ANNEXURE - 1

SYLLABUS FOR M.TECH IN COMPUTER SCIENCE AND ENGINEERING FOR THE SESSION 2015-2016

Course Structure (Computer Science & Engineering)

1st Semester: 700

Theoretical Courses	Subject Code	Subject Name	Marks	L	T	P	C	Core/Optional/Elective
Paper-I	CSE 901C TH	Design & Analysis of Algorithms	100 *(80+20)	04	0	0	04	CF
Paper-II	CSE 902C TH	Wireless Communication & Mobile Computing	100 *(80+20)	04	0	0	04	C
Paper-III	CSE 903C TH	Image Processing	100 *(80+20)	04	0	0	04	C
Paper-IV	CSE 904C TH	Probability and Random Process	100 *(80+20)	04	0	0	04	C (Offered by Department of Statistics)
Paper-V		Computer Skills 3	(As per University Norms) Compulsory Foundation					
Sessional Courses	**Subject Code**	**Subject Name**	**Marks**					
Sessional 1	CSE 905C PR	Image Processing Lab	100	0	0	04	02	C
Sessional 2	CSE 906C PR	Mobile Computing Lab	100	0	0	04	02	C
Total				16	0	08	24	

*80 (Theory) + 20 (Internal Assessment)

2nd Semester: 600

Theoretical Courses	Subject Code	Subject Name	Marks	L	T	P	C	Core/Optional/Elective
Paper-VI	CSE 101E TH	Elective Papers :	100 *(80+20)	04	0	0	04	E
	CSE 1001 E1	Pattern Recognition						
	CSE 1001 E2	Optical Communication & Network						
	CSE 1001 E3	Software Engineering						
	CSE 1001 E4	VLSI & Microprocessor						
Paper-VII	CSE 1002C TH	Language Translator	100 *(80+20)	04	0	0	04	C
Paper-VIII	CSE 1003C TH	Network Security & Cryptography	100 *(80+20)	04	0	0	04	C
Paper-IX	CSE 1004E TH	Elective Papers :	100 *(80+20)	04	0	0	04	E
	CSE 1004 E1	Optical Information Processing						
	CSE 1004 E2	Distributed Computing						
	CSE 1004 E3	Soft Computing						
	CSE 1004 E4	Introduction of Quantum Computing						
Sessional Courses	**Subject Code**	**Subject Name**	**Marks**					
Sessional 1	CSE 1005C PR	Term Paper Leading to Thesis	100	0	0	04	02	C
Sessional 2	CSE 1006C PR	Design project	100	0	0	04	02	C
Total				16	0	08	20	

*80 (Theory) + 20 (Internal Assessment)

3rd Semester: 500 Marks

Thesis Identification, Literature Survey and Plan of Work (Thesis: Phase-I)

Subject Code	Subject name	Marks	L	T	P	C	Core/Optional/Elective
CSE 1101C PR	Thesis Report Interim	100	0	0	04	04	C
CSE 1102C PR	Thesis Seminar Interim (Presentation & VIVA-VOCE)	200	0	0	04	04	C
CSE 1103C PR	Technical Communication	100	0	0	04	02	C
CSE 1104C PR	Workshop and Seminars	100	0	0	2	01	C
CSE1105E TH	Elective Papers:	100 *(80+20)	04	0	0	04	E
CSE 1105 E1	Business Ethics						E (Offered by Deptt. of MBA)
CSE 1105 E2	Fuzzy Set Theory						E (Offered by Deptt. of Mathematics)
CSE 1105 E3	Financial Management						E (Offered by Deptt. of Commerce)
CSE 1105 E4	Modern Control Systems						E (Offered by Deptt. of Electrical Engineering)
CSE 1105 E6	Big Data and Data Science		03	01	0	04	E
Total			04	0	14	15	

*80 (Theory) + 20 (Internal Assessment)

4th Semester: 500 Marks

Thesis Implementation (Thesis: Phase-II)

Subject Code	Subject name	Marks	L	T	P	C	Core/Optional/Elective
CSE 1201C PR	Thesis Report Final	200	0	0	08	04	C
CSE 1202C PR	Thesis Seminar Final (Presentation &VIVA-VOCE)	200	0	0	08	04	C
CSE 1203C PR	Workshop and Seminars	100	0	0	2	1	C
CSE 1204E TH	Elective Papers:	100 *(80+20)	04	0	0	04	E
CSE 1204 E1	Fundamentals of Management						E (Offered by Deptt. of MBA)
CSE 1204 E2	Bioinformatics: Sequence analysis						E (Offered by Deptt. of Molecular Biology & Bioinformatics)
CSE 1204 E3	Advanced Imaging Techniques						E
CSE 1204 E4	Web Technology						E (Offered by Deptt. of IT)
CSE 1204EF	Elective Foundation	100 *(80+20)				02	EF
CSE 1204EF1	Communicative English						Department of English
CSE 1204EF2	Yoga						Department of Physical Education
CSE 1204EF3	NSS and Social Services						
Total			04	0	18	15	

*80 (Theory) + 20 (Internal Assessment)

Total Credits: 72

Elective offered to other Departments in odd semesters:

Basics of Wireless Communication Credit: 4 Marks: 100

Fundamentals of Image Processing Credit: 4 Marks: 100

SYLLABUS FOR M.TECH IN COMPUTER SCIENCE AND ENGINEERING FOR THE SESSION 2014-2015

First Semester: 600

Theoretical Courses

Paper-I

CSE 901C TH: Design & Analysis of Algorithms Credit:4

Introduction: What is Algorithm? Algorithm and its specification. **Time Complexity:** Asymptotic Notation, Standard Notation and Common Functions, Asymptotic Analysis (Best, Worst, Average Case). Different cases of Time Complexity of Binary Search and Linear Search, Bubble Sort, Quick Sort, Merge Sort, Tournament Sort, Bucket Sort or Radix Sort, Insertion Sort, Selection Sort.**Greedy Algorithm:** Activity Selection Problem, Elements of the Greedy Policy, Hoffman Coding, Task Scheduling Problem, Coin Changing Problem/Algorithm, Prim's Algorithm And Kruskal's Algorithm And Comparisons. Knapsack Problem. Scheduling with Minimizing Time in the System.**Shortest Path Algorithm:** Dijkstra Algorithm, **Divide And Conquer Method:** Multiplying large integers. Strassen Matrix Multiplication. **Dynamic Programming:** Elements of Dynamic Programming, Making Change, Knapsack Problem, Shortest Path (Floyd Algorithm), Matrix Chained Multiplication, Assembly Line Scheduling. **Exploring Graphs:** Introduction, **Traversing Trees:** Pre order, Post order Numbering. DFS, BFS, Acyclic Graphs. **Backtracking:** Knapsack Problem, Eight Queen's Problem **Branch and Bound:** Assignment Problem. **Graph Algorithms: Single Source Shortest Path:** Bellman Ford Algorithm, Dijkstra Algorithm. **All Pairs Shortest Path:** Short Path of Floyd Warshall Algorithm, Johnson's Algorithm. **Computational Complexity:** Introduction to NP completeness, The Classes P and NP, Polynomial Reduction, NP Cook's Therom Complete Problems NP-completeness; Redurndancy . Approximation algorithms; Randomized algorithms;

Linear programming; Special topics: Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs), Numerical algorithms (integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primality testing, cryptographic computations),

References:

1. T. Cormen, C. Leiserson, R. Rivest, and C. Stein. Introduction to Algorithms (2nd edition). MIT Press / McGraw-Hill
2. Michael T. Goodrich and Roberto Tamassia. Algorithm Design: Foundations, Analysis, and Internet Examples. John Wiley & Sons
3. J. Kleinberg and É. Tardos. Algorithm Design. Addison-Wesley, 2005
4. Hovwitt and Sahani, " Fundamental of Algorithm.

Paper-II

CSE 902C TH: Wireless Communication & Mobile Computing Credit:4

Wireless Communication - Wired and wireless, Mobility of users and equipments, Overview of Electromagnetic Spectrum, Radio and Microwave communication, Infrared and Millimeter waves, Lightwave Transmission. Overview of Satellite Networks. Concepts of Spread Spectrum, CDMA System. Wireless LANs -MACA and MACAW protocols. Concepts of Cellular Network and related technologies like GSM, GPRS etc.

Mobile Computing – Characteristics, Infrastructure vs Infrastructureless Networks, Routing Protocols in Mobile Adhoc Network (MANET), Overview of Bluetooth Technology. Overview of Sensor Networks. Concepts of Mobile IP, Wireless Application Protocols and others. Overall security requirements and considerations in wireless and mobile computing systems. Concepts of fault tolerance.

References:

1. V.K.Garg & J.E.Wilks:Wireless and Personal Communication Systems: Fundamentals and Applications, IEEE Press and Prentice Hall,1996.
2. T.S.Rappaport, B.D.Woerner and J.H. Reed:Wireless Personal Communications: The Evolution of PCS,Dkyener Academic,1996.
3. G.I. Stuber: Principles of Mobile Communication,Kluener Academic,1996.
4. U.Black:Mobile and Wireless Networks, Prentice Hall PTR,1996.
5. Charles Parkins – Mobile Adhoc Ntworks
6. Wireless Communication- W. Stallings
7. Mobile Communication – J. Schiller
8. Reseach Papers of International Journals, Proceedings of Conferences.

Paper-III

CSE 903 TH: Image Processing **Credit:4**

Introduction, image definition and its representation, neighborhood. Orthogonal transformations like DFT, DCT, Wavelet.
Enhancement: contrast enhancement, smoothing and sharpening, filtering and restoration
Segmentation: pixel classification, global/local gray level thresholding, region growing, split/merge techniques, edge detection operators, Hough transform. Image feature/primitive extraction, component labeling, medial axis transform, skeletonization/thinning, shape properties, textural features – moments, gray level co occurrence matrix, structural features, Fourier descriptor, polygonal approximation. Compression: coding, quantization, spatial and transform domain based compression. Color image processing: color model, enhancement, and segmentation.
Mathematical morphology: basic concepts, erosion, dilation, opening, closing. Advanced applications like biomedical image processing, digital watermarking, etc

References:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley, California, 1993.
2. Rosenfeld and A. C. Kak, Digital Picture Processing, Vol. 1 & 2, 2nd ed. Academic Press, Inc. 1982.
3. Chanda and D. Dutta Mazumdar, Digital Image Processing and Analysis, Prentice Hall of India, New Delhi, 2000.

Paper-IV

CSE 904C TH: Probability and Random Processes **Credit:4**

1. Sample space and events, Probability axioms, conditional probability, independence of events, Bayes' rule. [3 lectures]
2. Random variables -discrete and continuous. Expectations, Moments, Tchebyshev's inequality, Characteristic function. Functions of one random variable. [6 lectures]
3. Discrete distributions: Binomial, Poisson, and continuous distributions: uniform, normal, exponential, gamma, Weibull etc. [7 lectures]
4. Stochastic convergence and limit theorems. [4 lectures]
5. Mean Square Estimation - linear regression. [3 lectures]
6. General concepts of stochastic processes, Markov chains, Markov processes [5 lectures]
7. Power spectrum, spectral representation, basic spectral estimation, [3 lectures]
8. Entropy [2 lectures]
9. Random walks, shot noise, deterministic signals in noise, [3 lectures]
10. Queuing theory (M/M/1 and M/M/C). [4 lectures]

Books:

1. Probability, Random Variables and Stochastic Processes - fourth Edition" by A. Papoulis and S. U. Pillai, McGraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Probability & Statistics with Reliability, Queuing and Computer Science Applications. Kishore S. Trivedi. Eastern Economy Edition, PHI.
3. Stochastic Processes. J. Medhi. 3rd Edition, New Age. International, 2009.
4. *Fundamentals* of *Mathematical Statistics*: A Modern Approach. S. C.*Gupta* (Prof.), Dr. V. K. *Kapoor*. Edition, 10.Publisher, Sultan Chand, 2000.

Paper V: Computer Skills

Sessional Courses

Sessional 1

CSE 905 PR: Image Processing Lab **Credit:2**

Understanding about different types of Digital images; Conversion between image data types; Basics of image display; Arithmetic Operations; Histogram Analysis; Neighborhood Processing; Image Geometry; The Fourier Transform of an image; Image Segmentation, Edge Detection; Morphological Operation; Color Image Processing; Image Compression; Wavelet Analysis

References Book:

1. "Digital Image Processing using Matlab", Rafael C. Gonzalez, Richard E. Woods, Steven Eddins.
2. "Mastering in Matlab", Duane C. Hanselman. Pearson Education.

Sessional 2

CSE 906 PR: Mobile Computing Lab **Credit:2**

Implementation of Code Division Multiple Access (CDMA); Write a program to divide a given area into equal hexagon and divide the given frequency range into the cells to create clusters; Study of NS2; Implementation of scenario files for AODV, DSR and other routing protocols in NS2; Implementation of OLSR protocol in NS2 and its study; Study of wireless sensor network in NS2; Study assignment on: Bluetooth and Wireless Application Protocol (WAP).

References:

1. Mobile Communication – J. Schiller.
2. Mobile Computing – Raj Kamal.

3. The ns Manual – Kevin Fall, Kannan Varadhan

Second Semester: 600

Theoretical Courses

Paper-VI

CSE 101E TH: Elective Papers **Credit:4**

CSE 101E1: Pattern Recognition

Introduction to pattern recognition and learning (supervised, unsupervised), training and test sets, feature selection.
Supervised learning and classification: Discriminant functions and decision boundaries Linear discriminant functions, relaxation procedure, non-separable behaviour Minimum distance classifier. Bayesian decision theory.Maximum likelihood classification. Parameter estimation, sufficient statistics, component analysis and discriminants (PCA, Fisher's) Nonparametric techniques. Density estimation, Parzen window, K-NN estimation, Decision Tree, SVM.
Unsupervised learning and clustering: Data description and clustering –similarity measures, criterion for clustering, Methods of clustering – partitional: KMean, KMode, KMedian, FCN, hierarchical, graph theoretic, density based, Cluster validity
Feature extraction and feature selection: Problems of dimensionality- Feature extraction --PCA-Feature selection –Karhunen Loeve, stochastic approximation, kernel approximation, divergence measures

References:

1. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification and Scene Analysis, 2nd ed., Wiley, New York, 2000.
2. J. T. Tou and R. C. Gonzalez, Pattern Recognition Principles, Addison-Wesley, London, 1974.

CSE 1001 E2: Optical Communication & Networking

Abstract:

The main objective of this course is to introduce the students to the basics of modern optics and free-space optical communication systems. Free-space optical communication systems has been developed for providing high-data rate optical communication in situations where laying of optical fiber cables in ground is expensive or impossible. Examples are: installing new optical lines in built-up urban areas, communications between ships at sea or between satellites orbiting in space. Free-space optical communication systems also provide viable solutions to last-mile distribution of optical channels in PONs and high security communications. This course introduces a student to fundamental issues of free space optical communications including generation and modulation of laser beams, transmission of laser beams through atmosphere, reception of optical signals, coherent optical communications. Current research topics are also discussed towards the end of the course.

Detailed Contents:

Topic Name	Content	No of lectures
Introduction	Advantages of free-space optical communications, overview of the technology	1
Basic topics for Optics and Electromagnetic theory	Propagation of Plane and Spherical waves, Gaussian beams from lasers, Power and Intensity of a beam, Coherence of light, Temporal and Spatial coherence, Interference, Diffraction theory, Fraunhofer diffraction formulas.	4
Optical Transmitter	Transmitter design, Wavelength Selection, Eye Safety, Optical Sources, LED, Laser Diodes, Electro-optic Modulators, Acousto-Optic Modulators and Beam deflectors, Lens formulas, Gaussian Beam through a Lens, Launching light beams directly from Optical Fibers, Optical Amplifiers.	6
IM-DD Receiver design	Collecting light, Diffraction limited spot, Photodiodes – p-i-n and APD, Poisson statistics, Time Constant and Receiver Circuit, Transimpedance amplifiers (TIA), Random Noise in Receivers, Noise at the output of a p-i-n+TIA Receiver, Receivers with APD, Excess noise, Optimum APD gain, BER Calculation, Quantum Limit, Timing Jitter and BER Degradation, Effects of Misalignment.	12
Effects of Atmosphere	Absorption, Scattering, Scintillation from Turbulence, Fading	6
Free-space optical communication systems	Beam pointing, Beam acquisition and tracking, Power Budget of an Ideal FSO Link, Realistic FSO Link Design, Coherent Optical Receivers, Heterodyne and Homodyne Receivers, SNR and BER Calculations for various Modulation formats, PPM, Non-line-of sight optical communication	10
Conclusion	Overview, research issues	1

Prerequisites: Knowledge of Communication Systems, Signals and Systems, Electromagnetic theory.

Suggested Text/s:

(a) Optical Communication - Gagliardi and Karp
(b) Photonics - Saleh and Teich
(c) Laser Communication - Majumdar and Ricklin
(d) Free-Space Optical Communication – Willebrand and Ghuman

Outcomes and Objectives:

(a) Ability to understand photonic components and subsystems required for free-spac optical communications.
(b) Ability to understand the effects of atmosphere on the propagation of laser beams.
(c) Apply the basic principles of optical communications to design free-space optical systems

Comments:

At present, simple demonstrations will be carried out during lectures using laser pointers and a few gratings and lenses. However, a teaching lab on modern optics and free-space optical communications should be developed in future for this course and other courses on optics/photonics/RF applications in modern ICT.

The lab will contain optical components such as diode lasers, lenses, and photodiodes, and optical measuring instruments so that students can make short distance optical communication links and networks. The lab will also contain optical CAD software packages so that students can design and simulate the behavior of complex laser communication systems needed for future generations.

CSE 101 E3: Software Engineering

Introduction and Brief Overview - Software process, modeling and analysis, software architecture, software design.
Software Modeling, Analysis, Testing - Analysis modeling and best practices, traditional practice diagrams such as DFDs and ERDs etc, Traditional Testing techniques – white box and black box testing.
Object-Oriented Software Engineering - Concept of OO Software – Design and Analysis, Overview of various UML diagrams and UML analysis modeling, analysis case studies, analysis tools, analysis patterns, OO software testing. Case study with complete examples
Software Architecture - Architectural styles, architectural patterns, analysis of architectures, formal descriptions of software architectures, architectural description languages and tools, scalability and interoperability issues, web application architectures, case studies.
Software Design - Design best practices, design patterns, extreme programming, refactoring, design case studies, component technology, object oriented frameworks, distributed objects, object request brokers, case studies.
Web Engineering, Clean room Engineering and other recent topics

References:

1. G. Booch, J. Rumbaugh, and I. Jacobson, I. The Unified Modeling Language User Guide. Addison-Wesley, 1999
2. E. Gamma, R. Helm, R. Johnson, and J. Vlissides. Design Patterns: Elements of Reusable Object-Oriented Software. Addison-Wesley, 1995
3. M. Shaw and D. Garlan. Software Architecture: Perspectives on an Emerging Discipline. Prentice-Hall, 1996
4. L. Bass, P. Clements, and R. Kazman. Software Architecture in Practice, Addison-Wesley, 1998.
5. J. Rumbaugh, I. Jacobson, and G.Booch. The Unified Modeling Language Reference Manual. Addison Wesley Longman, 1999.
6. I. Jacobson, G. Booch, and J. Rumbaugh, and I. Jacobson. The Unified Software Development Process. Addison Wesley Longman, 1999.
13
7. J. Rumbaugh, M. Blaha, W. Premerlani, F. Eddy, and W. Lorenson. Object-oriented Modeling and Design. PHI, EEE, 1997.

8. G. Booch. Object-Oriented Analysis and Design with Applications. Second Edition. Benjamin Cummings, 1994.
9. Jim Conallen. Building Web Applications with UML. Addison-Wesley, 2000.
10. K. Beck. Extreme Programming Explained. Pearson Education Asia, 2000.
11. Software engineering – design, reliability and management – Schuman Mar.
12. Software engineering – Pressman.

CSE 101 E4: VLSI &Microprocessor

Introduction to VLSI Design, Design Styles and parameters, popular technologies. Logic implementation with nMOS, CMOS. DCVS and PLAs. Pass vs.transistor logic,transit time, clocking, scaling, PLA minimization and folding, SIMPLIFY, ESPRESSO. Testability Issues. Physical Design algorithms: Partitioning, Floor planning and placement, Routing, compaction, gate arrays, FPGAs, MCMs. Data structures for layout desing -MAGIC. Design Rule checking, Expert systems, symbolic layout, complexity of layout algorithms.
Intel 8085 Microprocessor Architecture and its operation; Interfacing Devices; Introduction to Interfacing Memory and Input/output devices.Instruction Classification and Format, Instruction timings and operation status, Introduction to 8085 instruction set; Data transfer instructions, Arithmetic and logical operations, Branch operations, Advanced Instructions.Machine Language Programming, Assembly Language Programming, Debugging a Program,Programming Techniques viz Counting, Looping, Indexing, Stack operations andsubroutines.Intel 8085 interrupts, Different types of Interrupts, Interrupt Service Routines, Enabling and disabling Interrupts, Interrupt Vectors, Typical Interrupt Acknowledgment & Response .Basic Interfacing Concepts, Types of I/O, Interfacing Output Displays and Input Keyboards,Memory Mapped I/O and Interfacing Memory.Basics in Programmable I/Os, Intel 8255 Programmable Peripheral Interface, Intel 8253 Programmable Interval Timer, Intel 8155 and Intel 8755 Multipurpose Programmable Devices; Interfacing, Initialization, Programming typical Applications of all the devices.Interfacing Intel 8279 Programmable Keyboard/Display; Intel 8259 Programmable Interrupt Controller, modes; Intel 8257 DMA Controller, modes; Interfacing, Initialization,Programming typical Applications of all the devices.Serial I/O, Software Controlled Asynchronous Serial I/O, Hardware Controlled Serial I/O;Synchronous Serial Communication;

References:

1. C.Mead & L.Conway: Introduction to VLSI Systems, Addison Wesley.
2. A.Mukherjee: Introduction to CMOS VLSI, Prentice Hall.
3. Fabricius: Introduction to VLSI Design, TMH.
4. T.Ohtsuki: Layout Design and Verification, North Holland.
5. N.Sherwani: Algorithms for VLSI Physical Design Automation, Kluwer Academic.
6. M.Sarrafzadeh & C.K.Wong:An Introduction to VLSI Physical Design, MH.
7. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming & Applications with 8085", 5/E, Penram International Publishing (India) Pvt. Ltd., Reprint 2006.
8. R. Theagarajan, S. Dhanasekaran, S. Dhanapal, "MicroProcessor & It's Applications", New Age International Publishers, Reprint 2007. "
9. Introduction to Microprocessors: Software, Hardware, Programming, Leventhal; PHI

Paper-VII

CSE 1002C TH: Language Translator **Credit:4**

Introduction: Introduction to language theory, tokens. Alphabets, definition of grammar Production rules, sentences, sentential forms, language definitions, derivations. **Regular languages:** Pumping Lemma of regular sets, Minimization of finite automata. Chomsky Hierarchy of languages. **Finite Automata :** Finite automaton, Deterministic, Non-Deterministic and equivalence. Transition diagrams, epsilon transitions, Equivalence of regular expressions and FA. Moore and Mealy machines. **Context Free Language:** Relations between classes of languages, Context Free Grammar, Derivation trees, ambiguity simplification, Normal forms, applications. **Lexical Analysis:** Interface with input, parser and symbol table, token, lexeme and patterns, difficulties in lexical analysis, error reporting, and implementation. Regular definition, Transition diagrams,LEX. **Syntax analysis:** context free grammars, ambiguity, associativity, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, Bottom up parsing, operator precedence grammars, LR parsers (SLR,LALR, LR), YACC.**Pushdown Automata :** Pushdown automata, definitions, context free languages, construction of PDA for simple CFLs, Linear bounded automata. **Turing machines:**Turing machines , Introduction to computability , Universal Turing Machines , Types of Turing Machines , Techniques for construction of Turing machines , Halting problem.
Assembler, Loader, Linker: basic concept; absolute and Relocatable,assemblers and macroprocessors Linkers- concept and design; loaders,different types. Editors and debuggers. Interpreters. Compilers: - Various phases; lexical analyzers- design. Parsing top down (L.L. (1) and recursive descent), bottom- up , (Shift – reduce concept to L.R. (1) symbol tables,error handling. Syntax – directed Translation – attributes and intermediate codes. Optimization concepts and machine code. Generation Use of LEX andYACC.

References:

1. John C. Martin: Introduction to languages and the theory of computation, 2nd Ed., McGraw Hill.
2. D.P. Bovet & P. Gescenzi: Introduction to Theory of Complexity, PH.
3. Rozenberg & Salomaa: Handbook of Formal languages, Vol. I&II.

Paper-VIII

CSE 1003C TH: Network Security & Cryptography **Credit:4**

Network Security: Introduction – Basic Security Concepts - Threats, Vulnerabilities, and Attacks - Encryption, Digital Signatures, and Certification Authorities - Kerberos Key Exchange - Encryption on the World Wide Web - E-Mail Security - Operating System Security - LAN Security - Media and Protocols - Routers and SNMP - Virtual Private Networks – Firewalls –

Biometrics - Policies and Procedures - Auditing, Monitoring, and Intrusion Detection - Crisis Management – Cookies and Cache – Security of Web-based Systems

Suggested Text:

1. John E. Canavan, "Fundamentals of Network Security", Artech House, 2001.
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, 2006.

References:

1. Matt Bishop and Sathyanarayana S.Venkatramanayya, "Introduction to Computer Security", Pearson Education, 2005.
2. Matt Bishop, "Computer Security: Art and Science", Pearson Education, 2003.
3. Nitesh Dhanjani and Justin Clarke, "Network Security Tools", O'Reilly, 2005.

Cryptography: Extended Euclidean Algorithm, Congruence, Chinese Remainder Theorem, Euler's Theorem, Primitive elements and conjugates in finite fields, Quadratic Reciprocity Law, Jacobi and Legendre's symbols, Gaussian Integers, Carmichael Numbers and strong pseudo-primes, Addition Chain Problems.

• Factorization schemes of Solovay-Strassen, Miller-Rabin, Pollard, Factor bases and Continued Fraction methods.

• Classical Cyphers and one time pad, Public Key Cryptography-Diffie Hellmann, RSA, Massey O'Mara, EI Gamal Schemes, Kbapsacj based schemes, Mental Poker, Linear Feedback Shift Registers-Threshold schemes for Key Management, Access Control, Inference Control-Security of Statistical Databases.

• Elliptic curve Cryptosystems and Factorization-Lenstra's Algorithm.

• Packing and Covering radii of codes, Golay Code, Reed-Mueller Code, BCH Code, Reed Solomon Code, Quadratic Residue Code, Alternant Code, Goppa Code, Justine Code, MDS Codes, Invariant theory and self-dual codes, Concatenated codes, Bounds of Singleton, Johnson, Plotkin and Elias.

• Group Algebra, Weight Enumerators and Krawtchouk Polynomials, Automorphism groups of codes, Designs and codes-intersection numbers of t-designs.

References:

1. Neal Koblitz: A Course in Number Theory and Cryptography, Springer.
2. Itrlsnf & Rosen: Second Course in Number Theory, Springer.
3. Evangels Kramakis: Primality & Cryptography, John Wiley.
4. Mc Williams & Sloanne: Theory of Error Correcting Codes, Vol. I & II, Elsevier.
5. Steven Roman: Coding and Information Theory, Springer.

Paper-IX

CSE 1004E TH: Elective Papers **Credit:4**

CSE 1004 E1: Optical Information Processing

Objectives: To introduce the student to the basics of modern optics and photonic devices that can be used for high information processing and computing. The student will learn about 2-dimentional signals and systems and rudimentary image processing, optical physics related to the

propagation of laser beams and passage of the optical beams through two-dimensional phase objects such as lenses and prisms. The student will learn about interference, holography and acousto-optic interactions. Combining these ideas the student will learn how to calculate 2-D Fourier transform of images through diffraction of light, optical spectral analysis, holographic pattern recognition, image processing, cross-connect and switch design, optical neural networks and other computing systems.

Prerequisites: Knowledge of Signals and systems, Electromagnetic theory
Introduction: Image Processing: 2D signals, 2D Fourier transform**,** Properties of 2D Fourier transform,2D systems theory**,** Spatial filtering,2 class pattern recognition.
Optics: Propagation of plane waves, Gaussian beams**,** Diffraction analysis, Near and far field Diffraction Calculations, Coherence of light, Interference and Interferometers**,** Principles of Holography, Reconstruction from holograms**,** Applications of holography.
Optical Devices: Transparent phase objects, Prisms, Lenses, Spatial light Modulators, Gratings, Acousto-optic Devices.
Optical Signal Processing and Computing: Lens for 2D Fourier transform, Imaging and image processing, Spatial filtering with lens, Use of gratings in spatial spectrum analysis,
Acousto-optic based signal processing, Fourier transform holography, Optical pattern recognition, Joint transform correlator systems, Photorefractive effect, Optical bistability,Nonlinear optics, Optical switches, Optical computing, Optical neural networks, Review and Discussion

Possible Textbooks:

(1) Introduction to Fourier Optics – J.W. Goodman
(2) Optical Information Processing – F.T.S. Yu and S. Jutamulia
(3) Photonics – B. Saleh and M. Teich

CSE 1004 E2: Distributed Computing

Introduction: Important Issues. Models of Distributed Systems - Shared Memory Systems, Message Passing Systems. High level Nets Program Representation - Non-determinism - Guarded Commands - Atomicity-Fairness Central and Distributed Schedulers. Correctness Criteria - proving safety and liveness properties. Distributed Multual Excusion Distributed Shapshot Global State Collection Synchronous Message Passing -CSP-Client Server Computing. Fault Tolerant Systems-Fault Classification. Distributed Consensus-Byzantine Generals problem-Atomic Broadcast. Leader Election Clock Sunchronization.
References:
1. N.A.Lynch: Distributed Algorithms, Morgan Kayfmann Publishing Inc., CA,1996.
2. Tel: Introduction to Distributed Algorithms.
3. A.S. Tanenbaum: Distributed Operating Systems. Prentice Hall, N.J.,1995.

CSE 1004 E3: Soft Computing

Fuzzy logic: Conventional and fuzzy sets, operations on fuzzy sets, fuzzy numbers, crisp relations and fuzzy relations, realization of fuzzy systems using fuzzy relations, application of fuzzy logic in optimization, vision, pattern recognition.
Neurocomputing: Introduction to neural networks, threshold logic
Models of neurocomputing: Perceptron,. Adaline, Multi-layer perceptron, backpropagation learning, RBF network, Hopfield networks, ART –I and II, SOFM. Applications in pattern recognition and image processing.
Evolutionary computing: Introduction to Evolutionary Computation: Genetic algorithms, Genetic programming, Evolutionary strategies, Evolutionary programming.
Genetic algorithms – Chromosome representation, encoding, decoding, Genetic operators: Selection, Crossover, Mutation, Elitism, Schema Theorem, EGA, Convergence theorem, real-coded GA, Ordered GA, Steady-state GA, Multi-objective evolutionary algorithms, applications in search and optimization. Recent advances in Evolutionary Computing (Particle Swarm Optimization, Ant Colony Optimization).
Hybridizations: Different types of integrations, merits. Neuron-fuzzy, Neuro-GA, Fuzzy-GA, Neuro-fuzzy-GA

References:

1. G. J. Klir and B. Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 1995.
2. K. H. Lee, First Course on Fuzzy Theory and Applications, Springer, 2005.
3. S. Haykin, Neural Networks: A Comprehensive Foundation, 2nd ed., Prentice Hall, New Jersey, 1999.
4. J. M. Zurada, Introduction to Artificial Neural Systems, West Publishing Co., St. Paul, Minnesota, 1992.
5. J. Hertz, A. Krogh, and R. G. Palmer, Introduction to the Theory of Neural Computation, Addison Wesley, California, 1991.
12
6. B. Yegananarayanan, Artificial Neural Networks, Prentice Hall of India, New Delhi, 1999.
7. C. M. Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
8. D.E. Goldberg, Genetic algorithms in search, optimization and machine learning, Addison Wesley, 1989.
9. Z. Michalewicz, Genetic algorithms + data structures = evolutionary programs, Springer-Verlag, 1994.
10. J.S.R Jang, C.T Sun and E Mizutani, Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, Pearson Education, 1996.
11. S. Rajasekharan, G. A. V. Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms, PHI, 2003.
12. M. Dorigo aand T. Stutzle, Ant Colony Optimization, PHI, 2005.
13. J. Kennedy and R. C. Eberhart, Swarm Intelligence, Morgan Kaufmann Publishers Inc,US, 2001.

CSE 1004 E4: Introduction of Quantum Computing

Mathematical foundations and quantum mechanical principles [8 lectures]

a. Finite dimensional inner product spaces, Hermitian and unitary operators, projection operators, commutators
b. Hilbert space as state space, Schrodinger equation and time evolution, measurement, Heisenberg uncertainty relation, Dirac notation, density operators, quantum entanglement

Qubits, quantum gates and quantum circuits [20 lectures]

c. Concept of qubit, representation of qubit in Bloch Sphere, Multi qubit quantum state representation
d. Single, Two and Multi-qubit quantum gates, Matrix representation of gates, universal gates for quantum computing
e. Quantum Circuit, Reversible Computation using quantum circuits, quantum parallelism, quantum circuit representation, quantum computing language (QCL) for quantum process description, Quantum Circuit description languages
f. Quantum Adder Circuits, Quantum Fourier transform Circuit, Quantum Multiplier, Quantum Shift register.
g. Quantum Physical Machine Description, Quantum Circuit Cost.
h. Synthesis techniques for quantum circuit

Quantum algorithms [12 lectures]

i. Elements of quantum automata and quantum complexity theory.
j. Deutsch's algorithm, Deutsch-Jozsa Algorithm and the Bernstein-Vazirani Algorithm, Simon's algorithm
k. Quantum Fourier transform, Shor's Algorithm and its applications.
l. Grover's algorithm for searching and its applications.

Books:

1. Quantum Computation and Quantum Information by Michael Nielsen and Isaac Chuang, Cambridge Univ. Press.
2. P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing", Oxford University Press

Good lecture notes:

John Preskill's lecture notes-http://www.theory.caltech.edu/people/preskill/ph229/

David Mermin's lecture notes-http://people.ccmr.cornell.edu/mermin/qcomp/CS483.html

Sessional Courses

Sessional 1

CSE 1005C PR: Term Paper Leading to Thesis Sessional 2 **Credit:2**

CSE 1006C PR: Design Project **Credit:2**

Third Semester: 500

Thesis Identification, Literature Survey and Plan of Work (Thesis: Phase-I)

CSE 1101C PR: Thesis Report Interim **Credit:4**

CSE 1102C PR: Thesis Seminar Interim (Presentation & Viva-Voce) **Credit:4**

CSE 1103C PR: Technical Communication **Credit:2**

CSE 1104C PR: Workshop and Seminars **Credit:1**

CSE 1105 E TH: Elective Papers **Credit:4**

CSE 1105 E1: Business Ethics

CSE 1105 E2: Fuzzy Set Theory

CSE 1105 E3: Financial Management

CSE 1105 E4: Modern Control System

CSE 1105 E5: Big Data and Data Science

Data Science History; Pioneers; and Modern Trends, Taxonomy, The Curse of Big Data, New Types of Metrics, Three Classes of Metrics, Relationship among Metrics, 5V of Data Science 6L

Introduction to Big data Platform, Traits of Big data, Challenges of Conventional Systems, Evolution Of Analytic Scalability, Analytic Processes and Tools, Analysis vs. Reporting 6L

Modern Data Analytic Tools, Data Structure, Overview of R language, Data Types, Accessing Data, Cleaning Data 6L

Basic Statistical Concepts: Sampling Distributions; Re-Sampling; Statistical Inference; Prediction Error, Hash Joins, Model-Free Confidence Intervals, K-means Clustering, Independent Sample Tests, Basic Association Analysis, Association Rule Speedup 8L

Linear regression part 1, Linear regression part 2, Logistic regression, Naïve Bayes, Decision trees part 1, Decision trees part 2, Correlation and R-Squared for

Big Data, Monte Carlo Simulations 6L

Introduction to Hadoop/MapReduce, The MapReduce paradigm & Hadoop and HDFS overview, When to Use MapReduce, What MapReduce Can't Do, Comparison between SQL and NoSQL DBs, Overview on BigTable; Hive and Pig, Visualization tools 8L

Fourth Semester: 500

Thesis Implementation (Thesis: Phase-II)

CSE 1201C PR: Thesis Report Final **Credit:4**

CSE 1202C PR: Thesis Seminar Final (Presentation & Viva-Voce) **Credit:4**

CSE 1203C PR: Workshop and Seminars **Credit:1**

CSE 1204E TH: Elective Papers **Credit:4**

CSE 1204E1: Fundamentals of Management

CSE 1204E2: Bioinformatics: Sequence analysis

CSE 1204E3: Advanced Imaging Techniques

Basics of digital imaging-Prerequisite 4L
Significance of imaging in biomedical application 1L
Various imaging techniques used in biomedical imaging

- Principle and functionality of X-ray
- Principle and functionality of CT
- Principle and functionality of MRI
- Principle and functionality of PET
- Principle and functionality of SPECT 15L
- Principle and functionality of DTMRI
- Principle and functionality of EEG
- Principle and functionality of FRET
- Principle and functionality of FMRI
- Principle and functionality of MEG

Issues and challenges in thermal imaging. Technical details, application of thermal imaging in medical science. 5L

Fundamentals of infrared imaging, its use in remote sensing/GIS, issues in hyperspectral imaging. 10L

Principles and functioning of satellite imaging. Challenges pertaining to transmission/communication. 5L

CSE 1204E4: Web Technology

CSE 1204EF: Elective Foundation **Credit:2**

CSE 1204EF1: Communicative English

CSE 1204EF2: Yoga

CSE 1204EF3: NSS and Social Services

Basics of Wireless Communication Credit: 4

Wired and wireless, Mobility of users and equipments, Overview of Electromagnetic Spectrum, Radio and Microwave communication, Infrared and Millimeter waves, Lightwave Transmission. Overview of Satellite Networks. Concepts of Spread Spectrum, CDMA System. Wireless LANs -MACA and MACAW protocols. Concepts of Cellular Network and related technologies like GSM, GPRS etc.

Characteristics, Infrastructure vs Infrastructureless Networks, Routing Protocols in Mobile Adhoc Network (MANET).

References:

1. V.K.Garg & J.E.Wilks:Wireless and Personal Communication Systems: Fundamentals and Applications, IEEE Press and Prentice Hall,1996.
2. T.S.Rappaport, B.D.Woerner and J.H. Reed:Wireless Personal Communications: The Evolution of PCS,Dkyener Academic,1996.
3. G.I. Stuber: Principles of Mobile Communication,Kluener Academic,1996.
4. U.Black:Mobile and Wireless Networks, Prentice Hall PTR,1996.
5. Charles Parkins – Mobile Adhoc Ntworks
6. Wireless Communication- W. Stallings
7. Mobile Communication – J. Schiller
8. Reseach Papers of International Journals, Proceedings of Conferences

Fundamentals of Image Processing Credit: 4

Introduction, image definition and its representation, neighborhood. Orthogonal transformations like DFT, DCT, fog correction and convolution
Enhancement: contrast enhancement, smoothing and sharpening, filtering and restoration
Segmentation: pixel classification, global/local gray level thresholding, region growing, split/merge techniques, edge detection operators, Hough transform. Image feature/primitive extraction, component labeling, medial axis transform, skeletonization/thinning, shape properties, textural features – moments, gray level co occurrence matrix, structural features, Fourier descriptor, polygonal approximation. Compression: coding, quantization, spatial and transform domain based compression.

References:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley, California, 1993.
2. Rosenfeld and A. C. Kak, Digital Picture Processing, Vol. 1 & 2, 2nd ed. Academic Press, Inc. 1982.

3. Chanda and D. Dutta Mazumdar, Digital Image Processing and Analysis, Prentice Hall of India, New Delhi, 2000.