M. Tech Computer Engineering

(Theory Courses)

Syllabus

Department of Computer Engineering

Jamia Millia Islamia

M. TECH. COMPUTER ENGINEERING COURSE STRUCTURE
UNDER THE CHOICE BASED CREDIT SYSTEM (CBCS)

Codes for nature of courses

L : Lecture courses
P : Laboratory Based courses
S: Seminar/ Independent Study

Category of Courses

CORE : Departmental courses

Weight age for Course Evaluation

L : Lecture T : Tutorial P : Practical CCA : Continuous Class Assessment MTE :Mid Term Exam

M. TECH. COMPUTER ENGINEERING-1st YEAR (Effective from July 2020)

	Third Semester												
S.No.	Course No.	Course Name	Type of Course	Credit	Periods/ week			Examination Scheme (Distribution of Marks)				
								Mid Semester Evaluation			End Semester Evaluation	Total Marks
					L	T	P	CCA	MTE -1	MTE -2		
THEORY			**First Semester**									
01	MCEN-101	Cryptography & Network Security	**Core**	4	3	1	-	10	15	15	60	100
02	MCEN-102	Data Analytics	**CBCS**	4	3	l	-	10	15	15	60	100
03	MCEN-103	Advance Computer Networks	**Core**	4	3	l	-	10	15	15	60	100
04	MCEN-104	Algorithm Design	**Core**	4	3	1	-	10	10	10	45	100
05	MCEN-105	Advanced DBMS	**Core**	4	3	1	-	10	10	10	45	100
PRACTICAL (LAB.)												
06	MCEN-191	Advanced DBMS Lab	**Core**	1	-	-	2	5	5	5	10	25
07	MCEN-192	Algorithm Design Lab	**Core**	1	-	-	2	5	5	5	10	25
08	MCEN-193	Data Analytics Lab	**Core**	2	-	-	4	10	10	10	20	50
Total				**24**								**600**
THEORY			**Second Semester**									
01	MCEN-201	Machine Learning (CBCS)	**CBCS**	4	3	1	-	10	15	15	60	100
02	MCEN-202	Parallel Computing	**Core**	4	3	1	-	10	15	15	60	100
03	MCEN-20X	Elective -I	**Core**	4	3	1	-	10	15	15	60	100
04	MCEN-20X	Elective -II	**Core**	4	3	1	-	10	15	15	60	100
05	MCEN-20X	Elective -III	**Core**	4	3	1	-	10	15	15	60	100
PRACTICAL (LAB.)												
06	MCEN-291	Advance Computing Lab	**Core**	2	-	-	4	10	10	10	20	50
07	MCEN-292	WSN & IoT Lab	**Core**	2	-	-	4	10	10	10	20	50
08	MCEN-294	Machine Learning Lab	**Core**	2	-	-	4	10	10	10	20	50
Total				**26**							**Total**	**650**

M. TECH. COMPUTER ENGINEERING COURSE STRUCTURE UNDER THE CHOICE BASED CREDIT SYSTEM (CBCS)

M. TECH. COMPUTER ENGINEERING –2nd YEAR (Effective from July 2021)

	Third Semester											
S.No.	Course No.	Course Name	Type of Course	Credit	Periods/ week			Examination Scheme (Distribution of Marks)				
								Mid Semester Evaluation			End Semester Evaluation	Total Marks
					L	T	P	CCA	MT E-1	MT E-2		
THEORY			**Fifth Semester**									
01	MCEN-30X	Elective	**Core**	4	3	1	-	10	15	15	60	100
02	MCEN-303	Deep Learning	**CBCS**	4	3	1	-	10	15	15	60	100
PRACTICAL (LAB.)												
04	MCEN-392	Seminar	**Core**	2	-	-	2	-	15	15	20	50
05	MCEN-393	Minor Project	**Core**	4	-	-	8	20	20	20	40	100
06	MCEN-394	Deep Learning Lab	**Core**	2	-	-	4	10	10	10	20	50
Total				**16**								**400**
THEORY			**Fourth Semester**									
01	CEN-491	Dissertation	**Core**	12	-	-	**20**	180			120	300
Total				**12**							**Total**	**300**

List of Electives in 2nd Semester

MCEN – 203: Soft Computing Techniques
MCEN – 204: Wireless Technologies for WSN & IoT
MCEN – 205: Intelligent Systems
MCEN – 206: Multimedia Systems

List of Electives in 3rd Semester

MCEN – 302: Digital Image Processing
MCEN – 304: Pattern Recognition
MCEN – 305: Natural Language Processing

Cryptography & Network Security

Paper Code	**MCEN-101**
Course Credits	**4**
Lectures / week	**3**
Tutorial / week	**1**
Course Description	**UNIT – I** Modular Arithmetic, Linear congruence, Primality testing, Factorization, Chinese Remainder Theorem, Quadratic congruence, Fermat's Theorem, Euler's Theorem, Galois Field, Euclidean and Extended Algorithm, Diophantine equation. Exponentiation and logarithm, Need for network security, Security approaches, Principles of security, Types of Attacks, Services and Mechanisms. **UNIT- II** Block Encryption, Symmetrical key cryptography: DES rounds, S-Boxes, IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography, Advance Encryption Standard AES. Public key cryptography: Knapsack, RSA: keys generating, encryption and decryption. El-Gamal, Elliptical curve cryptography, use of public key cryptography Digital signature, DSS, Zero-knowledge signatures. **UNIT- III** Message Digest algorithms: Length of HASH, uses, Message Digest 4 and 5: algorithm (padding, stages, and digest computation.) SHA1 and SHA512: Overview, padding, stages. Message Authentication Codes (MACs). **UNIT- IV** Authentication Methods, Passwords, Single sign on, Entity Authentication, Authentication Protocol, Kerberos: purpose, authentication, serer and ticket granting server, keys and tickets, use of AS and TGS, replicated servers. Kerberos V4: names, inter-realm authentication, Key version numbers, KDC's Certification Revocation, Inter domain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution. **UNIT – V** Electronic mail security, IP security, Network management security. Security for electronic commerce: Secure Socket Layer. Secure Electronic Transaction, Pretty Good Privacy, Intruders and Viruses, Firewalls, Intrusion Detection system.

References / Text Books:

- Stallings, W., Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall Print.,2003
- Bruce Schneier, Applied cryptography, 2nd Edition Wiley
- Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice Hall Print, 2002.
- Behrouz A Forouzan, Cryptography and Network Security, 2nd Edition 2010, McGraw Hill.

Computer Usage / Software Requires:

Python/ Java/ C++

Advanced Computer Networks

Paper Code	**MCEN-103**
Course Credits	**4**
Lectures / week	**3**
Tutorial / week	**1**
Course Description	**UNIT – I** Network Services & Layered Architecture: Traffic characterization and quality of service, Network services, High performance networks, Network elements, Basic network mechanisms, layered architecture. **UNIT- II** ISDN & B-ISDN: Over view of ISDN, ISDN channels, User access, ISDN protocols, Brief history of B-ISDN and ATM, ATM based services and applications, principles and building block of B-ISDN, general architecture of B-ISDN, frame relay. **UNIT- III** ATM Networks: Network layering, Switching of virtual channels and virtual paths, applications of virtual channels and connections. QOS parameters, traffic descriptors, ATM service categories, ATM cell header, ATM layer, ATM adaptation layer. **UNIT- IV** Interconnection Networks: Introduction, Banyan Networks, Routing algorithm & blocking phenomenon, Batcher-Banyan networks, Crossbar switch, three stage class networks. Rearrangeable Networks: Re-arrangeable class networks, Folding algorithm, Bens network, looping algorithm. **UNIT – V** ATM Signaling, Routing and Traffic Control: ATM addressing, UNI signaling, PNNI signaling, PNNI routing, ABR Traffic management. TCP/IP Networks: History of TCP/IP, TCP application and Services, Motivation, TCP, UDP, IP services and Header formats, Internetworking, TCP congestion control. Queue Management: Passive & active, QOS in IP networks- Differentiated and integrated services.
References / Text Books:	• ISDN & B-ISDN with Frame Relay, William Stallings, PHI. • ATM Fundamentals, N. N. Biswas, Adventure books publishers, 1998. • High Performance TCP/IP Networking, Mahbub Hassan, Raj Jain, PHI, 2005.

- High Speed Networks and Internets, William Stallings, Pearson edu., 2002.

Computer Usage / Software Requires:

Algorithm Design

Paper Code	**MCEN-104**
Course Credits	**4**
Lectures / week	**3**
Tutorial / week	**1**

Course Description

UNIT – I

Review of Algorithm Analysis: Asymptotic notations, Rate of growth of functions, Recurrence analysis, Master's theorem and its proof, Time and space trade-off, Algorithms complexity analyses, Searching and Sorting algorithms, Lower bounds of searching and sorting.

UNIT- II

Design Techniques: Divide and Conquer technique, Greedy algorithms, Dynamic Programming, Backtracking, Branch and Bound.

UNIT- III

Advanced Data Structures: B-Trees, Red-black trees, Disjoint Sets, Union by Rank. Graph Algorithm: BFS, DFS, strongly connected components, All-Pairs Shortest Paths, Maximum Flow.

UNIT- IV

Advanced Design: Randomized algorithms, Amortized analysis, Approximate algorithms, Online algorithms.

UNIT – V

Pattern Matching and Computational Complexity: Naïve string matching, Rabin-karp matcher, FSA based matching, KMP string matcher; Complexity classes – P, NP, NP-Hard and NP-complete, Unsolvable problems, NP-Completeness and Reducibility, Examples and proofs of NP-complete problem, Cook's theorem.

References / Text Books:

- T. H. Cormen, C. E. Leiserson, R. L. Rivest, Introduction to Algorithms, Prentice Hall India, 1990.
- J Kleinberg, E Tardos, Algorithm Design, Pearson, 2014.
- R. Neapolitan, K Naimipour, Fundamentals of Algorithms, 4ed, Jones & Bartlett, 2011.
- V. Aho, J. E. Hopcraft, J. D. Ullman, The Design and Analysis of Computer Algorithms, Pearson, 1974.
- E Horwitz, S Sahni, Fundamentals of Computer Algorithms, University Press, 2008.

- R Motwani, P Raghavan, Randomized Algorithms, Cambridge University Press,
  1995.

NPTEL Lectures for Algorithms

Computer Usage / Software Requires:

Advanced Database Management System

Paper Code	**MCEN-105**
Course Credits	**4**
Lectures / week	**3**
Tutorial / week	**1**
Course Description	**UNIT – I** Relational Databases: Integrity Constraints revisited, Extended ER diagram, Relational Algebra & Calculus, Functional, Muiltivalued and Join Dependency, Normal Forms, Rules about functional dependencies. Query Processing and Optimization: Valuation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Null Values and Partial Information. **UNIT- II** Deductive Databases: Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation. Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases Parallel and Distributed Databases: Distributed Data Storage – Fragmentation & Replication, Location and Fragment Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation. **UNIT- III** Advanced Transaction Processing: Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors. **UNIT- IV** Active Database and Real Time Databases: Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and Concurrency Control, Compensation and Databases Recovery Image and Multimedia Databases: Modeling and Storage of Image and Multimedia Data, Data Structures – R-tree, k-d tree, Quad trees, Content Based Retrieval: Color Histograms, Textures, etc., Image Features, Spatial and Topological Relationships, Multimedia Data Formats, Video Data Model, Audio & Handwritten Data, Geographic Information Systems (GIS)

UNIT – V

WEB Database: Accessing Databases through WEB, WEB Servers, XML Databases, Commercial Systems. Data Warehousing: Data Warehousing Architecture, Multidimensional Data Model, Update Propagation OLAP Queries. Data Mining: Knowledge Representation Using Rules, Association and Classification Rules, Sequential Patterns, Algorithms for Rule Discovery Case Study: Oracle Xi

References / Text Books:

1. Elmarsi, Navathe, Somayajulu, Gupta, "Fundamentals of Database Systems", 4th Edition, Pearson Education, 2007
2. Garcia, Ullman, Widom, "Database Systems, The complete book", Pearson Education, 2007
3. R. Ramakrishnan, "Database Management Systems", McGraw Hill International Editions, 1998
4. Date, Kannan, Swaminathan, "An Introduction to Database Systems", 8th Edition Pearson Education, 2007
5. Singh S.K., "Database System Concepts, design and application", Pearson Education, 2006.
6. Silberscatz, Korth, Sudarshan, "Database System Concepts", Mcgraw Hill, 6th Edition, 2006
7. D. Maier, "The Theory of Relational Databases", 1993, Computer Science Press, Rokville, Maryland
8. Ullman, J. D., "Principals of database systems", Galgotia publications, 1999
9. Oracle Xi Reference Manual

Computer Usage / Software Requires:

MYSQL, Oracle

Python, Java

Machine Learning

Paper Code	**MCEN 201**
Course Credits	**4**
Lectures / week	**4**
Tutorial / week	**0**
Course Description	**UNIT – I Introduction:** Statistical learning: function estimation, the machine learning framework (model training, loss functions, optimization, regularization and validation). Parameter Estimation: Maximum Likelihood Estimation (MLE), Maximum a Posteriori (MAP) Estimation. Correlation and Regression, Bayes Optimal Classifier, Naïve Bayes Classifier **UNIT- II Supervised Learning:** Optimization methods: Gradient Descent. Regression: Polynomial Regression, Multivariate Regression, Extensions to Linear Models. Classification: Logistic Regression, Multiclass classification, One vs Rest, Linear Discriminant Analysis, Quadratic Discriminant Analysis. Resampling Methods: Cross Validation, Bootstrap, Linear Model Selection and Regularization. **UNIT- III Additive and Reduction Methods:** Generalized additive models, Adaptive Boosting, Gradient Boosting, Random Forest, Principal Component Analysis, Singular Value Decomposition, t-SNE. **UNIT- IV Graphical Models:** Bayesian Networks: d-separation. Sequential Modelling: Hidden Markov Models (Forward Algorithm, Viterbi Algorithm, Forward-Backward Algorithm). Conditional Random Fields, Recurrent Neural Networks. **UNIT – V Applications of Machine Learning:** Text Classification, Image Classification, Language Modelling, Distributional Semantics, Speech Recognition, Information Extraction, Question Answering, Machine Translation, Advance topics in Machine Learning.
Text Books	**An Introduction to Statistical Learning** by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, Springer 2013. **Pattern Recognition and Machine Learning** by Christopher Bishop Springer 2006.
References Books	Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning (ESL), Springer, 2009Shai Shalev-Shwartz and Shai Ben-David. Understanding Machine Learning: From Theory to Algorithms (UML), Cambridge University Press, 2014.
Computer Usage / Software Requires:	Python, sklearn, Tensorflow, Keras, Google Colab

SOFT COMPUTING TECHNIQUE

Paper Code	**MCEN-203**
Course Credits	**4**
Lectures / week	**3**
Tutorial / week	**1**
Course Description	**UNIT – I**

INTRODUCTION

Introduction to Soft Computing, Hard vs. Cost Computing paradigm, Constituents and Features of Soft Computing Approaches, Artificial Neural Networks, Fuzzy Logic, Genetic algorithm, Intelligent systems, Machine Intelligence, Applications of Soft computing.

UNIT- II

ANN BASICS

Function of Neuron, Biological Neuron, Artificial Neuron, Basic Model of ANN: connections, weights, bias, Activation functions, ANN architectures and characteristics, McCulloch-Pitts Neuron, Hebb Learning algorithm, Linear seperability, XOR problem, ANN Learning Types, Learning Rules.

UNIT- III

NEURAL NETWORK ARCHITECTURES

Perceptron, Multi-layer perceptron, ADALINE, MADALINE, Back-propogation training algorithm, Improving Network convergence, Network weight initialization techniques. Performance Metrics.

Auto and Hetero Associative Memory Networks, Bi-directional AM networks, Feedback Networks: Hopfield Networks.

Unsupervised learning: Kohonen Self-organizing feature map, Applications of ANN.

UNIT- IV

FUZZY LOGIC

Introduction to Fuzzy logic, Fuzzy set theory, Fuzzy set vs. Crisp set, Fuzzy relation & Crisp relation, Fuzzy logic operations, Tolerance & Equivalence relations, Membership functions, Features of membership functions, Membership value assignment, Basic Fuzzy arithmetic. Various T-norms and T-conorms.

Fuzzification methods, Defuzzification methods, Fuzzy rules, Fuzzy If-Then rule, Fuzzy rule base system, Fuzzy inference system: Models of FIS. Applications of Fuzzy logic.

UNIT – V

GENETIC ALGORITHM

Introduction to Genetic algorithm: working principle, encoding, fitness function, reproduction, Inheritance, cross-over, Modern variants of GA, Applications of Genetic algorithm.

References / Text Books:

- S. Haykin, "Neural Networks: A Comprehensive Foundations" Pearson.
- Sivanandam & Deepa, "Principles of Soft Computing Techniques", Wiley Publication.
- Karray and Silva, "Soft Computing & Intelligent Systems Design", Pearson Education.
- Rajasekaran & Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications", PHI.
- Timothy J Ross, "Fuzzy Logic with Engineering Applications", Wiley.
- David E Goldberg, "Genetic Algorithm in Search, Optimization & Machine Learning", Pearson

Computer Usage / Software Requires:

MATLAB

Wireless Technologies for WSN & IoT

Paper Code	**MCEN-204**
Course Credits	**4**
Lectures / week	**3**
Tutorial / week	**1**
Course Description	**UNIT – I** Cellular Standards: Cellular carriers and Frequencies, Channel allocation, Cell coverage, Cell Splitting, Microcells, Picocells, Handoff, 1st, 2nd, 3rd and 4th Generation Cellular Systems (GSM, CDMA, GPRS, EDGE,UMTS), Mobile IP, WCDMA . **UNIT- II** WLAN: Wi-Fi Organizations and Standards: IEEE, Wi-Fi Alliance, WLAN Connectivity, WLAN QoS & Power-Save, IEEE 802.11 Standards,802.11-2007,802.11a/b/g, 802.11e/h/I,802.11n **UNIT- III** Introduction: Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts. **UNIT- IV** Deployment, Configuration, Routing: Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self configuring localization systems, sensor management Network Protocols: Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network. Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing. **UNIT – V** Data Storage, Manipulation & Applications of WSN : Data centric and content based routing, storage and retrieval in network, compression

technologies for WSN, Data aggregation technique. Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring. WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

References / Text Books:

1. Wireless Communications – Principles and Practice; by Theodore S Rappaport, Pearson Education
2. Wireless Communications and Networking; By: Stallings, William; Pearson Education Pte. Ltd.
3. Bluetooth Revealed; By: Miller, Brent A, Bisdikian, Chatschik; Addison Wesley Longman Pte Ltd.
4. Wilson , "Sensor Technology hand book," Elsevier publications 2005.
5. Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005
6. Mobile and Personal Communications Services and Systems; 1st Edition; By: Raj Pandya; PHI
7. Fundamentals of Wireless Communication by Tse David and Viswanath Pramod, Cambridge University press
8. Mobile Communications; By: Schiller, Jochen H; Addison Wesley Longman Pte Ltd.
9. 3G Networks: Architecture, protocols and procedures based on 3GPP specifications for UMTS WCDMA networks, By Kasera, Sumit, Narang, and Nishit, TATA MGH
10. Wireless Sensor Networks: information processing by approach, ZHAO, FENG, GUIBAS and LEONIDAS J, ELSEVIER
11. Holger Karl and Andreas Wiilig, "Protocols and Architectures for Wireless Sensor Networks" John Wiley & Sons Limited 2008.

Computer Usage / Software Requires:

Python, NS3

Intelligent Systems

Paper Code	**MCEN-205**
Course Credits	**4**
Lectures / week	**3**
Tutorial / week	**1**
Course Description	**UNIT – I** Computational Intelligence, Agents and Environments, Rationality, Performance Measures, Omniscience, Learning and Autonomy, Nature of Environments, Task Environments, Structure of Agents, Agent Programs, Simple Reflex Agent, Model based Reflex Agents, Goal based Agents, and Utility based Agents, Learning Agents. **UNIT- II** Proposition Logic, Equivalence, validity and Satisfiability, Resolution, Forward and Backward Chaining, First Order Logic, Unification, Inference, Inference rules for quantifiers, Reduction to propositional Inference, Resolution Refutation, Conjunctive Normal Form of FOL, Completeness of Resolution, Knowledge Engineering in FOL. **UNIT- III** Introduction to Logical Programming, Facts, Rules & Queries in Prolog, Matching & Proof Search, Recursion in Prolog, Lists, Arithmetic & Operators, Definite Clause Grammar, Cuts and Negation, Database Manipulation and collecting Solutions, Working with Files. **UNIT- IV** Planning Problem, languages of Planning, Planning with State Space Search, Forward State Space Search, and Backward State space Search, Heuristic State Space Search, Partial Order Planning, Partial Order Planning with un-bound variables, Heuristics for POP, Planning Graphs, Planning Graphs for Heuristic estimation, GRAPHPLAN, Termination of GRAPHPLAN. **UNIT – V** Acting under Uncertainty, Basic Probability notation, Conditional Probability, Axioms of Probability, Inference using Full Joint Distribution, Independence, Bayes' Rule and its uses, Combining evidence, Probabilistic Reasoning.
References / Text Books:	• Artificial Intelligence, A Modern Approach. By Stuart Russell and Peter Norwig • Learn Prolog Now! By Patrick Blackburn, Johan Bos & Kristina Striegnitz

Computer Usage /
Software Requires:

Digital Image Processing

Paper Code	**MCEN-302**
Course Credits	**4**
Lectures / week	**3**
Tutorial / week	**1**
Course Description	**UNIT – I**

Introduction And Digital Image Fundamentals

The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

UNIT- II

Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering.

UNIT- III

Image Restoration:

A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Pereodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invarient Dedradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

UNIT- IV

Image Compression

Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

UNIT – V

Representation and Description

Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms.

Object Recognition: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods

References / Text Books:

TEXT BOOKS:

1. Rafael C. Conzalez & Richard E. Woods, "Digital Image Processing".
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI. 2003

REFERENCES:

1. Rosefield Kak, "Digital Picture Processing", 1999
2. W.K. Pratt, "Digital Image Processing", 2000

Computer Usage / Software Requires:

Deep Learning

Paper Code	**MCEN-303**
Course Credits	**4**
Lectures / week	**3**
Tutorial / week	**1**
Course Description	**UNIT – I** **INTRODUCTION TO DEEP LEARNING** Learning and its types, Supervised, Unsupervised, Reinforced Learning, Simple Neuron, Linear separability, XOR Problem, Artificial Neural Networks, Architectures of ANNs, Review of Error Back propagation algorithm, Need of Deep Neural Networks **UNIT- II** **LINEAR ALGEBRA & ML BASICS** Vector, scalar, Matrix & Tensor, Rank & Inverse of a Matrix, Eigen decomposition of a Matrix, Orthogonality of Matrices, Gram-Schmidt Orthogonalization process, Singular Value decomposition, Principal Component Analysis, Moore-Penrose pseudo inverse. Underfitting, Overfitting, Regularization L1 & L2, Early Stopping, Dropouts. **UNIT- III** **CONVOLUTIONAL NEURAL NETWORKS** Introduction to Convolutional neural networks, Convolutions & Strides, Pooling, Zero Padding, Convolution Arithmetic, CNN architectures: LeNet-5, AlexNet, ZFNet, C3D, GoogLeNet, ResNet, MobileNet, Optimizers for CNN, Network weight initialization techniques. **UNIT- IV** **SEQUENCE MODELING** Introduction to Recurrent Neural Networks (RNNs), Encoder-Decoder Sequence to Sequence Architecture, Deep RNNs, Long Short Term Memory (LSTM) networks, Bi-directional LSTM (Bi-LSTM). **UNIT – V** **DEEP LEARNING RESEARCH & APPLICATIONS:** Autoencoders and their types, Deep Generative Models, Attention mechanism based networks, Applications of Deep networks in Computer Vision, Speech Processing and NLP

- Ian Goodfellow, Youshua Bengio and Aaron Courville, "Deep Learning", MIT Press.

References / Text Books:

- Simon Haykin, “A comprehensive foundation to Neural Networks” PHI.

Python/Java

Computer Usage / Software Requires: