors affect the performance of the program. **Hardware/Software Requirement:** Linux Operating System, gcc compiler,Multi-core computer systems
3	Write a "Hello World" program using OpenMP library also display number of threads created during execution. **Hardware/Software Requirement:** Linux Operating System, gcc compiler,Dual core with HT or Quad-core or higher computer system.
4	Write a parallel program to calculate the value of PI/Area of Circle using OpenMP library. **Hardware/Software Requirement:** Linux Operating System, gcc compiler,Dual core with HT or Quad-core or higher computer system.
5	Write a parallel program to multiply two matrices using openMP library and compare the execution time with its serial version. Also change the number of threads using omp_set_num_threads() function and analyse how thread count affects the execution time. **Hardware/Software Requirement:** Linux Operating System, gcc compiler,Dual core with HT or Quad-core or higher computer system.
6	Install MPICH library and write a "Hello World" program for the same. **Hardware/Software Requirement:** Linux Operating System, MPICH, Multi-processor systems or MPI Cluster.
7	Write a parallel program to multiply two matrices using MPI library and compare the execution-time with it‘s OpenMP and serial version. **Hardware/Software Requirement:** Linux Operating System, MPICH, gcc, Multi-processor systems, or MPI Cluster.
8	Install MPICH on two and more machines and create a MPI cluster. Execute MPI programs on this cluster and check the performance. **Hardware/Software Requirement:** Linux Operating System, MPICH, Multi-processor systems or MPI Cluster.
9	Implement a program to demonstrate balancing workload on MPI platform. **Hardware/Software Requirement:** Linux Operating System, MPICH, Multi-processor systems or MPI Cluster.

10	Implement Two Vector addition using OpenCL/CUDA/ Parallel Matlab **Hardware/Software Requirement:** A CUDA-capable GPU, A supported version of Microsoft Windows,A supported version of Microsoft Visual Studio, The NVIDIA CUDA Toolkit
11	Implement even-odd/Bucket /Radix /Shell sort using OpenCL/CUDA/ Parallel Matlab **Hardware/Software Requirement:** A CUDA-capable GPU, A supported version of Microsoft Windows,A supported version of Microsoft Visual Studio, The NVIDIA CUDA Toolkit

Text Books:

5. Michael J. Quinn, ―Parallel Programming in C with MPI and OpenMP‖, McGraw-Hill International Editions, Computer Science Series, 2008.
6. Edward Kandrot and Jason Sanders, "CUDA by Example – An Introduction to General Purpose GPU Programming",Addison-Wesley Professional, 2010.

Reference Books:

6. Georg Hager, Gerhard Wellein, Chapman ―Introduction to High Performance Computing for Scientists and Engineers‖ Hall/CRC Computational Science Series, 2011.
7. Shane Cook, Morgan Kaufmann ―CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, 2012.

Term Work:

The Term work Marks are based on the weekly experimental performance of the students, Oral performance and regularity in the lab.

Students are expected to be prepared for the lab ahead of time by referring to the manual and performing the experiment under the guidance and discussion. Next week the experiment write-up to be corrected along with oral examination.

End Semester Examination:

End of the semester, there will be Oral examination based on the laboratory work and the corresponding theory syllabus.

		Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
CELDLO7062	**Big Data Analytics Lab**	**-**	**02**	**-**	**-**	**01**	**-**	**01**

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical & Oral	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	AVG	Mid Sem Exam					
CELDLO7062	**Big Data Analytics Lab**	-	-	-	-	-	25	--	25	50

Lab Objectives:

1. Solve Big Data problems using Map Reduce Technique and apply to various algorithms.
2. Identify various types of NoSQL databases and execute NOSQL commands
3. Understand implementation of various analytic techniques using Hive/PIG/R/Tableau, etc.
4. Apply streaming analytics to real time applications.

Lab Outcomes: At the end of the course, the students will be able to

1. Understand the concept of Big data Analytics
2. Apply techniques like Hadoop and MapReduce in solving real world problems
3. Understand different NoSQL systems to handle big data
4. Apply advance techniques for mining data streams
5. Understand need of big data analytics in various applications like recommender systems, social media applications, etc
6. Apply visualization techniques for analyzing big data.

Prerequisite: Data Base Management System, Data mining

Suggested List of Experiments

Experiment No.	Experiments Name	CO Mapping
1	A. Study of Hadoop ecosystem B Hadoop Installation on single node using Cloudera Quickstart Vm C. Basic Commands and adding files to HDFS	CO1
2	Write a program to implement word count program using MapReduce	CO2
3	Implementing simple algorithms in Map-Reduce: Matrix multiplication.	CO2
4	A. Install and Configure MongoDB B. Basic Commands in MongoDB - CRUD Operations	CO3
5	Implement Bloom Filter using any programming language	CO4
6	Implement FM Algorithm using any programming language	CO4
7	Case study: On Real Time Recommendation Systems	CO5
8	Data Visualization using R language	CO6

Text Books:

1. Big Data – A Primer, H. Mohanty, P. Bhuyan, D. Chenthati (Eds.), Springer, Studies in Big Data, vol. 11, 2015.
2. Mining of Massive Datasets, Jure Leskovec, AnandRajaraman, Jeffrey D. Ullman, Cambridge Universities Press, 2012.
3. EMC Education Services, Data Science and Big Data Analytics,Wiley

Reference Books:

1. Hadoop, VigneshPrajapati, PACKT Publishing 4. Bill Franks, Taming The Big Data Tidal Wave, 1st Edition, Wiley, 2012.

Term Work:

The Term work Marks are based on the weekly experimental performance of the students and mini-project, oral performance and regularity in the lab.

Students are expected to be prepared for the lab ahead of time by referring the manual and perform the experiment under the guidance and discussion. Next week the experiment write-up to be corrected along with oral examination.

End Semester Examination:

End of the semester, there will be Oral evaluation based on the laboratory work and the corresponding theory syllabus.

		The or	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/Oral Credit	Tutorial Credits	Total Credits
CELDLO7063	**Human Compute r Interactio**	**-**	**02**	**-**	**-**	**01**	**-**	**01**

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical & Oral	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA 1	IA2	AVG	Mid Sem Exam					
CELDLO7063	**Human Computer Interaction Lab**	-	-	-	-	-	25	-	25	50

Lab Objectives:

1. Learn the foundation of human machine interaction.
2. Understand the importance of human psychology in designing good interfaces.
3. Be aware of mobile interaction design and its usage in day – to – day activities.
4. Understand various design technologies to meet user requirements.
5. Encourage to indulge into research in Machine Interaction Design.

Lab Outcomes: At the end of the course, the students will be able to

CO1: Understand human psychology and apply HMI principles in day-to-day activities.
CO2: Apply interactive design process and develop user centric interface for real world applications.
CO3: Identify and apply good user interface (UI) design principles.
CO4: Analyze and evaluate user interface design.
CO5: Understand and apply mobile interface design principles for developing mobile device apps.
CO6: To create applications for social and technical task by applying the core theories and models from the field of HCI

Prerequisite: Web Technologies; Software Engineering; Experience in designing interfaces for applications and web sites. Basic knowledge of designing tools and languages like HTML, Java, etc

Suggested List of Experiments

Experiment No.	Experiments Name	CO Mapping
1	To understand the trouble of interacting with machine and redesign interface of any home appliances.	CO1
2	To create a low fidelity prototype design to teach mathematics to children of 4-5 years' age in schools in Rural /Urban Sector.	CO2
3	To create a high-fidelity prototype design to teach mathematics to children of 4-5 years age in schools in Rural /Urban Sector and evaluate design using heuristics approach.	CO2
4	To understand good screen design by applying user interface design principles.	CO3
5	To calculate screen complexity of existing graphical user interface and redesign the interface to minimize the screen complexity	CO4
6	To design a mobile app navigator for a student new in your Institute/ Shopping mall	CO5
7	To design an UI application for Institute event management using Menus and Windows	CO6
8	To design appropriate icons pertaining to a given domain	CO6

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction‖, 3rdEdition, Pearson Education, 2004.
2. Wilbert O. Galitz, —The Essential Guide to User Interface Design, Wiley publication.
3. Alan Cooper, Robert Reimann, David Cronin, —About Face3: Essentials of Interaction design, Wiley publication.
4. Jeff Johnson, —Designing with the mind in mind, Morgan Kaufmann Publication. 5. Donald A. Normann, — Design of everyday things, Basic Books; Reprint edition 2002.
6. Brian Fling, —Mobile Design and Development‖, First Edition, O'Reilly Media Inc., 2009.

Reference Books:

1. Rogers Sharp Preece, Interaction Design: Beyond Human Computer Interaction, Wiley.
2. Guy A. Boy —The Handbook of Human Machine Interaction, Ashgate publishing Ltd.
3. Kalbande, Kanade, Iyer, Galitz's Human Machine Interaction, Wiley Publications.

Term Work:

The Term work Marks are based on the weekly experimental performance of the students and mini-project, oral performance and regularity in the lab.

Students are expected to be prepared for the lab ahead of time by referring the manual and perform the experiment under the guidance and discussio$_{3}$n$_{6\cdot5}$Next week the experiment write- up to be corrected along with oral examination.

End Semester Examination:

End of the semester, there will be Oral evaluation based on the laboratory work and the corresponding theory syllabus.

Course Code	Course Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
CELDLO7064	**Intrusion Detection System-Lab**	-	02	-	-	01	-	01

Course Code	Course Name	Examination Scheme								
		Theory Marks					Term Work	Practical & Oral	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA 1	IA2	AVG	Mid Sem Exam					
CELDLO7064	**Intrusion Detection System-Lab**	-	-	-	-	-	25	-	25	50

Course Objectives:

1. Compare alternative tools and approaches for Intrusion Detection through quantitative analysis to determine the best tool or approach to reduce risk from intrusion.
2. Identify and describe the parts of all intrusion detection systems and characterize new and emerging IDS technologies according to the basic capabilities all intrusion detection systems share

Course outcomes: At the end of the course learner will able to

1. Understand the vulnerability in network and address common vulnerabilities.
2. Know basic and fundamental risk management principles as it relates to IDPS
3. Analysed the network behaviour and prevention techniques
4. Understand and analysed host based IDPS
5. Understand and analysed Multiple IDPS Technologies
6. Analysed various IDPS Products

Experiment No.	Name of the Experiment	CO Mapping
1	Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.	CO1
2	Study of packet sniffer tools like wireshark, ethereal, tcpdump etc. Use the tools to do the following 1. Observer performance in promiscuous as well as non-promiscous mode. 2. Show that packets can be traced based on different filters.	CO1
3	Detect ARP spoofing using open source tool ARPWATCH.	CO2
4	Use the Nessus tool to scan the network for vulnerabilities.	CO2
5	Install IDS (e.g. SNORT) and study the logs.	CO3
6	Protect Ypur EC2 instance by leveraging IDS/IPS solution on AWS	CO4

7	Monitor Host-Based Intrusion Detection System Alerts on Amazon EC2 Instances	CO4
8	Intrusion Detection system using SNORT for given scenario	CO5
9	Port Scan Attacks and Its detection using SNORT	CO5
10	Detecting ICMP based Network Reconnaissance using SNORT	CO5
11	SYN Flood attacks and its Detection using SNORT	CO6

Text Books

1. Guide to Intrusion Detection and Prevention Systems- Karen Scarfone Peter Mell- Computer Security Division Information Technology Laboratory National Institute of Standards and Technology Gaithersburg, **National Institute of Standards and Technology Special Publication 800-94**

Reference Books

1. Tim Crothers, Implementing Intrusion Detection Systems: A Hands–On Guide for Securing the Network, John Wiley and Sons.
2. Christopher Kruegel, FedrickValeur, Intrusion Detection and Correlation: Challenges and Solutions, Springer.

Term Work:

The Term work Marks are based on the weekly experimental performance of the students, Oral performance and regularity in the lab.

Students are expected to be prepared for the lab ahead of time by referring the manual and perform the experiment under the guidance and discussion. Next week the experiment write-up to be corrected along with oral examination.

End Semester Examination:

End of the semester, there will be oral evaluation based on the laboratory work and the corresponding theory syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pr/ Oral	Total
ILON7021	Disaster Management and Mitigation Measures	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme								
		Theory						TW	Pr/ Oral	Total
		Internal Assessment				End Sem Exam	Exam. Duration (in Hrs)			
		Test1	Test2	Avg.	Mid Sem Exam					
ILON7021	Disaster Management and Mitigation Measures	20	20	20	20	60	2	--	--	100

Course Pre-requisite: None

Course Description:

This course aims for disaster managers eventually to work themselves out of their job. The ultimate success of disaster management would be the elimination of the underlying causes of disasters which would contribute to disaster prevention. Obviously, total prevention will not be feasible, but minimizing the people's vulnerability to disaster and responding to emergencies in positive ways will make an enormous impact on the current deadly state of disaster events. This enhances awareness of Disaster Risk Management institutional processes in India and builds skills to respond to disasters.

Course Objectives:

1. To understand the various types of disaster occurring around the world.
2. To identify extent and damaging capacity of a disaster.
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand role of individual and various organization during and after disaster.
5. To know warning systems, their implementation and based on this to initiate training to a laymen.
6. To understand application of GIS in the field of disaster management.
7. To understand the emergency government response structures before, during and after disaster.

Course Outcomes: At the end of the course learner will able to,

CO1: Acquire fundamentals of disasters, long term effects global warming, perspective and concepts of human life.

CO2: Understand natural as well as man-made disaster and their extent and possible effects on the economy.

CO3: Planning of national importance structures based upon the previous history.

CO4: Understand government policies, acts and various organizational structure associated with an emergency.

CO5: Know the simple do's and dont's in such extreme events and act accordingly. CO6: Know the preventive and mitigation disaster measures.

Module No.	Detailed Content	Hrs.
1	**Introduction:** Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.	04
2	**Natural Disaster and Manmade disasters:** Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion. Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.	08
3	**Disaster Management, Policy and Administration:** Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management. Policy and administration: Importance and principles of disaster management policies, command and co-ordination of in disaster management, rescue operations-how to start with and how to proceed in due course of time, study of flowchart showing the entire process.	06
4	**Institutional Framework for Disaster Management in India:** Importance of public awareness, Preparation and execution of emergency management programme. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India. Methods and measures to avoid disasters, Management of casualties, set up of emergency facilities, importance of effective communication amongst different agencies in such situations. Use of Internet and softwares for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard.	07
5	370	07

	Financing Relief Measures: Ways to raise finance for relief expenditure, Role of government agencies and NGO's in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGO's and the works they have carried out in the past on the occurrence of various disasters, Ways to approach these teams. International relief aid agencies and their role in extreme events.	
6	**Preventive and Mitigation Measures:** Pre-disaster, during disaster and post-disaster measures in some events in general, Structural mapping: Riskmapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication. Non-Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. Do's and dont's in case of disasters and effective implementation of relief aids.	**07**
	Total	**39**

Evaluation Scheme:

1) **In-Semester Assessment:**

- Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

2) **End-Semester Examination:**

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus

References:

1. Harsh K.Gupta, "Disaster Management", Universities Press Publications.
2. O.S. Dagur, "Disaster Management: An Appraisal of Institutional Mechanisms in India", published by Centre for land warfare studies, New Delhi, 2011.
3. Damon Copolla, "Introduction to International Disaster Management", Butterworth Heinemann Elsevier Publications.
4. Jack Pinkowski, "Disaster Management Handbook", CRC Press Taylor and Francis group.
5. Rajdeep Dasgupta, "Disaster management & rehabilitation", Mittal Publications, New Delhi.
6. R B Singh, "Natural Hazards and Disaster Management, Vulnerability and Mitigation", Rawat Publications.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pr/ Oral	Total
ILON7022	Cyber and Data Laws	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme								
		Theory						TW	Pr/ Oral	Total
		Internal Assessment				End Sem Exam	Exam. Duration (in Hrs)			
		Test1	Test2	Avg.	Mid Sem Exam					
ILON7022	Cyber and Data Laws	20	20	20	20	60	2	--	--	100

Course Description:

This Course gives Introduction to the Cyber World and Cyber Law, Regulatory Framework such as International Legal Regime, International legal regime relating to E-Commerce and Domestic Legal Regime. What is Cybercrime, Kinds of cybercrimes and relevant provisions under Information Technology Act 2000 Indian Penal Code? Also addresses the Important Issues in Global E-commerce, Issues relating to Access, Trust, Privacy and Security, Consumer Protection and so on.

Course Objectives:

- To understand and identify different types cybercrime and cyber law
- To recognized Indian IT Act 2008 and its latest amendments
- To learn various types of security standards compliances

Course Outcomes: At the end of the course learner will able to

1. Understand the concept of cybercrime and its effect on outside world
2. Interpret and apply IT law in various legal issues
3. Apply various tools used for cyber-crime for investigation
4. Distinguish different aspects of cyber law & its compliance
5. Apply and analysed IT Acts for current cyber crimes
6. Apply Information Security Standards compliance during software design and development.

Module No.	Detailed Content	Hrs.
1	**Introduction to Cybercrime:** Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.	6
2	**Cyber offenses & Cybercrime** Social egg attacks, Cyber stalking, Botnets, Attack vector, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges for wireless Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	6
3	**Tools for Cyberline** Methods, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, Covert channels, storage and timing covert channels, counter measures for covert communication, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Identity Theft -ID Theft	6
4	**The Law of IT Compliance** How to conduct investigations: Cooperation with investigations, Numerous Examples of Fraud (PostMordems), Securities Fraud, Federal Sentencing Guidelines, Codes of Ethics, Hotlines, Reporting, Whistleblowing, Employee Monitoring, Entrapment, Raids & Seizures Electronic Banking , The Need for an Indian Cyber Law.	5
5	**Indian IT Act** Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	8
6	**Information Security** Standard compliances, Information Security Standard compliances SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	8
	Total	39

Evaluation Scheme:

1) **In-Semester Assessment:**

- Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

2) **End-Semester Examination:**

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Text books:

1. Sood, “Cyber Laws Simplified”, McGraw Hill.
2. Anthony Reyes, “Cyber Crime Investigations: Bridging the Gaps Between Security Professionals, Law Enforcement, and Prosecutors”, Syngress Publishing, 2007.
3. Nina Godbole, Sunit Belapure, “Cyber Security”, Wiley India, New Delhi.

Reference books:

1. Suresh T. Vishwanathan, “The Indian Cyber Law”, Bharat Law House, New Delhi.
2. Bare Act, “The Information technology Act, 2000”, Professional Book Publishers, New Delhi.
3. Prashant Mali, “Cyber Law & Cyber Crimes”, Snow White Publications, Mumbai.
4. Nina Godbole, “Information Systems Security”, Wiley India, New Delhi.
5. Kennetch J. Knapp, “Cyber Security & Global Information Assurance”, Information Science Publishing.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pr/ Oral	Total
ILON7023	Design of Experiments	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme								
		Theory						TW	Pr/ Oral	Total
		Internal Assessment				End Sem Exam	Exam. Duration (in Hrs)			
		Test1	Test2	Avg.	Mid Sem Exam					
ILON7023	Design of Experiments	20	20	20	20	60	2	--	--	100

Course Pre-requisite:

- Probability
- Statistics

Course Description:

This course objective is to learn how to plan, design and conduct experiments efficiently and effectively, and analyze the resulting data to obtain objective conclusions. Both design and statistical analysis issues are discussed. Opportunities to use the principles taught in the course arise in all aspects of today's industrial and business environment. Applications from various fields will be illustrated throughout the course. All experiments are designed experiments; some of them are poorly designed, and others are well-designed. Well-designed experiments allow you to obtain reliable, valid results faster, easier, and with fewer resources than with poorly-designed experiments. You will learn how to plan, conduct and analyze experiments efficiently in this course.

Course Objectives:

1. To impart students a holistic view of the fundamentals of experimental designs, analysis tools and techniques, interpretation and applications.
2. Learn how to plan, conduct and analyze experiments efficiently.

Course Outcome: Upon completion of this course, the students will be able to:

1. Understand the fundamentals of experiments and its uses.
2. Analyze experimental designs such as randomized block design, Latin square,

factorial and fractional factorial designs.

3. Understand and explore multifactor experiments.
4. Analyze special experimental designs.
5. Analyze response surface methodology.
6. Apply Taguchi method in analyzing experimental data

Module No.	Detailed Content	Hrs.
1	**Experimental Design Fundamentals:** Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression model.	08
2	**Single Factor Experiments:** Completely randomized design, Randomized block design, Latin square design Statistical analysis, estimation of model parameters, model adequacy checking, and pair wise comparison tests.	08
3	**Multi Factor Experiments:** Two and three factor full factorial experiments, 2K factorial Experiments, Confounding and blocking designs.	08
4	**Special Experimental Design:** Special experimental design, Fractional factorial design, nested designs, Split plot design.	04
5	**Introduction to Response Surface Methodology:** Experiments with random factors, rules for expected mean squares, approximate F- tests.	04
6	**Taguchi Method:** Steps in experimentation, design using Orthogonal arrays, data analysis, Robust design control and noise factors, S/N ratios, parameter design, and case studies.	07
	Total	39

Evaluation Scheme:

1) **In-Semester Assessment:**

- Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

2) **End-Semester Examination:**

- Question paper will comprise of full syllabus.

- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Textbooks:

1. Montgomer, D.C., “Design and analysis experiments”, John Wiley and sons 2003.
2. Nicolo Belavendram, “Quality by design: Taguchi techniques for industrialexperimentation”, prentice hall, 1995.

Reference Books:

1. Phillip J. Rose, “Taguchi techniques for quality engineering”, McGraw Hill, 1996.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pr/ Oral	Total
ILON7024	Financial Management	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme								
		Theory						TW	Pr/ Oral	Total
		Internal Assessment				End Sem Exam	Exam. Duration (in Hrs)			
		Test1	Test2	Avg.	Mid Sem Exam					
ILON7024	Financial Management	20	20	20	20	60	2	--	--	100

Course Pre-requisite: None

Course Description:

Overall Objective of this course is to develop awareness among you about the importance and need of learning techniques for managing finances either on a project, in an organization or in a profit making unit. The course goes into details of financial planning, measurement, analysis and eventually controlling the finances. Varies techniques and tools useful for managing the finances and budgeting will be explored in this course.

Course Objectives:

1. To understand the operational nuances of a Indian financial system, instruments and market
2. To study concepts of value of money, returns and risks, corporate finance, working capital and its management
3. To study technique of making decisions related to finance function.

Course Outcomes: At the end of the course learner will able to

1. Understand Indian finance system and corporate finance.
2. Understand Present and future value of money.
3. Evaluate Risk and return on investment.
4. Under the importance of working capital and portfolios.
5. Possess the techniques of managing finance in an organization.
6. Take investment, finance as well as dividend decisions

Module No.	Detailed Content	Hrs.
1	**The Financial Systems**: Functions of the Financial System, Financial Assets, Financial Markets, Financial Market Returns, Financial Intermediaries, Regulatory Infrastructure, Growth and Trends in the Indian Financial System. Overview of Financial Statements— Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	06
2	**Time value of Money**: Time Lines and Notation, Future Value of a Single Amount,Present Value of a Single Amount, Future Value of an Annuity, Present Value of an Annuity, Present Value of a Perpetuity, Intra-Year Compounding and Discounting.	08
3	**Risk and Return:** Historical Returns and Risk, Expected Return and Risk of a Single Security and a Two-security Portfolio, Risk and Return of a Single Security and a Two-security Portfolio, Measurement of Market Risk , Determinants of Beta , Relationship Between Risk and Return.	06
4	**Techniques of Capital Budgeting:** Capital Budgeting Process, Project Classification, Investment Criteria, Net Present Value, Benefit-Cost Ratio, Internal Rate of Return, Modified Internal Rate of Returns (MIRR), Payback Period, Accounting Rate of Return, Investment Appraisal in Practice. Concepts of Meaning Working Capital; Importance and Factors Affecting an Entity‘s Working Capital Needs; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	04
5	**The Cost of Capital:** Cost of Debt and Preference, Cost of Equity, Determining the Proportions, Weighted Average Cost of Capital, Weighted Marginal Cost of Capital, Determining the Optimal Capital Budget, Divisional and Project Cost of Capital, Floatation Cost and the Cost of Capital, Factors Affecting the Weighed Average Cost of Capital	09
6	**Capital Structure and Firm Value:** Assumptions and Definitions, Net Income Approach, Net Operating Income Approach, Traditional Position, Modigliani and Miller Position, Taxation and Capital Structure, Tradeoff Theory, Signaling Theory, Dividend Policy and Firm Value, Miller and Modigliani Position	06
	Total	39

Evaluation Scheme:

1) **In-Semester Assessment:**

- Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

2) **End-Semester Examination:**

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus

Text Books:

1. Financial Management Theory & Practice by Prasanna Chandra, Publisher: TMH, New Delhi 2004
2. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
3. Fundamentals of Financial Management by Van Horne, Publisher: Prentice Hall of India.

Reference Books:

1. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi
2. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
3. Advanced Accounting by Gupta R.L. and RadhaSwamy M., Publisher: Sultan Chand & Sons, New Delhi.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pr/ Oral	Total
ILON7025	Design Thinking	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme								
		Theory								
		Internal Assessment				End Sem Exam	Exam. Duration (in Hrs)	TW	Pr/ Oral	Total
		Test1	Test2	Avg.	Mid Sem Exam					
ILON7025	Design Thinking	20	20	20	20	60	2	--	--	100

Course Pre-requisite: None

Course Objectives:

1. Recognize the importance of DT
2. Explain the phases in the DT process
3. List the steps required to complete each phase in DT process
4. Apply each phase in the DT process
5. Use doodling and storytelling in presenting ideas and prototypes
6. Create value proposition statements as part of their presentations
7. Recognize how DT can help in functional work
8. Recognize how Agile and DT complement each other to deliver customer satisfaction

Course Outcomes: At the end of the course learner will able to…

1. Recognize the importance of Design Thinking and identify the steps required to conduct an immersion activity.
2. Create personas in the define phase of DT.
3. Recognize the steps to create problem statements in the define phase of design thinking.
4. Apply the steps in the ideate phase of DT.
5. Create a prototype and recognize the importance of service value proposition.
6. Test a prototype created through a DT process.

Module No.	Detailed Content	Hrs.

1	**Introduction:** Recognize the importance of Design Thinking why is Design Thinking important for business? Why is Design Thinking important for you? , Identify the steps in the DT process What is DT? Empathize (search for rich stories and find some love), Define (user need and insights – their POV), Ideate (ideas, ideas, ideas), Prototype (build to learn), Test (show, don't tell)	**6**
2	**Empathy Phase:** Recognize the steps in the empathize phase of DT; What is empathy? Ask What? How? Why? Different types to developing Empathy towards People Identify the steps required to conduct an immersion activity. How to empathize? Intro to Immersion Activity; Conduct an immersion activity and fill up the DT question template, Immersion activity.	**7**
3	**Define Phase:** Creating personas: Recognize the steps to create personas in the define phase of DT. What is a persona and how do I create one? Four Different Perspectives on Personas 1) Goal-directed Personas 2) Role-Based Personas 3) Engaging Personas 4) Fictional Personas, 10 steps to Creating Your Engaging Personas and Scenarios Recognize the steps to create problem statements in the define phase of DT, Problem statements, defining problem statements, Define the problem statements in the define phase of DT.	**6**
4	**Ideate Phase:** How to Ideate? Recognize the steps in the ideate phase of DT, Apply the steps in the ideate phase of DT, Ideation games: Game 1: Six Thinking Hats, Game 2: Million-dollar idea, Ideate to find solutions, Characteristics Required for Successful Ideation, Recognize how doodling can help to express ideas, Recognize the importance storytelling in presenting ideas and prototypes, What is Storytelling in DT?	**7**
5	**Prototype phase:** Recognize the importance of the prototype phase in DT, Prototype your idea, Create a prototype: Types of Prototyping 1) Low-Fidelity Prototyping 2) High-Fidelity Prototyping, Guidelines for Prototyping, Recognize the importance of service value proposition, Create a value proposition statement.	**7**
6	**Testing Phase:** Testing in Design Thinking, Test the Prototype, Role of DT in your work, discuss How DT can help me to become a better coder? Agile and DT complement each other to deliver customer satisfaction, Share your Satori.	**6**
	Total	**39**

Evaluation Scheme:

1) **In-Semester Assessment:**

- Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
- Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

2) **End-Semester Examination:**

- Question paper will comprise of full syllabus.
- In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus

Text Books:

- Hooked by Nir Eyal
- The Art of Creative Thinking by Rod Judkins
- Start Up nation by Dan Senor Saul singer
- Start with Why by Simon Sinek

Web Resources:

- What is Design Thinking? Interaction Design Foundation
- What are some of the good examples of design thinking? – Quora
- Design thinking 101: Principles, Tools & Examples to transform your creative process
- Understanding Design thinking WF NEN
- Design Thinking and Innovation at Apple Wei Li
- Stanford Webinar- Design Thinking = Method, Not Magic
- Stanford Design Thinking Virtual Crash Course
- So Many Uses- activity to spark creativity and design

Course Code	Course Name	Theory Hrs	Practical Hrs	Tutorial Hrs	Theory Credit	Practical/ Oral Credit	Tutorial Credits	Total Credits
CESL701	Skill Based Lab V- Cloud Architecture Lab	-	02	-	-	01	-	01

Course Code	Course Name	Examination Scheme								
		Theory Marks					Term Work	Practical & Oral	Oral	Total
		In-Sem Evaluations				End Sem Exam				
		IA1	IA2	AVG	Mid Sem Exam					
CESL701	Skill Based Lab V- Cloud Architecture Lab	-	-	-	-	-	25	25		50

Course Objectives:

1. To differentiate between on-premises, hybrid-cloud, and all-in cloud.
2. To describe the basic global infrastructure of the AWS Cloud.
3. To understand the Networking and security components in cloud environment.
4. To understand the database as a service.
5. To use of monitoring service.

Course outcomes: At the end of the course learner will able to

1. Understand AWS Cloud Computing Infrastructure.
2. Launch an EC2 instance in AWS cloud with storage.
3. Use of DynamoDB and AWS RDS for database design.
4. Apply the AWS Beanstack to deploy the static website with database and security groups.
5. Use of AWS IAM for user, role and Policy.
6. Use of monitoring tools.

Experiment No.	Name of the Experiment	CO Mapping
1	Overview of AWS Cloud computing Infrastructure with Region, AZ and PoP	CO1
2	Introduction and Implementation of OpenStack- Private Cloud	CO1
3	Introduction to Amazon S3 (Bucket Policy and bucket versioning).	CO2
4	Introduction to Amazon EC2	CO2
5	Introduction to Amazon DynamoDB	CO3

6	Introduction to Amazon Relational Database Service (Amazon RDS)	CO3
7	Introduction to Amazon Virtual Private Cloud (Amazon VPC)	CO4
8	Introduction to AWS Identity and Access Management (IAM)	CO4
9	Hosting a Static Website Using Amazon Simple Storage Service (Amazon S3)	CO4
10	Develop a static website and store in S3 bucket using version control • Configure a bucket to host a static website. • Upload content to a bucket. • Turned on public access to bucket objects. • Securely share a bucket object using a preassigned URL. • Secure a bucket using a bucket policy. • Update the website.	CO5
11	Design the policy for user requirements using Policy Builder	CO5
12	Create a AWS cloud config instance and asses configurations of AWS resources like EC2 and Database	CO6
13	Set a cloud watch alarm on CPU utilization of an EC2 instance and monitor the Graphs	CO6

Text Books

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, McGraw Hill Publication.

Reference Books

1. Joe Baren, Hisham Baz, Tim Bixler, Biff Gaut, Kevin E. Kally, Sean Senior, John Stamper, “AWS Certified solutions Architect : Official Study Guide”, Sybex publications.

Term Work:

The Term work Marks are based on the weekly experimental performance of the students, Oral performance and regularity in the lab.

Students are expected to be prepared for the lab ahead of time by referring the manual and perform the experiment under the guidance and discussion. Next week the experiment write-up to be corrected along with oral examination.

End Semester Examination:

End of the semester, there will be oral evaluation based on the laboratory work and the corresponding theory syllabus.

Semester VIII

Course Code	Course Name	Teaching Scheme (Contact Hours 2 Hr/week)					Credits Assigned	
		Theory	Practical	Tutorial			Practical	Total
CEP801	Major Project / Internship	-	30	-			15	15
		Evaluation Scheme						
		Internal Assessment (150 Marks)					End Sem Oral	Total
		Evaluation 1		Evaluation 2	Report	Attendance		
		50		50	30	20	100	250

Course Description:

The Major Project/Industry Internship course serves as the capstone experience that encapsulates the culmination of academic learning and the transition into the professional realm of engineering. This pivotal course is not just a mere academic requirement but a transformative journey that bridges the gap between classroom knowledge and the dynamic demands of the industry. It is a profound opportunity for students to immerse themselves in project-based learning, enabling them to harness their theoretical understanding and apply it to real-world challenges. The Major Project/Industry Internship course is a gateway to acquiring essential practical skills and instilling a profound sense of responsibility for project management, innovative problem-solving, and effective implementation strategies. It empowers students to cultivate a holistic view of engineering by fostering creativity, innovation, and critical thinking, all within the framework of bringing forth ground breaking technologies and solutions.

This course provides a transformative experience, one that prepares students for the ever-evolving landscape of engineering by nurturing their ability to think, adapt, and excel in the professional world.

Course Objectives:

1. To offer potential avenues for acquiring, comprehending, and refining the real-time technical and managerial skills essential for the job.
2. To familiarize students with the authentic industrial environment, which goes beyond the scope of classroom simulations, thereby cultivating competent professionals for the industry.
3. To provide exposure to the current technological developments relevant to the subject area of training.
4. To promote academic, professional and/or personal development.
5. To create conditions conducive to quest for knowledge and its applicability on the job.

Course Outcomes:

On successful completion of this course, learner/student will be able to:

1. Demonstrate proficiency in applying theoretical knowledge to real-world projects.
2. Develop skills in documenting and presenting technical work.
3. Enhance communication and time management skills.
4. Provide solutions for complex problems within the industry context.
5. Exhibit enhanced problem-solving skills by addressing issues encountered during the major project/internship.
6. Demonstrate integrity and responsibility in handling professional tasks.

Guidelines for the course:

Undergraduate students are required to select either the In-house Major Project or the Industry Internship as a compulsory component of their academic curriculum. This choice allows students to tailor their educational experience to their career aspirations and interests, ensuring they gain relevant hands-on experience and practical knowledge in preparation for their professional journey.

Inhouse Major Project:

1. Individual student or group of students (max 3 students/ group) should undertake major project.
2. Students are expected to carry out comprehensive surveys to identify critical needs, gain insights into societal issues, and subsequently formulate innovative solutions.
3. Students should submit major project proposal in consultation with faculty supervisor/internal committee of faculties/ Head of Department.
4. Faculty supervisor will give inputs to students during major project activity; however, focus shall be on self-learning.
5. Student shall understand problem effectively, propose multiple solutions and select best possible solution in consultation with guide / supervisor.
6. Student should attempt solution to the problem by experimental/simulation methods.
7. The solution to be validated with proper justification and compile the report in standard format.
8. Student should visit the institute regularly and maintain satisfactory attendance.
9. Student should present his/her project progress to their respective guide.

Industry Internship:

1. As per the curriculum requirements, the semester-long internship should be a minimum of 4 months in duration.
2. Internships of less than 4 months in duration will not be considered for evaluation under the industry internship category. Additionally, students are encouraged to participate in one- or two-month internships, with the condition that they also undertake an in-house major project concurrently.
3. The candidate should submit a synopsis of the proposed work to be done during Internship programme/ Industrial Project. The synopsis received should be examined or evaluated by the departmental committee.
4. Intimation of commencement of internship shall be submitted to the HOD concerned before the commencement of the ongoing semester.
5. Two guides will supervise the internship project work, one from the department and one from industry.
6. Industry/Educational Organization must submit the month-wise satisfactory attendance of the students to the department.
7. Candidate should regularly visit the institute and present his/her project progress report to their respective guide(s).
8. The final internship project presentation is evaluated on the basis of the recommendation given by outside supervisor, and further can be evaluated by institute guide.
9. Industry/ Institute should allow to produce results obtained during project/ internship period in the project report. The written certificate to this effect from the industry/ institute is mandatory before consideration of the proposed project/ internship.
10. After completion of internship, students are required to submit report of work done as per the template provided by the department, copy of internship certificate, feedback from employer/internship mentor, stipend proof (in case of paid internship).

Guidelines for Internal Assessment:

Inhouse Major Project:

1. The review/ progress monitoring committee shall be constituted for assessing the projectwork. There will be 2 reviews to evaluate the progress of major project. The assessment will be based on formulation of project work, literature review, feasibility of solution, clearly stated requirements and specifications, design of proposed system, implementation details, validation of results.
2. Report should be prepared as per the template (Latex) given by the department.
3. In internal assessment, shall focus on student's understanding, contribution and response to questions.
4. Student should visit the institute regularly and maintain satisfactory attendance.
5. The internal marks are based on the performance of the student (individual and as a group), review performances, quality of the report, Oral Presentation and regularity.
6. Students are expected to participate in various state and national level Hackathon's competitions/ publish a paper in Conferences/ Journals etc with prior approval of supervisor.

Industry Internship:

1. The departmental internship evaluation committee shall be constituted for assessing the progress of internship work. There will be 2 evaluations to assess the progress of internship work. The assessment will be based on formulation of project work, literature review, feasibility of solution, clearly stated requirements and specifications, design of proposed system, implementation details, validation of results.
2. Internship report should be prepared as per the guidelines given by the department.
3. In internal assessment, focus shall be on student's understanding, contribution and response to questions.
4. Students should report to internal mentor at least twice in a month and present his/her internship progress.
5. The internal marks are based on the performance of the students, review performances, quality of the report, Oral Presentation and regularity.

End Sem ORAL Examination:

After successful completion of the inhouse major project/industry internship work, this course will be evaluated jointly by panel of Internal and External Examiners under supervision of HoD.