Courses of Study

(Detailed Course Contents)

Master of Technology

Computer Science & Engineering

(2020-2022 Batch)

Shri Mata Vaishno Devi University

Kakryal, Katra 182320 Jammu & Kashmir

Course Structure of
M. Tech (Computer Science & Engineering) programme, Batch 2020-2022

Semester I — **First Year**

Course Code	Course Title	L-T-P	Credit
CSL 6025	Advanced Programming	3-0-0	3
CSP 6025	Advanced Programming Lab	0-0-2	1
CSL 6103	Artificial Intelligence & fuzzy Logic	3-1-0	4
CSL 7133	Research Methodology	4-0-0	4
CSL 6113	Digital Image Processing	3-0-0	3
CSP 6113	Digital Image Processing Lab	0-0-2	1
CSL 6105	Advance Computer Network	3-0-0	3
CSP 6105	Advance Computer Network Lab	0-0-2	1
	Total Credits	**16-1-6**	20

Semester II — **First Year**

Course Code	Course Title	L-T-P	Credit
CSL 6088	Data Mining and Web Algorithms	3-0-0	3
CSL 6034	Soft Computing	3-0-0	3
CSP 6034	Soft Computing Lab	0-0-2	1
CSL 6109	Internet of Things	3-0-0	3
CSP 6109	Internet of Things Lab	0-0-2	1
CSL 6152	Cloud Computing	3-0-0	3
CSP 6152	Cloud Computing Lab	0-0-2	1
	Elective-1	3-0-0	3
CSC 6171	Colloquium	0-0-2	1
	Open Elective-1	3-0-0	3
	Total Credits	**18-0-8**	22

Semester III — **Second Year**

Course Code	Course Title	L-T-P	Credit
CSL 7141	Mobile & Pervasive Computing	3-0-0	3
CSL 6042	Optimization Techniques	4-0-0	4
CSL 6036	Deep Learning	3-0-0	3
CSP 6036	Deep Learning Lab	0-0-2	1
CSL 7223	High Performance Computing	3-0-0	3
	Elective-II	3-0-0	3
CSD 7004	Dissertation (preliminary)	0-0-10	5
	Total Credits	**16-0-12**	22

Semester IV — **Second Year**

Course Code	Course Title	L-T-P	Credit
CSD 7005	Dissertation	0-0-40	20
	Total Credits	**0-0-40**	20

Total credits in M.Tech (CSE) =**84**

Minimum Total Credits to be earned in order to become eligible for award of M.Tech. (Two Year Full Time) Degree: 80

List of Electives

Course Code	Course Title	L-T-P	Credit
	Elective – I		
CSE 6125	Cyber Security	3-0-0	3
CSE 6102	Advance Algorithms	3-0-0	3
CSL 6110	Big Data Science & Analytics	3-0-0	3
CSE 6016	E-Commerce & Cyber Law	3-0-0	3
CSE 6017	Block Chain Coding	3-0-0	3
	Elective – II		
CSE 7016	Software Defined Networks	2-0-2	3
CSL 7015 / CSE 7015	Information & Coding Theory	3-0-0	3
CSE 7045	Robotics	3-0-0	3
CSE 7057	Embedded Systems	3-0-0	3
CSE 7114	Multimedia & Virtual Reality	3-0-0	3

Advanced Programming

CSL 6025 **3– 0– 0 = 3**

Course Outcomes

CO1	Understand the syntax, control structures, data structures of java programming language. Ability to demonstrate simple Java programmes
CO2	Ability to code any given algorithm, or provide a solution to real-life-problem using JAVA language
CO3	Ability to build Desktop Applications with GUI(Graphical User Interface) and Database connectivity to create real-life/business solutions
CO4	Inculcating the ability to enjoy coding and build simple games like Tic-Tac-Toe etc.
CO5	Ability to use Industry standard IDEs (Integrated Development Environments) like NetBeans/Eclipse for coding, debugging etc
CO6	Ability to code and manage at least a few thousand lines of code which enforces the use of Industry best practices like documentation etc.

Course Contents:

The purpose of the course is to introduce the concepts of JAVA for real world problem solving. The course discusses the basics as well as advanced concepts in JAVA and involves assignments & projects to solve real life problems using JAVA language

UNIT 1 Basic Concepts

OOP concepts, Data types, Operators, Control statements, Input using Scanner/BufferedReader, Output, String manipulations using String class, Big Numbers, Arrays, 2D, 3D arrays, Classes, Encapsulation, Getters and Setters, Comments, Access modifiers, Constructors, Functions, Overloading constructors and functions.

UNIT 2 Inheritances, Generic Classes, Interfaces, Exception Handling, Multithreading, Dynamic binding, Final classes and methods, Abstract classes, Inner classes, Protected access, Object class, Generic classes and methods, Interfaces, Object cloning, Comparing Objects using Comparable, Exception Handling, Checked & Unchecked Exceptions, Multithreading, Threads synchronization, Classical synchronization problems like Producer-Consumer/Dining Philosophers

UNIT3 COLLECTIONS

Collection interface, Set interface, List interface, Queue interface, SortedSet interface, HashSet class, LinkedHashSet class, TreeSet class, ArrayList class, Vector class, LinkedList class, PriorityQueue class, Arrays class, Collections class, map interface, HashTable class, LinkedHashMap class, HashMap class, Sortedmap interface, TreeMap class, Iterator, ListIterator, Stack

UNIT 4 Database Connectivity & GUI Development using AWT/SWING

Accessing Database with JDBC, Understanding the fundamentals of AWT framework and its limitations, creating Frames using Swing, Layout managers, Buttons, Menus. Event Handling, Adapter classes, Introduction to JAVAFX for creating rich GUI applications, Introduction to Networking, Connecting to sever, Sending email, Introduction to EJB, Introduction to Applets

Reference Books:

- Core Java-Volume I & II by Cay S.Horstmann, Gary Cornell, Pearson Education
- Java-How to Program, Deitel and Deitel: PHI Publication
- Thinking in JAVA, Bruce Eckel, Pearson
- Head First Java, Bert Bates & Kathy Sierra, O'Reilly publications
- The Complete Reference Java , Herbert Schildt: TMH

Advanced Programming Lab

CSP 6025 **0– 0– 2 = 1**

List of Experiments:

1. Program to display Hello world
2. Program to understand command line arguments
3. Program to Input values using Scanner/BufferedReader class, do simple calculations and print values
4. Program to learn about data types & various arithmetic/bitwise/logical/unary operators
5. Program to understand loops and conditions
6. Program to generate patterns and series like Fibonacci/Prime/Even/Odd etc.
7. Program to understand Classes & Objects
8. Program to understand Inheritance and its concepts
9. Program to understand Constructor overloading & calling super class constructor
10. Program to understand method overloading and overriding
11. Program to understand the importance of Getters and Setters
12. Program to understand various access modifiers
13. Program to understand various types of comments in Java

14. Program to understand Interfaces, Abstract class, Inner Class
15. Program to understand Final Classes and Methods
16. Program to learn String, StringBuffer, StringBuilder classes
17. Program to BigInteger and BigDecimal classes
18. Program to understand Arrays & do matrix problems
19. Program to understand raw and generic ArrayList, Auto boxing and Unboxing
20. Program to understand concepts like Array of Objects & ArrayList of Objects
21. Program to sort/sorting algorithms
22. Program to understand methods available in Math class
23. Program to understand the Cosmic superclass "Object"
24. Program to understand the concept of Object Cloning
25. Program to compare objects using Comparable
26. Program to understand Collections(HashMap, HashTable, Set, TreeSet etc.) & Iterators
27. Program to understand try-catch-finally block in Exception Handling
28. Program to understand throw and throws keywords, checked and unchecked Exceptions
29. Program to create user defined exceptions
30. Program to understand Multithreading using Thread class and Runnable Interface
31. Program to understand Thread Synchronization
32. Program the classical Problems of Thread Synchronization like Dining Philosophers, Producer-Consumer
33. Program to learn about various (byte/character etc.) streams in Java
34. Program to learn about File I/O
35. Program to Create GUI frames using Swing/AWT and Event Handling
36. Program to understand various layout managers,
37. Program to understand the Adapter classes,
38. Program to connect to database and perform operations like Create Table, Update Table, Select query, Insert query
39. Program to strengthen logic building in students using simple/medium level problems from CodeChef etc.
40. Program to learn about basic concepts of JavaFx
41. Program to learn about basic Networking concepts like sockets, Client & Server
42. Program to learn about sending emails
43. Program to learn about basic EJB concepts
44. Program to learn about basic Applet concepts

Artificial Intelligence & fuzzy Logic

CSL 6103 **3– 1– 0 = 4**

Course Outcomes

CO1	Familiarize with propositional and predicate logic and their roles in logic programming
CO2	Understand logical programming and write programs in declarative programming style
CO3	Learn the knowledge representation and reasoning techniques in rule based systems, case-based systems, and model-based systems

Course Contents:

UNIT 1 Introduction

AI History and applications. Overview of AI application areas: game playing, automated reasoning and theorem proving, expert systems, natural language understanding, planning and robotics, machine learning and Alan Turing Test.

UNIT 2 The Propositional and Predicate Logic

Symbol and sentences, the semantics of the Propositional Calculus & Predicate Calculus. Inference Rules and Theorem Proving. Axioms, Literals, Horn clause & Clausal forms.

UNIT 3 Reasoning

Inductive, Deductive, Abductive and Default reasoning. More examples on Resolution proof.

UNIT 4 Problem Solving as Search

Structures and strategies for state space search. Algorithms for Heuristic search, Heuristic evaluation functions, Heuristic search and expert systems, using Heuristics in games, Time & Complexity issues etc**.**

UNIT 5 Knowledge Representation

Knowledge representation Techniques; a survey of network representation; conceptual graphs; structured representations; frames, scripts; issues in knowledge representation: hierarchies, inheritance, exceptions; efficiencies.

UNIT 6 Knowledge Elicitation and Knowledge Acquisition

An overview of the induction methods, types and tools. Stages in Knowledge acquisition with examples. Analyzing, coding, documenting and diagramming. Scope of knowledge.

UNIT 7 Expert Systems
Overview of expert system technology; rule-based expert systems; Construction of ES. Components of an ES. The explanation facility. Rule-based formation and forward and backward chaining techniques for problem solving.

UNIT 8 Reasoning with uncertain and incomplete information
The statistical approach to uncertainty, Bayesian reasoning, the Dempster-Shafer theory of evidence, Certainty Factor, Reasoning with Fuzzy sets.

Reference Books:

- Artificial Intelligence: Strategies and techniques for complex problems solving by George Luger, Addison-Wesley, 2003.
- Artificial Intelligence - A Modern Approach by Stuart Russell & Peter Norvig, Prentice Hall.
- Artificial Intelligence - A New Synthesis by Nils J. Nilsson, Morgan Kaufmann Publishers.

Research Methodology

CSL 7133 **4 – 0 – 0 = 4**

Course Outcomes

CO1	Develop skills in qualitative and quantitative data analysis and presentation
CO2	Identify and interpret the issues and concepts salient to the research process.
CO3	To identify various sources of information for literature review and data collection.
CO4	Analyze the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
CO5	Evaluate the concepts and procedures of sampling, data collection, analysis and reporting.

Course Contents:

UNIT-1.
Research Methodology: An Introduction Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Research Method versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, problem Encountered by Researchers in India. Defining the Research Problem: Definition of Research Problem, Selecting the Problem, Necessity of Defining the Problem Technique Involved in Defining a Problem.

UNIT - 2
Measurement and Scaling Technique: Measurement in Research, Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques. Processing and Analysis of Data: Processing Operations, Some Problems in Processing, Elements /Types of Analysis, Statistics in Research, Measures of Central Tendency, Measures of Dispersion Measures of Asymmetry (Skewness), Measures of Relationship, Partial Correlation, Association in case of Attributes, Other Measures.

UNIT - 3
Sampling Fundamentals: Need for Sampling, Some Fundamental Definitions, Central Limit Theorem, Sampling Theorem, Sandler's A-test, Concept of Standard Error, Estimation, Estimating the Population Mean, Estimating the Population Proportion, Sample size and its Determination, Determination of Sample Size through the Approach, Based on Precision Rate and Confidence Level, Determination of Sample Size through the Approach, Based on Bayesian Statistics. Analysis of Variance and Covariance: Analysis of variance(ANOVA), basic principles, technique, setting up analysis of variance table, short cut method for one- way ANOVA, coding method, two-way-ANOVA, ANOVA in Latin Square-Design, Analysis of Co-variance(ANOCOVA), technique, assumption in ANOCOVA.

UNIT - 4
Analysis and Report Writing: Graphical plots: Charts, Box plots, histograms, Scatter plots and normal probability plots, Time series methods: Lag plots, Corellograms, Variograms ,
Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing a Research Report.

Reference Books:

- Kothari C.R. (reprint 2011), Research Methodology – Methods and Techniques (New Age International, New Delhi)
- Montgomery, Douglas C. (2007), Design and Analysis of Experiments. (Willey India)
- Montgomery, Douglas C. & Runger, George C. , Applied Stastics & Probability for Engineers (Wiley India)
- S.P Gupta Statistical Methods S Chand and Co.

Digital Image Processing

CSL 6113 **3– 0– 0 = 3**

Course Outcomes

CO1	Understand image formation for the acquisition of images.
CO2	Get broad exposure of the various applications of image processing in industry, medicine, agriculture etc.
CO3	Get knowledge of existing algorithms for the processing of digital images.
CO4	Apply knowledge/skills to solve industrial problems based on image processing.
CO5	Think independently to evolve new methods and procedures with the analysis of image processing problems and techniques.

Course Contents:

Unit-1 Introduction and Digital Image Fundamentals

Application of Image Processing, Image Processing definition, steps in image Processing, Image Sensing and Acquisition, Image Sampling and Quantization, Spatial and Intensity resolution-Effect of reducing spatial resolution, DPI, Effect of reducing image gray levels. Basic relationships between pixels and adjacency

Unit-2 Intensity Transformation and Spatial Filtering

Basics of intensity transformation and spatial filtering, intensity transformation functions- image negative, log transformation, power law; Piecewise-linear transformation functions- contrast stretching, intensity level slicing, bit plane slicing; Histogram Processing-histogram stretching, histogram equalization, Spatial Filtering, Spatial Correlation and Convolution, Smoothing Spatial Filters, order statistic filters, Sharpening Spatial Filters- The Laplacian, The Gradient-Robert cross gradient operator, Sobel operators

Unit-3 Image Restoration

Model of the image degradation/restoration process, Noise Models, Periodic Noise, Estimation of noise parameters, Restoration in the presence of noise-spatial filtering- Mean filters, Order-statistics filters, Median filter, Max and Min filters, Mid-point filter, Alpha-trimmed mean filter, adaptive filters.

Unit-4 Color Image Processing

Introduction to the color image processing, color models: RGB, HSI, CMY/ CMYK; Conversion of color models: converting colors from RGB to HSI, HSI to RGB, RGB to CMY and CMY to RGB etc. Pseudo coloring of images.

Unit-5 Image Compression

Introduction to image compression, need of compression, methods of image compression: coding redundancy, spatial and temporal redundancy, irrelevant information, models of image compression, Huffman coding, Arithmetic coding, LZW coding, run-length coding, block transform coding, JPEG compression, predictive coding

Unit-6 Image Segmentation

Fundamental, Point, Line and Edge detection, edge linking and boundary detection, Hough transform, thresholding, region-based segmentation, region splitting and merging

Reference Books:

- Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 3rd edition, Pearson Education.
- David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", Prentice Hall
- A.K. Jain, "Fundamental of Digital Image Processing", PHI
- W.K. Pratt, "Digital Image Processing

Digital Image Processing Lab

CSP 6113 **0– 0– 2 = 1**

List of Experiments:

1. Input a colored image and convert it into Black & White Image using Matlab Function.
2. Input an image and compare the effects of reduced Quantization levels to produce False Contouring.
3. Input an image and compare the effects of increased Quantization levels to produce Saturation affect.
4. Input an image and down-sample the image to a desired size.
5. Input an image an up-sample it to study the effect on image clarity.
6. Input an image and resize it to a desired size.
7. Write a code in Matlab to display the negative of an image.
8. Write a code in Matlab to improve the contrast of an image and compare the original and enhanced image.
9. Write a code in Matlab to observe thresholding (or extreme mage contrast).
10. Perform Gray level slicing on an image using both with and without background slicing techniques and compare the outputs.
11. Write a code in Matlab to hide a text in an input image and retrieve the same.

12. Write a Matlab code to improve the dynamic range of an input image using Log transformation or power law transformation.
13. Add Gaussian noise to an image and perform low –pass Average filtering on the image to study the effect.
14. Add salt & pepper noise to an image and perform Low-pass median filtering on it to analyse the effect.
15. Write a Matlab code to zoom an image using both replication as well as interpolation and compare the results.
16. Input an image and perform histogram stretching on it to see the resulting image.
17. Input an image to perform histogram equalisation on it and plot the resulting image to analyse the effect.
18. Perform masking on an input image using Sobel , Roberts and Prewitts operators.

Advance Computer Network

CSL 610 5 **3– 0– 0 = 3**

Course Outcomes

CO1	Remember & understand the components requirement of networks
CO2	Applying Various Protocols in Different Networks
CO3	Analyzing various Networks and Protocols
CO4	Evaluating Different Networks and Protocols in Various scenarios
CO5	Creating various networks & protocols

Course Contents:

UNIT-I:
Review of Physical, Data link layer, TCP/IP: Datalink Protocols; ARP and RARP.

UNIT-II:
Network Layer: Routing algorithms and protocols, Congestion control algorithm, Router Operation, Router configuration, Internetworking, IP Protocol, IPv6 (an overview), Network layer in ATM Network.

UNIT-III:
Transport Layer: Transport Service, Transport Protocol (TCP, UDP, protocol etc.).

UNIT-IV:
Application layer: Security, DNS, SNMP, RMON, Electronic Mail, WWW etc.

UNIT-V:
Network Security: Firewalls (Application and packet filtering), Virtual Public Network.

UNIT-VI:
Evolution of Wireless Networks, Infrastructure based wireless networks, Infrastructure less wireless Networks, Personal Area Networks, Body Area Networks, Mobile Ad hoc Networks, Vehicular Ad hoc Networks, WiMAX, Wireless Mesh Networks, Sensor Networks, Underwater Sensor Networks.

UNIT-VII:
Flying Ad hoc Networks, UAVs, Cloud Computing, Social Networks, Optical Networks, Blockchain, Networks for Cyber Physical Systems, Internet of Things,Internet of Nano Things, Nano Communication Networks, Quantum Internet, Various Future Generation Systems and Networks

Reference Books:

- Tananbaum A.S., "Computer Networks", 3rd Ed, PHI, 1999.
- Laura Chappell (ed), "Introduction to Cisco Router Configuration", Techmedia, 1999.
- Subramaniam M., "Network Management: Principles and Practice", Pearson.
- References:
- Black U., "Computer Networks-Protocols, Standards and Interfaces", PHI, 1996.
- Stallings W., "Computer Communication Networks", PHI.
- Stallings W., "SNMP, SNMPv2, SNMPv3, RMON 1&2", 3rd Ed., Addison Wesley, 1999.
- Michael A. Miller, "Data & Network Communications", Vikas Publication.

Advance Computer Network Lab

CSP 610 5 **0– 0– 2 = 1**

List of Experiments:

1. Introduction to NetSim,
2. Understand IP forwarding within a LAN and across a router . Study the working of spanning tree algorithm by varying the priority among the switches
3. Understand the working of "Connection Establishment" in TCP using NetSim.

4. Study the throughputs of Slow start + Congestion avoidance (Old Tahoe) and Fast Retransmit (Tahoe) Congestion Control Algorithms
5. Study how the Data Rate of a Wireless LAN (IEEE 802.11b) network varies as the distance between the Access Point and the wireless nodes is varied
6. Study the working and routing table formation of Interior routing protocols, i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF)
7. Experiment on M/D/1 Queue
8. Plot the characteristic curve throughput versus offered traffic for a Slotted ALOHA system
9. Understand the impact of bit error rate on packet error and investigate the impact of error of a simple hub based CSMA / CD network
10. To determine the optimum persistence of a p-persistent CSMA / CD network for a heavily loaded bus capacity
11. Analyze the performance of a MANET, (running CSMA/CA (802.11b) in MAC) with increasing node density
12. Analyze the performance of a MANET, (running CSMA/CA (802.11b) in MAC) with increasing node mobility
13. Study the working of BGP and formation of BGP Routing table

Data Mining and Web Algorithms

CSL 6088 **3– 0– 0 = 3**

Course Outcomes

CO1	Understand the importance and construction of data ware house and Prepare the data needed for data mining using pre pre-processing techniques
CO2	Perform exploratory analysis of the data to be used for mining and implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on data sets.
CO3	Apply web algorithm to solve practical problems: page ranking, recommendation system.

Course Contents:

Unit-1 Introduction

Motivation of Mining, significance of Data Mining, Data Mining—On What Kind of Data? Data Mining Functionalities—Kinds of Patterns Can Be Mined, Interesting Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or Data Warehouse System, Major Issues in Data Mining.

Unit-2 Data Warehouse

Data Warehouse Concepts: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining.

Data Pre-processing: Data extraction, Data Cleaning, Data Integration and Transformation, Data Reduction, Loading into Staging area, Post Load Processing

Dimensional modeling and OLAP Technology: Defining Dimensional model, Granularity of Facts, Additivity of facts, Helper tables, Implementing Many–to-Many Relationship between fact and dimension tables, Implementing changing dimensions, Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction

Unit-3 Data Mining

Association Algorithms: Usability and Complexity Analysis of Apriori Algorithm, Sampling Algorithm, Partitioning, Using multiple minimum supports , Rough set approach

Classification Algorithms: Issues Regarding Classification and Prediction, Bayesian Classification, Usability and Complexity Analysis of Bayesian algorithm, Nearest Neighbour algorithm, Decision Tree based algorithm , Rule based Algorithm

Clustering Algorithms: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Usability and Complexity Analysis of Agglomerative Hierarchical Algorithm, k-means Partitioning Algorithm

Unit-4 Web Mining

Searching , crawling and indexing Algorithms: Link Based Search Algorithm, Web Crawling, Indexing, Searching, Zone Indexing, Term-Frequency, Link Analysis Algorithm.

Ranking Algorithms: Page rank, Hits ranking algorithms

Web caching Algorithm: LRV, FIFO, LRU, Random, OPT

Recommendation Algorithms: Collaborative Filtering, Item-to-Item recommendation, Memory Based Recommendation,

Reference Books:

- Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining
- Data Mining: Concepts and Techniques, Pei, Han and Kamber, Elsevier, 2011.

Soft Computing

CSL 6034 **3– 0– 0 = 3**

Course Outcomes

CO1	To understand the fundamental theory and concepts of neural networks, neuro-modelling, several neural network paradigms and its applications.
CO2	To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.
CO3	To understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.

Course Contents

Unit I: Artificial Neural Network

Introduction – Fundamental concept – Evolution of Neural Networks – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network. Supervised Learning Network: Perceptron Networks – Adaline – Multiple Adaptive Linear Neurons – Back-Propagation Network – Radial Basis Function Network.

Unit II

– Linear Separability – Hebb Network. Supervised Learning Network: Perceptron Networks – Adaline – Multiple Adaptive Linear Neurons – Back-Propagation Network – Radial Basis Function Network.

Unit III: Fuzzy Set Theory Introduction to Classical Sets and Fuzzy sets

Classical Relations and Fuzzy Relations – Tolerance and Equivalence Relations – Noninteractive Fuzzy sets – Membership Functions: Fuzzification – Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods.

Unit IV :Fuzzy Set Theory

Fuzzy Arithmetic and Fuzzy Measures: Fuzzy Rule Base and Approximate Reasoning: Truth values and Tables in Fuzzy logic – Fuzzy Propositions – Formation of Rules – Decomposition and Aggregation of rules – Fuzzy Reasoning – Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

Unit V: (Genetic Algorithm) Introduction – Basic Operators and Terminologies in GAs – Traditional Algorithm vs. Genetic Algorithm – Simple GA – General Genetic Algorithm – The Scheme Theorem – Classification of Genetic Algorithm – Holland Classifier Systems – Genetic Programming. Applications of Soft Computing: A Fusion Approach of Multispectral Images with SAR Image for Flood Area Analysis – Optimization of Travelling Salesman Problem using Genetic Algorithm Approach – Genetic Algorithm based Internet Search Technique – Soft Computing based Hybrid Fuzzy Controllers – Soft Computing based Rocket Engine – Control.

Reference Books:

- S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007. ISBN: 10: 81-265-1075-7.
- S. Rajasekaran and G.A.V.Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI, 2003.
- Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997. 3. J.S.R.Jang, C. T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 2004, Pearson Education.

Soft Computing Lab

CSP 6034 **0– 0– 2 = 1**

List of experiments

1. Design and simulate the behaviour of AND Gate using Perceptron Network in C for bipolar inputs and targets.
2. Design and simulate the behaviour of OR Gate using Adaline Network in C for bipolar inputs and targets.
3. Design and simulate the behaviour XOR Gate using Madaline network in C language for bipolar inputs and targets.
4. Design and simulate the behaviour of XOR gate using Back Propagation Network in c for Bipolar inputs and Binary targets.
5. Write a program in C to Implement the various primitive operations of classical sets.
6. Write a program in C to implement and verify various Laws associated with Classical sets.
7. Write a program in C to perform various primitive operations on Fuzzy Sets with Dynamic Components.
8. Write a program in C to verify various Laws associated with Fuzzy Sets.
9. Write a program in C to perform Cartesian product over two given Fuzzy Sets.
10. Write a program in C to perform Max-Min Composition of Two Matrices obtained from Cartesian Product.

11. Write a program in C to perform Max-Product Composition of Two Matrices obtained from Cartesian Product.
12. Write a program in C to maximize $F(X) = X^2$ using Genetic Algorithm where $0<X<31$

Internet of Things

CSE 6109 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understand the vision of IoT from a global context.
CO2	Understand and identify the areas for requirements of applications of IoT.
CO3	Determine the Market perspective of IoT.
CO4	Use of Devices, Gateways and Data Management in IoT.
CO5	Develop applications of IoT in Industrial and Commercial and Real World Design Constraints.

Course Contents:

Unit I: Introduction

What is the Internet of Things? : History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities

Unit II: Fundamental IOT Mechanisms and Key Technologies

Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology

Unit III: Radio Frequency Identification Technology

RFID: Introduction, Principle of RFID, Components of an RFID system, Issues

EPCGlobal Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things.

Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication

WSN specific IoT applications, challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.

Unit IV: Resource Management in The Internet Of Things

Clustering, Software Agents, Clustering Principles in an Internet of ThingsArchitecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization.

Identity portrayal, Identity management, various identity management models: Local, Network, Federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, Identity and trust.

Unit V: Internet of Things Privacy, Security and Governance

Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non repudiation and availability, Security model for IoT.

Unit VI: Business Models For The Internet Of Things

Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things.

Unit VII: Internet of Things Application

Smart Metering Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards

Reference Books:

- Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
- Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
- Parikshit N. Mahalle& Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).

Internet of Things Lab

CSP 6109 **0 – 0 – 2 = 1**

List of experiments

1. Define and Explain Eclipse IoT Project.
2. List and summarize few Eclipse IoT Projects.
3. Sketch the architecture of IoT Toolkit and explain each entity in brief.
4. Demonstrate a smart object API gateway service reference implementation in IoT toolkit.
5. Write and explain working of an HTTP- to-CoAP semantic mapping proxy in IoT toolkit.
6. Describe gateway-as-a-service deployment in IoT toolkit.
7. Explain application framework and embedded software agents for IoT toolkit.
8. Explain working of Raspberry Pi.

Cloud Computing

CSL 6152 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understand the architecture and different types of clouds
CO2	Case studies of different cloud servers
CO3	Understanding popular cloud platforms and creating virtual machines

Course Contents:
Unit I: Cloud Computing Fundamental: Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications.

Unit II: Cloud Applications: Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages
Unit III: Cloud Services Management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics : Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat)
Unit IV: Application Development: Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.
Reference Books:

- Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN: 978-0521137355]
- Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach [ISBN: 0071626948]
- Dimitris N. Chorafas, Cloud Computing Strategies [ISBN: 1439834539]

Cloud Computing Lab

CSP 6152 **0 – 0 – 2 = 1**

List of Experiments

1. Implementation of Para-Virtualization using VM Ware's Workstation/ Oracle's Virtual Box and Guest O.S
2. Creating a Warehouse Application in SalesForce.com.
3. Creating. Application in SalesForce.com using Apex programming an Language
4. Implementation of SOAP Web services in C#/JAVA Applications.
5. Installation and Configuration of Hadoop.
6. Create an application (Ex: Word Count) using Hadoop Map/Reduce.
7. Case Study: PAAS (Facebook, Google App Engine)
8. Case Study: Amazon Web Services.

Colloquium

CSC 6171 **0-0-2=1**

Course Contents:
The students will deliver talks on their experience during the 50 working days of practical training and topics of current interest in the computer science and engineering field. These would include technology, research as well as standards issues.

Mobile & Pervasive Computing

CSL 7141 **3 –0– 0 = 3**

Course Outcomes

CO1	The basis of Mobile and Pervasive Computing and its enabling technologies.
CO2	The scientific and engineering principles related to the enabling technologies.
CO3	Distributed computer systems architecture and organization.
CO4	Networking and communication systems theory and practice (inc. important issues such as security).

Course Contents:
Unit 1 : Introduction
Introduction to mobile computing, Adaptability in mobile computing, mechanism for adaption, support to build adaptive applications, applications of mobile computing.
Unit 2: Mobility Management
Registration area**,** location management principles and techniques, Mobile IP and their classification,

Unit 3: Data Dissemination
Challenges, data dissemination, Mobile data caching, cache consistency, performance and architectural issues, Mobile Cache management techniques, broadcasting invalidation report, handing disconnection, energy and bandwidth efficiency algorithms.

Unit 4: Adhoc Networks
Introduction to Adhoc networks, routing issues, Body, Personal, and Local Ad Hoc Wireless Networks, Multicasting Techniques in Mobile Ad Hoc Networks, Quality of Service in Mobile Ad Hoc Networks, Power-Conservative Designs in Ad Hoc Wireless Networks, Energy efficient algorithms for routing in Adhoc networks, clustering techniques, Coding for the Wireless Channel, Unicast Routing Techniques for Mobile Ad Hoc Networks, Position-Based Routing in Ad Hoc Wireless Networks.

Unit 5: Sensor Networks
Introduction to sensor networks, Data aggregation and data dissemination techniques in sensor networks, localization in sensor networks, Energy saving issues for Wireless Sensor, Broadcast Authentication and Key Management for Secure Sensor Networks, Embedded Operating Systems for Wireless Microsensor Nodes, Time Synchronization and Calibration in Wireless Sensor Networks, The Wireless Sensor Network MAC, Topology Construction and Maintenance in Wireless Sensor Networks.

Unit 6: Security in Adhoc and Sensor Networks
Basic concepts of cryptography, Key generation and management techniques, D-H algorithm, DES, Algorithms for key generation and distribution, overhead issues in key management w.r.t. mobile clients, Hashing techniques.

Unit 7: Mobile Middleware
Introduction to mobile middleware, adaption, agents, and service discovery.

Reference Books:

- Sandeep K Gupta, Frank Adelstein, Golden G. Richard, Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing: TMH

Optimization Techniques

CSL 6042 **4 – 0 – 0 = 4**

Course Outcomes

CO1	To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems
CO2	To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology
CO3	To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

Course Contents:

UNIT 1 Convex sets and functions
Convex sets and functions, constrained optimization methods: Introduction, Kuhn-Tucker conditions, convex optimization, Lagrange multipliers,
Non-linear programming: One-dimensional minimization method, search method, unconstrained and constrained optimization theory and practices.

UNIT 2 Reliability
Reliability: Basic concepts, conditional failure rate function, Failure time distributions, Certain life models, Reliability of a system in terms of the reliability of it's components, series system, Parallel system.

UNIT 3 Dynamic Programming
Dynamic Programming: Multistage decision problems, computation procedure and case studies.

UNIT 4 Queuing system
Fundamentals of queuing system, Poisson process, the birth and death process, special queuing methods.

Reference Books:

- S.S Rao.. Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
- Chong, E.K.P.and Zak, S. H.. An Introduction to Optimization, John Wiley & Sons, N.Y.
- Peressimi A.L., Sullivan F.E., Vhl, J.J..Mathematics of Non-linear Programming, Springer – Verlag

Deep Learning

CSL 6036 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Explain different neural network architectures and how these are used in current applications.
CO2	Implement, train, and evaluate neural networks using existing software libraries.
CO3	Present and critically assess current research on neural networks and their applications.
CO4	Relate the concepts and techniques introduced in the course to your own research.
CO5	Plan and carry out a research project on neural networks within given time limits.

Course Contents:

Unit 1:

Introduction to Machine Learning, Supervised Learning, Unsupervised Learning, Examples and Applications of Supervised Learning, Examples and Applications of Unsupervised Learning, Classification Algorithms: Naïve Bayesian Classifiers, Decision Tree, Random Forest

Unit 2:

Classification Algorithms: K-NN and other algorithms, Regression Algorithms: Linear and Logistic Regression, Unsupervised Algorithms: Clustering algorithms, Association Rule Mining algorithms

Unit 3:

History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks

Unit 4:

Backpropagation, Gradient Descent (GD), Autoencoders, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders, Deep Belief Networks (DBN), Restricted Boltzman Machine (RBM), Regularization: Bias Variance Tradeoff, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods

Unit 5:

Convolutional Neural Networks, Recurrent Neural Networks, Backpropagation through time (BPTT), LSTMs (Long Short Term Memory Neural Networks

Reference Books:

- Deep Learning, An MIT Press book, Ian Goodfellow and Yoshua Bengio and Aaron Courville
- http://www.deeplearningbook.org

Deep Learning Lab

CSP 6036 **0 – 0 – 2 = 1**

List of Experiments:

1. Design and simulate the McCulloch Pitts Neuron Network model in Python language.
2. Design and simulate the behaviour of AND Gate using Perceptron Network in Python language for bipolar inputs and binary targets.
3. Design and simulate the behaviour of OR Gate using Adaline Network in Python language for bipolar inputs and binary targets.
4. Design and simulate the behaviour of XOR Gate using Madaline Network in Python language for bipolar inputs and binary targets.
5. Design and simulate the behaviour of XOR gate using Back Propagation Network in Python language for bipolar inputs and binary targets.
6. Multi Layer Perceptrons implementation for solving Linearly Separable Problems.
7. Multi Layer Perceptrons implementation for solving Non-Linearly Separable Problems.
8. Multi Layer Perceptrons implementation for solving Non-Linearly Separable Problems like XOR problems.
9. Feed Forward Neural Networks model implementation in Python language.
10. Auto-encoders implementation in Python language.
11. Back Propagation Network models like Gradient Descent in Python language.
12. Simple Image Classification using Convolutional Neural Network - Deep Learning in python.
13. Recurrent Neural Networks model in Python language.
14. Some Applications of Deep Belief Network
15. BPTT - Deep Learning in python.
16. LSTM - Deep Learning in python.

High Performance Computing

CSL 7223 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Describe and use the main design techniques for sequential and parallel algorithms
CO2	Design, prove the correctness and analyze the computational complexity of sequential and parallel algorithms
CO3	Understand the differences among parallel and sequential algorithms solving the same problem and recognize which one is better under different conditions
CO4	Understand parallel algorithm for different architectures
CO5	Describe and use basic and advanced parallel algorithms

Course Contents:

Unit-I:

Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

Unit-II:
Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost optimality, An example of illustrate Cost-optimal algorithms- such as summation, Min/Max on various models.

Unit-III:
Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC/, Parallel Sorting Networks on CREW/EREW/MCC/, linear array

Unit-IV:
Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

Unit-V:
Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithms- Permutation, Combinations, Derrangements.

Reference Books:
- M.J. Quinn, "Designing Efficient Algorithms for Parallel Computer" by Mc Graw Hill.
- S.G. Akl, "Design and Analysis of Parallel Algorithms"
- S.G. Akl, "Parallel Sorting Algorithm" by Academic Press

Dissertation (preliminary)

CSD 7004 **0 – 0 – 10 = 5**

Course Contents:
Research and development projects based on problems of practical and theoretical interest. Problem definition, background research, development of overall project plan. Evaluation will be based on student seminars, written reports, and evaluation of the developed system and/or theories.

Dissertation

CSD 7005 **0 – 0 – 40 = 20**

Course Contents:
Research and development projects based on problems of practical and theoretical interest. Problem definition, background research, development of overall project plan. Evaluation will be based on student seminars, written reports, and evaluation of the developed system and/or theories.

Cyber Security

CSE 6125 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Student should understand cyber-attack, types of cybercrimes, cyber laws and also how to protect them self and ultimately society from such attacks

Course Contents:

UNIT 1
Introduction to Security: Need for security, Security approaches, Principles of security, Types of attacks.

UNIT 2
Digital Privacy, Online Tracking, Privacy Laws, Types of Computer Security risks (Malware, Hacking, Pharming, Phishing, Ransomware, Adware and Spyware, Trojan, Virus, Worms, WIFI Eavesdropping, Scareware, Distributed Denial-Of-Service Attack, Rootkits, Juice Jacking), Antivirus and Other Security solution, Password, Secure online browsing, Email Security, Social Engineering, Secure WIFI settings, Track yourself online, Cloud storage security, IOT security, Physical Security Threads.

UNIT 3
Systems Vulnerability Scanning Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap.

UNIT 4
Network Defense tools Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System

UNIT 5
Introduction to Cyber Crime and law Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world.

Reference Books:

- Cryptography and Network Security: Behrouz A. Forauzan 2/e
- Cryptography and Network Security: William Stallings 4/e
- Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw Hill.
- Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley

ADVANCE ALGORITHMS

CSL 6102 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understand the key techniques and theory behind the type of random variable and distribution
CO2	Use effectively the various algorithms for applications involving probability and statistics in computing (data analytics)
CO3	Evaluate and Perform hypothesis testing and to conclude
CO4	Design and build solutions for a real world problem by applying relevant distributions

Course Contents:

Design Paradigms: Overview:
Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound.

Max Flow Problem

String Matching
Introduction to string-matching problem, Naïve algorithm, Rabin Karp, Knuth Morris Pratt, BoyerMoore algorithms and complexity analysis.

Theory of NP- Hard and NP-Complete Problems.
P, NP and NP-Complete complexity classes; A few NP-Completeness proofs; Other complexity classes.

Approximation Algorithms
Introduction, Combinatorial Optimization, approximation factor, Polynomial Time Approximation Schemes (PTAS), FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem etc. Analysis of the expected time complexity of the algorithms.

Parallel Algorithms
Introduction, Models, speedup and efficiency, Some basic techniques, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity.

Probabilistic Algorithms & Randomized Algorithms
Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretic techniques, Applications on graph problems

Reference Books:

- Introduction to Algorithms : T.H. Cormen, C.E.Leiserson and R.L. Rivest
- Fundamentals of Algorithmics : G.Brassard and P.Bratley
- Approximation Algorithms: Vijay V.Vazirani
- Randomized Algorithms: R. Motwani and P.Raghavan
- Reference book: Algorithmics :The spirit of computing: D.Harel

Big Data Science & Analytics

CSL 6110 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Be exposed to big data
CO2	Understand the methods of data collections
CO3	Learn the different ways of Data Analysis
CO4	Be familiar with the visualization of data

Course Contents:

Unit I Introduction To Big Data
Introduction to Big Data Platform – Challenges of conventional systems – Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs. reporting – Modern data analytic tools, Statistical concepts: Sampling distributions, resampling, statistical inference, prediction error.

Unit Ii Data Analysis
Regression modelling, Multivariate analysis, Bayesian modelling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics – Rule induction – Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.

Unit Iii Mining Data Streams
Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments -

Counting oneness in a window – Decaying window – Realtime Analytics Platform(RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

Unit Iv Frequent Itemsets And Clustering

Mining Frequent itemsets – Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques - Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

Unit V Frameworks And Visualization

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques, interaction techniques; Systems and applications:

Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
4. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007
5. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
6. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.

E-Commerce & Cyber Laws

CSE 6016 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Demonstrate an understanding of the foundations, importance, types and the technical infrastructure requirement of E-commerce and E-business.
CO2	Understand the components of Business model, importance of business models in E-commerce and analyse the impact of E-commerce on business models and strategy.
CO3	Recognize and discuss the E-commerce issues like data privacy and security and various solutions to achieve the privacy and security in e-commerce.
CO4	Understand and assess electronic prepaid and post-paid payment systems for e-commerce.
CO5	Understand the Indian IT Act 2000 that govern electronic commerce activities, different types of cybercrime and apply critical thinking in analysing judicial decision related to e-commerce cybercrimes.

Course Contents:

Unit-1- Introduction to E-commerce

Define E-commerce, Brief history of E-commerce, Forces fueling E-commerce, Challenges to traditional methods, Types of E-commerce, E-Business, E business trident, E-com Vs E-Business.

Unit-2 E-Commerce Challenges and Issues

E-commerce Challenges, E-commerce Issues- Technical issues, Privacy vs Security, Data, Type of data, Protection of data, Security – challenges and requirements, E-commerce players and attacks, Defenses: Firewall, Network security, , Emerging firewall management issues, Types of online transactions, Requirement for online transactions, Securing the Network Transactions – Cryptography - Encryption, Public key encryption vs Private key encryption, Security Protocols for Web Commerce – SSL, SET, SHTTP.

Unit-3 Electronic Payment system.

Overview of E- payment system, Pre, Post and Instant payment methods in e-commerce, Digital cash, Properties, Electronic cheques and benefits, online credit card system, types of credit card payments, secure electronic transactions, Debit cards, E-benefit transfer.

Unit-4 E business Issues and Internet Marketing

E-Business, Organizational issues, Implementation issues, Marketing issues, Model for E business, Internet Marketing, Different stages of internet marketing, Critical success factor of internet marketing, E commerce strategies for development, E-commerce & sales.

Unit -5 Cyber laws

Definition, Need for cyber laws, Jurisprudence of Indian cyber law, Cyber crimes and criminal justice IT ACT2000 objectives, E-governance, digital signature, Sections related to ,Electronic records, Attribution, acknowledgement and dispatch of Electronic Records, security of E-records and digital signature, Controller functions, Certificates, subscriber duties, Penalties and Adjudications, Cyber regulation Appellate tribunal, Offences, Contracts in the InfoTech world, Power of arrest without warrant a critique, IT Act Modifications. Cyber consumer protection.

Reference Books:

- E Commerce, Bharat Bhasker TMH
- E- Commerce, Ravi kalakote, Pearson ed.
- E commerce , Lauden , PHI
- Cyber Law Simplified, Vivek Sood, TMH

Block Chain Coding

CSE 6017 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Know the Basic concepts, Design, Architecture, Mining, Network and Security aspects of a Block chain & Crypto currency.
CO2	Know the basics of the languages used in building Block chain & Smart Contracts.
CO3	Understand the application of Block chain in various other domains like Smart Contracts, IoT, Business Process Management etc.

Course Contents:

Unit 1

Introduction to Bit coin, Basic concepts about: Transactions, Transaction Blocks, Blockchain, Mining, Bitcoin Addresses, Wallet technology, Transaction inputs and outputs, Transaction Script, Digital Signature, Advanced Concepts in Transactions and scripting.

Unit 2

The Bit coin Network: Peer to Peer Network Architecture, Full Nodes and SPV Nodes, Encryption and authentication in connections, Transactions Pool, Structure of Block, Block Header, Block Header Hash and Height, Genesis Block, Markle Trees, Linking Blocks in chains.

Unit 3

Mining and Decentralized consensus, Aggregating Transactions in Blocks, Mining the Block, Validating Block, Mining and the Hashing Race, Consensus Attacks, Bit coin Security principles and best practices, Block Chain Applications.

Unit 4

Introduction to Hyper ledger-Fabric/Ethereum for building distributed ledgers (blockchain), Smart contracts, decentralized blockchain applications.

Reference Books:

- Mastering Bitcoin – Programming the Open Blockchain, 2nd Edition by Andreas M Antonopoulos, O'Reilly Publications
- Building Blockchain Projects: Building decentralized Blockchain applications with Ethereum and Solidity, by Narayan Prusty, Packt publications
- Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer, by Nitin Gaur, Packt publications
- Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, by Imran Bashir, Packt Publications
- Blockchain: Blueprint for a New Economy, 1st Edition, by Melanie Swan, O'Reilly publications
- Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits

Software Defined Networks

CSE 7016 **2 – 0 – 2 = 3**

Course Outcomes

CO1	Understand the fundamentals of SDN
CO2	Understand the characteristics of SDN controllers and their implications
CO3	Apply SDN programming tools and approaches for programming of SDN
CO4	Understand the key SDN applications, security of SDN and Network Function Virtualization (NFV)
CO5	Understand the design and implementation techniques for SDN.

Course Contents:

History and Evolution of Software Defined Networking (SDN): Separation of Control Plane and Data Plane, IETF Forces, Active Networking.

Control and Data Plane Separation: Concepts, Advantages and Disadvantages, the OpenFlow protocol.

Network Virtualization: Concepts, Applications, Existing Network Virtualization Framework (VMWare and others), Mininet based examples.

Control Plane: Overview, Existing SDN Controllers including Floodlight and OpenDaylight projects.

Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts.

Data Plane: Software-based and Hadrware-based; Programmable Network Hardware.

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs.

Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

Data Center Networks: Packet, Optical and Wireless Architectures, Network Topologies.

Use Cases of SDNs: Data Centers, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering.

Programming Assignments for implementing some of the theoretical concepts listed above

Reference Books:

- SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10: 1-4493-4230-2.
- Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844
- SDN and OpenFlow for Beginners by Vivek Tiwari, Sold by: Amazon Digital Services, Inc., ASIN: , 2013.
- Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014.
- Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015.
- OpenFlow standards, http://www.openflow.org, 2015.
- Online Reading Lists, including: http://www.nec-labs.com/~lume/sdn-reading-list.html, 2015.

Information & Coding Theory

CSE 7015 /CSL 7015 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Understands the fundamentals of coding theory
CO2	Understands concept of source coding.
CO3	Understands channel coding theorem.

Course Contents:

UNIT 1 Mathematical Background and Introduction

Introduction to algebraic structures, Field extensions, Quadratic Residues, Krawtchouk Polynomials, Combinatorial Theory, Probability Theory, Shannon's Theorem, Coding Gain, Problems.

UNIT 2 Linear and Good Codes

Block Codes, Linear codes, Hamming codes, Majority Logic decoding, Weight enumerators, The Lee Metric, Hadamard codes and generalizations, Binary Golay code, The Ternary Golay code, Constructing codes from other codes, Reed-Muller codes, Kerdock codes

UNIT 3 Bounds on Codes and Cyclic Codes

Gilbert bound, Asymptotic Plotkin bound, Griesmer bound, The Linear Programming bound, Cyclic codes, Zeros of a Cyclic codes, The Idmpotent of a cyclic codes, Other representations of a Cyclic codes.

Reference Books:

- Introduction to Coding Theory, J. H. Van Lint

Robotics

CSE 7045 **3 – 0 – 0 = 3**

Course Outcomes

CO1	To acquire the knowledge on advanced algebraic tools for the description of motion
CO2	To develop the ability to analyze and design the motion for articulated systems
CO3	To develop an ability to use software tools for analysis and design of robotic systems

Unit 1: Computer vision (6 Contact Periods)

Introduction. The human eye and the camera. Vision as an information processing task. Homogeneous transformations. A geometrical framework for vision. 2D and 3D images interpretation. Industrial applications.

Unit 2: Digital Image (7 Contact Periods)

Basics of image processing. Image acquisition. Segmentation, Binary and grey morphology operations. Thresholding. Filtering. Edge and corner detection. Features detection. Contours.Tracking edges and corners. Object detection and tracking. Image data compression, Real time Image processing.

Unit 3: Lighting in Machine Vision (8 Contact Periods)

Lighting in Machine Vision. Introduction. Light used in machine vision. Basic rules and laws of light distribution. Filters. Light sources. Light techniques. Choice of illumination.

Camera and Optical System. Camera technology. Analog and digital camera. Camera model. CCD and CMOS Technology. Sensor size. Intrinsic and extrinsic camera parameters. Camera calibration.Systems of lenses The thin lens. Beam converging and beam diverging lenses. General imaging equation. Aberrations. Practical aspects.

Unit 4: Fundamental of Robot (7 Contact Periods)

Robotics. Introduction. Robot. Definition. Robot anatomy. Robot parts and their functions. Classification of robot and robotic systems. Laws of robotic. Co-ordinate systems. Drives and control systems, Power transmission systems. Planning for navigation. Different applications.

Unit 5 : Robot actuator effectors (8 Contact Periods)

Robot actuator effectors. Types of end effectors. Types of grippers. Interface. Sensors. Touch and Tactile sensors.

Kinematics of Robot. Introduction. Definition. Open and closed kinematic mechanisms. Matrix representation. Homogeneous transformation, forward and inverse kinematics. Direct vs inverse kinematic task. Programming. Basics of Trajectory planning.

Unit 6: Industrial applications (5 Contact Periods)

Quality control. Mapping and robot guidance. Motion estimation. Passive navigation and structure from motion .Autonomous systems.

Reference Books:

- Computer Vision: Algorithms and Applications, Richard Szeliski, Ed. Springer, ISBN-10: 1848829345, ISBN-13: 978-1848829343, Publishing, 2010.
- Handbook of Robotics, Bruno Siciliano, Ed. Springer-Verlag Berlin and Heidelberg GmbH & Co. K, ISBN-10: 354023957X, ISBN-13: 978-3540239574,Publishing, 2008.

Embedded Systems

CSE 7057 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Foster ability to understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.
CO2	Foster ability to write the programs for microcontroller.
CO3	Foster ability to understand the role of embedded systems in industry
CO4	Foster ability to understand the design concept of embedded systems.

UNIT 1 PRODUCT SPECIFICATION (7 Contact Periods)

Hardware / Software partitioning – Detailed hardware and software design –Integration –Product testing Selection Processes, Microprocessor Vs Micro Controller, Performance tools Bench marking RTOS Micro Controller, Performance tools, Bench marking, RTOS availability,Tool chain availability, Other issues in selection processes.

UNIT 2 PARTITIONING DECISION (8 Contact Periods)

Hardware / Software duality – coding Hardware – ASIC revolution Managing the Risk –Co-verification – execution environment – memory organization – System startup –Hardware manipulation – memory mapped access – speed and code density.

UNIT 3 INTERRUPT SERVICE ROUTINES (7 Contact Periods)

Watch dog timers – Flash Memory basic toolset – Host based debugging – Remote debugging – ROM emulators – Logic analyser – Caches – Computer optimisation –Statistical profiling

UNIT 4 IN CIRCUIT EMULATORS (6 Contact Periods)

Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers.

UNIT 5 TESTING (6 Contact Periods)

Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance.

Reference Books:

- Arnold S. Berger – "Embedded System Design", CMP books, USA 2002.
- Sriram Iyer, "Embedded Real time System Programming"
- ARKIN, R.C., Behaviour-based Robotics, The MIT Press, 1998.

Multimedia And Virtual Reality

CSE 7114 **3 – 0 – 0 = 3**

Course Outcomes

CO1	Graduate will demonstrate an ability to do research by designing and conducting experiments, analyze and interpret multimedia data individually as well as part of multidisciplinary teams.
CO2	Graduates will demonstrate an ability to design a system, component or process as per needs and specifications of the customers and society needs.
CO3	Graduates will demonstrate an ability to prepare short films and documentaries to showcase their knowledge of multimedia tools.

UNIT 1 Multimedia preliminaries and applications (9 Contact Periods)

Multimedia preliminaries and applications: Development and use of multimedia packages; introduction to virtual reality and modeling languages. CD-ROM and the Multimedia Highway, Introduction to making multimedia - The Stages of project, the requirements to make good multimedia, Multimedia skills and training, Training opportunities in Multimedia. Motivation for multimedia usage, Frequency domain analysis, Application Domain & ODA etc. Multimedia-Hardware and Software: Multimedia Hardware –

Macintosh and Window production Platforms, Hardware peripherals – Connections, Memory and storage devices, Media software – Basic tools, making instant multimedia, Multimedia software and Authoring tools, Production Standards.

UNIT 2 Multimedia building blocks (7 Contact Periods)

Multimedia – making it work – multimedia building blocks – Text, Sound, Images, Animation and Video, Digitization of Audio and Video objects, Data Compression: Different algorithms concern to text, audio, video and images etc., Working Exposure on Tools like Dream Weaver, 3D Effects, Flash Etc.

UNIT 3 Multimedia and the Internet (7 Contact Periods)

Multimedia and the Internet: History, Internet working, Connections, Internet Services, The World Wide Web, Tools for the WWW – Web Servers, Web Browsers, Web page makers and editors, Plug-Ins and Delivery Vehicles, HTML, Designing for the WWW – Working on the web, Multimedia Applications – Media Communication, Media Consumption, Media Entertainment, Media games.

UNIT 4 Multimedia-looking towards Future (6 Contact Periods)

Multimedia-looking towards Future: Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing, Assembling and delivering a project-planning and costing, Designing and Producing, content and talent, Delivering, CD-ROM technology.

Reference Books:

- Steve Heath, 'Multimedia and Communication Systems' Focal Press, UK.
- Tay Vaughan, 'Multimedia: Making it Work', TMH
- Keyes, 'Multimedia Handbook', TMH

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