Post Graduate Department of Computer Sciences,

The University of Kashmir, Srinagar - 190006

Curriculum for Master of Technology in Computer Science

2020 – 2021

Structure of Curriculum for M. Tech. in Computer Science

Semester-I (24 Credit unit Semester)						
Course Code	**Course name**	**Category**	**Hours / Week**			**Credits**
			L	T	P	
CORE SUBJECTS						
CSE20511	Embedded Systems	Core	4	0	0	4
CSE20512	Lab Embedded Systems	Core	0	0	4	2
CSE20513	Graph Theory	Core	4	0	0	4
CSE20514	Lab Graph Theory	Core	0	0	4	2
CSE20515	Artificial Intelligence	Core	4	0	0	4
ELECTIVE SUBJECTS						
CSE20516x	Elective 1	Elective	4	0	0	4
CSE20516x	Elective 2	Elective	4	0	0	4

List of Elective Subjects:

i) CSE205161 Advance Data Communications
ii) CSE205162 Advanced Database Management Systems
iii) CSE205163 Engineering Mathematics
iv) CSE205164 Object Oriented ~~Analysis~~ Method & Design

Semester-II (24 Credit unit Semester)						
Course Code	**Course name**	**Category**	**Hours / Week**			**Credits**
			L	T	P	
CORE SUBJECTS						
CSE20521	Network Security and Cryptography	Core	4	0	0	4
CSE20522	Lab Network Security and Cryptography	Core	0	0	4	2
CSE20523	Image Processing	Core	4	0	0	4
CSE20524	Lab Image Processing	Core	0	0	4	2
CSE20525	Machine Learning	Core	4	0	0	4
ELECTIVE SUBJECTS						
CSE20526x	Elective 1	Elective	4	0	0	4
CSE20526x	Elective 2	Elective	4	0	0	4

List of Elective Subjects:

i) CSE205261 Advanced Algorithms
ii) CSE205262 Software Reliability Engineering
iii) CSE205263 Optimization Techniques
iv) CSE205264 Big Data

Semester-III (24 Credit unit Semester)						
Course Code	**Course name**	**Category**	**Hours / Week**			**Credits**
			L	T	P	
	CORE SUBJECTS					
CSE20531	Minor Project	Core	0	4	0	4
CSE20532	Parallel and Distributed ~~Algorithms~~ Computing	Core	4	0	0	4
CSE20533	Real Time Operating Systems	Core	4	0	0	4
CSE20534	Advanced Wireless and Mobile Computing	Core	4	0	0	4
	ELECTIVE SUBJECTS					
CSE20535x	Elective 1	Elective	4	0	0	4
CSE20535x	Elective 2	Elective	4	0	0	4

List of Elective Subjects:

i) CSE205351 Cloud Computing
ii) CSE205352 Internet of Things
iii) CSE205353 Natural Language Processing
iv) CSE205354 Block Chain

Semester-IV (24 Credit unit Semester)						
Course Code	**Course name**	**Category**	**Hours / Week**			**Credits**
			L	T	P	
	CORE SUBJECTS					
CSE20541	Major Project Problem Identification	Core	0	2	0	2
CSE20542	Major Project Problem Analysis	Core	0	4	0	4
CSE20543	Major Project Software Development	Core	0	6	0	6
CSE20544	Major Project Research Component	Core	0	6	0	6
CSE20545	Major Project Dissertation	Core	0	6	0	6

Semester - I

Subject Code: CSE20511
Course Name: Embedded Systems

Unit I: Introduction.
Embedded systems and Cyber Physical Systems: Definition, Characteristics, Design Challenges, Classification, Application areas. **(4 Lectures)**
Embedded Hardware Architecture: General Purpose Processor, Microprocessor Design Options, Microcontroller, Digital Signal Processor, ASIC, PLDs, COTS; Embedded Systems Memory; Other Hardware Components: I/O Subsystem, Timers and counters, Interrupt Subsystem, UART, PWM and Analog-Digital Conversion, Sensors and Actuators. **(6 Lectures)**
Embedded Software Architectures: Round Robin, Round Robin with Interrupts, Function Queue Scheduling, Real-time Operating System (RTOS); Programming Languages and Tools; Embedded IDE; Debugging. **(5 Lectures)**

Unit II: The 8051 Microcontroller.
Microcontroller: Introduction, Criteria for choosing a microcontroller; Overview of 8051 Microcontroller family: Architecture, Memory Organization of 8051, SFRs, I/O Ports, Addressing modes. **(5 Lectures)**
Basic Assembly Language programming concepts: 8051 Instruction set, Assembler Directives, Subroutine, Stack. **(5 Lectures)**
Time delay generations and calculations, Programming of 8051 Timers, Counter Programming, Watch Dog Timer, Real Time clock. **(5 Lectures)**

Unit III: 8051 Communication and Interrupts.
Basics of Communication: Overview of RS-232, I^2C Bus, UART, USB; Communication with 8051: Using I/O Ports, 8051 Serial Port, 8051 connections to RS-232. **(5 Lectures)**
8051 interrupts: Interrupt vectors and interrupt processing, Level triggered and edge triggered, Masking and priorities; Programming of 8051 Timer interrupts, Programming of External hardware interrupts, Programming of the serial communication interrupts. **(5 Lectures)**

Unit IV: 8051 Interfacing.
Basic Concepts of Interfacing: Introduction; 8051 Interfacing to external memory and Accessing External data Memory and External Code Memory. **(5 Lectures)**
Interfacing to LCD/Keyboard, DAC/ADC, Sensors, Stepper Motor, 8255. **(5 Lectures)**

Text Books:

1. Shibu K V. *Introduction to Embedded Systems*, TMH.
2. M.A. Mazidi and J. G. Mazidi. *The 8051 Microcontroller and Embedded Systems*, PHI.
3. Raj Kamal. *Embedded Systems*, TMH.

Subject Code: CSE20512
Course Name: Lab Embedded Systems

List of Experiments:

Week	Description of the experiment
Week 1	• Design the schematic to connect an LED to 8051 on proteus via a pullup resistor. • Write assembly or C code to make the LED blink on a pre specified Duty Cycle.
Week 2	• Design the schematic to add a push down switch to schematic designed in **week 1** via a pulldown resistor. • Write assembly or C code to toggle an LED on the push of the button.
Week 3	• Design the schematic to interface a relay with 8051 for controlling a bulb. • Write assembly or C code to control the on/off of a bulb via a relay on the push of the button.
Week 4	• Design the schematic to interface a 4 x 4 key pad with 8051. • Write assembly or C code to detect and decode a keypress from the 4 x 4 key pad with 8051.
Week 5	• Design the schematic to interface a 7-segment display with 8051. • Write assembly or C code to detect and decode a keypress from the 4 x 4 key pad with 8051 and display it on the 7-segment display.
Week 6	• Design the schematic and write assembly or C code to blink an LED using 8051 timers.
Week 7	• Design the schematic and write assembly or C code to display the number of button presses on 3-segment displays using 8051 counters.
Week 8	• Design the schematic and write assembly or C code to control a dc motor using 8051 via an H-Bridge. Use two buttons for forward and reverse.
Week 9	• Design the schematic and write assembly or C code to read and display value from a variable resistor on a 7-segment display using an ADC.
Week 10	• Design the schematic and write assembly or C code to interface a 16 x 2 LCD with 8051 for displaying "Hello World".
Week 11	• Design the schematic and write assembly or C code to interface a 16 x 2 LCD with 8051 for displaying a real time clock.
Week 12	• Design the schematic and write assembly or C code to interface two 8051 microcontrollers via the serial port for interchanging data at 9600bps. Use 16 x 2 LCD to display the received data.
Week 13	• Design an embedded solution for automatically controlling the irrigation system of a green house. Your job is to control the sprinklers depending upon the temperature of the green house. The LCD should display the current temperature and the last time when the sprinklers where on.

Subject Code: CSE20513
Subject Name: Graph Theory

Unit I

Graphs and subgraphs, Adjacency and incidence matrices, isomorphism. Paths and connections, Cycles, The shortest path problem, Sperners Lemma, Trees, Cut Edges and Bonds Cut Vertices, Cayleys Formula, The connector Problem

Unit II

Connectivity, Blocks with example, Eulerian tours and Hamilton Cycles, The Chinese postman problem, The travelling salesman problem, Matching and Coverings in Bipartite Graphs, Perfect Matchings, The Personnel Assignment Problem, The Optimal Assignment Problem.

Unit III

EDGE COLOURINGS:- Edge Chromatic Number , Vizing's Theorem. , The Timetabling Problem, INDEPENDENT SETS AND CLIQUES, Ramsey's Theorem , Turan's Theorem. Applications, VERTEX COLOU'RINGS :- Chromatic Number , Brooks' Theorem ,Chromatic Polynomial , Girth and Chromatic Number Applications

Unit IV

Plane and Planar Graphs, Dual Graphs , Euler's Formula, Bridges, Kuratowski's Theorem , The Five-Colour Theorem and the Four-Colour Conjecture, , Non-hamiltonian Planar Graphs , Directed Graphs, Directed Paths, Directed Cycles, Applications, NETWORKS, Flows , Cuts , The Max-Flow Min-Cut Theorem Applications , Menger's Theorems , Feasible Flows , THE CYCLE SPACE AND BOND SPACE , Circulations and Potential Differences. , The Number of Spanning Trees. Applications.

Text book :-

1. *GRAPH THEORY WITH APPLICATIONS,* J. A. Bondy and U. S. R. Murty published by Elsevier Science Publishing Co., Inc

References:-

1. Douglas B. West, Introduction to Graph Theory, Second Edition, Prentice-Hall
2. Reinhard Diestel: “Graph Theory”, Electronic Edition 2010.
3. B. Bollobas: “Modern Graph Theory” Springer, 1998.
4. Deo Narsingh,”Graph Theory With Applications To Engineering And Computer Science”, PHI Learning Pvt. Ltd,

Subject Code: CSE20514
Subject Name: Lab Graph Theory

1. Write a program to implement a graph using incidence matrix, adjacency matrix and adjacency list.
2. Write a program to find the number of cycles in a graph.
3. Write a program to find the shortest path in a graph.
4. Write a program to for determining (a) the components of a graph; (b) the girth of a graph.
5. Write a program to show that every properly labelled simplicial subdivision of a triangle has an odd number of distinguished triangles.
6. Write a program to implement a binary search tree along with its traversal and insertion and deletion of a node?
7. Write a program to show that simple connected graph that has exactly two vertices which are not cut vertices is a path.
8. Write a program to implement Kruskal's Algorithm.
9. Write a program to construct the closure of a graph and finding a Hamilton cycle if the closure is complete.
10. Write a program to implement the Fleury's algorithm to find the Euler tour of a graph.
11. Write a program to implement THE TRAVELLING SALESMAN PROBLEM ?
12. Write a program to implement Hall's algorithm for matching of bipartite graph ?
13. Write a program to optimal assignment problem using graphs?
14. Write a program for finding a proper edge colouring of a bipartite graph G.?

Subject Code: CSE20515
Subject Name: Artificial Intelligence

UNIT I
Introduction to biological neural networks. Artificial neural networks (ANN). Analogy between biological and artificial neural networks. Neuron as a basic building element of an ANN. Activation functions. Perceptron. Learning with a perceptron. Limitations of a perceptron. Multilayer neural networks. Learning with a multilayer perceptron. Backpropagation algorithm. Synergistic neural networks. Distributed neural networks. Distributed and synergistic neural networks. Applications of ANNs.

UNIT II
Inductive learning algorithms. Categories of inductive learning algorithms. Rule extraction with inductive learning algorithms. ID3 algorithm. AQ algorithm. RULES algorithms. SAFARI algorithm. Applications of inductive learning algorithms.

UNIT III
Fuzzy logic and uncertainty. Fuzzification. Linguistic terms. Fuzzy sets. Hedges. Fuzzy Hedge Operations. Fuzzy set operations. Fuzzy vector matrix multiplication. Fuzzy Max-Min inferencing. Fuzzy Max-Product inferencing. Multiple premise fuzzy inferencing. Fuzzy multiple rule aggregation. De-fuzzification. Applications of fuzzy logic.

UNIT IV
Artificial intelligence techniques in fingerprint, face, and iris recognition.

Text Books and Reference Material:
1. Artificial Intelligence: A Modern Approach by Stuart Russell.
2. Artificial Intelligence: A Guide to Intelligent Systems by Michael Negnevitsky
3. Machine Learning by Tom Mitchell
4. Selected Journal and Conference Papers

Subject Code: CSE205161
Subject Title: Advanced Data Communication

Unit I
Bandwidth and Channel Capacity. Quantifying Channel Capacity for noiseless channel(Nyquist Law) and noisy channel(Shannon's Law). Example of a digital telephone system to explain basic concepts of analog signals, digital signals, sampling. Data Rate versus Baud Rate. Nyquist Criterion for Sampling. Signal-to-Noise ratio. Local area network(LAN) concepts and characteristics.

Unit II
Wide area networks(WANs). WAN technologies (traditional packet and circuit switching, Frame Relay, ATM). ISDN(narrowband) concepts and services. Overview of the OSI model. Transmission media – factors affecting distance and data rate. Guided transmission media: Twisted-Pair, Co-axial Cable. Principles and advantages of optical networks. Types of optical fibers and lasers.

Unit III
Unguided transmission media: Terrestrial Microwave & Satellite Microwave systems and applications. Data encoding. Difference between modulation and encoding. NRZ-L, NRZ-I encoding. Multilevel Binary and Biphase Coding techniques and their implementations. ASK,FSK,PSK and QPSK. PCM concepts: sampling, quantization. Amplitude Modulation.

Unit IV
Reliable transmission of data: Asynchronous and Synchronous transmission. Error detection: Parity-based, CRC-based. FCS computation. Error control and recovery techniques. Concept of ARQ standard and its versions. Concept of Multiplexing. FDM. Synchronous and Statistical TDM. Spread Spectrum Techniques: Direct Sequence and Frequency Hopping.

Reference Books:

1. William Stallings, "Data and Computer Communications", 8^{th} Edition, Pearson Education.
2. Behrouz Fourouzan " Data Communications & Networking", 4^{th} Edition, TMH.
3. Andrew Tanenbaum, "Computer Networks", Pearson Education 4/e.
4. Ulysses Black, "Principles of Data Communications ", PHI.
5. Morley, Gelber, "The Emerging Digital Future", Addison-Wesley.

Subject Code: CSE205162
Subject Name: Advanced Database Management Systems

UNIT I: Object Based Database Systems

Object Database Concepts Overview: Object Oriented Concepts and Features, Object Identity, Complex data types, Encapsulation of Operations and Object Persistence, Type Hierarchies and Inheritance.

Object Based Extensions to SQL: User-Defined Types using CREATE TYPE and Complex Objects ODMG Object Model and the Object Definition Language.

UNIT II: Temporal Database Systems

Temporal Data model: Conceptual Objects, Temporal Objects, temporal Constraints, Temporal and Non Temporal Attributes, Conceptual Relationships, Temporal Relationships and constraints among relationships.

The Temporal Query Language: Temporal Projection, Temporal Selection, Temporal Version Restriction Operators, Temporal Scope Operators.

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UNIT III: Parallel Database Systems:

I/O Parallelism: Partitioning Techniques, Managing Skew.

Interquery Parallelism and Intraquery Parallelism, Intra-operator Parallelism (Parallel Sort and Parallel Join).

Inter-operator Parallelism: Pipelined Parallelism and Independent Parallelism

Query Optimization.

UNIT IV: Distributed Database Systems:

Distributed Database Concepts. Data Fragmentation, Replication and Allocation Techniques For Distributed Database Design, Concurrency Control and Recovery.

NOSQL Databases: Introduction, the CAP theorem, Document based NOSQL systems and MongoDB, NOSQL Key-Value Stores, Column Based NOSQL Systems, NOSQL Graph Databases and Neo4j.

Text Book:

Advanced Database Systems by Nabil R. Adam and Bharat K . Bhargava, ISBN 3-540-57507-3 Springer-Verlag Berlin Heidelberg New York

Recommended Books:

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2017
2. ADVANCED DATABASE SYSTEMS by Dr.John Kandiri
3. Abraham Silberschatz, Henry F. Korth, S.Sudarshan, "Database System Concepts", 6th Edition, 2014

Subject Code: CSE205163
Subject Name: Engineering Mathematics

Unit I
Linear Algebra –Basic Concepts , Matrices , multiplication , operation and properties, Identity matrices , diagonal matrices, Transpose matrices , Symmetric matrices , Trace , Linear Independence and Rank , Inverse and Orthogonal matrices, Range and Nullspace of a matrix, Determinant, Quadratic forms and Positive SemiDefinite Matrices, Eigenvalue and Eigen Vectors, The Gradient, Hessian , Gradient and Hessian of linear and Quadratic functions. Least Squares, Gradient of the Determinant, Eigen Values as Optimization.

Unit II
Elements of Probability, Random Variables, Cumulative Distribution functions, Probability mass function, Probability density function, Expectation, Variance, Two random variables, Conditional distributions, Bayes Rule, Independence, Expectation and co-variance, Multiple Random variables, Random vectors.

Unit III
Gaussian Processes, Multivariate Gaussian, Binary Linear Regression, The squared exponential Kernel, Gaussian Process regression, Multivariate Gaussian Distribution. The co-variance matrix, The diagonal co-variance matrix, Iso-contours, Linear Transformation interpretation.

Unit IV
Convex sets, Convex functions, Jensen's Inequality, Sublevel sets, Convex Optimization Problems, Special Cases. Lagrange Duality, Lagrangian, Primal and Dual Problems, Complementary slackness, The KKT Conditions.

References Books
Linear Algebra and its applications by David C. Lay , Addison Wesley.
Probability Theory and Stochastic Processes with applications by Oliver Knill –Overseas Press.
Applied Multivariate Statistical Analysis by Richard A. Johnson and Dean W. Wichern – PHI
Multivariate Data Analysis by Joseph F. Hair, William C. Black , babin and Anderson – Pearson
Convex Optimization Theory by Dimitri P. Bertsekas
Combinatorial Optimization Algorithms and Complexity by Papadimitrion and Kenneth Steiglitz

Subject Code: CSE205164
Subject Name: Object Oriented Methods & Design

Unit 1
OOAD – Introduction, Applying UML and Patterns in OOAD, Assigning Responsibilities, what is analysis and Design, An Example, The UML, Iterative Development–a Unified Process idea, Additional UP Best Practices and Concepts, The UP Phases and Schedule oriented Terms, The UP disciplines. Process Customization and the development case. The Agile UP. The Sequential Waterfall Lifecycle. Inception. Artifacts that may start in inception, Understanding requirements, types of requirements.

Unit 2
Use –case Model, Writing requirements in context, goals and stories, background, use cases and adding value, use cases and functional requirements, use case types and formats. Goal and scope of a use case, Finding primary actors, goals and use cases, writing use cases in an essential UI-free style, Actors, Use Case Diagrams, Use Cases writing the UP, Case Study. Identifying other requirements. From inception to elaboration.

Unit 3
Use Case Model: Drawing System Sequence Diagrams. Example of an SSD. Inter System SSDs, SSDs and Use Cases, System Events and the System Boundary, Name System Events and Operations, Showing Use Case Text, SSDs within the UP. Domain Model: Visualizing Concepts, Domain Models, Conceptual Class Identification, Candidate Conceptual classes, Adding Associations, The UML association notation, NextGen POS Domain Model Associations, NextGen POS Domain Model, Adding Attributes, Non Primitive Data Type Classes, Adding Detail with Operation Contracts, Contract Sections, Post Conditions, Contracts, Operations and the UML. Operation Contracts within the UP.

Unit 4
From Requirements to Design, Interaction Diagram Notation, Sequence and Collaboration Diagrams, GRASP, Responsibilities and methods, interactions diagrams, Patterns, GRASP: Pattern of General Principles in Assigning Responsibilities, Information Expert, creator, Low Coupling, High Cohesion, Controller, Object Design and CRC Cards, Design Model: Use Case Realization with GRASP Patterns, Determining Visibility, Creating Design Class Diagrams, Mapping Design to Code. GRASP : More Patterns , Polymorphism , Pure Fabrication , Indirection , Protected Variations , GoF Design Patterns : Adapter , Factory , Singleton , Strategy , Façade , Observer / Publish-Subscribe / Delegation Event Model ,Relating Use Cases , Modeling Generalization , Refining the Domain Model , Adding New SSDs and Contracts , Modeling Behaviour in Statechart Diagrams.

Textbook: - Craig Larman,"Applying UML and Patterns", PHI

Reference Books:

1. James Rumbaugh, "Object Oriented Models and Design" Pearson Education 2/e Harrington."
2. C & Object Oriented Paradigm" John Viley & sons Publication
3. Ali Bahrani "Object Oriented Systems Development" McGraw -Hill 1999
4. Lafore Robert, "Object Oriented Programming in C++", Galgotia Publications.
5. Balagurusami, E, "Object Oriented with C++", Tata McGraw-Hill.

Semester – II

Subject Code: CSE20521
Subject Name: Network Security and Cryptography

Unit 1:
Part 1: The OSI Security Architecture, Security Attack – Threats, Vulnerabilities, and Controls, Types of Threats (Attacks)[3L]
Part 2: Security Services – Confidentiality, Integrity, Availability, Authentication, Access Control and Non repudiation; Security Mechanism. [3L]
Part 3: Introduction to Number Theory: Prime Number Generation and Testing for Primality, Fermat's and Euler's Theorems, Modular Arithmetic, Euclidean and Extended Euclidean Algorithm, Euler's Phi Function. [4L]

Unit 2:
Part 1: Introduction to Cryptology. Types of Encryption Systems – Based on Key, Based on Block; Confusion and Diffusion; One-time pad, Block Ciphers and Data Encryption Standard [4L]
Part 2: Block Cipher Modes of operation, Advanced Encryption Standard. Stream Ciphers, Random Number Generation. Shift Register based stream Ciphers, RC4 [5L]
Part 3: Public-Key Cryptography. RSA Cryptosystem [3L]

Unit 3:
Part 1: Double and Triple Encryption. Key Management, Diffie-Hellman Key Exchange [3L]
Part 2: Digital Signatures, The RSA signature scheme, Hash Functions, The Secure Hash Algorithm SHA-1 [5L]
Part 3: Message Authentication Codes, HMAC and CBC-MAC, Message Digest [4L]

Unit 4:
Part 1: IP Security, Authentication Header, Encapsulating Security Payload, Electronic Mail Security [4L]
Part 2: Network intrusion Detection system using machine learning: Supervised and Unsupervised. General IDS model and Taxonomy. IDS Signatures. [4L]
Part 2: DDoS Attacks. Specification and rate based DDoS. Defending against DoS attacks in scout: signature based solutions. [4L]

References

- Paar, Christof, and Jan Pelzl. *Understanding cryptography: a textbook for students and practitioners*. Springer Science & Business Media, 2009.
- William, S., and Cryptography Stalling. "Network Security, 4/E." Prentice Hall. (2006).
- Forouzan, Behrouz A., and Debdeep Mukhopadhyay. *Cryptography and network security (Sie)*. McGraw-Hill Education, 2011.
- Endorf, C., Schultz E and Mellander J, "Intrusion Detection and prevention". McGraw Hill. 2003

Subject Code: CSE20522
Subject Name: Lab Network Security and Cryptography

Experiment 1: Using Wireshark, Demonstrate Packet Sniffing for Router Traffic
Experiment 2: Demonstrate Intrusion Detection System using SNORT
Experiment 4: Perform Wireless Audit of an Access Point and Decrypt WEP and WPA
Experiment 5: Using KF Sensor, Setup a Honey Pot and Monitor the Honeypot on Network.
Experiment 6: Using NMAP, Find

- Open Ports on a system
- Machine that are Active
- Version of operating System

Experiment 7: Implement Ceaser Cipher Encryption Decryption
Experiment 8: Implement Hill Cipher Encryption Decryption
Experiment 9: Implement Playfair Cipher Encryption Decryption
Experiment 10: Implement Vigenere Cipher
Experiment 11: Implement Rail Fence (Row Column Transformation)
Experiment 12: Implement RSA Algorithm

Software's Required.

1. Wireshark
2. SNORT
3. Net Stumbler
4. KF Sensor
5. NMAP
6. Turbo C

Subject Code: CSE20523
Subject Name: Image Processing

Unit I
Introduction Digital Image processing, Origins of DIP, Examples, Fundamental steps in DIP, Components of DIP. Fundamentals Elements of visual perception, Light and the electro magnetic spectrum, Image Sensing and acquisition, Image sampling and quantization, basic relationships between pixels

Unit II
Image Enhancement Background, some basic gray level transformation, Histogram processing, enhancement using arithmetic /Logic operation, Basics of Spatial filtering, smoothing spatial filters, sharpening spatial filters

Unit III
Image enhancement Background , Introduction to the Fourier transform and the frequency domain, smoothing frequency- domain filters, sharpening frequency domain filters, homomorphic filters & implementation

Unit IV
Image restoration Noise models, restoration in the presence of noise only – spatial filtering, Periodic noise reduction by frequency domain filtering. Inverse filtering Image compression Fundamentals. Image compression models, error free compression,lossy compression

Text Books
Digital Image Processing by Woods & Gonzalez
Reference Books
Digital Image Processing, Kenneth R Castleman, Pearson Education,1995.
Digital Image Procesing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, McGraw Hill Education ,2009. Pvt Ltd, NewDelhi
Fundamentals of Digital image Processing, Anil Jain.K, Prentice Hall of India, 1989. 5. Image Processing, Sid Ahmed, McGraw Hill, New York, 1995.

Subject Code: CSE20524
Subject Name: Lab Image Processing

Basics of an Image Processing (reading an image to mat lab, display pixel operations, flipping and cropping).
Viewing digital images, bits and bytes, raster scan format, quantization
Scaling, translation and rotation, sums and differences
Histograms and stretches, convolutional filters
Fourier transforms and the frequency domain, filters
FFTs, Image filtering: smoothing and sharpening
2D convolution and correlation
Creating multiple image sequences for the project
Image enhancement.
Image compression
Color image processing
Image segmentation
Image Morphology
Image Restoration
Edge detection in an Image
Blurring 8 bit color versus monochrome
Object Reorganization like circles and triangles.

Subject Code: CSE20525
Subject Name: Machine Learning

Unit 1
Clustering Algorithms, Euclidean and Mahalanobis Distances, Basic Sequential Algorithm Scheme, K-Means Algorithm, Fuzzy C-Means Clustering, Clustering with Gaussian Probability Density Function. Cluster Validity index. Compactness Cluster Measure, Distinctness Cluster Measure, Validity Index Using Standard Deviation, Point Density Based Validity Index, Validity index using Local and Global Data Spread,

Unit 2
Support Vector Machines. Binary Linear Support Vector Machines, Optimal Hyperplane, Canonical Form, Kernel Functions, Solving Non-linear Classification problems with Linear Classifier. Multiclass Suport Vector Machines, Directed Acyclic Graph Support Vector Machines. Application of Support Vector Machines.

Unit 3
Dimensionality Reduction, Principal Component Analysis, Fisher Linear Discriminant, Multiple Discriminant Analysis. Watershed Based Clustering. Sub-Space Grid Based Approach. Coarse and Fie Rule Extraction using Sub-Space Grid Based Approach for Clustering.

Unit 4
Convolutional Neural Network Architectures and applications.

Reference Books and Material

1. *Machine Learning* by Tom M. Mitchel, McGraw-Hill publication
2. *Advances in Deep Learning, M. Arif Wani,*
3. *Pattern Classification* by Duda and Hart. John Wiley publication
4. The Elements of Statistical Learning: Data Mining, Inference, and Prediction by Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer.
5. Learning From Data, Yaser S. Abu-Mostafa, Hsuan-Tien Lin, Malik Magdon-Ismail, AML Book.
6. Introduction to Machine Learning by EthemAlpaydin, The MIT Press.
7. Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and Hall/CRC.
8. Selected Journal and Conference Papers

Subject Code: CSE205261
Subject Name: Advanced Algorithms

Unit I
Introduction to Algorithms, Analysis of algorithms, Designing Algorithms, Growth of Functions, Asymptotic notations (5L)
Recurrences, The Master Method, (2L)
Probabilistic Analysis. The hiring problem, Indicator random variables, randomized algorithms (5L)

Unit II
Advanced Data structures: Red-Black Trees, B Trees, Binomial Heap, Augmenting Data Structures, Interval trees (6L)
Network Flow Algorithm: Flow networks, Ford_fulkerson method, Pre-flow push algorithm, push relabel algorithms (6L)

Unit III
Dynamic Programming: elements of dynamic programming, Rod cutting (2L)
Multithreaded Algorithms: Basics of dynamic multithreading, Multithreaded matrix multiplication, Multithreaded merge sort (6L)
Matrix operations: Strassens multiplication algorithm, inverting matrices (4L)

Unit IV
String Matching: The naive string-matching algorithm, The Rabin-Karp algorithm, String matching with finite automata, The Knuth-Morris-Pratt algorithm (6L)
Computational Geometry: Line-segment properties, determining whether any pair of segments intersects, Finding the convex hull, Finding the closest pair of points (6L)

References:

1. Coremen, Leiserson, Rivest,Stein, “Introduction to Algorithms”, Third edition, PHI
2. Horowitz, Sahni, Rajasekaran “Fundamentals of Computer Algorithms”, Galgotia Publications
3. Michael T. Goodrich, Roberto Tamassia “Algorithm Design and Applications” , Wiley

Subject Code: CSE205262
Subject Name: Software Reliability Engineering

UNIT-I: BASIC RELIABILITY CONCEPTS: Reliability Measures (Definition of reliability, Mean time to failure (MTTF), Failure rate function, Maintainability and availability), Common Techniques in Reliability Analysis (Reliability block diagram, Network diagram, Fault tree analysis, Monte Carlo simulation), Markov Process Fundamentals (Stochastic processes, Standard Markov models, General procedure of Markov modelling)

UNIT-II: Nonhomogeneous Poisson Process (NHPP) Models (General formulation, Reliability measures and properties, Parameter estimation); MODELS FOR SOFTWARE RELIABILITY: Basic Markov Model (Model description, Parameter estimation). Execution Time models: Basic execution time model, logarithmic Poisson model;

UNIT-III: Imperfect debugging models (Monotonous death process, Birth-death process, Imperfect debugging model considering multi-type failure), Modular Software Systems: The Littlewood semi-Markov model; Software NHPP Models: Calender time models: Goel-Okumoto (GO) model, Hyper-exponential model, exponential fault categorization model;

UNIT-IV: S-shaped NHPP models: Delayed S-shaped NHPP model, Inflected S-shaped NHPP model; Failure rate dependent flexible model, SRGM for error removal phenomenon, SRGM defining Complexity of faults, generalized SRGM(Erlang model), Incorporating fault complexity considering learning phenomenon; Some other NHPP models: Duane model-Log-power model, Musa-Okumoto model

References:
1. Musa, Iannino, Okumoto, "Software Reliability: Measurement, Prediction, Application", McGraw-Hill, 1987.
2. Min Xie Yuan-Shun Dai and Kim-Leng Poh, "Computing System Reliability: Models and Analysis " KLUWER ACADEMIC PUBLISHERS, 2004
3. P. K. Kapur, H. Pham, A. Gupta, P. C. Jha,"Software Reliability Assessment with OR Applications", Springer-Verlag London Limited 2011
4. Hoang Pham, "system software reliability", Springer, 2006
5. Michael R. Lyu, "Handbook of software reliability engineering-IEEE Computer Society Press_ McGraw Hill (1996)".
6. M. Lyu, ed. "Handbook of Software Reliability Engineering", McGraw-Hill and IEEE Computer Society Press, 1996 7. Pham, H. (2000). 'Software Reliability', Springer-Verlag, Singapore.

Subject Code: CSE205263
Subject Name: Optimization Techniques

Unit I
Linear programming –formulation-Graphical and simplex methods-Big-M method Two phase method-Dual simplex method-Primal Dual problems.

Unit II
Unconstrained one dimensional optimization techniques -Necessary and sufficient conditions – Unrestricted search methods-Fibonacci and golden section method Quadratic Interpolation methods, cubic interpolation and direct root methods.

Unit III
Unconstrained n dimensional optimization techniques – direct search methods – Random search – pattern search and Rosen brooch's hill claiming method- Descent methods-Steepest descent, conjugate gradient, quasi -Newton method.

Unit IV
Constrained optimization Techniques- Necessary and sufficient conditions – Equality and inequality constraints-Kuhn-Tucker conditions-Gradient projection method-cutting plane method- penalty function method .

Text Book
1. Ashok D. Belegundu, Tirupathi R. Chandrupatla, "Optimization Concepts and Applications in Engineering", Cambridge University Press.

References
1. Rao,S.S.,‟Optimization :Theory and Application‟ Wiley Eastern Press, 2nd edition 1984.
2. Taha,H.A., Operations Research –An Introduction,Prentice Hall of India,2003.
3. Fox, R.L., „Optimization methods for Engineering Design‟, Addition Welsey, 1971.

Subject Code: CSE205264
Subject Name: Big Data

Unit I

Introduction to BigData Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error

Unit II

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 - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

Unit III

Hadoop: History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features, Hadoop environment.

Unit IV

Frameworks: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere Big Insights and Streams. Predictive Analytics- Simple linear regression- Multiple linear regression- Interpretation 5 of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.

References:

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
2. Tom White “Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.
4. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP, 2012.
5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley& sons, 2012.
6. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.
7. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.

Semester - III

Subject Code: CSE20531
Subject Name: Minor Project

Minor project to be completed under the supervision of assigned faculty member on a topic to be selected in consultation with the supervisor.

Subject Code: CSE20532
Subject Name: Parallel and Distributed Computing

UNIT I
Introduction to Parallel and Distributed Computing, Flynn's Taxonomy of Parallel Architectures: Parallel/Vector Computers, Shared Memory Multiprocessors (UMA, NUMA, COMA), Distributed Memory Multiprocessors, Multivector and SIMD computers, Data Parallel Pipelined and Systolic Architectures, Instruction set Architectures (CISC, RISC, VLIW, superpipelined, vector processors), Performance Evaluation of Computer Systems, PRAM Model of Parallel Computation, PRAM Algorithms: Parallel Reduction, List Ranking, Preorder tree traversal.

UNIT II
Interconnection Topologies and Routing for Parallel Processing Systems: Categorization of Topologies, On-Chip Interconnection Topologies, Supercomputer Interconnection Topologies: Blue Waters, Blue Gene/Q, A case Study of HPC, Topology detection, Comparison of Topologies: The Moore Bound, Routing in Static Networks: Topology independent Routing (Point-to-Point routing, Broadcasting, Gossiping), Topology dependent routing.

UNIT III
Shared Memory Programming with Pthreads (Critical Sections, Busy Waiting, Mutexes, Barriers And Condition Variables, Read-Write Locks), Shared Memory Programming with OpenMP: Cover OpenMP basics, Distributed Memory Parallel Programming: Cover MPI programming basics with simple programs and most useful directives, Collective Communication, Parallel Sorting Algorithm, Performance Evaluation of MPI programs.

UNIT IV
Advnced Topics: Introduction to OpenCL, Parallel programming with OpenACC, Introduction to Data Parrallelism and CUDA C, Distribuited Object Computing Tools: Basic Models (RMI, CORBA, DCOM), Trends and Visions (Cloud and Grid Computing, P2P computing, Autonomic Computing).

Text Books:
Advanced computer architectures, Dezso Sima (UNIT I)
Advanced computer architecture, Kai Hwang & Naresh Jotwani (UNIT I)
Parallel Programming for Multicore and Cluster systems, Thomas Rauber Gudula Runger (UNIT I)
An introduction to parallel programming, Peter S.Pacheco (UNIT III)
Tools and Environment for Parallel and Distributed Computing, Salim Hariri Manish Parashar (UNIT IV)
Programming Massively Parallel Processors, David Kirk (UNIT IV)

REFERENCES:
Interconnection Topologies and Routing for Parallel Processing Systems : Gabriele Kotsis, Technical Report Series, ACPC/TR 92-19,1992 (UNIT II)
Topology and Routing Aware Mapping on Parallel Processors, Thesis, Dept. of Mathematics & computer sciences , Sri satya sai institute of high learning (UNIT II)

Subject Code: CSE20533
Subject Name: Real-Time Operating Systems

Unit I – Introduction
Basic OS Principles and Structures review; Real-Time Systems – Basic Model, Characteristics, Hard vs. Soft, Applications; Real-Time Reference Model – Tasks and Types; Software Architectures – Petri nets, RTOS Architecture, Real-Time Kernels.

Unit II – Real Time Task Scheduling
Classification of Real-Time Scheduling Algorithms; Common Approaches; Clock Driven; Priority Driven – Earliest Deadline First, Rate Monotonic, Deadline Monotonic; Overview of Real-Time Multiprocessor Scheduling.

Unit III – Real-Time Resource Sharing/Synchronization
Resource Sharing among Real-Time Tasks – Contention and Control; Priority Inversion; Priority Inheritance Protocol; Highest Locker Protocol; Priority Ceiling Protocol.

Unit IV – Real World RTOSs
Features of RTOSs; UNIX and Windows as RTOSs – Pros and; POSIX Standard; Survey of Contemporary RTOSs – Case Study of any one, Porting to a Target; RTOS Benchmarking; RTOS Application Domains.

References
Andrew S. Tanenbaum, *Modern Operating Systems (Third Edition)*, Pearson Education.
David E. Simon, *An Embedded Software Primer*, Pearson Education.
Laplante, P., *Real-Time Systems Design and Analysis* (Third Edition), IEEE/Wiley Interscience.
Rajib Mall, *Real-Time Systems: Theory and Practice (Second Edition)*, Pearson Education.
Jane W.S. Liu, *Real-Time Systems (Sixth Edition)*, Pearson Education.
Raj Kamal, *Embedded Systems: Architecture, Programming and Design (Third Edition)*, Tata McGraw-Hill Education
Additional Reading
µC/OS II Reference manual, Programmers manual.
VXworks Programmers manual.
Getting started with RT-Linux, FSM Labs., Inc.

Subject Code: CSE20534
Subject Name: Advanced Wireless & Mobile Computing

Unit I

Classification and types of Wireless telephones. Introduction to Cordless, Fixed Wireless(WLL), Wireless with limited mobility(WLL-M) and (Fully)Mobile Wireless phones. Introduction to various generations of mobile phone technologies and future trends. Wireline vs. Wireless portion of mobile communication networks. Mobile-Originated vs. Mobile-Terminated calls. Mobile-Phone numbers vs. Fixed-Phone numbers.

Unit II

Concept of cells, sectorization, coverage area, frequency reuse, cellular networks & handoffs. Wireless Transmission concepts; types of antennas; concepts of signal propagation, blocking, reflection, scattering & multipath propagation. Comparison of multiple access techniques FDM, TDM and CDM. Concept and use of chip-sequences.

Unit III

Concept of Forward and Reverse CDMA channel for a cell/sector. Concept/derivation of Walsh codes & Code Channels within a CDMA Channel. Simplified illustration of IS-95 CDMA using chip sequences. Purpose of Pilot, Sync, Paging, Forward Traffic Channels. Purpose of Access & Reverse TCs.

Unit IV

GSM reference architecture and components of Mobile Networks: MS, BTS, BSC, MSC; their basic functions and characteristics. Use of HLR and VLR in mobile networks. Handoff scenarios in GSM. Basic Concept of OFDM and LTE technology for mobile networks.

References Books:

1. K.Pahlavan, P.Krishnamurthy, “Principles of Wireless Networks”, PHI.
2. T. Rappaport, “Wireless Communications, Principles and Practice (2nd Edition)”,Pearson.
3. Andy Dornan, “The Essential Guide to Wireless Communications Applications”, Pearson.
4. Jochen Schiller, “Mobile Communications”, Pearson.

Subject Code: CSE205351
Subject Name: Cloud Computing

UNIT I

CLOUD COMPUTING FUNDAMENTALS (8 hours) 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 (6 hours) 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

MANAGEMENT OF CLOUD SERVICES (12 hours) 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 (10 hours) Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.

REFERENCES

1. Gautam Shroff, “Enterprise Cloud Computing Technology Architecture Applications”, Cambridge University Press; 1 edition, [ISBN: 9780521137355], 2010.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing, A Practical Approach” McGraw-Hill Osborne Media; 1 edition [ISBN: 0071626948], 2009.
3. Dimitris N. Chorafas, “Cloud Computing Strategies” CRC Press; 1 edition [ISBN: 1439834539],2010.

Subject Code: CSE205352
Subject Name: Internet of Things

Unit I: Introduction to IoT
Definition & Characteristics of Iot, Physical Design of Iot, Things in Iot, Iot Protocols; Logical Design Of Iot: Iot Functional Blocks, Iot Communication Models, Iot Communication APIs; IoT Levels and Templates [8 Lectures]
Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle [4 Lectures]

Unit II: IoT Enabling Technologies and IoT challenges
Wireless Sensor Networks, Cloud Computing, Big Data Analytic, Communication Protocols, Machine to Machine, Difference between IoT and M2M, Software define Network, Embedded Systems [6 Lectures]
Design challenges, Development challenges, Security challenges, Other challenges [6 Lectures]

Unit III: IoT Architecture
Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. [4 Lectures]
Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again [2 Lectures]
Data representation and visualization, Interaction and remote control. Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things [6 Lectures]

Unit IV: Internet of Things with Arduino
Setting up the Arduino development environment: Options for Internet connectivity, Interacting with basic sensors, Interacting with basic actuators, Configuring Arduino for the IoT [4 Lectures]
Grabbing the content from a web page, Sending data to the cloud, Monitoring sensor data from a cloud dashboard, Monitoring several Arduino boards at, Storing data on Google Drive [4 Lectures]
Basic local M2M interactions, Cloud M2M with IFTTT; Case Study: IoT based Flood Monitoring and Alert System [4 Lectures]

Text Books:

1. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1stEdition, VPT, 2014. (ISBN-13: 978-8173719547)
2. Schwartz, Marco. “Internet of Things with Arduino Cookbook”. Packt Publishing Ltd, 2016.
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014. (ISBN-13: 978-0124076846)

References:

1. The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World, Michael Miller

Web resources:
http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-ofthings-1.html
https://developer.mbed.org/handbook/AnalogIn
http://www.libelium.com/50_sensor_applications/
M2MLabs Mainspring http://www.m2mlabs.com/framework
Node-RED http://nodered.org/

Subject Code: CSE205353
Subject Name: Natural Language Processing

Unit I
Introduction to Natural Language Processing, Applications of NLP, Different levels of Language Analysis, Representation and Understanding, Linguistic Background, Grammar and sentence structure, Top down parser, Bottom up chart parser, Transition Network Grammars, Finite state Models and Morphological Processing. Feature Systems and Augmented Grammars, Morphological Analysis and Lexicon.

Unit II
Grammars for Natural Language, Encoding uncertainty : Shift Reduce Parsers, A deterministic parser, Partial Parsing, Ambiguity resolution , Part of speech tagging, Probabilistic Context free grammars, Best first parsing.

Unit III
Semantics and logical form, word sense and ambiguity, Speech acts and embedded sentences, defining semantic structure Semantic Interpretation an compositionality, A simple grammar and lexicon with semantic interpretation, Lexicalized semantic interpretation and semantic roles, Semantic interpretation using feature unification.

Unit IV
Selectional restrictions, Semantic filtering, semantic networks, statistical word sense disambiguation, statistical semantic preferences, Combining approaches to disambiguation. Grammatical relations, Semantic grammars, template matching, semantically driven parsing techniques, scooping phenomenon, co-reference and binding constraints.

REFERENCES
Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming.
Charniack, Eugene, Statistical Language Learning, MIT Press,.
Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.
Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press.

Subject Code: CSE205354
Subject Name: Block Chain

To be Taught using Research Papers

Semester – IV

Subject Code: CSE20541 to CSE20545
Subject Name: Major Project

Major project to be completed under the supervision of assigned faculty member on a topic to be selected in consultation with the supervisor.