आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

NAAC ACCREDITED

IFTM UNIVERSITY

N.H.-24 Lodhipur Rajput, Delhi Road, Moradabad, Uttar Pradesh- 244102

www.iftmuniversity.ac.in

Study & Evaluation Scheme of
Master of Technology
[Session 2020-21]

Programme:	**Computer Science & Engineering**
Course Level:	**PG Degree**
Duration:	**Two Years (Four Semesters)**
Medium of Instructions:	**English**
Minimum Required Attendance:	**75%**
Maximum Credit:	**65**

Programme Outcomes (POs):

On completion of the programme the graduates will

1. be able to apply the knowledge of computing tools and techniques in the field of areas such as Big Data, Network security, Image processing for solving real world problems encountered in the Software Industries.
2. be able to analyze various technologies & tools associated with MATLAB, NS-2,Netsim
3. be able to identify the challenges with respect to IT Industry and pursue quality research in this field with social relevance.

Course Structure & Evaluation Scheme

BRANCH: M.Tech. in Computer Science & Engineering
(Effective from Session 2018-19)

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YEAR: I **SEMESTER: I**

S.NO	COURSE CODE	SUBJECT	PERIODS			SESSIONAL				ESE	TOTAL	CREDITS
			L	T	P	TA	AT	CT	Total			
1.	MCS101	Advanced Distributed Systems	3	1	0	5	5	10+10	30	70	100	4
2.	MCS102(A)	Elective –I	3	1	0	5	5	10+10	30	70	100	4
3.	MCS103	Advanced Computer Architecture	3	1	0	5	5	10+10	30	70	100	4
4.	MCS104	Foundation in Computer Science	3	1	0	5	5	10+10	30	70	100	4
PRACTICALS/Seminar/Projects												
5.	MCS155	Computer System Lab-1	0	0	2	10	10	30	50	50	100	2
											500	18

YEAR: I **SEMESTER: II**

S.NO	COURSE CODE	SUBJECT	PERIODS			SESSIONAL				ESE	TOTAL	CREDITS
			L	T	P	TA	AT	CT	Total			
1.	MCS201	Advanced Computer Networks	3	1	0	5	5	10+10	30	70	100	4
2.	MCS202	Machine Vision and Image Processing	3	1	0	5	5	10+10	30	70	100	4
3.	MCS203	Soft Computing	3	1	0	5	5	10+10	30	70	100	4
4.	MCS204(B)	Elective-II	3	1	0	5	5	10+10	30	70	100	4
PRACTICALS/Seminar/Projects												
5.	MCS255	Computer System Lab-2	0	0	2	10	10	30	50	50	100	2
											500	18

Year: II **Semester-III**

S.NO	COURSE CODE	SUBJECT	PERIODS			SESSIONAL				ESE	TOTAL	CREDITS
			L	T	P	TA	AT	CT	Total			
1.	MCS301(C)	Elective III	3	1	0	5	5	10+10	30	70	100	4
2.	MCS302(D)	Elective IV	3	1	0	5	5	10+10	30	70	100	4
3.	MCS303	Independent Study and Seminar	0	0	2	10	10	80	100	--	100	2
PRACTICALS/Seminar/Projects												
4.	MCS354	Pre-Dissertation	0	0	2	10	10	30	50	150	200	4
											500	14

Year: II **Semester: IV**

S.NO	COURSE CODE	SUBJECT	PERIODS			SESSIONAL				ESE	TOTAL	CREDITS
			L	T	P	TA	AT	CT	Total			
PRACTICALS/Seminar/Projects												
1.	MCS451	Dissertation	0	0	30	150	50	150	350	150	500	15

List of Electives (CSE)

Elective-I

COURSE CODE	NAME OF THE ELECTIVE
MCS102(1)	Advanced Algorithms
MCS102(2)	Computational Geometry
MCS102(3)	Parallel Algorithm

Elective II

COURSE CODE	NAME OF THE ELECTIVE
MCS204(1)	Object Oriented Software Modeling
MCS204(2)	Game Theory
MCS204(3)	System Security

Elective III

COURSE CODE	NAME OF THE ELECTIVE
MCS301(1)	Data Mining & Warehousing
MCS301(2)	Natural Language Processing
MCS301(3)	Intelligent Systems

Elective IV

COURSE CODE	NAME OF THE ELECTIVE
MCS302(1)	Process Engineering
MCS302(2)	Digital Forensic
MCS302(3)	Complexity Theory

IFTM University, Moradabad
Master of Technology (M.Tech) Computer Science & Engineering
M.Tech I[st] Year (I Semester)
(Effective from the session 2018-19)

MCS 101 ADVANCED DISTRIBUTED SYSTEMS L:T:P: 3:1:0

OBJECTIVES:

1. Study software components of distributed computing systems. Know about the communication and interconnection architecture of multiple computer systems.
2. Recognize the inherent difficulties that arise due to distributedness of computing e sources. Understanding of networks & protocols, mobile & wireless computing and their applications to real world problems.
3. At the end students will be familiar with the design, implementation and security issues of distributed system.

Unit–I

Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. System Models: Architectural models, Fundamental Models Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's & vectors logical clocks, Causal ordering of messages, global state, termination detection. Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non-token based algorithms, performance metric for distributed mutual exclusion algorithms.

Unit–II

Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms. Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system.

Unit–III

Distributed Objects and Remote Invocation: Communication between distributed objects, Remote procedure call, Events and notifications. Security: Overview of security techniques, Cryptographic algorithms, Digital signatures Cryptography pragmatics, Case studies: Needham Schroeder, Kerberos, SSL & Millicent. Distributed File Systems: File service architecture, Sun Network File System, The Andrew File System and recent advances.

Unit–IV

Transactions and Concurrency Control: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control. Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.

Unit–V

Distributed Algorithms: Introduction to communication protocols, Balanced sliding window protocol, Routing algorithms, Destination based routing, APP problem, Deadlock free Packet switching, Introduction to Wave & traversal algorithms, Election algorithm. Case Studies: CORBA and RMI.

COURSE OUTCOMES:

After successful completion of this course, student will be able to

- Understand the concepts and issues related to distributed systems.
- Design and develop the programs for distributed environment.
- Manage performance, reliability and other issues while designing in distributed environment.

SUGGESTED READINGS:

1. Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
2. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design" Pearson Ed.
   - Gerald Tel, "Distributed Algorithms", Cambridge University Press

SUGGESTED WEBSITES:

1. swayam.gov.in
2. https://particular.net/adsd
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/

Note: Adhere to the latest editions of the Suggested Readings

MCS 103 ADVANCED COMPUTER ARCHITECTURE L:T:P: 3:1:0

OBJECTIVES:

1. Study basic computer organization, design and micro-operations.
2. Understanding of CPU functioning and computer arithmetic.
3. Learning various methods and techniques of memory organization.

Unit-I

Parallel computer models: The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multifactor and SIMD computers.

Program and network properties: Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit II

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Unit III

Arithmetic for computers: Signed and unsigned Numbers, Addition and Subtraction, Multiplication, Division, Floating Point. CPU Performance and Its factors, evaluating performance of CPU.

Unit IV

Memory Hierarchy: Introduction, The basics of Cache, Measuring and Improving of Cache Performance, Virtual Memory, Common framework for memory hierarchies

Unit V

Enterprise Memory subsystem Architecture: Enterprise RAS Feature set: Machine check, hot add/remove, domain partitioning, memory mirroring/migration, patrol scrubbing, fault tolerant system.

COURSE OUTCOMES:

Students will be able to:

1. To describe basic structure of the computer system.
2. To demonstrate the arithmetic algorithms for solving ALU operations.
3. To describe instruction level parallelism and hazards in typical processor pipelines.
4. To describe superscalar architectures, multi-core architecture and their advantages
5. To demonstrate the memory mapping techniques.
6. To identify various types of buses, interrupts and I/O operations in a computer system

SUGGESTED READINGS:

1. Kai Hwang, “Advanced computer architecture”; TMH. 2000
2. D. A. Patterson and J. L. Hennessey, “Computer organization and design”, Morgan Kaufmann, 2nd Ed. 2002
3. M. Morris Mano, “Computer System Architecture”, PHI 3rd Ed. 2004

SUGGESTED WEBSITES:

1. http://cs.baylor.edu/~maurer/aida/courses/archintro.pdf.
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 104 FOUNDATION IN COMPUTER SCIENCE L:T:P: 3:1:0

OBJECTIVES:

1. To understand the basics of computer system, its architecture, database and Networks.
2. To understand the basic concepts, terminology of IT and familiar with the use of IT tools.
3. To Learn and explore new IT techniques in various applications and to identify the issues related to security.

Unit I

Data Structure and Algorithms: Algorithm Complexity, Arrays, Linked list, Stack, Queue, Tree, Graphs. Hash Table, Hash Functions, Collision Resolution Techniques, and Hash Table Implementation, Huffman algorithm. Search and Sorting algorithms, B-trees, Divide and Conquer with examples such as Sorting, Greedy Knapsack, Matrix Chain Multiplication

Unit II

Theory of Automata: Introduction to defining language, Kleene closures, Finite Automata (FA), Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA), Construction of DFA from NFA and optimization, FA with output: Moore machine, Mealy machine and Equivalence, Applications and Limitation of FA, Context free grammar: Ambiguity, Simplification of CFGs, Normal forms for CFGs, Pumping lemma for CFLs, Push Down Automata, Introduction to Turing Machine.

Unit III

Discrete Mathematics: Set Theory proofs of some general identities on sets, Relation: Types of relations, composition of relations, equivalence relation, and partial ordering relation. Functions: various type of functions, one to one, into and onto function, inverse function, composition of functions, recursively defined functions. Pigeon-hole principle, Algebraic Structures.

Unit IV

Computer Network: Introduction Concepts: The OSI reference model, services, Local Access Network Design, Physical Layer, Transmission Media, Switching methods, ISDN, Terminal Handling. Medium Access sub layer, LAN protocols, Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling, Network Layer, Internetworking -TCP / IP, IP packet, IP address, IPv6.

Unit V

Operating System: Concurrent Processes, Semaphores, Test and Set operation; Inter Process Communication models and Schemes, CPU Scheduling: Performance Criteria, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling, Deadlock, Prevention, Avoidance and detection, Recovery from deadlock. Memory Management: Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging.

COURSE OUTCOMES:

Students who successfully complete this course will be able to:

1. Understand various Types Data Structure and Algorithms.
2. Understand about Theory of Automata
3. Understand about Discrete Mathematics.
4. Understand about Discrete Mathematics.
5. Understand about Computer Network
6. Understand about Operating System

SUGGESTED READINGS:

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley
2. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, Printice Hall of India
3. Forouzen, "Data Communication and Networking", TMH
4. B. Kolman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, Prentice Hall
5. K.L.P. Mishra and N. Chandrasekaran, “Theory of Computer Science : Automata, Languages and Computation”, PHI

SUGGESTED WEBSITES:

1. https://www.intostudy.com/en/universities/city-university-london/courses/international-foundation-in-computer-science
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

Master of Technology (M.Tech) Computer Science & Engineering
M.Tech Ist Year (II Semester)

MCS 201 ADAVANCED COMPUTER NETWORK L:T:P: 3:1:0

OBJECTIVES:

1. To understand the fundamental concepts of computer networking and provide the knowledge of different protocols at different layers of models.
2. To understand the techniques used to share network bandwidth among the multiple users and provide the depth knowledge of DLL fundamentals.
3. Learn how the data is transferred between the computers over the network.

Unit I

Review of Physical Layer, Data link layer, LAN Technologies, ISDN, Frame-relay & ATM, Data link Protocol.

Unit II

Network Layer: ARP, RARP, ICMP, Routing Algorithms and Protocols, Router Operation, Router Configuration, Internetworking, IPv4 Protocol, IPv6 (an overview).

Unit III

User Datagram Protocol: Header, Checksum and Port Numbers. Transmission Control Protocol: Services and Headers, Connection establishment and Termination, Timeout of Connection Establishment and TCP timeout and retransmission, Maximum Segment Size, Reset Segments, TCP options.

Unit IV

Application Layer: DNS, SNMP, RMON, Electronic Mail, WWW, Network Security: Firewalls (Application and Packet Filtering), Virtual Private Network, And Cryptography

Unit V

Case study:

Study of various network simulators, Network performance analysis using NS2

COURSE OUTCOMES:

Students will be able to:

1. Demonstrate the understanding of advance data communication technologies.
2. Demonstrate the understanding of WAN Technology typically ATM.
3. Demonstrate the understanding of packet switching protocols such as X.25, X.75.
4. Explore the issues of advance internet routing protocols and also QoS based protocols.
5. Analyze issues of traffic requirements and perform capacity planning.
6. Demonstrate the understanding of protocol used for management of network.

SUGGESTED READINGS:

1. Black U, “Computer Networks-Protocols, Standards and Interfaces”, PHI, 1996.
2. Stallings W., “Data and Computer Communications”, 6th Ed., PHI, 2002.
3. Stallings W., “SNMP, SNMPv2, SNMPv3, RMON 1 & 2”, 3rd Ed., Addison Wesley,1999.
4. Laurra Chappell (Ed), “Introduction to Cisco Router Configuration”, Techmedia,1999.
5. Behrouz A. Forouzan, “TCP/IP Protocol Suit”, TMH, 2000.
6. Tananbaum A. S., “Computer Networks”, 3rd Ed., PHI, 1999.

SUGGESTED WEBSITES:

1. https://lecturenotes.in/subject/955/advanced-computer-network-acn/note
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 202 MACHINE VISION AND IMAGE PROCESSING L:T:P: 3:1:0

OBJECTIVES:

1. Understand the mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement.
2. Understand the mathematical principles of image restoration, image compression, and image segmentation.
3. Develop a theoretical foundation of fundamental concepts of digital image processing.

Unit I

Digital Image Fundamentals: - Digital image Representation – Functional **Unit**s of an Image processing system. Visual perception – Image Model _ Image sampling and Quantization – grayscale resolution – pixel relationship – image geometry. Image Transforms – **Unit**ary Transform, Discrete Fourier Transform, Cosine Transform, Sine Transform, Hadamard Transform, Slant and KL Transform.

Unit II

Image Enhancement – Histogram processing – Spatial operations – Image smoothing –Image Sharpening – Color Image Processing methods- Color Image Models

Unit III

Image restoration and compression Degradation Model – Discrete Formulation – Circulant matrices – Constrained and Unconstrained restoration geometric transformations fundamentals – Compression Models – Error Free Compression – Lossy Compression – International Image Compression Standards.

Unit IV

Image Analysis and Computer Vision: Spatial feature Extraction – Transform feature –Edge detection-Boundary Representation-Region Representation-Moment Representation-Structure-Shape Features-Texture-Scene Matching and Detection-Image Segmentation-Classification techniques-Morphology-Interpolation.

Unit V

Sensing 3D shape: how the 3rd dimension changes the problem. Stereo 3D description, 3Dmodel, matching, TINA. Direct 3D sensing-structured light, range finders, range image segmentation. Emerging IT applications: Recognition of characters, Fingerprints and faces-Image databases.

COURSE OUTCOMES:

Students will be able to:

1. Gain knowledge about basic concepts of Machine Learning
2. Identify machine learning techniques suitable for a given problem
3. Solve the problems using various machine learning techniques
4. Apply Dimensionality reduction techniques.
5. Design application using machine learning techniques

SUGGESTED READINGS:

1. Fundamentals of Digital Image Processing-A.K.Jain
2. Image Processing and machine vision-Milan Sonka,Vaclav Hlavae
3. Pattern Recognition Principles-J.T. Tou and R.C.Gonzalez
4. Syntactic Pattern Recognition and applications.-King Sun Fun
5. Computer vision-Fairhurst (PHI).
6. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 2nd Ed, Pearson Edu, 2004
7. A.K. Jain, "Fundamental of Digital Image Processing", PHI. 2003

SUGGESTED WEBSITES:

1. https://staff.fnwi.uva.nl/r.vandenboomgaard/IPCV20172018/LectureNotes/index.html
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 203 **SOFT COMPUTING** **L:T:P: 3:1:0**

OBJECTIVES:

1. Understand basics of fuzzy system, genetic algorithms & their relations.
2. Learn artificial neural networks, models 7 their functions.
3. Apply genetic algorithms & artificial neural networks as computation tools to solve a variety of problems in various areas of interest ranging from optimization problems to text analytics.

Unit I

Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Unit II

Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

Unit III

Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers,

Uncertainty based Information: Information & Uncertainty, No specificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

Unit IV

Introduction of Neuro-Fuzzy Systems: Architecture of Neuro Fuzzy Networks.

Application of Fuzzy Logic: Medicine, Economics etc.

Unit V

Genetic Algorithm: An Overview, GA in problem solving, and Implementation of GA

COURSE OUTCOMES:

Students will be able to:

1. Ability to analyze and appreciate the applications which can use fuzzy logic.
2. Ability to design inference systems.
3. Ability to understand the difference between learning and programming and explore practical applications of Neural Networks (NN).
4. Ability to appreciate the importance of optimizations and its use in computer engineering fields and other domains.
5. Students would understand the efficiency of a hybrid system and how Neural Network and fuzzy logic can be hybridized to form a Neuro-fuzzy network and its various applications.

SUGGESTED READINGS:

1. "Introduction to the Theory of Neural Computation", Hertz J. Krogh, R.G. Palmer, Addison-Wesley, California, 1991.
2. "Fuzzy Sets & Fuzzy Logic", G.J. Klir & B. Yuan, PHI, 1995.
3. "An Introduction to Genetic Algorithm", Melanie Mitchell, PHI, 1998.
4. "Soft computing and Intelligent System Design", F. O. Karray and C. de Silva, Pearson, 2009.
5. "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
6. "Neural Networks: Algorithms, Applications and Programming Techniques", Freeman J.A. & D.M. Skapura, Addison Wesley, Reading, Mass, (1992).

SUGGESTED WEBSITES:

1. https://lecturenotes.in/subject/124/soft-computing-sc
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

ELECTIVES

MCS 102(1) ADVANCED ALGORITHMS L:T:P: 3:1:0

OBJECTIVES:

Course objectives:

Upon completion of this course, students will be able to do the following:

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations.

Unit I

Recurrences - Master Method, Probability, AVL Trees, Red-Black Trees, Augmenting Data Structures

Unit II

Amortized Analysis, Optimal Binary Search Trees, Priority Queues, Binomial Heaps, Fibonacci Heaps. Medians/Selection

Unit III

Graph Algorithms Minimum Spanning Trees, Brief review of Prim, Kruskal's Algorithm, Max-Flow/Bipartite Matching, Preflow-push methods, Vertex and edge connectivity, Depth-First Search, Biconnected Components

Unit IV

String Matching, Knuth-Morris-Pratt Algorithm, Rabin-Karp Algorithm, Suffix Trees. Matrices: Strassen's Matrix Multiplication

Unit V

Computational Geometry, Intractability, Sample Intractable Problems, Complexity Classes, Reductions, Polynomial-Time Approximation, Parallel Algorithms/P-Completeness*

COURSE OUTCOMES:

Students will be able to:

1. Describe analysis techniques for algorithms.
2. Identify appropriate data structure and design techniques for different problems
3. Identify appropriate algorithm to be applied for the various application like geometric modeling, robotics, networking, etc.
4. Appreciate the role of probability

SUGGESTED READINGS:

1. S. Baase, Computer Algorithms, Introduction to Design and Analysis, 2nd edition, Addison-Wesley, 1988.
2. R.L. Graham, D.E. Knuth, and O. Patashnik. Concrete Mathematics, Addison-Wesley, 1989.
3. D. Gusfield. Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, Cambridge University Press, 1997.
4. D. Gusfield and R. Irving. The Stable Marriage Problem: Structure and Algorithms, MIT Press, 1989.
5. E. Horowitz and S. Sahni. Fundamentals of Computer Algorithms, Computer Science Press, 1978.
6. D.E. Knuth, The Art of Computer Programming, Vols. 1 and 3, Addison-Wesley
7. Cormen, Leiserson, Rivest, Introduction to Algorithms, MIT Press, 1990.

SUGGESTED WEBSITES:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-854j-advanced-algorithms-fall-2008/lecture-notes/
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 102(2) **COMPUTATIONAL GEOMETRY** **L:T:P: 3:1:0**

OBJECTIVES:

The participants will after the course have detailed knowledge of the fundamental problems within computation geometry and general techniques for solving problems within computational geometry and practical experience with implementation issues involved in converting computation geometry algorithms into running programs.

Unit I

Convex Hulls: construction in 2d and 3d, lower bounds, Triangulations: Polygon Triangulations, Representations, Point-set Triangulations and Planer Graphs.

Unit II

Voronoi diagrams: construction and applications, variants, Delayney triangulations: Divide and conquer, flip and incremental algorithms, duality of Voronoi diagrams, min max angle properties.

Unit III

Geometric Searching: point-location, fractional cascading, linear programming with prune and search, finger trees, concatenable queues, segment trees, interval trees, Visibility: algorithm for weak and strong visibility, visibility with reflections, art gallery problems.

Unit IV

Arrangements of lines: arrangements of hyper planes, zone theorems, many-faces complexity and algorithms, Combinatorial Geometry: Ham sandwich cuts.

Unit V

Sweep Techniques: plane sweep for segment intersections, Fortune's sweep for Voronoi diagrams, and topological sweep for line arrangements, and randomization for computational Geometry: algorithms, techniques for counting, Robust geometric computing, Applications of computational geometry.

COURSE OUTCOMES:

The participants must at the end of the course be able to:

1. Construct algorithms for simple geometrical problems.
2. Implement computational geometry algorithms.

SUGGESTED READINGS:

1. France P. Preparata, Mical Ian Shamos, "Computational Geometry; An introduction" Springer Verlag.
2. Mark Berg, Mark Van Kreveld, Mark Overmars and Otfried Schwarzkopf, "Computational Geometry: Algorithms and Applications", Springer.

SUGGESTED WEBSITES:

1. https://ocw.mit.edu/courses/mechanical-engineering/2-158j-computational-geometry-spring-2003/lecture-notes/
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 102(3) PARALLEL ALGORITHMS L:T:P: 3:1:0

OBJECTIVES:

The course provides a modern introduction to design, analysis and implementation of sequential and parallel algorithms. In particular, the course is based on a pragmatic approach to parallel of message-passing algorithms through the C language and the MPI library.

Unit I

Sequential Models, 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 measure 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 Algorithms, K^{th} 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 Graph, Search and Traversal, Combinatorial Algorithms- Permutations and Combinations, Derangements.

COURSE OUTCOMES:

After the course the student should be able to

1. Describe and use the main design techniques for sequential algorithms;
2. Design, prove the correctness and analyze the computational complexity of sequential algorithms;
3. Understand the differences among several algorithms solving the same problem and recognize which one is better under different conditions;
4. Describe and use basic sequential algorithms;
5. Describe and use basic data structures; know about the existence of advanced data structures;
6. Understand the difference between sequential and parallel algorithms; Design, implement and analyze message-passing based parallel algorithms in C using the MPI library;
7. Describe and use basic parallel algorithms.

SUGGESTED READINGS:

1. M J Quinn, “Designing efficient Algorithms for parallel Computer” by Mc Graw Hill.
2. S.G. Akl, “Design and Analysis of Parallel algorithms”.
3. S.G. Akl “Parallel sorting Algorithm” by Academic Press.

SUGGESTED WEBSITES:

1. https://lecturenotes.in/subject/282/parallel-algorithms
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 204(1) OBJECT ORIENTED SOFTWARE MODELING L:T:P: 3:1:0

OBJECTIVES::

1. To understand the object oriented concepts for designing object oriented models.
2. To understand the use of UML (Unified Modeling Language) for object oriented analysis and design.
3. To describe the step by step object oriented methodology of software development from problem statement through analysis, system design, and class design.
4. To understand the issues for implementing object oriented designs or models.
5. To understand the concept of different patterns for constructing software architectures through object oriented models.
6. To understand the problems, communicating with application experts, modeling enterprises, preparing documentation, and designing programs by using object oriented models.

Unit I

Review of Object Orientation: Class and objects, effect of inheritance on polymorphism and variable declarations, concepts that define object orientation.

Unit II

Requirements: Developing requirements, reviewing requirements, managing requirements, Difficulties and risks in domain and requirement analysis, requirement documents, Case studies and discussion on the above topics.

Unit III

Unified Modeling Languages: Visual modeling with UML, Use case model- use case, actor, and roles, Modeling with classes – association, multiplicity, generalization, process of creating class diagram – difficulties and risks in creating class diagram. Modeling interaction and behavior – interaction diagrams, state diagram and activity diagram, implementing classes based on interaction and state diagram- difficulties and risks in modeling interactions and behavior.

Unit IV

Architecting and Designing Software: The process of design, design principles, architectural patterns, design document, difficulties and risks in design. Frameworks: reusable subsystem. Design patterns – Singleton, observer, adapter, Façade, proxy with examples.

Unit V

Implementation, Usability, Testing and Quality: Mapping models to Code, Mapping Object Model to Database Schema Usability Principles- user interface design evaluating user interfaces Testing and Quality – strategies, defects, test cases and test plan, inspections, quality assurance.

COURSE OUTCOMES:

1. Demonstrate the ability to apply the knowledge of object oriented concepts for solving system modeling and design problems.
2. Design and implement object oriented models using UML appropriate notations.
3. Ability to apply the concepts of object oriented methodologies to design cleaner software from the problem statement.
4. Apply the concept of domain and application analysis for designing UML Diagrams.
5. Comprehend the concept of architectural design approaches for system design and implementation issues for object oriented models. 6. Illustrate the concept of patterns for constructing software architectures.

SUGGESTED READINGS:

1. Timothy C. Lethbridge, Robert Laganiere “Object-Oriented Software Engineering– A practical software development using UML and Java”, Tata McGraw-Hill, New Delhi.
2. Mike O’Docherty “Object-Oriented Analysis & design – understanding system development with UML 2.0”, John Wiley.
3. Bernd Bruegge, “Object oriented software engineering”, Second Edition, Pearson Education.
4. Stephan R. Schach, “Object oriented software engineering”, Tata McGraw Hill
5. Booch, Jacobson, Rumbagh, “The UML user Guide”, Pearson Education
6. Ali Bahrami, “Object Oriented System Development”, McGraw Hill.
7. David William Brown, “An Introduction to Object Oriented Analysis Objects and UML in Plain English”, 2nf Edition, Wiley.

SUGGESTED WEBSITES:

1. https://lecturenotes.in/subject/807
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 204(2) **GAME THEORY** **L:T:P: 3:1:0**

OBJECTIVES:

Upon successful completion of this course, the student will be able to:

1. Define the basics of a "game", Translate the basic of a "game" into a wide range of conflicts , Analyze conflict dynamics from the standpoint of rationality, Evaluate conflict dynamics from the standpoint of the self interests of the "Players" ,Integrate increasing analytical skills into increasingly complex conflicts ,Theorize possible and probable strategies where information is incomplete ,Appraise theoretical predictions obtained from Game Theory analyses against real world conflicts
2. Formulate strategic alternatives which take into account the actions of others ,Identify Nash Equilibria in various everyday settings ,Recognize the classic "Prisoners' Dilemma" ,Appraise the application of Prisoners' Dilemma to a variety of real-world conflicts, Evaluate Game Theory principles in workplace settings.

Unit I

Introduction to Non Co-operative Game Theory: Extensive Form Games, Strategic Form Games, Pure Strategy Nash Equilibrium

Unit II

Non co-operative Game Theory (in detail), Mixed Strategies, Existence of Nash Equilibrium, Computation of Nash Equilibrium, Two Player Zero-Sum Games, Bayesian Games

Unit III

Mechanism Design: An Introduction, Dominant Strategy Implementation of Mechanisms, Vickrey-Clorke-Groves Mechanisms, Bayesian Implementation of Mechanisms, Revenue Equivalence Theorem, Design of Optimal Mechanisms

Unit IV

Cooperative Game Theory, Correlated Strategies, Correlated Equilibria, The Two Person

Unit V

Bargaining Problem, Games in Coalitional Form, The Core Shapley Value, Other Solution Concepts for Co-operative Games

COURSE OUTCOMES:

Game theory provides a mathematical framework for understanding the optimal outcome and what the tradeoffs are to achieve that outcome. We build models using game theory to help our clients make strategic and tactical decisions within the context of many possible scenarios and competitive responses.

SUGGESTED READINGS:

1. Roger B. Myerson. Game Theory: Analysis of Conflict. Harvard University Press, September 1997.
2. Andreu Mas-Colell, Michael D. Whinston, and Jerry R. Green. Microeconomic Theory. Oxford University Press, New York, 1995.
3. Martin J. Osborne, Ariel Rubinstein. A Course in Game Theory. The MIT Press, August 1994.
4. Philip D. Straffin, Jr. Game Theory and Strategy. The Mathematical Association of America, January 1993.
5. Ken Binmore, Fun and Games: A Text On Game Theory, D. C. Heath & Company, 1992.
6. Paul Klemperer, Auctions: Theory and Practice, The Toulouse Lectures in Economics, Princeton University Press, 2004.

SUGGESTED WEBSITES:

1. http://home.ku.edu.tr/~lkockesen/teaching/econ333/uggame_lect.htm
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 204(3) SYSTEM SECURITY L:T:P: 3:1:0

OBJECTIVES:

1. To explain how communication works in computer networks and to understand the basic terminology of computer networks
2. To explain the role of protocols in networking and to analyze the services and features of the various layers in the protocol stack.
3. To understand design issues in Network Security and to understand security threats, security services and mechanisms to counter them.

Unit I

Introduction: Classical security Techniques and Computer Network Security Concepts. Confidentiality and Security, Security Policy and Operations Life Cycle, Security System Development and Operations

Unit II

Secure Networking Threats: The Attack Process. Attacker Types. Vulnerability Types. Attack Results. Attack Taxonomy. Threats to Security: Physical security, Biometric systems, monitoring controls, and Data security and intrusion and detection systems.

Encryption Techniques: Conventional techniques, Modern techniques, DES, DES chaining, Triple DES, RSA algorithm, Key management. Message Authentication and Hash Algorithm, Authentication requirements and functions secure Hash Algorithm, Message digest algorithm, digital signatures. AES Algorithms.

Unit III

Designing Secure Networks: Components of a Hardening Strategy. Network Devices. Host Operating Systems. Applications. Appliance-Based Network Services. Rogue Device Detection, Network Security Technologies The Difficulties of Secure Networking. Security Technologies. Emerging Security Technologies General Design Considerations, Layer 2 Security Considerations. IP Addressing Design Considerations. ICMP Design Considerations. Routing Considerations. Transport Protocol Design Considerations

Unit IV

Network Security Platform Options: Network Security Platform Options. Network Security Device Best Practices, Common Application Design Considerations. E-Mail. DNS. HTTP/HTTPS. FTP. Instant Messaging.

IPsec VPN Design Considerations: VPN Basics. Types of IPsec VPNs. IPsec Modes of Operation and Security Options. Topology Considerations. Design Considerations. Site-to-Site Deployment Examples.

Unit V

Secure Network Management and Network Security Management: Organizational Realities. Protocol Capabilities. Tool Capabilities. Secure Management Design Options. Network Security Management, Firewalls, Trusted systems and IT act and cyber laws.

COURSE OUTCOMES::

Successful completion of the program, candidates will be familiar with cyber security landscapes and able to

1. Analyze and evaluate the cyber security needs of an organization.
2. Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
3. Measure the performance and troubleshoot cyber security systems.
4. Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.
5. Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators
6. Design and develop security architecture for an organization.
7. Design operational and strategic cyber security strategies and policies.

SUGGESTED READINGS:

1. Sean Convery, “Network Security Architectures, Published by Cisco Press, First Ed. 2004
2. William Stalling “Cryptography and Network Security” Fourth Ed., Prentice Hall, 2006
3. Charles P. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing” 3rd Edition, Prentice Hall, 2003
4. Jeff Crume “Inside Internet Security” Addison Wesley, 2003

SUGGESTED WEBSITES:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-858-computer-systems-security-fall-2014/lecture-notes/
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

Master of Technology (M.Tech) Computer Science & Engineering
M.Tech 2nd Year (III Semester)

MCS 301(1) DATA MINING AND WAREHOUSING L:T:P: 3:1:0

OBJECTIVES:

1. To understand the basic principles, concepts and applications of data warehousing and data mining,
2. Ability to do Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
3. Have a good knowledge of the fundamental concepts that provide the foundation of data mining.

Unit I

Data Warehousing: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting.

Unit II

Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.

Unit III

Overview, Motivation (for Data Mining),Data Mining-Definition & Functionalities, Data Processing, Form of Data Preprocessing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.

Unit IV

Concept Description: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases.

Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical class Description, Mining Association Rules in Large Databases, Association rule mining, mining Single-Dimensional Boolean Association rules from Transactional Databases– Apriori Algorithm, Mining Multilevel Association rules from Transaction Databases and Mining Multi-Dimensional Association rules from Relational Databases

Unit V

Classification and Predictions: What is Classification & Prediction, Issues regarding Classification and prediction, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network, Back propagation Algorithm, Classification methods K-nearest neighbor classifiers, Genetic Algorithm.

Cluster Analysis: Data types in cluster analysis, Categories of clustering methods, Partitioning methods. Hierarchical Clustering- CURE and Chameleon, Density Based Methods-DBSCAN, OPTICS, Grid Based Methods- STING, CLIQUE, Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis

COURSE OUTCOMES:

1. Understand the functionality of the various data mining and data warehousing component Knowledge, Understand
2. 2 Appreciate the strengths and limitations of various data mining and data warehousing models Apply, Create
3. 3 Explain the analyzing techniques of various data Analyze
4. 4 Describe different methodologies used in data mining and data ware housing. Analyze
5. 5 Compare different approaches of data ware housing and data mining with various technologies

SUGGESTED READINGS:

1. M.H.Dunham,"Data Mining:Introductory and Advanced Topics" Pearson Education
2. Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques" Elsevier
3. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World : A Practical Guide for Building Decision Support Systems, Pearson Education
4. Mallach,"Data Warehousing System",McGraw –Hill

SUGGESTED WEBSITES:

1. https://lecturenotes.in/subject/32/data-mining-and-data-warehousing-dmdw
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 301(2) NATURAL LANGUAGE PROCESSING L:T:P: 3:1:0

OBJECTIVES:

1. Teach students the leading trends and systems in natural language processing.
2. Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
3. Teach them to recognize the significance of pragmatics for natural language understanding.
4. Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Unit I

Introduction to NLP, Achievement and brief history, open problems, major goal, characteristic of Language, Language structure, Language analyzer

Unit II

Study of grammar and semantics Morphology, word formation, theory of semantics, componential theory of meaning, truth conditional theory of meaning, pragmatics and discourse

Unit III

Machine translation Introduction, problems of machine translation. Approaches, language Accesor, Structure of Anusaraka system.

Unit IV

Lexical; functional grammar (LFG) and Indian languages, Overview of LGF, LFG formalism, well formedness conditions, computational aspects, CFG and Indian languages, functional specification, tree adjoining grammar.

Unit V

Tagging (introduction), Estimating the Parameters of HMMs, the Forward-Backward Algorithm. Implementation Issues. The task of Tagging. Tagsets, Morphology, Lemmatization, Tagging methods. Manually designed Rules and Grammars. Statistical Methods (overview).

COURSE OUTCOMES:

After successful completion of this course, student will be able to

1. Understand approaches to syntax and semantics in NLP.
2. Understand approaches to discourse, generation, dialogue and summarization within NLP.
3. Understand current methods for statistical approaches to machine translation.
4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP

SUGGESTED READINGS:

1. Natural language processing by Akshar Bhartati, Sangal and Chaitanya, Eastern Economy Edition, PHI Learning.
2. An introduction to Linguistics, language grammar and semantics by P Syal, and D.V.Jindal, Eastern Economy Edition, New Delhi: PHI, 2007.
3. Natural Language Processing by Zurafsky, Pearson.

SUGGESTED WEBSITES:

1. https://lecturenotes.in/subject/371/natural-language-processing-nlp
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 301(3) INTELLIGENT SYSTEMS L:T:P: 3:1:0

OBJECTIVES:

1. Understand the framework of MIS organization and approaches in development of MIS. Understand the basics of data representation and the computer hardware required in information system. Apply the criteria for Investment in hardware and software to solve practical problems.
2. Know the role of software in problem solving and applications of expert system and neural networks. Design the important components to support the decision making processes in an Executive Support system. Apply the latest techniques in artificial and computational intelligence that can be used to facilitate decision making processes. Understand office automation.
3. Possess the knowledge to evaluate the different commercially available or public domain tools that can be used to tackle specific problems related to business decision making. Possess the ability to understand and decide if future new techniques in artificial and computational intelligence can be used to solve different practical business problems.

Unit I

Intelligent Agents: Introduction, How agents should act, structure: Table-driven, Simple reflex, Goal-based, Utility-based, Agents that keep track of world, Environments.

Unit II

Problem Formulation: Problem solving, formulating problems: Knowledge and problem types, Well-defined problems and solutions, Measuring problem-solving performance, Choosing states and actions.

Unit III

Search Methods: Searching for solutions, Search strategies: Time, space, optimality and completeness issues. Un-informed search methods: Breadth-first, Depth-first, Iterative deepening, Bidirectional search, Avoiding repetitions, Constraint satisfaction search.

Unit IV

Informed search methods: Best first search: Greedy search, A*, Heuristic functions, Memory bounded search: IDA*, SMA*. Iterative improvement algorithms: Hill climbing, Simulated annealing, Application in CSPs.

Unit V

Uncertain Knowledge and Reasoning: Uncertainty, Probabilistic Reasoning Systems, Making simple decisions, Making complex decisions. Reasoning: Agents that reason logically, First-order logic, Inferences in 1st order logic.

COURSE OUTCOMES:

Students will be able to:

1. Ability to develop a basic understanding of AI building blocks presented in intelligent agents.
2. Ability to choose an appropriate problem solving method and knowledge representation technique.
3. Ability to analyze the strength and weaknesses of AI approaches to knowledge– intensive problem solving.
4. Ability to design models for reasoning with uncertainty as well as the use of unreliable information.
5. Ability to design and develop the AI applications in real world scenario.

SUGGESTED READINGS:

1. Russell S., Norving P., “Artificial Intelligence – Modern Approach”
2. Henry P., “Artificial Intelligence”, 3rd Ed., Winstone
3. Patric H., “Lisp programming language”, Winstone

SUGGESTED WEBSITES:

1. https://www.academia.edu/4668207
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 302(1) PROCESS ENGINEERING L:T:P: 3:1:0

OBJECTIVES:

1. To understand concepts and philosophy of Process Reengineering.
2. To learn various PR and alternate methodologies.
3. To understand and analyze the role of Information Technology and change management in the implementation of PR.
4. To expose practically PR implementation and best practices through research papers and case discussions.

Unit I

SDLC in S/W and IS engineering, Relationship of SDLC to process models, Classical process models: Code and fix, Waterfall, Prototype, Spiral, V, Fountain, Iterative and Incremental process models.

Unit II

Process meta-models: Zhy meta-models, limitations of classical models, Activity based models, IBIS, Contextual model, and Map model, Tracing, Backtracking, Guidance: passive, active.

Unit III

The personal process and team process, Maturity models: the five levels of CMM, metrices to be collected for upward movements in levels

Unit IV: introduction to ITIL, Six Sigma, ISO9000, Differences between these classes of problems handled by these.

Unit V

Business process models, business objects, relationships, roles, co-ordination activity, Workflow models, Formulating Business process models, Building situations specific business models, architecture, organization.

COURSE OUTCOMES:

On completion of this course, the students will be able to

1. Understanding various PR methodologies and their applications.
2. Understanding the critical success factors for implementing PR.
3. Appreciate various alternative techniques of PR
4. Basic understanding of PR and their applications in education and industry.

CO5. Analyze and integrate issues and challenges of applying tools/techniques of Information Technology for BPR and learn to apply them in the industry. CO6. Familiarizing, analyzing and applying the role of process of Change Management in implementing BPR.

SUGGESTED READINGS:

1. Pressmen. “Software Engineering”, Mcgraw-Hill
2. Sommerville, “Software Engineering”, Pearson.
3. Pfleegar, “Software Engineering Theory and Practice”, Pearson.

SUGGESTED WEBSITES:

1. https://lecturenotes.in/subject/1058/process-engineering-pe
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 302(2) **DIGITAL FORENSIC** **L:T:P: 3:1:0**

OBJECTIVES:

To provide students with a comprehensive overview of collecting, investigating, preserving, and presenting evidence of cyber crime left in digital storage devices. To introduce topics of forensic data examination of computers and digital storage media. Investigation of computers used for wrong-doing. Understand file system basics and where hidden files may lie on the disk, as well as how to extract the data and preserve it for analysis. Understand some of the tools of e-discovery. Legal aspects must form a constant background for these types of investigations.

Unit I

Transform Methods: Fourier transformation, Fast Fourier Transformation, Discreet cosign Transformation, Mellin Fourier transformation, Wavelets, Split image in perceptual bands, Application of transformation in Steganography.

Unit II

Biometrics: Overview of Biometrics, Biometric identification, Biometric Verification, Biometric Enrollment, Biometric system security.

Authentication and Biometrics: Secure Authentication protocols, Access Control Security Services, Authentication Method's, Authentication Protocols, Matching Biometric samples, Verification By Humans.

Common Biometrics: Finger Print Recognition, Face recognition, Speaker Recognition, Iris Recognition, Hand Geometry, Signature Verification, Positive and Negative of Biometrics. Matching: Two kinds of errors, Score distribution, Estimating Errors from Data, Error rate of match Engines, Definition of FAR and FRR.

Unit III

Introduction to information hiding: Technical Steganography, Linguistic Steganography, Copy Right Enforcement, Wisdom From cryptography. Principals of Steganography: Framework for secret Communication, Security of Steganography System, Information Hiding in Noisy Data, Adaptive VS non Adaptive Algorithms, Active and malicious Attackers, Information Hiding in Written Text.

Unit IV

Survey of Steganographic Techniques: Substitution System and Plane tools, Transform Domain Techniques: Spread spectrum and information hiding, Statistical Steganography, Distortion Techniques, Cover Generation Techniques.

Steganalysis: Looking for signatures: - Extracting hidden information, disabling hidden information.

Unit V

Watermarking and Copyright Protection: Basic Watermarking, Watermarking Applications, Requirements and Algorithmic Design issues, Evaluation and Benchmarking of Watermarking system.

COURSE OUTCOMES:

1. Understand the importance of a systematic procedure for investigation of data found on digital storage media that might provide evidence of wrong-doing.
2. Understand the file system storage mechanisms of two common desktop opera ting systems
3. Use tools for faithful preservation of data on disks for analysis.
4. Find data that may be clear or hidden on a computer disk.
5. Learn the use of computer forensics tools used in data analysis, such as searching, absolute disk sector viewing and editing, recovery of files, password cracking, etc.
6. Understand how to present the results of disk data analysis in a court proceeding as an expert witness.
7. Understand the limitations imposed by data privacy laws.

SUGGESTED READINGS:

1. Katzendbisser, Petitcolas, "Information hiding Techniques for Steganography and digital watermarking", Artech House.
2. Peter Wayner, "Disappearing Cryptography: Information Hiding, Steganography and Watermarking 2/e", Elsevier.
3. Bolle, Connell et. al. ,"Guide to Bioinformatics", Springer.

SUGGESTED WEBSITES:

1. https://lecturenotes.in/subject/993/digital-forensics-df
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings

MCS 302(3) **COMPLEXITY THEORY** **L:T:P: 3:1:0**

OBJECTIVES:

The complexity of a problem describes whether the problem can be solved using algorithms, and how many resources (in form of time and space) it takes to solve a problem algorithmically. The course studies problems that cannot be solved and problems for which it is difficult to design efficient algorithms. We see how we can recognize such hard problems.

Unit I

Models of Computation: resources (time and space), algorithms, compatibility, complexity.

Unit II

Complexity classes, P/NP/PSPACE, reductions, hardness, completeness, hierarchy, relationship between complexity classes.

Unit III

Randomized computations and complexity: Logical characterization, incompleteness, Approximability.

Unit IV

Circuit Complexity, lower Bounds, Parallel Computing and Complexity, Counting problems, Interactive Proofs.

Unit V

Probabilistically checkable proofs, Communication Complexity, Quantum compunction.

COURSE OUTCOMES:

On completion of the course the student should have the following learning outcomes

1. Understands what an algorithm is, and which problems that be solved by an algorithm.
2. Understands the relationship between formal languages and Turing machines.
3. Knows about various complexity classes and the relationship between them
4. Recognize problems that cannot be solved computationally, and recognize NP-hard problems.
5. Prove the NP-completeness of some of the most basic hard problems.
6. Perform polynomial-time reductions
7. The student can recognize computationally hard problems, and contribute to research on classification of new problems as tractable or intractable.

SUGGESTED READINGS:

1. Christos H. Papadimitriou, “Combinatorial Optimization: Algorithms and Complexity”.
2. Sanjeev Arora and Boaz Barak, “Complexity Theory: A modern approach”
3. Stevan Homer, Alan L. Sleman, computability and complexity theory, Springer.

SUGGESTED WEBSITES:

1. https://people.eecs.berkeley.edu/~luca/notes/complexitynotes02.pdf
2. swayam.gov.in
3. onlinecourses.nptel.ac.in
4. https://www.geeksforgeeks.org/
5. https://www.tutorialspoint.com/dip/image_processing_introduction.htm

Note: Adhere to the latest editions of the Suggested Readings