Program Structure for Last Year Computer Engineering
Semester-VII-Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) TH – P – TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Course Category
CEC701	Machine Learning	3– 0 – 0	03	3 – 0 – 0	03	PC
CEC702	Big Data Analytics	3 – 0 – 0	03	3– 0 – 0	03	PC
CEDLC703	Department Level Elective -III	3– 0 – 0	03	3– 0 – 0	03	DLE
CEDLC704	Department Level Elective -IV	3– 0 – 0	03	3– 0 – 0	03	DLE
ILC705	Institute Level Elective -I	3 – 0 – 0	03	3– 0 –0	03	ILE
CEL701	Machine Learning- Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
CEL702	Big Data Analytics Lab	0 – 2 – 0	02	0 –1 – 0	01	DLE
CEDLL703	Department Level Elective -III Lab	0 – 2 – 0	02	0 – 1 – 0	01	DLE
CEPR75	Project Based Learning - Major Project -A	0 – 6 – 0	06[#]	0 – 3 – 0	03	PBL
INT71	Internship-VI	2 to 4 Weeks		--	--	INT
Total		**15– 12 – 0**	**27**	**15 - 06- 00**	**21**	

[#] Load of learner, not the faculty [#] PBL-PR-1- (Preparation for Conference paper, TPP, participation in competition as Termwork)

Major Project A and B: Students can form groups with minimum 2 (Two) and not more than 3 (Three)
Faculty Load : In Semester VII – ½ hour per week per project group
In Semester VIII – 1 hour per week per project group

Semester-VII - Examination Scheme

Course Code	Course Name	Marks									
		CA				ESE	TW	O	P	P&O	Total
		T-1	T-2	Average (T-1 & T-2)	IA						
CEC701	Machine Learning	30	30	30	10	60	--	--	--	--	100
CEC702	Big Data Analytics	30	30	30	10	60	--	--	--	--	100
CEDLC703	Department Level Elective - III	30	30	30	10	60	--	--	--	--	100
CEDLC704	Department Level Elective - IV	30	30	30	10	60	--	--	--	--	100
ILC705	Institute Level Elective -I	30	30	30	10	60	--	--	--	--	100
CEL701	Machine Learning- Lab	--	--		--	--	25	25	--	--	50
CEL702	Big Data Analytics Lab	--	--		--	--	25	25	--	--	50
CEDLL703	Department Level Elective - III Lab	--	--		--	--	25	25	--	--	50
CEPR75	Project Based Learning - Major Project -A	--	--		--	--	25	---	---	50	75
INT71	Internship-VI	--	--	--	--	--	--	--	--	--	--
Total		**150**	**150**	**150**	**50**	**300**	**100**	**75**	**---**	**50**	**725**

Department Level Electives

Department Optional Courses	Semester	Group (A, B, C, D)	Choice of Group
Department Level Elective -3	VII	CEDLC7031: Computer Vision CEDLC7032: Adhoc Wireless Network CEDLC7033: Ethical Hacking and Security CEDLC7034: Natural Language Processing	Group A: Databases/Data Science Group B: Network & Communications Group C: Security / IoT / Blockchain Group D: AI/ ML/ DL
Department Level Elective -4	VII	CEDLC7041: Augmented and Virtual Reality CEDLC7042: Internet Communication CEDLC7043: Blockchain CEDLC7044: Information Retrieval	

Institute Level Electives

Institute level Optional Courses	Semester	Subject
Institute Optional Course -1	VII	ILC7051: Product Lifecycle Management ILC7052: Reliability Engineering ILC7053: Management Information System ILC7054: Design of Experiments ILC7055: Operation Research ILC7056: Cyber Security and Laws ILC7057: Disaster Management and Mitigation Measures ILC7058: Energy Audit and Management ILC7059: Development Engineering

Course Code	Course Name	Credits (TH+P+TUT)
CEC701	Machine Learning	(3+0+0)

Prerequisite:	1. Linear Algebra 2. Calculus 3. Basic Probability and Statistics 4. Data Structures 5. Algorithms 6. Data Mining
Course Objectives:	1. To introduce students to the basic concepts and techniques of Machine Learning. 2. To have comprehensive hands on with regression methods, classification & clustering methods 3. To demonstrate dimensionality reduction techniques
Course Outcomes:	**After the successful completion of this course, learner will be able to:** 1. Acquire the basic knowledge on the fundamentals of Machine Learning. 2. Explore regression, classification 3. Explore clustering methods 4. Identify suitable applications where machine learning techniques can be incorporated 5. Solve the problems using various machine learning techniques 6. Demonstrate Dimensionality reduction techniques

Module No & Name	Sub Topics	CO mapped	Hrs/ Sub topic	Total Hrs / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	--	**02**	**02**
1. Introduction to Machine Learning	Machine Learning, Types of Machine Learning, Steps in developing a Machine Learning Application, Issues in Machine Learning, Applications of Machine Learning	**CO1**	**02**	**04**
	Training Error, Generalization error, Overfitting, Underfitting, Bias-Variance trade-off		**02**	
2. Learning with Regression	Linear Regression, Multivariate Linear Regression	**CO2, CO4, CO5**	**02**	**04**
	Logistic Regression, Performance Metrics for Regression.		**02**	
3. Basic classification	Learning with Trees**:** Decision Trees, Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART)	**CO2, CO4, CO5**	**04**	**08**
	Performance Metrics for Classification		**01**	

	Introduction to Ensemble Learning, Understanding Ensembles, K-fold cross validation, Boosting, Stumping,XGBoost, Bagging, Subagging, Random Forest, Comparison with Boosting, Different ways to combine classifiers		**03**	
4. Advanced Classification	Radial Basis Functions:-Introduction to Radial Basis Functions, RBF Kernels, Architecture of RBF network, Training of RBF network, Comparison of RBF with multilayer perceptron	**CO2, CO4, CO5**	**03**	**10**
	Ruled Based Classification, classification by Bayesian Belief networks, Hidden Markov Models		**04**	
	Support Vector Machine: Optimal decision boundary, Margins and support vectors, SVM as constrained optimization problem, Quadratic Programming, SVM for linear and nonlinear classification, Kernel trick., Support Vector Regression, Multiclass Classification		**03**	
5. Learning with Clustering	Introduction to clustering: What is clustering, Applications of clustering **,**Clustering aspects: Clustering algorithm, distance or similarity function, clustering quality	**CO3, CO4, CO5**	**02**	**08**
	Major clustering Approaches: Partitioning, Hierarchical, Model based, Density Based, Graph Based		**01**	
	Graph Based Clustering: Clustering with minimal spanning tree Model based Clustering: Expectation Maximization Algorithm Density Based Clustering: Density-based spatial clustering of applications with noise (DBSCAN)		**05**	
7. **Dimensionali -ty Reduction**	Introduction to Dimensionality reduction, Dimensionality Reduction Techniques	**CO6**	**01**	**05**
	Principal Component Analysis, Linear Discriminant Analysis, Single Value Decomposition		**04**	
ii. Conclusion Lecture	Recap of Modules, Outcomes, Application and Summarization	**-**	**01**	**01**
Total Hours				**42**

Books:	
Text Books	1. Peter Harrington, “Machine Learning in Action”, DreamTech Press 2. Ethem Alpaydın, “Introduction to Machine Learning”, MIT Press 3. Tom M.Mitchell, “Machine Learning” McGraw Hill 4. Stephen Marsland, “Machine Learning An Algorithmic Perspective”, CRC Press

Reference Books	1. Han Kamber, Data Mining Concepts and Techniques‖, Morgan Kaufmann Publishers 2. Margaret.H.Dunham, Data Mining Introductory and Advanced Topic, Pearson Education 3. Kevin P. Murphy , Machine Learning ― A Probabilistic Perspective. 4. William W.Hsieh, "Machine Learning Mehods in the Environmental Sciences", Cambridge 5. Richard Duda ,Peter E Hart,David G Stork " Pattern classification " A Wiley-Interscience Publication 6. Zhi-Hua Zhou Ensembles Methods :Foundations and Algorithm,CRC Press, Taylor and Francis Group. 7. Samir Roy and Chakraborty, ―Introduction to soft computing‖, Pearson Edition.

Useful Links:

1. Data sets for Machine Learning algorithms:- https://www.kaggle.com/datasets
2. http://deeplearning.net/datasets/
3. Machine Learning repository- https://archive.ics.uci.edu/ml/index.php
4. https://www.visualdata.io/discovery
5. https://towardsdatascience.com/machine-learning/home
6. https://machinelearningmastery.com/
7. https://www.analyticsvidhya.com/

Continuous Assessment for 40 marks:

1. Test 1 – 30 marks
2. Test 2 – 30 marks
3. Internal assessment --10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.

Course Code	Course Name	Credits (TH+P+TUT)
CEC702	**Big Data Analytics**	**3-0-0**

Prerequisite:	1. Java programming, 2. Basics of SQL 3. Probability 4. Data mining and machine learning methods.
Course Objectives:	1. To provide an overview of an exciting growing field of big data analytics. 2. To introduce programming skills to build simple solutions using big data technologies such as MapReduce and scripting for NoSQL, and the ability to write parallel algorithms for multiprocessor execution. 3. To enable students to have skills that will help them to solve complex real-world problems in for decision support.
Course Outcomes:	**After successful completion of this course, learner will be able to:** 1. Describe the basic concepts of big data and Hadoop Framework. 2. Use various distributed storage system and NoSQL databases to collect, manage, store, query and analyze big data. 3. Apply scalable algorithms based on Hadoop to perform big data analytics. 4. Interpret Complex real-world problems in various applications like recommender systems, social media applications, page ranking, etc. 5. Analyze data using R programming.

Module No & Name	Subtopics	CO mapped	Hrs / Sub Topics	Total Hrs/ Module
i. Prerequisites and Course Outline	Basics of SQL, Concepts of Distributed Computing used in Hadoop, Probability basics.	**-**	**02**	**02**
1. Introduction	Introduction to Big Data: Big Data characteristics, Types of Big Data, Traditional vs. Big Data business approach, Case Study of Big Data Solutions	**CO1**	**01**	**03**
	Introduction to Hadoop: Concept of Hadoop, Hadoop Core Components, Hadoop Ecosystem, Hadoop limitations		**02**	
2. Storage system HDFS and NOSQL	Distributed File Systems: Physical Organization of Compute Nodes, Large-Scale File-System Organization.	**CO2**	**02**	**07**
	NoSQL : Introduction to NoSQL, NoSQL Business Drivers, NoSQL Data Architecture Patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Variations of NoSQL architectural patterns, NoSQL Case Study, NoSQL		**05**	

	solution for big data, Understanding the types of big data problems, Analyzing big data with a shared-nothing architecture, Choosing distribution models: master-slave versus peer-to-peer, NoSQL systems to handle big data problems.			
3. Batch Processing	MapReduce: The Map Tasks, Grouping by Key , The Reduce Tasks, Combiners, Details of MapReduce, Execution, Coping With Node Failures.	**CO3**	**03**	**07**
	Algorithms Using MapReduce: Matrix-Vector multiplication by MapReduce, Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce , Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce Matrix - Matrix Multiplication using MapReduce		**04**	
4**. Stream Processing**	The Stream Data Model: A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing.	**CO4**	**01**	**09**
	Sampling Data techniques in a Stream		**01**	
	Filtering Streams: Bloom Filter with Analysis.		**01**	
	Counting Distinct Elements in a Stream, Count-Distinct Problem, Flajolet-Martin Algorithm, Combining Estimates, Space Requirements		**03**	
	Counting Ones in a Window: The Cost of Exact Counts The Datar-Gionis-Indyk-Motwani Algorithm, Query Answering in the DGIM Algorithm, Decaying Windows.		**03**	
5. Big Data Applications	Recommendation Systems A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Case study on recommendation systems.	**CO6**	**03**	**07**
	Link Analysis PageRank Overview, Efficient computation of PageRank: PageRank Iteration Using MapReduce, Use of Combiners to Consolidate the Result Vector.		**02**	

	Mining Social-Network Graphs Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities, Case study on social network graphs.		**02**	
6. **Data Analytics with R**	Introduction to basics of R, Introduction to RStudio, Working directories in RStudio, datatypes, operators in R, Pipe operator		**01**	**06**
	Basic Expressions in R, Variables in R, Working with Vectors, Storing and Calculating Values in R, Creating and using Objects, Interacting with users,		**02**	
	Handling data in R workspace, Executing Scripts, Creating Plots, Accessing help and documentation in R,		**01**	
	Reading datasets and Exporting data from R, Manipulating and Processing Data in R, Using functions instead of script, built-in functions in R,		**01**	
	Data Visualization: Types, Applications		**01**	
ii. Course Conclusion	Recap of Modules, Outcomes, Application and Summarization	**--**		**01**
Total Hours				**42**

Books:	
Text Books	1. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press. 2. Anand Rajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press. 3. Dan McCreary and Ann Kelly “Making Sense of NoSQL” – A guide for managers and the rest of us, Manning Press 4. Dr. Bharti Motwani “Data Analytics with R”, Wiley
Reference Books	1. Bill Franks “Taming the Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics”, Wiley 2. Chuck Lam, “Hadoop in Action”, Dreamtech Press 3. Jared Dean, “Big Data, Data Mining and Machine Learning: Value Creation for Business Leaders and Practitioners”, Wiley India Private Limited, 2014. 4. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Publishers, 3rd ed, 2010. 5. Lior Rokach and Oded Maimon, “Data Mining and Knowledge Discovery Handbook”, Springer 2nd Edition, 2010 6. Ronen Feldman and James Sanger, “The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”, Cambridge University Press, 2006

	7. Vojislav Kecman, “Learning and Soft Computing”, MIT Press, 2010. 8. Tom White “Hadoop: The Definitive Guide”, O'Reilly Media, Inc., June 2009

Useful Links:

1. https://hadoop.apache.org
2. https://hadoop.apache.org/docs/r2.8.0/hadoop-project-dist/hadoop-common/core-default.xml

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 30 marks
2. Test 2 – 30 marks
   Average of 2 tests out of 30 marks
3. Internal assessment --10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Theory Examination will be of 60-Marks for 02 hrs 30 minutes duration.

Course Code	Course Name	Credits (TH+P+TUT)
CEDLC7031	**Computer Vision**	**3-0-0**

Prerequisite:	1.Image processing 2.Mathmatics (Linear algebra, calculus, geometry, Fourier transform)
Course Objectives:	1.To review image processing techniques 2.To understand shape and region analysis. 3.To understand Hough Transform and its applications to detect lines, circles, ellipses. 4.To understand three-dimensional image analysis techniques and motion analysis. 5.To implement computer vision algorithms for real-world problems.
Course Outcomes:	**After the successful completion of this course, learner will be able to** : 1. Apply fundamental image processing techniques 2. Evaluate shapes and regions 3. Illustrate Hough Transform for line, circle, and ellipse detections. 4. Analyze different 3D vision techniques 5. Acquire knowledge of motion analysis 6. Design applications using computer vision techniques

Module No. & Name	Sub Topics	CO mapped	Hrs / Sub Topics	Total Hrs/ Module
i. Prerequisites and Course Outline	Fundamental concepts image processing.	**-**	**02**	**02**
1.Introduction to computer vision	Introduction to computer vision, CV challenges, Comparison between image processing and Computer vision	**CO1**	**02**	**05**
	Classical filtering operations; thresholding techniques; edge detection technique, Applications		**03**	
2. Shapes And Regions	Binary shape analysis; connectedness; object labeling and counting; distance functions; skeletons and thinning	**CO2**	**03**	**08**
	Deformable shape analysis, Boundary tracking procedures; active contours; shape models and shape recognition; centroidal profiles; handling occlusion; boundary length measures; boundary descriptors; chain codes; Fourier descriptors; region descriptors; moments		**05**	

3. Hough Transform	Line detection; Hough Transform (HT) for line detection; foot-of-normal method; line localization; line fitting;	**CO3**	**04**	**07**
	RANSAC for straight line detection; HT based circular object detection; accurate centre location; speed problem; ellipse detection, applications		**03**	
4. 3D Vision	Methods for 3D vision; projection schemes; shape from shading; photometric stereo; shape from texture; shape from focus;	**CO4**	**04**	**08**
	Active range finding; surface representations; point-based representation; volumetric representations; 3D object recognition; 3D reconstruction		**04**	
5. Introduction to Motion	Triangulation; bundle adjustment; translational alignment; parametric motion;	**CO5**	**03**	**06**
	Spline-based motion; optical flow; layered motion		**03**	
6 Applications	Applications: Face detection, face recognition, eigen faces, surveillance, foreground-background separation, particle filters, Chamfer matching, tracking, and occlusion;	**CO6**	**03**	**05**
	Combining views from multiple cameras; human gait analysis; locating roadway; road markings; identifying road signs; locating pedestrians, etc.; Case Studies and recent researches in Computer Vision.		**02**	
ii.Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	**--**	**01**	**01**
Total Hours				**42**

Books:	
Text Books	1. R. Szeliski, Computer Vision: Algorithms and Applications, Springer. 2. D. Forsyth, J. Ponce, Computer Vision: A Modern Approach, Pearson Education. 3. J. Solem, Programming Computer Vision with Python: Tools and Algorithms for Analyzing Images, O'Reilly.
Reference Books	1. M. Nixon and A. Aquado, Feature Extraction & Image Processing for Computer Vision, 3rd Edition, Academic Press. 2.R. Jain, R. Kasturi, B. Schunck, Machine Vision, Indo American Books.

	3.S. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press 4. Rafael C. Gonzalez : Digital image processing,Pearson
Useful Links:	
1. https://towardsdatascience.com/computer-vision-for-beginners-part-1-7cca775f58ef	
2. https://www.kaggle.com/learn/computer-vision	
3. https://graphics.stanford.edu/courses/cs205a-13-fall/assets/notes/cs205a_notes.pdf	
Continuous Assessment for 40 marks: 1.Test 1 – 30 marks 2.Test 2 – 30 marks 3.Internal assessment --10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.	

Course Code	Course Name	Credits (TH+P+TUT)
CEDLC7032	**Adhoc Wireless Networks**	**3 - 0 - 0**

Prerequisite:	1. Computer Network, 2. Cryptography and System security
Course Objectives:	1. To Identify the major issues associated with ad-hoc networks 2. To identify the requirements for protocols for wireless ad-hoc networks as compared to the protocols existing for wired network 3. To explore current ad-hoc technologies by researching key areas such as algorithms, protocols, hardware, and applications 4. To Provide hands-on experience through real-world programming projects 5. To provide advanced in–depth networking materials to graduate students in networking research.
Course Outcomes:	**After the successful completion of this course, learner will be able to**: 1. Identify the characteristics and features of Adhoc Networks 2. Explained the concepts & be able to design MAC protocols for Ad Hoc networks 3. Implement protocols / Carry out simulation of routing protocols of Adhoc Networks 4. Interpret the flow control in transport layer of Ad Hoc Networks 5. Analyze security principles for routing of Ad Hoc Networks 6. Utilize the concepts of Adhoc Networks in VANETs

Module No & Name	Sub Topics	CO mapped	Hrs / Sub Topics	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	**-**		**02**
1. Introduction	Introduction to wireless Networks. Characteristics of Wireless channel, Issues in Ad hoc wireless networks,	**CO1**	**01**	**03**
	Adhoc Mobility Models: - Indoor and outdoor models, Introduction to Adhoc networks – definition, characteristics features, applications		**02**	
2.MAC protocols for Wireless Ad-Hoc Networks	Introduction, Issues in designing MAC for Wireless Ad-Hoc Networks, Design Goals and classification of MAC for Wireless Ad-Hoc Networks.	**CO1**	**02**	**10**
	Contention based MAC protocols for Wireless Ad-Hoc Networks, with reservation mechanisms, scheduling Mechanisms, MAC protocols using directional antennas		**04**	

	Other MAC Protocols, IEEE standards MAC Protocols: 802.15.1(WPAN based on Bluetooth), 802.15.4 (WSN/Zigbee), 802.15.6 (WBAN).		**04**	
3. Routing Protocols for Wireless Ad-Hoc Networks	Introduction, Issues in designing a routing protocol for Wireless Ad-Hoc Networks, Classification of routing protocols, Table driven routing protocols like DSDV, WRP.	**CO2**	**04**	**08**
	On- demand routing protocols like ABR, DSR, TORA, AODV etc, Hybrid Routing Protocols : ZRP		**02**	
	Routing Protocols with efficient flooding mechanism, Hierarchical Routing Protocols, Power aware routing protocols		**02**	
4 Transport Layer	Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks.	**CO3, CO4**	**03**	**06**
	Classification of transport layer solutions: Split Approach, End-to-End approach : TCP-F,TCP-ELFN, Ad-Hoc TCP, TCP Buffering capability and Sequencing information, End-to-End Quality of Service.		**03**	
5 Security	Security attacks in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Link Layer security attacks: 802.11 MAC , WPA and variations.	**CO4, CO5**	**03**	**06**
	Network Security Attacks: Routing Protocol Attacks: attacks using falsifying route errors and broadcasting falsifying routes, spoofing attacks, Rushing attacks, Secure routing in Ad hoc wireless Networks.		**03**	
6 Vehicular Ad-Hoc Network (VANET)(MANET)	Introduction: Challenges and Requirements Layered architecture for VANETs, DSRC /WAVE standard (IEEE802.11p), IEEE 802.11p protocol Stack (PHY & MAC), (MANET Protocols)	**CO5, CO6**	**02**	**06**
	A Survey on Proposed MAC Approaches for VANETs like TDMA, SDMA and CDMA based approaches, DSRC MAC & LLC,		**02**	
	Georouting: CBF, Flooding with broadcast suppression/case study, Delay Tolerant Network, Introduction to Opportunistic Networking in Delay Tolerant Vehicular Ad Hoc Networks, Clustering and dissemination algorithm.		**02**	

ii.Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	--		**01**
Total Hours				**42**

Books:

Text Books	1. Siva Ram Murthy and B.S. Manoj , ―Ad hoc Wireless Networks Architectures and protocols‖, 2nd edition, Pearson Education, 2007 2. C. K. Toh, ―Adhoc Mobile Wireless Networks‖, Pearson Education, 2002 3. Charles E. Perkins, ―Adhoc Networking‖, Addison – Wesley, 2000 4. Dipankar Raychaudhuri, Mario Gerla, ―Emerging Wireless Technologies and the Future Mobile Internet, D, Cambridge
Reference Books	1. Subir Kumar Sarkar, ―Ad-Hoc Mobile Wireless Networks: principles, protocols and applications‖ CRC Press 2. Stefano Basangi, Marco Conti, Silvia Giordano, Ivan Stojmenovic, ―Mobile Ad-Hoc Networking, ― John-Wiley and Sons Publications, 2004 3. Hannes Hartenstein,Kenneth Laberteaux, ―VANET Applications and Interworking Technologies,‖ Wiley Publications 4. Christoph Sommer , Falko Dressler, ―Vehicular Networking,‖ Cambridge University Press, 2014

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 – 30 marks
2. Test 2 – 30 marks
3. Internal assessment --10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.

Course Code	Course Name	Credits (TH+P+TUT)
CEDLC7033	**Ethical Hacking and Security**	**Credits (3+1+0)**

Prerequisite:	Computer Network, Cryptography and System Security
Course Objectives:	1. To describe fundamentals of vulnerabilities and attacks 2. To discuss different system vulnerabilities. 3. To describe different website vulnerabilities. 4. To describe social engineering and Denial of service attacks. 5. To explain wireless network attacks. 6. To discuss different hacking application.
Couse Outcomes:	**After the successful completion of this course, learner will be able to** : 1. To describe concepts of hacking and how to detect hacker attacks. 2. To apply different system vulnerabilities and hacking methods. 3. To identify website vulnerabilities and explore hacking web applications. 4. To analyse social engineering and Denial of service attacks. 5. To examine wireless network attacks. 6. To examine different applications related to hacking to gain the knowledge.

Module No & Name	Sub Topics/ Hrs/Subtopic	CO mapped	Total Hrs/ Module
Pre-requisite	Revision	**-**	**1**
1.Introduction	What is hacking, Vulnerability, attack, phases of attack, types of hacker, Detecting hacker attacks: for windows, for UNIX machines, Ethical hacking plan, hackers methodology, Foot printing and reconnaissance /scanning networks	**CO1**	**6**
2.System hacking	Hack a smartphone, smartphone hacking prevention tips, Hack Operating Systems: Windows, Social engineering hacking, password attacks, Password Cracking Countermeasures, Trojans, Backdoors, Viruses and worms and Countermeasure tools	**CO2**	**7**
3. Websites Hacking	Website vulnerabilities, Directory Traversal Attack, Default Script Attack, Website password attacks, countermeasures against website hacking, hacking webservers, Hacking Web Applications	**CO3**	**6**
4. Social Engineering, DOS and	Social Engineering : Social Engineering Cycle, Computer-Based Social Engineering	**CO4**	**6**

Session Highjacking	Denial-of-Service Attack: types of attacks, DDoS, Attack classes, DOS Countermeasures, Performing a DoS Attack, Session highjacking,		
5. Wireless Network attacks	Wireless Network attacks: accidental association, malicious association, Ad-hoc Networks, Non-traditional networks, MAC spoofing, Man in middle attacks, Denial of service attacks, network injection attack, Wireless Network authentication, securing wireless transmissions	**CO5**	**7**
6. Applications	Various attacks scenarios and their remedies like SQL injection, Hacking Wireless Networks, Evading Intrusion Detection Systems, Firewalls, and Honeypots, Buffer Overflow, Penetration Testing	**CO6**	**8**
ii.Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	--	**1**
Total Hours			**42**

Books:	
Text Books	1. Certified Ethical Hacker (CEH) Preparation Guide Lesson-Based Review of Ethical Hacking and Penetration Testing, Ahmed Sheikh, Apress 2. Hacking, Hacking practical guide for beginners, Jeff Simon
Reference Books	1. The Basics of Hacking and Penetration Testing Ethical Hacking and Penetration Testing Made Easy SECOND EDITION Dr. Patrick Engebretson 2. Hacking, Computer Hacking, Security, Testing, Penetration Testing and Basic security, Gary Hall and Erin Watson
Continuous Assessment for 40 marks: 1.Test 1 for 40% of syllabus – 30 marks 2.Test 2 for 40% of syllabus – 30 marks 3.Internal assessment --10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Examination for 60 marks 02 hrs 30 min duration.	

Course Code	Course Name	Credits (TH+P+TUT)
CEDLC7034	**Natural Language Processing**	3-0-0
Prerequisite:	1. Data structure & Algorithms 2. Theory of computer science 3. Probability Theory	
Course Objectives:	1. To understand natural language processing and to learn how to apply basic algorithms in this field. 2. To get acquainted with the basic concepts and algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics. 3. To design and implement applications based on natural language processing 4. To implement various language Models.	
Course Outcomes:	**On successful completion of course, learner should be able to:** 1. Define broad understanding of the field of natural language processing and the capabilities and limitations of current natural language technologies, 2. Explain the concepts of Word level Analysis. 3. Apply approaches to syntax analysis in language model. 4. Determine approaches to semantics analysis in language model. 5. Formulate NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction...etc.	

Module No & Name	Subtopics	CO mapped	Hrs/ Sub topic	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	--	**02**	**02**
1. Introduction	History of NLP, Generic NLP system, levels of NLP , Knowledge in language processing	**CO1**	**02**	**04**
	Ambiguity in Natural language , stages in NLP, challenges of NLP , Applications of NLP		**02**	
2. Word Level Analysis	Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization,	**CO2**	**03**	**10**
	Regular expression,		**01**	
	Finite automata, Finite State Transducers (FST), Morphological parsing with FST, Lexicon free FST Porter stemmer. N–grams, N-gram language model, N-gram for spelling correction.		**06**	
3. Syntax analysis	Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) ,Rule based POS	**CO3**	**04**	**08**

	tagging, Stochastic POS tagging, Issues – Multiple tags & words,			
	Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM).		**04**	
	Self-Study : Maximum Entropy, and Conditional Random Field (CRF)			
4. Semantic Analysis	Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy,	**CO3**	**05**	**08**
	WordNet, Robust Word Sense Disambiguation (WSD), Dictionary based approach		**03**	
5. Pragmatics	Discourse –reference resolution, reference phenomenon ,	**CO4**	**03**	**06**
	Syntactic & semantic constraints on co reference		**03**	
6. Applications (preferably for Indian regional languages)	Introduction to Machine translation, Information retrieval, Question answers system, categorization, summarization, sentiment analysis, Named Entity Recognition.	**CO5**	**03**	**03**
ii.Course Conclusion	Course Conclusion		**01**	
Total Hours				**42**

Books:	
Text Books	1. Daniel Jurafsky, James H. Martin ―Speech and Language Processing‖ Second Edition, Prentice Hall,2008. 2. Christopher D. Manning and Hinrich Schutze, Foundations of Statistical NaturalLanguage Processing, MIT Press, 1999.
Reference Books	1. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, OxfordUniversity Press (2008). 2. Daniel M Bikel and Imed Zitouni ― Multilingual natural language processing applications, Pearson,2013 3. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) 4. Steven Bird, Ewan Klein, Natural Language Processing with Python, O ‘Reilly 5. Brian Neil Levine, An Introduction to R Programming 6. Niel J le Roux, Sugnet Lubbe, A step by step tutorial: An introduction into R application and programming
Assessment:	
Continuous Assessment: **1.** Test 1 – 30 marks	

2. Test 2 – 30 marks 3. Internal assessment --10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty.
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.

Course Code	Course Name	Credits (TH+P+TUT)
CEDLC7041	**Augmented and Virtual Reality**	3 - 0 - 0
Prerequisite:	Computer Graphics	
Course Objectives:	1. Presents a review of current Virtual Reality (VR) 2. Provides a detailed analysis of the engineering, scientific and functional aspects of VR 3. Develop VR and AR applications 4. Describe virtual environments and simulators	
Couse Outcomes:	**At the end of the course, the students should be able to:** 1. Describe how VR systems work and list the applications of VR 2. Elaborate geometric presentation of the virtual world and its operations 3. Explain the concepts of motion and tracking in VR systems 4. Design and implementation of the hardware that enables VR systems to be built. 5. Describe how AR systems work and analyze the hardware requirement of AR 6. Use different tools to design and develop AR/VR applications	

Module No. & Name	Sub Topics	CO mapped	Hrs / Sub Topics	Total Hrs/ Module
i. Prerequisites and course Outline	Prerequisite Concepts and Course Introduction	--		**02**
1. Introduction to Virtual Reality	What is virtual reality?, The beginnings of VR, VR paradigms	**CO1**	**02**	**05**
	Collaboration, , Representation , Virtual reality systems , User interaction		**03**	
2. The Geometry of Virtual Worlds	Geometric Models, Changing Position and Orientation	**CO2**	**02**	**06**
	Axis-Angle Representations of Rotation		**02**	
	Viewing Transformations, Chaining the Transformations		**02**	
3. Motion in Real and Virtual Worlds	Velocities and Accelerations , The Vestibular System	**CO3**	**02**	**06**
	Physics in the Virtual World		**02**	
	Mismatched Motion and Vection		**02**	
4. Applying Virtual Reality	Virtual reality: the medium, Form and genre, What makes an application a good candidate for VR	**CO4**	**02**	**07**
	Promising application fields, Demonstrated benefits of virtual reality		**02**	

	More recent trends in virtual reality application development		**02**	
	A framework for VR application development		**01**	
5. Introduction of Augmented Reality (AR)	Terminology, Simple augmented reality, , Marker detection	**CO5**	**02**	**08**
	Augmented reality as an emerging technology, Augmented reality applications		**02**	
	Marker pose, Marker types and identification: Template markers, 2D bar-code markers		**02**	
	Imperceptible markers: Image markers, Infrared markers, Miniature markers, Discussion on marker use, General marker detection application		**02**	
6. Applications and Development Tools	Designing and developing 3D user interfaces Application of VR and AR, Digital Entertainment: VR Technology in Film & TV Production	**CO6**	**03**	**07**
	Demonstration of Digital Entertainment by VR tools,		**03**	
	Development Tools in VR. X3D Standard: Blender, Unity **Self-Learning topics**: Unreal engine 4, Three.js		**01**	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization	**--**		**01**
Total Hours				**42**

Books:

Text Books	1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016 2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)‖. Morgan Kaufmann Publishers, San Francisco, CA, 2002 3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig,William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009. 4. Theory and applications of marker-based augmented reality SanniSiltanen 5. Virtual Reality Filmmaking, Celine Tricart,2018
Reference Books	1. AR Game Development‖, 1st Edition,Allan Fowler, A press Publications, 2018, ISBN 978- 1484236178 2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494 3. Learning Virtual Reality, Tony Parisi,O'Reilly Media, Inc., 2015, ISBN-9781491922835 4. 3D User Interfaces Theory and Practice, Joseph J, 2017

Useful Links:

1. https://nptel.ac.in/courses/106/106/106106138/
2. https://www.mooc-list.com/course/introduction-xr-vr-ar-and-mr-foundations-coursera
3. http://msl.cs.uiuc.edu/vr/
4. https://nptel.ac.in/courses/121/106/121106013/

Assessment:
Continuous Assessment for 40 marks: 1. Test 1 – 30 marks 2. Test 2 – 30 marks 3. Internal assessment - 10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty
End Semester Theory Examination will be of 60 marks for 2hr 30min duration.

Course Code	Course Name	Credits (TH+P+TUT)
CEDLC7042	**Internet Communication**	**3 - 0 – 0**
Prerequisite:	1. Computer Networks. 2. Cryptography and System Security	
Course Objectives:	1. To focus on Internet protocol, standards, services and administration. 2. To discuss the Internet communication protocol and security services 3. To discuss multimedia communication standards and compression techniques 4. To discuss the Multimedia communication across the networks	
Course Outcomes:	**After successful completion of the course student will be able to** 1. Interpret the Internet as a communication System. 2. Analyze the traditional and digital communication technology. 3. Identify the new communication technology. 4. Explain the internet communication using SIP. 5. Recognize the principles of VoIP Network Analysis and how to apply them. 6. Realize potential VoIP network security infrastructure misconfigurations.	

Module No. & Name	Sub Topics	CO mapped	Hrs / Sub topics	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	**-**		**02**
1. Introduction to Internet communication	Power and Meanings of the Internet as a Communication System, uses of internet,	**CO1**	**01**	**04**
	Central digital and internet definition, structural features of interactive technology, internet over traditional media, virtual reality**.**		**03**	
2. Convergence of communication technologies	Traditional Media and the Rise of Digital Communication Technologies,	**CO1**	**01**	**07**
	The Development and Evolution of Digital Technologies,		**02**	
	Study of CMC, immediacy vs mediation, communication through CMC, defining and finding cyberspace, hyperlink: get a real life		**04**	
3. New communication technology	A brief history of cybernetic technology	**CO2, CO3**	**01**	**05**
	Internet vs cybernetic organism, characteristics of online communication		**02**	
	Forming online identity, online communication and law		**02**	
	The value position of SIP, SIP open source code and SIP products.	**CO3, CO4**	**02**	**09**

4. Internet communication using SIP	Internet multimedia protocols, protocols for media description, media transport, and other multimedia.		**03**	
	Mobility on wider concept, intelligent network services using SIP: ITU Service CS-1, CS-2, SIP internetworking with ITU-T protocols.		**04**	
5.VoIP : P2P , wireless	Overview of IPv6, introduction to VoIP, basic VoIP concept.	**CO5, CO6**	**01**	**07**
	VoIP protocols: signaling protocols, session description protocols, media gateway control protocols, Media transport protocol		**02**	
	VoIP over P2P, VoIP over WLAN, VoIP capacity, VoIP packet prioritization, handoff performance		**04**	
6. Basics of VoIP implementation	Stages of VoIP implementation,	**CO5, CO6**	**01**	**07**
	Achieving the VoIP quality and reality, VoIP implementation issue,		**02**	
	VoIP security risk :VoIP infrastructure risk, VoIP risk from attacks		**04**	
ii. Course Conclusion	Recap of Modules, Outcomes, Application and Summarization	**-**		**01**
Total Hrs:				**42**

Books:	
Text Books	1. "Internet communication" by James W. Chesebro, David T. McMahan and Preston C. Russett, peter lang international academic publication 2. Online Communication: Linking Technology, Identity, & Culture Textbook by Andrew F. Wood and Matthew J. Smith, Publisher: Lawrence Erlbaum Associates 3. Internet Communication using SIP: Delivering VoIP and Multimedia Services with Session Imitation Protocol, by Henry Sinnreich and Alan B. Johnston, Willey Publication 4. A packet guide to Voice Over IP by Bruce Hartpence O'reilly Publication 5. VoIP Security by James F. Ransome and Jhon W. Rittinghouse Published by Elsevier digital press.
Reference Books	1. IP Telephony: Deploying Voice-over-IP Protocols by Olivier Hersent, Jean-Pierre Petit, David Gurle, published by Jhon Wiley and sons ltd. 2. Internet Multimedia Communication using SIP by Rogelio Martinez Perea, Published by Elsevier 3. VoIP: Wireless, P2P and New Enterprise Voice Over IP by Samarat Gangualy, Sudeept Bhatanagar, David Gurle, published by Jhon Wiley and sons ltd. 4. Voice Over IPV6 Architecture for next generation VoIP network by Daniel Minoli, Elsevier Publication.
Assessment:	
Continuous Assessment: 1. Test 1 – 30 marks	

2. Test 2 – 30 marks 3. Internal assessment --10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.

Course Code	Course Name	Credits (TH+P+TUT)
CEDLC7043	**Blockchain**	**3 - 0 - 0**
Prerequisite:	Cryptography	
Course Objectives:	1. To get acquainted with the concept of Distributed ledger system and Blockchain 2. To learn the concepts of consensus and mining in Blockchain 3. To acquire the knowledge of Bitcoin network, nodes and their roles, bitcoin cryptocurrency, keys, wallets and transactions 4. To understand Ethereum Ecosystem 5. To explain how to use the solidity programming language to develop a smart contract for blockchain and to demonstrate deployment of smart contracts using frameworks. 6. To analyze Blockchain for IOTA	
Course Outcomes:	**After the successful completion of this course, learner will be able to:** 1. Describe the basic concept of Blockchain and Distributed Ledger Technology 2. Illustrate the consensus in Blockchain 3. Interpret the knowledge of Bitcoin network, nodes and their roles and understand the concepts of keys, wallets and transactions in the Bitcoin Network 4. Interpret the components of Ethereum ecosystem 5. Implement smart contract in Ethereum using solidity and to analyse different development frameworks. 6. Integration of the Blockchain with IoT, AI, ML and Information Security	

Module No. & Name	Sub Topics	CO mapped	Hrs / Sub topics	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	**-**	**02**	**02**
1.Introduction to Blockchain	Introduction, Distributed Ledger Technologies (DLTs) Introduction, Types of DLTs, Origin of Blockchain, Components of Blockchain	**CO1**	**02**	**06**
	A Block in a Blockchain: Structure of a Block, Block Header , Block Identifiers: Block Header Hash and Block Height , The Genesis Block, Linking Blocks in the Blockchain.		**04**	
2. Consensus and Mining	Decentralized Consensus, Byzantine General's Problem, Independent Verification of Transactions, Mining Nodes, Aggregating Transactions into Blocks, Constructing the Block header, Mining the Block, Successfully Mining the Block, validating a New Block, Assembling and Selecting Chains of Blocks,	**CO2**	**03**	**06**

	Blockchain Forks, types of Blockchains, Introduction to different consensus algorithms Proof of Work and Proof of Stake, PBFT		**03**	
3. Bitcoin	**Introduction to Bitcoin**: What is Bitcoin and the history of Bitcoin, Getting the first bitcoin, finding the current price of bitcoin and sending and receiving bitcoin, Bitcoin Transactions., **Bitcoin Concepts:** keys, addresses and wallts,	**CO3**	**03**	**10**
	Bitcoin Network: Peer-to-Peer Network Architecture, Node Types and Roles, Incentive based Engineering The Extended Bitcoin Network, Bitcoin Relay Networks, Network Discovery, Full Nodes, Exchanging "Inventory"		**03**	
	Simplified Payment Verification (SPV) Nodes, Bloom Filters, SPV Nodes and Privacy, Encrypted and Authenticated Connections, Transaction Pools.		**04**	
4. Ethereum	Ethereum components: miner and mining node, Ethereum virtual machine, Ether, Gas, Transactions, accounts,	**CO4**	**02**	**04**
	swarm and whisper, Ethash, end to end transaction in Ethereum, Patricial merkle tree, architecture of Ethereum **Self learning Topic:** Hyperledger Fabric		**02**	
5. Smart Contract Development and Deployment	Solidity programming, Smart Contract programming using solidity, mapper function, ERC20 and ERC721 Tokens, comparison between ERC20 & ERC721, ICO, STO Metamask (Ethereum Wallet), setting up development environment, use cases of smart contract, smart Contracts: Opportunities, Risks	**CO5**	**03**	**08**
	Ethereum client, Ethereum Network, Introduction to Go Ethereum(Geth), Geth Installation and Geth CLI, Setting up a Private Ethereum Blockchain. Introduction to Truffle, Smart Contract deployment on a Private Blockchain. Introduction to Ganache		**03**	
	Introduction to Dapp, Dapp architecture, testing, Connecting to the Blockchain and Smart Contract, Web3js, Deployment		**02**	
6. Integration of Blockchain with emerging technologies	Blockchain in IoT,	**CO6**	**01**	**05**
	Blockchain in AI ,		**02**	
	Blockchain in Information security,		**01**	
	Blockchain in Banking and Finance		**01**	
	Self learning topics: Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare,			

	Blockchain in Real-estate. Blockchain in Supply Chain, The Blockchain and IoT			
ii. Course Conclusion	Recap of Modules, Outcomes, Application and Summarization	-		**01**
Total Hours				**42**

Books:	
Text Books	1. "Mastering Bitcoin, PROGRAMMING THE OPEN BLOCKCHAIN", 2nd Edition by Andreas M. Antonopoulos, June 2017, Publisher(s): O'Reilly Media, Inc. ISBN: 9781491954386. 2. Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. Antonopoulos Dr. Gavin Wood, O'reilly. 3. Blockchain Technology, Chandramouli Subramanian, Asha A George, Abhillash K. A and Meena Karthikeyen, Universities press. 4. Solidity Programming Essentials: A beginner's Guide to Build Smart Contracts for Ethereum and Blockchain, Ritesh Modi, Packt publication. 5. Blockchain and Distributed systems by Pavel.
Reference Books	1. Mastering Blockchain, Imran Bashir, Packt Publishing 2. Mastering Bitcoin Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media 3. Blockchain Technology: Concepts and Applications, Kumar Saurabh and Ashutosh Saxena, Wiley. 4. The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them, Antony Lewis.for Ethereum and Blockchain, Ritesh Modi, Packt publication.
Useful Links:	1. https://ethereum.org/en/ 2. https://www.trufflesuite.com/tutorials 3. https://hyperledger-fabric.readthedocs.io/en/release-2.2/whatis.html 4. https://www.blockchain.com/ 5. https://andersbrownworth.com/blockchain/ 6. https://andersbrownworth.com/blockchain/public-private-keys/ 7. https://www.coursera.org/learn/cryptocurrency 8. https://coinmarketcap.com/
Assessment:	
Continuous Assessment: 1. Test 1 – 30 marks 2. Test 2 – 30 marks 3. Internal assessment--10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.	

Course Code	Course Name	Credits (TH+P+TUT)
CEDLC7044	**Information Retrieval**	**3 - 0 – 0**

Prerequisite:	1. Data structures and algorithms 2. Database concepts
Course Objectives:	1. To learn the fundamentals of information retrieval system and classify various Information retrieval models. 2. To understand the query processing techniques & operations and compare the relevance of query languages for text and multimedia data. 3. To evaluate the significance of various indexing and searching techniques for information retrieval. 4. To develop an effective user interface for information retrieval.
Course Outcomes:	**After the successful completion of this course, learner will be able to:** 1. Describe the fundamental concepts of the Information retrieval system. 2. Summarize the different information retrieval models. 3. Solve text and multimedia retrieval queries and their operations. 4. Analyze text processing techniques and operations in information retrieval system. 5. Examine various indexing and searching techniques. 6. Design the user interface for an information retrieval system.

Module No. & Name	Sub Topics	CO mapped	Hrs /sub topic	Total Hrs/ Module
i. Prerequisite and Course Outline	Prerequisite Concepts and Course Introduction.	**-**	**-**	**02**
1. Introduction	Motivation, Basic Concepts, difference between data and information ,The retrieval Process	**CO1**	**01**	**03**
	Information System: Components, parts and types of information system; Definition and objectives of information retrieval system	**CO1**	**02**	
2. IR Models	Modeling: Taxonomy of Information Retrieval Models, Retrieval: Adhoc and filtering, Formal Characteristics of IR models, Classic Information Retrieval	**CO2**	**03**	**07**
	Alternative Set Theoretic models, Probabilistic Models, Structured text retrieval Models, models for Browsing; Multimedia IR models: Data Modeling.	**CO2**	**04**	
3. Query Processing	Query Languages: Keyword based Querying, Pattern Matching, Structural Queries, Query Protocols	**CO3**	**03**	**08**

and Operations	Query Operations: User relevance feedback, Automatic local analysis, Automatic global analysis, Multimedia IR Query Languages, case studies	**CO3**	**05**	
4. Text Processing	Text and Multimedia languages and properties: Metadata, introduction to Markup Languages, Multimedia	**CO4**	**03**	**07**
	Text Operations: Document Preprocessing, Document Clustering, Text Compression, Comparing Text Comparison Technique	**CO4**	**04**	
5. Indexing and Searching	Introduction to Indexing and Searching, Inverted files, Other indices for text, Boolean Queries, Sequential Searching, Pattern Matching, Structural Queries, Compression	**CO5**	**04**	**11**
	Multimedia IR: Indexing and Searching:-A Generic Multimedia indexing approach, One- dimensional time series, Two dimensional color images, Automatic Feature extraction; Searching Web: Challenges, Characterizing the web, Search Engines. Browsing, Meta searches, Searching needle in haystack, Searching using Hyperlinks	**CO5**	**07**	
6. User interface and visualization	Introduction to visualization techniques and UI, types of user interface, Human Computer interaction, the information access process, starting points, query specifications, context, using relevance judgments, interface support for the search process	**CO6**	**03**	**03**
ii. Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	**-**	**-**	**01**
Total Hours				**42**

Books:	
Text Books	1. "Modern Information Retrieval", Ricardo Baeza-Yates, berthier Ribeiro- Neto, ACM Press- Addison Wesley 2. Information Retrieval Systems: Theory and Implementation, Gerald Kowaski, Kluwer 3. Storage Network Management and Retrieval by Dr. Vaishali Khairnar, Nilima Dongre, Wiley India
Reference Books	1. Introduction to Information Retrieval by Christopher D. Manning and Prabhakar Raghavan, Cambridge University Press 2. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons 3. Introduction to Modern Information Retrieval. G.G. howdhury, Neal Schuman

Assessment:
Continuous Assessment for 40 marks: 1. Test 1 – 30 marks 2. Test 2 – 30 marks 3. Internal assessment --10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.

Course Code	Course Name	Credits (TH+P+TUT)
ILC7051	**Product Lifecycle Management**	**3 - 0 - 0**
Prerequisite:	**--**	
Course Objectives:	1. To familiarize the students with the need, benefits and components of PLM 2. To acquaint students with Product Data Management & PLM strategies 3. To give insights into new product development program and guidelines for designing and developing a product 4. To familiarize the students with Virtual Product Development	
Course Outcomes:	**After the successful completion of this course, learner will be able to:** 1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation. 2. Illustrate various approaches and techniques for designing and developing products. 3. Apply product engineering guidelines / thumb rules in designing products for molding, machining, sheet metal working etc. 4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant 5. Analyze the environmental aspects in product design. 6. Assess the life cycle of the product and cost.	

Module No. & Name	Sub Topics	CO mapped	Hrs / Sub Topics	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	**-**		**02**
1.Introduction to Product Lifecycle Management (PLM)	Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications	**CO1**	**05**	**10**
	PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy , Change management for PLM.		**05**	

1. Product Design	**Product Design:** Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering,	**CO2**	**05**	**09**
	Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process		**04**	
2. Product Data Management (PDM)	Product Data Management (PDM):Product and Product Data, PDM systems and importance, Components of PDM,	**CO3**	**03**	**05**
	Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation		**02**	
3. Virtual Product Development Tools	For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up Model building,	**CO4**	**03**	**05**
	Model analysis, Modeling and simulations in Product Design, Examples/Case Studies		**02**	
4. Integration of Environmental Aspects in Product Design	Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies.	**CO5**	**02**	**05**
	End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design		**03**	
5. Life Cycle Assessment and Life	Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment,	**CO6**	**03**	**05**

Cycle Cost Analysis:	Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis		**02**	
ii. Course Conclusion	Recap of Modules, Outcomes, Application and Summarization	-		**01**
Total Hours				**42**

Books:	
Text Books	1. John Stark, ―Product Lifecycle Management: Paradigm for 21st Century Product Realisation‖, Springer-Verlag, 2004. ISBN: 1852338105. 2. Saaksvuori Antti, Immonen Anselmie, ―Product Life Cycle Management‖, Springer, Dreamtech, ISBN: 3540257314.
Reference Books	1. Fabio Giudice, Guido La Rosa, Antonino Risitano, ‖Product Design for the environment-A life cycle approach‖, Taylor & Francis 2006, ISBN: 0849327229. 2. Michael Grieve, ―Product Lifecycle Management: Driving the next generation of lean thinking‖, Tata McGraw Hill, 2006, ISBN: 0070636265.
Assessment:	
Continuous Assessment for 40 marks: 1.Test 1– 30 marks 2.Test 2– 30 marks 3.Internal assessment --10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.	

Course Code	Course Name	Credits (TH+P+TUT)
ILC7052	Reliability Engineering	3 - 0 - 0

Course Objectives:	1. To familiarize the students with various aspects of probability theory. 2. To acquaint the students with reliability and its concepts. 3. To introduce the students to methods of estimating the system reliability of simple and complex systems. 4. To understand the various aspects of Maintainability, Availability and FMEA procedure.
Course Outcomes:	**After the successful completion of this course, learner will be able to:** 1. Apply the concept of Probability to engineering problems 2. Apply various reliability concepts to calculate different reliability parameters 3. Estimate the system reliability of simple and complex systems 4. Apply different techniques for reliability analysis. 5. Compare different design methods. 6. Carry out a Failure Mode Effect and Criticality Analysis.

Module No. & Name	Sub Topics	CO mapped	Hrs / Sub Topics	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-		**02**
1. Probability theory, Probability Distributions, Measures of Dispersion	**Probability theory:** Probability: Standard definitions and concepts; Conditional Probability, Bay's Theorem.	**CO1**	**02**	**08**
	Probability Distributions: Central tendency and Dispersion; Binomial, Normal, Poisson, Weibull, Exponential, relations between them and their significance		**02**	
	Measures of Dispersion: Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Variance, Skewness and Kurtosis.		**04**	
2. Reliability Concepts, Failure Data Analysis, Reliability Hazard Models	**Reliability Concepts:** Reliability definitions, Importance of Reliability, Quality Assurance and Reliability, Bath Tub Curve.	**CO2**	**02**	**08**
	Failure Data Analysis: Hazard rate, failure density, Failure Rate, Mean Time To Failure (MTTF), MTBF, Reliability Functions		**04**	
	Reliability Hazard Models: Constant Failure Rate, Linearly increasing, Time Dependent Failure Rate, Weibull Model. Distribution functions and reliability analysis.		**02**	

3. System Reliability	System Configurations: Series, parallel, mixed configuration, k out of n structure, Complex systems.	**CO3**		**05**
4. Reliability Improvement	Redundancy Techniques: Element redundancy, Unit redundancy, Standby redundancies. Markov analysis.	**CO4**	**04**	**08**
	System Reliability Analysis – Enumeration method, Cut-set method, Success Path method, Decomposition method		**04**	
5. Maintainability and Availability	System downtime, Design for Maintainability: Maintenance requirements, Design methods: Fault Isolation and self-diagnostics,.	**CO5**	**03**	**05**
	Parts standardization and Interchangeability, Modularization and Accessibility, Repair Vs Replacement. Availability – qualitative aspects		**02**	
6. Failure Mode, Effects and Criticality Analysis	Failure mode effects analysis, severity/criticality analysis, FMECA examples.	**CO6**	**02**	**05**
	Fault tree construction, basic symbols, development of functional reliability block diagram, Fau1t tree analysis and Event tree Analysis.		**03**	
ii. **Course Conclusion**	Recap of Modules, Outcome, Applications, and Summarization.	**-**		**01**
Total Hours				**42**

Books:

Text Books	1. Charles E. Ebeling, ―Reliability and Maintainability Engineering‖, Tata McGraw Hill. 2. P.D.T. Conor, ―Practical Reliability Engg.‖, John Wiley & Sons, 1985. 3. K.C. Kapur, L.R. Lamberson, ―Reliability in Engineering Design‖, John Wiley & Sons.
Reference Books	1. L.S. Srinath, ―Reliability Engineering‖, Affiliated East-Wast Press (P) Ltd., 1985. 2. B.S. Dhillion, C. Singh, ―Engineering Reliability‖, John Wiley & Sons, 1980. 3. Murray R. Spiegel, ―Probability and Statistics‖, Tata McGraw-Hill Publishing Co. Ltd.

Assessment:

Continuous Assessment for 40 marks:

1. Test 1– 30 marks
2. Test 2– 30 marks
3. Internal assessment --10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.

Course Code	Course Name	Credits (TH+P+TUT)
ILC7053	**Management Information System**	**3 - 0 - 0**

Course Objectives :	1. The course is blend of Management and Technical field. 2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built. 3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage. 4. Identify the basic steps in systems development.
Course Outcomes (COs):	**Upon completion of the course, the learners will be able to:** 1. Describe how information system transforms business. 2. Explain the impact information systems have on an organization. 3. Describe IT infrastructures and its components and its current trends. 4. Explain the principal tools and technologies for accessing information from databases. 5. Explain how to improve business performance and decision making. 6. Describe types of systems used for enterprise-wide knowledge management.

Module	Detailed Contents	CO Mapped	Hrs / Sub Topics	Total Hrs/ module
i. **Prerequisites and Course Outline**	Prerequisite Concepts and Course Introduction.	**-**	**02**	**02**
1.Introduction to Information System	Computer Based Information Systems, Impact of IT on organizations.	**CO1**	**02**	**04**
	Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS.	**CO1**	**02**	
1.**Data and Knowledge Management**	Data and Knowledge Management: Database Approach, Big Data, Data Warehouse and Data Marts, Knowledge Management.	**CO2 CO3**	**04**	**07**
	Business intelligence (BI): Managers and Decision Making, BI for Data Analysis and Presenting Results.	**CO2 CO3**	**03**	
2.**Ethical Issues and Privacy**	Ethical Issues and Privacy: Information Security.	**CO3**	**03**	**07**
	Threat to IS, and Security Controls.	**CO3**	**04**	
3.**Social Computing (SC)**	Social Computing (SC): Web 2.0 and 3.0, SC in Business-Shopping, Marketing.	**CO4**	**03**	**07**
	Operational and Analytic CRM, E-business and E-Commerce – B2B B2C. Mobile Commerce.	**CO4**	**04**	
	Computer Networks Wired and Wireless technology.	**CO5**	**03**	**06**

4.**Computer Networks**	Pervasive Computing, Cloud Computing Model.	**CO5**	**03**	
5.**System Design: Methodology and Consideratios**	Information System within Organization: Transaction Processing Systems, Functional Area Information System.	**CO6**	**04**	**08**
	ERP and ERP support of Business Process. Acquiring Information Systems and Applications: Various System Development life cycle models; Managing Without Authority; Areas of Further Study.	**CO6**	**04**	
ii. **Course Conclusion**	Recap of Modules, Outcome, Applications, and Summarization.	**-**	**01**	**01**

Text Books:	1. K. Rainer, Brad Prince, Management Information Systems, Wiley. 2. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, Prentice Hall.
Reference Books:	1. S. Jawadekar, Management Information Systems, McGraw Hill. 2. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall.
Useful Links:	1. https://www.nptel.ac.in/ 2. https://www.coursera.org/
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks (Test 1: 30 Marks, Test 2: 30 Marks, Internal Assessment: 10 Marks). • Test 1 shall be conducted on completion of approx. 40% syllabus and Test 2 shall be conducted on completion of additional 40% syllabus (but excluding contents covered in Test 1). Duration of each test shall be one hour. • Internal Assessment shall be based on during-the-lecture quiz / assignments / field studies / course-specific activity.
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.	

Course Code	Course Name	Credits (TH+P+TUT)
ILC7054	**Design of Experiments**	3-0-0
Prerequisites:	---	
Course Objectives :	1. To understand the issues and principles of Design of Experiments (DOE) 2. To list the guidelines for designing experiments 3. To become familiar with methodologies that can be used in conjunction with designs for robustness and optimization	
Course Outcomes (COs):	**Upon completion of the course, the learners will be able to:** 1. Plan data collection to turn data into information and to make decisions that lead to appropriate action. 2. Analyze the different fitting regression models. 3. Apply different two-level factorial designs. 4. Differentiate the different fractional factorial methods. 5. Apply the methods taught to real life situations. 6. Explain methods to plan, analyze, and interpret the results of experiments.	

Module	Detailed Contents	CO Mapped	Hrs/ Sub topic	Total Hrs/ Module
i. Prerequisites and Course outline	Prerequisite Concepts and Course Introduction.	**-**	**02**	**02**
1. **Introduction**	Strategy of Experimentation, Typical Applications of Experimental Design.	**CO1**	**01**	**03**
	Guidelines for Designing Experiments, Response Surface Methodology.	**CO1**	**02**	
2. **Fitting Regression Models**	Linear Regression Models, Estimation of the Parameters in Linear Regression Models, Hypothesis Testing in Multiple Regression.	**CO2**	**04**	**08**
	Confidence Intervals in Multiple Regression, Prediction of new response observation, Regression model diagnostics, Testing for lack of fit.	**CO2**	**04**	
3. **Two Levels Factorial Designs**	The 2^2 Design, The 2^3 Design, The General2k Design.	**CO3**	**03**	**07**
	A Single Replicate of the 2^k Design, The Addition of Center Points to the 2^k Design, Blocking in the 2^k Factorial Design, Split-Plot Designs.	**CO3**	**04**	
4. **Two Levels Fractional Factorial Methods**	The One-Half Fraction of the 2^k Design, The One-Quarter Fraction of the 2^k Design, The General 2^{k-p} Fractional Factorial Design.	**CO4**	**04**	**07**
	Resolution III Designs, Resolution IV and V Designs, Fractional Factorial Split-Plot Designs.	**CO4**	**03**	
5. Response Surface	Introduction to Response Surface Methodology, The Method of Steepest Ascent.	**CO5**	**04**	**07**

Methods and Designs	Analysis of a Second-Order Response Surface, Experimental Designs for Fitting Response Surfaces.	**CO5**	**03**	
6. **Taguchi Approach**	Crossed Array Designs and Signal-to-Noise Ratios.	**CO6**	**02**	**04**
	Analysis Methods, Robust design examples.	**CO6**	**02**	
iii. **Course conclusion**	Recap of Modules, Outcomes, Applications, and Summarization.	**--**	**01**	
Total Hrs				**42**
Text Books:	1. R. Mayers, D. Montgomery and C. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, John Wiley & Sons, New York. 2. D. Montgomery, Design and Analysis of Experiments, John Wiley & Sons, New York. 3. W. Dimond, Peactical Experiment Designs for Engineers and Scientists, John Wiley and Sons.			
Reference Books:	1. G. Box, J Hunter and W. Hunter, Statics for Experimenters: Design, Innovation and Discovery, Wiley. 2. A. Dean, and D. Voss, Design and Analysis of Experiments, Springer. 3. P. Ross, Taguchi Technique for Quality Engineering, McGraw Hill. 4. M. Phadake, Quality Engineering using Robust Design, Prentice Hall.			
Useful Links:				
1. https://nptel.ac.in/courses/110/105/110105087/ 2. https://www.udemy.com/course/design-of-experiments-i/				
Continuous Assessment for 40 marks: 1. Test 1– 30 marks 2. Test 2– 30 marks 3. Internal assessment --10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty				
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.				

Course Code	Course Name	Credits (TH+P+TUT)
ILC7055	**Operations Research**	3-0-0
Course Objectives:	**1.** To understand Research and Research Process **2.** To acquaint students with identifying problems for research and develop research strategies **3.** To familiarize students with the techniques of data collection, analysis of data and interpretation	
Course Outcomes:	**Learner will be able to…** **1.** Define and formulate linear programming problems and solve them by applying appropriate techniques. **2.** Determining the optimum solution for transportation and Assignment models. **3.** Choose the appropriate queuing model for a given practical application and propose the best strategy and value of the given game model. **4.** Use CPM and PERT techniques, to plan, schedule and control project activities. Determining the optimum sequence to process jobs. **5.** Judge classical & probabilistic inventory models and simulate different real life probabilistic situation using Monte Carlo simulation technique. **6.** Selecting the best strategy from various alternatives by applying various Tools and methodology for decision-making.	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
i. Prerequisite and Course outline	Prerequisite concepts, Introduction, Structure of the Mathematical Model, Limitations of operational research.	-	01	01
1.Linear Programming	1.1 Linear Programming: Problem formulation, Graphical Method and simplex method.	1	04	10
	1.2 Artificial Variable Simplex Techniques: Big-M Method and Two-Phase Method.	1	03	
	1.3 Advanced Topics in Linear Programming: Duality in Linear Programming and the Dual Simplex Method.	1	03	
2.Transportation models and Assignment Models	2.1 Transportation Model: North-west corner method, Row Minima method, Column Minima method, Least – cost method, Vogel's Approximation method, Optimality by MODI method and Unbalanced Transportation	2	03	

Module No. & Name	Sub Topics	CO Mapped	Hrs/ Sub Topic	Total Hrs/ Module
	Problem.			06
	2.2 Assignment Model: The Hungarian method for solution of Assignment problems, Unbalanced assignment problem and maximization problem.	2	03	
3.Queuing Model and Game Theory	3.1 Queuing Models: Introduction, Single-channel, Finite population model with Poisson Arrivals and Exponential Service Times (Limited Source Model).	3	03	06
	3.2 Game Theory, Saddle Point, Minimax (Maximin) Method of Optimal strategies, Value of The Game. Solution of Games with Saddle Points, Dominance Principle. Rectangular Games Without Saddle Point – Mixed Strategy for 2 x 2 Games.	3	03	
4. Network analysis in project planning and Sequencing models	4.1 Project Management: Phases of project management, Network construction, Critical Path Method (CPM) and Process Evaluation & Review Techniques (PERT). (Exclude Cost analysis, crashing, resource scheduling and updating)	4	04	07
	4.2 Sequencing Models: Processing n jobs through one machine, two machines and three machines, Processing n jobs through m machines.	4	03	
5. Inventory Control and Simulation	5.1 Inventory Models: Introduction, Inventory models with Deterministic demand (with and without shortages) and Inventory models with price breaks.	5	04	07
	5.2 Simulation: Definition, Types of Simulation Models, Monte Carlo Technique, Practical Problems, Applications in Queuing and Inventory problems.	5	03	
6. Decision Theory	Steps in Decision theory approach, Decision – Making Environments, Decision making under conditions of certainty and uncertainty, Decision making under conditions of Risk and Decision Trees.	6	04	04
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization	–	01	01
		Total		**42**

Reference Books:	1. Taha, H.A. "Operations Research - An Introduction", Prentice Hall, (7th Edition), 2002. 2. Ravindran, A, Phillips, D. T and Solberg, J. J. "Operations

Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2009
3. Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2002.
4. Operations Research, S. D. Sharma, KedarNath Ram Nath-Meerut
5. Operations Research, KantiSwarup, P. K. Gupta and Man Mohan, Sultan Chand & Sons

Useful Links:

1. https://onlinecourses.nptel.ac.in/noc19_ma29/preview

2. https://www.coursera.org/courses?query=operations%20research

Continuous Assessment (CA):

The distribution of Continuous Assessment marks will be as follows –

1.	Class Test 1 (T-1)	30 marks
2.	Class Test 2 (T-2)	30 marks
3.	Internal Assessment	10 marks

Class Tests (30 Marks):

Two class tests of 30 marks each should be conducted in a semester. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus (but excluding contents covered in Test I) is completed.
Average of the two class tests (T-1 and T-2) will be considered.

Internal Assessment(IA):

Marks will be allotted as per designed rubrics.

End Semester Theory Examination will be of 60 Marks for 02 hrs 30 min duration.

Course Code	Course Name	Credits (TH+P+TUT)
ILC7056	Cyber Security and Laws	3-0-0
Course Objectives:	1. To understand and identify different types cybercrime and cyber law 2. To recognized Indian IT Act 2008 and its latest amendments 3. To learn various types of security standards compliances	
Course Outcomes:	**Learner will be able to…** 1. Explain the concept of cybercrime and its effect on outside world 2. Classify and Examine the Cyber Offences and security implication. 3. Illustrate and identify the modus operandi followed in cyber-crimes. 4. Explain the aspects in Indian Cyber Laws 5. Explain the penalties in cyber law 6. Apply Information Security Standards compliance during software design and development	

Module	Detailed Contents	CO Mapped	Hrs/ Sub topic	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	**-**	**-**	**02**
1. Introduction to Cybercrime	Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the	**CO1**	**04**	**04**
2. Cyber Offenses & Cybercrime	How criminal plan the attacks, Social Engg, Cyber stalking, Cyberc afé and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era	**CO2**	**03**	**09**
	, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations,		**03**	
	Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops		**03**	
3. Tools and Methods Used in Cyberline	Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks.	**CO3**	**03**	**06**
	SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)		**03**	

4. The Concept of Cyberspace	E-Commerce , The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law ,The Intellectual Property Aspect in Cyber Law.	**CO4**	**04**	**08**
	The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in Cyber Law .		**02**	
	Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law		**02**	
5. Indian IT Act	Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	**CO5**	**06**	**06**
6. Information Security Standard compliances	SOX, GLBA,	**CO6**	**02**	**06**
	HIPAA, ISO,		**02**	
	FISMA, NERC, PCI.		**02**	
ii.Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	**--**	**01**	**01**
Total Hrs				**42**

Text Books:	1. Nina Godbole, Sunit Belapure, *Cyber Security*, Wiley India, New Delhi 2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi 3. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi. 4. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
Reference Books:	1. Nina Godbole, *Information Systems Security*, Wiley India, New Delhi 2. Kennetch J. Knapp, *Cyber Security &Global Information Assurance* Information Science Publishing. 3. William Stallings, *Cryptography and Network Security*, Pearson Publication
Useful Links:	1. Websites for more information is available on : The Information Technology ACT, 2008- TIFR : https://www.tifrh.res.in 2. Website for more information , A Compliance Primer for IT professional https://www.sans.org/reading-room/whitepapers/compliance/ compliance-primer-professionals-33538

Assessment:

Continuous Assessment for 40 marks:

1. Test 1 for 40% of syllabus – 30 marks
2. Test 2 for 40% of syllabus – 30 marks
3. Internal assessment --10 marks

Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty

End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.

Course Code	Course Name	Credits (TH+P+TUT)
ILC7057	**Disaster Management and Mitigation Measures**	**3-0-0**

Prerequisite:	Basics of Physics
Course Objectives:	1. To understand physics and 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 understand application of GIS in the field of disaster management 6. To understand the emergency government response structures before, during and after disaster
Course Outcomes:	**After the successful completion of this course, the learner will be able to:** 1. Illustrate the importance of Disaster Management 2. Discuss natural as well as manmade disaster and their extent and possible effects on the economy. 3. Use government policies, acts and various organizational structure associated with an emergency. 4. Devise various Framework for Disaster Management in India. 5. Reviewing various approaches of disaster relief measures. **6.** Genralize the simple do‘s and don‘ts in such extreme events and act accordingly.

Module No. & Name	Sub Topics	CO mapped	Hrs /Sub Topics	Total Hrs/ Module
i. Prerequisites and Course outline	Prerequisite Concepts and Course Introduction.	**-**		**02**
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.	**CO1**	**03**	**03**
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.	**CO2**	**05**	**09**
	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.		**04**	

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.	**CO3**	**03**	**06**
	Policy and administration: Importance and principles of disaster management policies, command and coordination 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.		**03**	
4. Institutional Framework for Disaster Management in India	Importance of public awareness, Preparation and execution of emergency management program. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India.	**CO4**	**03**	**06**
	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 software for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard.		**03**	
5.Financing Relief Measures	Ways to raise finance for relief expenditure, role of government agencies and NGO ‘s in this process. .	**CO5**	**03**	**09**
	Legal aspects related to finance raising as well as overall management of disasters.		**03**	
	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		**03**	
6.Preventive and Mitigation Measures	Pre-disaster, during disaster and post-disaster measures in some events in general Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication	**CO6**	**03**	**06**
	Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. Do ‘s and don’t’s in case of disasters and effective implementation of relief aids.		**03**	
ii.Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	**--**		**01**
Total Hours				**42**

Books:	
Text Books	1. Disaster Management by Harsh K.Gupta, Universities Press Publications. 2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O.S.Dagur, published by Centre for land warfare studies, New Delhi, 2011. 3. Introduction to International Disaster Management by Damon Copolla, Butterworth Heinemann Elsevier Publications. 4. Disaster Management Handbook by Jack Pinkowski, CRC Press Taylor and Francis group.
Reference Books	1. Disaster management & rehabilitation by Rajdeep Dasgupta, Mittal Publications, New Delhi. 2. Natural Hazards and Disaster Management, Vulnerability and Mitigation – R B Singh, Rawat Publications 3. Concepts and Techniques of GIS –C.P.Lo Albert, K.W. Yonng – Prentice Hall (India) Publications
Assessment:	
Continuous Assessment for 40 marks: 4. Test 1 – 30 marks 5. Test 2 – 30 marks **6.** Internal assessment --10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.	

Course Code	Course Name	Credits (TH+P+TUT)
ILC7058	Energy Audit and Management	3-0-0
Prerequisite:		
Course Objectives:	1. To understand the importance energy security for sustainable development and the fundamentals of energy conservation. 2. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management 3. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.	
Course Outcomes:	**After the successful completion of this course, the learner will be able to:** 1. Illustrate present state of energy security and its importance. 2. Describe the basic principles and methodologies adopted in energy audit of a utility. 3. Apply the energy performance evaluation of some common electrical installations and identify the energy saving opportunities. 4. Evaluate the energy performance evaluation of some common thermal installations and identify the energy saving opportunities 5. Analyze the data collected during performance evaluation and recommend energy saving measures. 6. Reviewing the concepts of Energy Conservation in buildings	

Module No. & Name	Sub Topics	CO mapped	Hrs / Sub Topics	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-		**02**
1.Energy Scenario	Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance,	**CO1**	**02**	**04**
	Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance		**02**	
2. Energy Audit Principles	Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs	**CO2**	**02**	**08**
	Bench marking, Energy performance, Matching energy use to requirement, maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring& targeting;		**04**	
	Energy audit Instruments; Data and information-analysis. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI), Internal rate of return (IRR)		**02**	

3. Energy Management and Energy Conservation in Electrical System	Electricity billing, Electrical load management and maximum demand Control; Power factor improvement	**CO3**	**03**	**10**
	Energy efficient equipment's and appliances, star ratings. **Energy efficiency measures in lighting system, Lighting control:** Occupancy sensors, daylight integration, and use of intelligent controllers.		**03**	
	Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives		**04**	
4. Energy Management and Energy Conservation in Thermal Systems	Review of different thermal loads; Energy conservation opportunities in: Steam distribution system.	**CO4**	**02**	**10**
	Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application		**04**	
	HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities		**04**	
5. Energy Performance Assessment	On site Performance evaluation techniques, Case studies based on: Motors and variable speed drive, pumps.	**CO5**	**02**	**04**
	HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis.		**02**	
6. Energy conservation in Buildings	Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources	**CO6**		**03**
ii.Course Conclusion	Recap of Modules, Outcomes, Applications, and Summarization.	**--**		**01**
Total Hours				**42**

Books:	
Text Books	1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science 2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System 3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons 4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI). 5. Energy Management Principles, C.B.Smith, Pergamon Press
Reference Books	1. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press

	2. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press
Useful links:	
1. www.energymanagertraining.com 2. www.bee-india.nic.in	
Assessment:	
Continuous Assessment: 1. Test 1 – 30 marks 2. Test 2 – 30 marks **3.** Internal assessment --10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester theory Examination for 60 marks of 02 hrs 30 min duration	

Course Code	Course Name	Credits (TH+P+TUT)
ILC7059	Development Engineering	3 - 0 – 0

Prerequisite:	-
Course Objectives:	1. To understand the characteristics of rural Society and the Scope, Nature and Constraints of rural Development 2. To study Implications of 73rd CAA on Planning, Development and Governance of Rural Areas 3. An exploration of human values, which go into making a 'good' human being, a 'good' professional, a 'good' society and a 'good life' in the context of work life and the personal life of modern Indian professionals 4. To understand the Nature and Type of Human Values relevant to Planning Institutions
Course Outcomes:	**After the successful completion of this course, learner will be able to:** 1. Apply knowledge for Rural Development. 2. Demonstrate post-independence rural development. 3. Apply knowledge for Initiatives and Strategies. 4. Develop acumen for higher education and research. 5. Master the art of working in group of different nature. 6. Develop confidence to take up rural project activities independently.

Module No. & Name	Sub Topics	CO mapped	Hrs / Sub Topics	Total Hrs/ Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-		**02**
1.Introduction to Rural Development	Introduction to Rural Development Meaning, nature and scope of development; Nature of rural society in India; Hierarchy of settlements; Social, economic and ecological constraints for rural development Roots of Rural	**CO1**	**04**	**08**
	Development in India Rural reconstruction and Sarvodaya programme before independence; Impact of voluntary effort and Sarvodaya Movement on rural development; Constitutional direction, directive principles; Panchayati Raj - beginning of planning and community development; National extension services		**04**	
2. Post-Independence rural Development	Post-Independence rural Development Balwant Rai Mehta Committee – three tier system of rural local Government.	**CO2**	**02**	**04**
	Need and scope for people 's participation and Panchayati Raj; Ashok Mehta Committee - linkage between Panchayati Raj, participation and rural development		**02**	

3. Rural Development Initiatives in Five Year Plans	Rural Development Initiatives in Five Year Plans Five Year Plans and Rural Development; Planning process at National, State, Regional and District levels; Planning, development, implementing and monitoring organizations and agencies.	**CO3**	**03**	**06**
	Urban and rural interface - integrated approach and local plans; Development initiatives and their convergence; Special component plan and sub-plan for the weaker section; Micro-eco zones; Data base for local planning; Need for decentralized planning; Sustainable rural development.		**03**	
4. Post 73rd Amendment Scenario	Post 73rd Amendment Scenario 73rd Constitution Amendment Act, including - XI schedule, devolution of powers, functions and finance; Panchayati Raj institutions - organizational linkages; Recent changes in rural local planning;	**CO4**	**02**	**04**
	Gram Sabha - revitalized Panchayati Raj; Institutionalization; resource mapping, resource mobilization including social mobilization; Information Technology and rural planning; Need for further amendments		**02**	
5. Values and Science and Technology Material development	Values and Science and Technology Material development and its values; the challenge of science and technology; Values in planning profession, research and education.	**CO5**	**03**	**10**
	Types of Values Psychological values — integrated personality; mental health; Societal values — the modern search for a good society; justice, democracy, rule of law, values in the Indian constitution; Aesthetic values — perception and enjoyment of beauty; Moral and ethical values; nature of moral judgment; Spiritual values; different concepts; secular spirituality; Relative and absolute values;		**05**	
	Human values— humanism and human values; human rights; human values as freedom, creativity, love and wisdom.		**02**	
6. Ethics Canons of ethics	Ethics Canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.	**CO6**	**04**	**07**
	Work ethics; Professional ethics; Ethics in planning profession, research and education.		**03**	
ii. Course Conclusion	Recap of Modules, Outcomes, Application and Summarization.		**-**	**01**
Total Hours				**42**
Books:				
Text Books	1. ITPI, "Village Planning and Rural Development", ITPI, New Delhi 2. Thooyavan, K.R, " Human Settlements: A 2005", MA Publication, Chennai			

	3. GoI, "Constitution (73rd GoI, New Delhi Amendment) Act", GoI, New Delhi 4. Planning Commission, Five Year Plans, Planning Commission 5. Planning Commission, Manual of Integrated District Planning, 2006, Planning Commission New Delhi
Reference Books	1. Planning Guide to Beginners 2. Weaver, R.C., The Urban Complex, Doubleday. 3. Farmer, W.P. et al, Ethics in Planning, American Planning Association, Washington. 4. How, E., Normative Ethics in Planning, Journal of Planning Literature, Vol.5, No.2, pp. 123-150. 5. Watson, V. Conflicting Rationalities: -- Implications for Planning Theory and Ethics, Planning Theory and Practice, Vol. 4, No.4, pp.395– 407
Assessment:	
Continuous Assessment 1. Test 1 – 30 marks 2. Test 2 – 30 marks **3.** Internal assessment--10 marks Internal assessment will be based on assignments/quizzes /case study/activity conducted by the faculty	
End Semester Theory Examination will be of 60-Marks for 02 hrs 30 min duration.	

Lab Code	Lab Name	Credits (P+TUT)
CEL701	**Machine Learning Lab**	**1-0**

Prerequisite:	1. Linear Algebra 2. Calculus 3. Basic Probability and Statistics 4. Data Structures 5. Algorithms Data Mining 6. Python Programming
Lab Objectives:	1. To introduce students to the basic concepts and techniques of Machine Learning. 2. To introduce Machine Learning Tools 3. To have comprehensive hands on with regression methods, classification, Ensemble Learning & clustering methods. 4. To demonstrate dimensionality reduction Techniques
Lab Outcomes (LOs):	**At the end of the course, the students will be able to** 1. Apply basic knowledge on the fundamentals of Machine Learning to a particular problem 2. Explore Machine Learning Tools 3. Implement regression and Classification algorithms 4. Implement clustering algorithms 5. Design application using machine learning techniques 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory

Lab No.	Experiment Title	LO mapped	Hrs / Lab
0	**Prerequisites**		**02**
1	To implement Linear Regression.	**LO2, LO3, LO6**	**02**
2	To implement Logistic Regression.	**LO2, LO3, LO6**	**02**
3	To implement Classification And Regression Trees (CART)	**LO2,LO3, LO6**	**02**
4	To implement Random Forest.	**LO2, LO3, LO6**	**02**
5	To implement Radial Basis functions.(RBF) (Vitrual Lab)	**LO3, LO6**	**02**
6	To implement Support Vector Machine (SVM).	**LO2, LO3, LO6**	**02**
7	To implement Graph Based Clustering.	**LO4, LO6**	**02**
8	To implement Expectation Maximization Algorithm.	**LO4, LO6**	**02**
9	To implement Principal Component Analysis (PCA)	**LO5, LO6**	**02**
10	To implement Linear Discriminant Analysis (LDA)	**LO5, LO6**	**02**

11	Mini Project	**LO1, LO2, LO3, LO4, LO5, LO6**	**06**
Books:			
Text Books	1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition 2. Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 3rd Edition		
Term work:			
1. Term work should consist of 8 experiments. **2.** Term work should consist Miniproject. (It is suggested that students should select and solve real world problem in the domain of Agriculture, Healthcare and Education etc.) **3.** The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work. 4. Total 25 Marks = 15 Marks for Experiments and 10 Marks for Mini Project			
Oral Exam: Oral exam will be based on the entire syllabus of **CEC701** and **CEL701**			

Lab Code	Lab Name	Credits (P+TUT)
CEL702	**Big Data Analytics Lab**	1+0

Lab Prerequisite:	Java Programming
Lab Objectives:	**1.** To interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
Lab Outcomes:	**On successful completion of course, the learner will be able to:** 1. Apply scalable algorithms based on Hadoop and Map Reduce to perform Big Data Analytics. 2. Apply NoSQL tools to solve big data problems. 3. Implement commands of various technologies of Hadoop Ecosystem. 4. Implement various data stream algorithms. 5. Develop applications to solve big data problems. 6. Apply ethical principles like timeliness and adhere to the rules of the laboratory.

Suggested Experiments

Lab No.	Experiment Title	LO mapped	Hrs /Lab
0	Lab Prerequisite	**-**	**02**
1	Hadoop distributions for installation of Hadoop	**LO1, LO6**	**02**
2	Execution of Basic HDFS Commands: Copying File to Hadoop. Copy from Hadoop File system and deleting file. Moving and displaying files in HDFS.	**LO1, LO6**	**02**
3	Implementing simple algorithms in Map-Reduce: Matrix multiplication/ Aggregates and Joins/ Sorting and Searching, etc	**LO1, LO6**	**02**
4	To install and configure MongoDB/ Cassandra/ HBase/ Hypertable to execute NoSQL commands. (Any one)	**LO2, LO6**	**02**
5	Use of Sqoop tool to transfer data to Hadoop and To execute basic commands of Sqoop.	**LO3, LO6**	**02**
6	Create HIVE Database and Descriptive analytics-basic statistics, visualization using Hive/PIG/R.	**LO3, LO6**	**02**
7	Data Stream Management (Any one) -Implementing DGIM algorithm using any Programming Language/ -Implement Bloom Filter using any programming language. -Implement Flajolet Martin algorithms using any programming language	**LO4, LO6**	**02**
8	Social NetworkAnalysis using R programming	**LO4, LO6**	**02**
9	Mini Project. One large data application to be implemented (Use standard Datasets available on the web) (mandatory)	**LO5, LO6**	**12**

Useful Links:

1. https://hadoop.apache.org

2. https://hadoop.apache.org/docs/r2.8.0/hadoop-project-dist/hadoop-common/core-default.xml
3. https://sqoop.apache.org/
4. https://hive.apache.org/
5. https://pig.apache.org/docs/r0.16.0/start.html
6. https://medium.com/@deepeshtripathi/setup-multi-node-hadoop-cluster-using-ambari-fc929cd1d0d4
7. https://www.r-project.org
Term work:
1. Term work should consist of a minimum of 7 experiments.
2. Mini Project based on the content of the syllabus (Group of 2-3 students)
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Programming Exercises : 15-marks, Mini Project: 10-marks)
Oral Exam: Oral exam will be based on the entire syllabus of **CEC702** and **CEL702**

Lab Code	Lab Name	Credits (P+TUT)
CEDLL7031	Computer Vision Lab	1-0

Prerequisite:	1.Image Processing 2.Mathematics (Linear algebra, calculus, geometry, Fourier transform)
Lab Objectives:	1. To review image processing techniques for computer vision 2. To understand shape and region analysis and Hough Transform 3. To apply three-dimensional image analysis techniques 4. To implement computer vision algorithms
Lab Outcomes (LOs):	**At the end of the course, the students will be able to** 1. Use image processing techniques for computer vision 2. Analyze shapes and regions and Hough Transform 3. Apply3D vision techniques **4.** Identify motion techniques 5. Study and design real time application using machine vision technique 6. Apply ethical principles like timeliness and adhere to the rule of the laboratory.

Lab No.	Experiment Title	LO mapped	Hrs/ Module
0	Image processing:To study the Image Processing concept	**--**	**02**
1	Implement image smoothing/ image sharpening	**LO1, LO6**	**02**
2	Implement the shapes and regions: a. Skeletons and thickening and thinning b. boundary detection procedures.	**LO2, LO6**	**02**
3	Implement circular object detection through Hough Transforms	**LO2, LO6**	**02**
4	Implementation of RANSAC algorithm.	**LO2, LO6**	**02**
5	Construct 3D model from images	**LO3, LO6**	**02**
6	Implementation of SIFT algorithm.	**LO3, LO6**	**02**
7	Implement spline- based motion algorithm.	**LO4, LO6**	**02**
8	Implement optical flow method	**LO4, LO6**	**02**
9	Implement object detection and tracking from video	**LO5, LO6**	**02**
10	Make a case study on machine vision applications published in IEEE/ACM/Springer or any prominent journal	**LO5, LO6**	**02**

Books:	
Text Books	1.Jan Erik Solem "*Programming Computer Vision with Python: Techniques and Libraries for Imaging and Retrieving Information*" , ORELLY Publication

	2.Boguslaw Cyganek, J. Paul Siebert "*Introductory Techniques for 3-D Computer Vision"* Wiley Publications
Useful Links:	
1. https://www.coursera.org/learn/advanced-computer-vision-with-tensorflow	
2.https://www.kaggle.com/learn/computer-vision	
3.https://cse19-iiith.vlabs.ac.in/	
Term work:	
1. Term work should consist of minimum 8 experiments 2. Journal must include at least 2 assignments on content of theory and practical of the course "Machine Vision" 3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work. 4. Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks)	
Oral Exam: Oral exam will be based on the entire syllabus of **CEDLC7031** and **CEDLL7031**	

Lab Code	Lab Name	Credits (P+TUT)
CEDLL7032	**Ad-hoc Wireless Networks Lab**	**1-0**
Lab Prerequisite:	1.Knowledge about Computer Network 2. Cryptography and System security	
Lab Objectives:	1. This course deals with the comprehensive knowledge of various techniques in mobile networks/Ad-hoc networks and sensor based networks. 2. The objective of this course is to facilitate the understanding of Infrastructure less networks and their importance in the future directions for wireless communications	
Lab Outcomes (LOs):	1. Explore the knowledge of NS2 and NS3 by installing it and make it ready 2. Synthesize a simulation and evaluate the performance of WLAN 802.11 and Bluetooth 3. Analyze and implement MAC & Network layer protocols using open source and synthesis as well as evaluate its performance 4. Implement Transport layer protocols / Carry out simulation of routing protocols of Ad-hoc Networks 5. Interpret the use of security procedure and evaluate its performance. 6. Explore the capability of SUMO and MOVE as well as Nessi by installing it and analyze it by applying on various scenarios 7.Apply the ethical principles like timeliness and adhere to the rule of Laboratory	

Lab No.	Experiment Title	LO mapped	Hrs/ Lab
0	Prerequisite	-	**02**
1	Installation of NS2 & NS3 in Fedora 19 (32 bit) OS Linux	**LO1, LO7**	**02**
2	Simulating IEEE 802.11 wireless LAN in Ad-Hoc Mode using NS2	**LO2, LO7**	**02**
3	Implementation a Bluetooth network in NS3 with application as transfer of a file from one device to another device.	**LO2, LO7**	**02**
4	To implement and compare MAC layer protocols, MACAW, MACA-BI and MACA with piggybacked Reservation using NS-3	**LO3, LO7**	**02**
5	Develop sample wireless network in which a. implement AODV and AOMDV protocol b. Calculate the time to receive reply from the receiver using NS2. c. Generate graphs which show the transmission time for packet. Implement wireless network. Capture data frame and identify fields using NS2.(all 3 need to implement)	**LO4, LO7**	**02**

6	Communicate between two different networks (NS-3) which has following specifications: a. One network has Class A network with ―TORA protocol‖ b. Second has Class B network ―AODV protocol‖	**LO4, LO7**	**02**
7	To calculate and compare average throughput for various TCP variants like TCP-F (Feedback) and Ad-Hoc TCP using NS-3	**LO5, LO7**	**02**
8	Explore and use security tools like WEP & WPA and evaluate its performance on mobile terminals	**LO5, LO7**	**02**
9	Simulation of Urban Mobility (SUMO) along with MOVE is software that helps in simulating the VANETs. Install it on Fedora 19 (32 bit) OS Linux	**LO6, LO7**	**02**
10	Create a simulation for road traffic with 6 junctions. There are various vehicles going on and your own car also. Select a shortest route for your car. Demonstrate with simulation software SUMO and MOVE	**LO6, LO7**	**03**
11	A car acts as a malicious node and can be analyzed for the packet loss before and after malicious activity. Using SUMO and MOVE	**LO6, LO7**	**02**
12	Create an Ad-hoc Network using nessi Simulation software and include events incorporate dropped packets, infected flows, compromised machines, unavailable services etc, and check its performance	**LO4, LO6 LO7**	**03**

Reference Link:

1. http://www.isi.edu/nsnam/ns/ : NS-2 software download (D1)
2. https://nsnam.isi.edu/nsnam/index.php/NS_manual (D2)
3. https://www.nsnam.org/ : Ns-3 Software Download (D3)
4. http://www.nsnam.com/2013/11/vanet-simulator-in-fedora-19-32-bit.html (D4)
5. http://www.sumo.dlr.de/userdoc/Tutorials/Quick_Start.html (D5)
6. http://veins.car2x.org/ (D6)
7. http://www.nessi2.de/ (D7)

Text book for Reference:

1. Ekram Hossain and Teerawat Issariyakul, ―Introduction to Network Simulator NS-2,‖ Springer , Second Edition.
2. Jack L. Burbank, ―Introduction to Network Simulator 3,‖ Wiley Publications.
3. Siva Ram Murthy and B.S. Manoj , ―Ad hoc Wireless Networks Architectures and protocols‖, 2nd edition, Pearson Education, 2007
4. Michael Gregg, ―Build your own security lab,‖ Wiley India edition

Term work:

1. Term work should consist of a minimum of 8 experiments
2. Journal must include at least 2 assignments on content of theory and practical of the course " Ad-hoc wireless network"
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks)

Oral Exam :

Oral exam will be based on experiment list(**CEDLL7032)** and syllabus of Ad-hoc wireless network(**CEDLC7032)**

Lab Code	Lab Name	Credits (P+TUT)
CEDLE7033	**Ethical Hacking and Security Lab**	1- 0
Lab Prerequisite:	1. Computer Network 2. Cryptography and System Security	
Lab Objectives:	1. Learn about basic command of linux and different types of attack. 2. Learn about picklerick and eternal blue lab. 3. Learn steganography tool and password cracking tools. 4. Learn to use wifi hacking and google dorking.	
Lab Outcomes (LOs):	**At the end of the course, the student will be able to** 1. Explore basics of bash scripting and social engineering toolkit. 2. Use attack tools like steghide, gobuster, dirb. 3. Use picklerick and eternal blue lab to test the hacking skill. 4. Explore SQL injection and DOS attack. 5. Explore Wifi hacking(on mobile), google dorking and SSRF attack. 6. Apply ethics and strictly follow rules and regulations of laboratory.	

Lab No.	Experiment Title	LO mapped	Hrs/Lab
0	Prerequisite	**-**	**2**
1	Perform Basics Commands of Linux, Bash Scripting	**LO1, LO6**	**2**
2	Perform Spear Phishing Attack using Social Engineering Toolkit or Zphish	**LO1, LO6**	**2**
3	Perform Steganography Attacks using steghide	**LO2, LO6**	**2**
4	Solve the eternal blue lab on TryHackMe https://tryhackme.com/room/blue	**LO3, LO6**	4
5	Solve this lab to test your skills and write a report on the same https://tryhackme.com/room/picklerick	**LO3, LO6**	4
6	Perform Directory Traversal Attack on either brokencrystals.com or testphp.vulnweb.com using gobuster or dirb	**LO2, LO6**	**2**
7	Perform SQL Injection on either brokencrystals.com or testphp.vulnweb.com	**LO4, LO6**	**2**
8	Perform DOS Attack using hping3	**LO4, LO6**	**2**
9	Perform SSRF Attack on testphp.vulnweb.com	**LO5, LO6**	**2**
10	Perform WiFi Hacking on a mobile Hotspot	**LO5, LO6**	**2**
12	Find sensitive information using Google Dorking	**LO5, LO6**	**2**

Term work:

1. Term work should consist of minimum 8 experiments
2. Journal must include at least 2 assignments on content of theory and practical of the course “Ethical Hacking and Security”
3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks (Experiments: 20-marks, Assignments: 05-marks)

Oral : Oral examination will be based on theory **CEDLEC7033** and practical syllabus **CEDLE7033.**

Lab Code	Lab Name	Credits (P+TUT)
CEDLL7034	**Natural Language Processing Lab**	1-0

Lab Prerequisite:	1. Data structure & Algorith sms 2. Theory of computer science 3. Probability Theory
Lab Objectives:	1. To understand natural language processing and to learn how to apply basic algorithms in this field. 2. To get acquainted with the basic concepts and algorithmic description of the main language levels:morphology, syntax, semantics, and pragmatics. 3. To design and implement applications based on natural language processing 4. To implement various language Models.
Lab Outcomes:	**On successful completion, of course learner will be able to:** 1. Implement the text preprocessing and word analysis using different natural languages. 2. Evaluate the morphological analysis and design the n-gram models. 3. Implement the POS tagging and chunking process. 4. Develop Corpus and projects based on concept of natural language processing. 5. Apply ethical principles like timeliness and adhere to the rule of the laboratory. 6. Write accurate documentation for mini project perform.

Suggested Experiments

Lab No.	Experiment Title	LO mapped	Hrs/ Lab
0	NLTK Installation and Basics	-	**02**
1.	Study various applications of NLP and Formulate the Problem Statement for Mini Project based on chosen real world NLP applications: [Machine Translation, Text Categorization, Text summarization, chat Bot, Plagiarism, Spelling & Grammar checkers, Sentiment / opinion analysis, Question answering, Personal Assistant, Tutoring Systems, etc.]	**LO4, LO5, LO6**	**02**
2.	Apply various text pre-processing techniques for any given text : Tokenization and Filtration & Script Validation.	**LO1, LO5, LO6**	**02**
3.	Apply various other text pre-processing techniques for any given text :Stop Word Removal, Lemmatization Stemming.	**LO1, LO5, LO6**	**02**
4.	Perform morphological analysis and word generation for any given text	**LO2, LO5, LO6**	**02**
5.	Implement N-Gram model for the given text input	**LO2, LO5, LO6**	**02**

6.	Study the different POS taggers and Perform POS tagging on the given text.	**LO3, LO5, LO6**	**02**
7.	Perform Chunking for the given text input	**LO3, LO5, LO6**	**02**
8.	Implement Named Entity Recognizer for the given text input	**LO3, LO5, LO6**	**02**
9.	Implement Text Similarity Recognizer for the chosen text documents	**LO3, LO5, LO6**	**02**
10.	Exploratory data analysis of a given text (Word Cloud)	**LO4, LO5, LO6**	**02**
	Mini Project Report: For any one chosen real world NLP application. Implementation and Presentation of Mini Project	**-**	**12**

Books:

Text Books	1. Steven Bird, Ewan Klein, "Natural Language Processing with Python", O'Reilly 2. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana "Practical Natural Language Processing", O'Reilly Media.

Useful Links:

1. https://www.nltk.org/
2. https://nlp-iiith.vlabs.ac.in/

Term work:

1. Term work should consist of a minimum of 7 experiments from above list.
2. The final certification and acceptance of term work ensures that satisfactory performance of tutorials.
3. Total 25 Marks (Lab Assignment : 15 marks, Mini Project : 10 marks)

Oral Exam:
Oral exam will be based on experiment list(**CEDLL7034)** and syllabus of (**CEDLC7034).**

Course code	Course Name	Credits
CEPR75	**Project Based Learning - Major Project -A**	**3**

PBL Objectives:	1. To encourage students for knowledge acquisition and use latest technology. 2. To make students to develop presentation skills. 3. To use written communications to report and technical writing.
PBL Outcomes:	**Upon completion of the course, the learners will be able to:** 1. Review literature, Design solutions, components or processes for complex engineering problems on the basis of research knowledge. 2. Implement projects using modern tools which are useful to society. 3. Apply contextual knowledge to assess the public health/safety/societal/ environmental issues for sustainable development. 4. Document the work in project report and log book by referring reputed material. 5. Apply ethical principles and commit to professional ethics, responsibilities norms of the engineering practice and engage in independent and life-long learning. 6. Present their work in clear and effective manner with professional values like team work, time management and make financial arrangements .

Project Guidelines:

1	To proceed with the project work it is very important to select a right topic. Project can be undertaken on any subject addressing IT programme. Research and development projects on problems of practical and theoretical interest should be encouraged.
2	Project work must be carried out by the group of at least two students and maximum three and must be original.
3	Students can certainly take ideas from anywhere, but be sure that they should evolve them in the unique way to suit their project requirements.
4	The project work can be undertaken in a research institute or organization/ company/any business establishment.
5	Student must consult internal guide along with external guide (if any) in selection of topic.
6	Head of department and senior staff in the department will take decision regarding selection of projects.
7	Student has to submit weekly progress report to the internal guide and where as internal guide has to keep track on the progress of the project and also has to maintain attendance report. This progress report can be used for awarding term work marks. (Log book should be prepared by every group for maintaining weekly group.)
8	In case of industry projects, visit by internal guide will be preferred.

Project Report Format:

At the end of semester a project report should preferably contain at least following details:-

- Abstract
- Introduction
- Literature Survey
  - a) Survey Existing system
  - b) Limitation of the Existing system or research gap
  - c) Problem Statement and Objective
  - d) Scope
- Proposed System
  - a) Analysis/Framework/ Algorithm
  - b) Details of Hardware & Software
  - c) Design details
  - d) Methodology (your approach to solve the problem)
- Implementation Plan for next semester
- Conclusion
- References

Distribution of Term work marks for both semesters shall be as below:		**Marks**
1	Marks awarded by guide based on log book	5
2	Marks awarded by review committee for presentation	10
3	Quality of Project report	5
4	Effort taken by students ● Paper publish/Filling patent/creation of product/startup ● Idea/project/poster/TPP competition (National/international)	5
Review / progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines		

One-year project:	
1	In first semester entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on presentation given by students group. • First shall be for finalization of problem • Second shall be on finalization of proposed solution of problem.
2	In second semester expected work shall be procurement of component's/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester. • First review is based on readiness of building working prototype to be conducted. • Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester.
Assessment criteria of Major Project	
Major Project shall be assessed based on following criteria;	
1	Clarity of problem and quality of literature Survey for problem identification
2	Requirement gathering via SRS/ Feasibility Study

3	Completeness of methodology implemented
4	Design, Analysis and Further Plan
5	Novelty, Originality or Innovativeness of project
6	Societal / Research impact
7	Effective use of skill set: Standard engineering practices and Project management Standard
8	Contribution of an individual's as member or leader
9	Clarity in written and oral communication
10	Verification and validation of the solution/ Test Cases
11	Full functioning of working model as per stated requirements
12	Technical writing /competition/hackathon outcome being met
In one year project (sem VII and VIII), first semester evaluation may be based on first 10 criteria and remaining may be used for second semester evaluation of performance of students in mini projects.	
Guidelines for Assessment of Major Project Practical/Oral Examination:	
1	Report should be prepared as per the standard format.
2	Major Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organizations having experience of more than five years approved by the head of Institution.
3	Project groups have to prepare a Conference paper/participate in project competition/ Technical paper presentation/ national international competitions etc.

Review / progress monitoring committee may consider points for assessment based on one year project as mentioned in general guidelines.

Internship Code	Internship Name	Hours/Duration	Credits
INT76	**Internship-VI**	**80-160 hrs (2-4 Weeks)**	---

Prerequisite:	In depth knowledge about societal/research/innovation/entrepreneurial problems and appropriate applicable solutions available through use of technology**.**
Internship Objectives:	1. To gain the experience in preparing and writing Technical documentation/ reports for product/projects. 2. To Identify and analyse the societal/research/entrepreneurial problem in detail to define its scope with problem specific data. 3. To develop clarity of presentation based on communication, teamwork and leadership skills.
Internship Outcomes:	**Upon completion of the course, students will be able to:** 1. Apply the engineering and technical knowledge for problem identification, analysis, design and developing solutions. 2. Present and demonstrate the real time problem solution across national/international project competitions and conference.

Activity- PBL-Major Project A-Work/ Seminars	**Supporting Activities to be completed under Internship**
	For Sem VII PBL Course-Major Project-A, selected topic: 1. Review literature through reference papers from reputed conferences/ journals like IEEE, Elsevier, ACM etc. which are not more than 3 years old.
	2. Participate in multiple Project Competitions presenting the Project A solution
	3. Participation in International Conferences presenting the literature review and/or hypothesis for innovative solution.
	4. Participation at institute annual International Conference on Advances in Science and Technology-ICAST & other Conferences /Journals.

Term Work Assessment:
Duration to be considered for assessment:
Week Ends/ Semester Break/End of Semester (After ESE & Before Next Term Start)

Guidelines:	1. Batch wise Faculty Supervisor who is the proctor (mentor) of the batch will be allotted as in-charge for the course, at start of the Academic year. 2. Students will submit the participation certificate of the activities to the faculty mentors. 3. Department IIIC Cell coordinator will collect, maintain each student proofs/reports from all faculty mentors, department internship analysis report will be prepared & submitted to Dean, IIIC for AICTE-CII survey data 4. Students will submit evaluation sheet by attaching Xerox copies of all participation/ IPR/ Copyright certificates & faculty mentor will verify it with original copies, for assessment purpose.