M.Tech Computer and Information Science

Sl.No	Course Code	Course Title	Core/ Elective	Credits	Lec.	Lab.	Int. Ass. Marks	Ext. Marks	Total Marks
Semester-I									
1	CSC3101	Mathematical Concepts for Computer Science	C	4	3	3	50	50	100
2	CSC3102	Information Retrieval	C	3	3	0	50	50	100
3	CSC3103	Algorithms for modern data models	C	4	3	3	50	50	100
4	-	Elective I	E	3	3	0	50	50	100
5	-	Elective -II	E	3	3	0	50	50	100
6	CSC3109	Computer Lab-I	C	1		3	100		100
Total for Semester -I				18	15	9			600
Electives									
CSC3104: Wireless Communications & Networking									
CSC3105: Virtualized Systems									
CSC3106: Parallel Computer Architecture									
CSC3107: Intelligent Systems									
CSC3108: Number Theory and Cryptography									
Semester-II									
1	CSC3201	Advanced Data Mining	C	4	3	3	50	50	100
2	CSC3202	Computer Vision	C	3	3	0	50	50	100
3	CSC3203	Seminar	C	1	0	3	50		50
4	-	Elective -III	E	3	3	0	50	50	100
5	-	Elective -IV	E	3	3	0	50	50	100
6	-	Elective-V	E	3	3	0	50	50	100
7	CSC3207	Computer Lab-I	C	1		3	100		100
Total for Semester -II				18	15	9			650
Electives									
CSC3204: Bioinformatics									
CSC3205: Computational Linguistics									
CSC3206: Adhoc Networks									

Semester-III									
1	CSC3301	Project & Viva Voce	C	18	0	15	100	200	300
Semester-IV									
1	CSC3401	Project & Viva Voce	C	18	0	15	100	250	350
Total Credits for Degree: 72								1900	

CSC3101: MATHEMATICAL CONCEPTS FOR COMPUTER SCIENCE

Core/Elective: **Core** Semester: **1** Credits: **4**

Course Description

This course introduces the study of mathematical structures that are fundamentally discrete in nature. It introduces linear algebra, logic, computability, graph theory and probability. The course is intended to cover the main aspects which are useful in studying, describing and modelling of objects and problems in the context of computer algorithms and programming languages.

Course Objectives

To understand vectors and matrices To study mathematical logic

To study detailed models of computability To study graph theory and its applications To understand application of probability

Course Content

1. Linear Algebra: Vector spaces, Orthogonality, Eigen-value analysis, Vector and matrix norms, Multivariable analysis, Vector and matrix calculus, Unconstrained and constrained optimization problem solving methods.

2. Logic: Propositional logic, Truth tables, Tautologies, Resolution proof system, Predicate logic, Temporal logic

3. Computability: Turing Machines, Recursive and Recursively Enumerable languages, Decidability, Resource bounded computation, Complexity classes, Complexity measures, Relationships among complexity measures, Polynomial time and space, Theory of NP-completeness

4. Basic definitions of Graphs, connectivity of a graph, cut points, cycles – Hamiltonian graphs – sub graphs - spanning sub graphs - isomorphic graphs - matrix representation of graphs, Bipartite graphs, Tree, different characterization of trees - Algorithms on graphs – BFS, DFS Dijkstra’s algorithm for shortest path, Floyd’s algorithm for all pairs of shortest paths, Kruskal’s and Prim’s algorithm for minimum spanning tree

5. 5. Random Variables and Stochastic Processes: Random variables, Functions of random variables, Sequences of random variables, Stochastic processes, Markov chains, Markov processes and queuing theory

REFERNCES

1. Discrete Mathematical Structures for Computer Science (1st Ed): Bernard Kolman, Robert Busby, PHI (1984)
2. Linear Algebra and Probability for Computer Science Applications (1st Ed): Ernest Davis, CRC Press (2012)
3. Graph Theory and Its Applications (2nd Ed): Jonathan L. Gross and Jay Yellen, CRC (2005)
4. Schaum's Outline of Probability, Random Variables, and Random Processes (2nd Ed) : Hwei Hsu, McGraw-Hill (2010)

CSC3102: INFORMATION RETRIEVAL

Core/Elective: **Core** Semester: **1** Credits: **4**

Course Description

Information retrieval is the academic discipline which underlies computer-based text search tools. This course covers both the theory and practice of text retrieval technology. Topics include automatic index construction, formal models of retrieval, textual representations, efficiency issues, Internet search engines, text classification, and multilingual retrieval.

Course Objectives

Students will learn the underlying technology of search engines.

Gain practical experience building simple, but true-to-practice retrieval software

Appreciate topics in the broad area of information retrieval, including evaluation, classification, cross-language retrieval, and computational linguistics

Course Content

1. Introduction, Data Retrieval & Information Retrieval, An Information Retrieval System, Automatic Text Analysis, Index term weighting, Probabilistic Indexing

2. Classification, Measures of Association, Cluster Hypothesis, Single Link Clusters, File Structures, Inverted Files, Index Sequential Files, Ring Structures, Doubly Chained Trees, Hash Addressing

3. Modeling, Boolean Model, Vector Model, Probabilistic Model, Set Theoretical Models, Structured Text Retrieval Models, Models for Browsing

4. Search Engines, Boolean Search, Matching Functions, Serial Search, Cluster Representatives, Cluster based retrieval

5. Evaluation, Relevance, Precision and Recall, Interpolation, Averaging techniques, The Swets Model

REFERNCES

1. Modern Information Retrieval: The Concepts and Technology behind Search (2nd Ed): Ricardo Baezce Yates, Berthier Ribeiro-Neto, AW (2011)
2. Introduction to Information Retrieval (1st Ed): Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Cambridge University Press (2008)
3. Search Engines: Information Retrieval in Practice (1st Ed): Bruce Croft, Donald Metzler and Trevor Strohman, AW (2009)
4. Information Retrieval: C.J. Van Rijsbergen, http://www.dcs.gla.ac.uk/Keith/Preface.html
5. Information Retrieval Systems, Theory & Implementation (1st Ed): Gerald Kowalski, Springer (1997)
6. Information Storage & Retrieval (1st Ed): Robert Korfage, Wiely (1997)

CSC3103: ALGORITHMS FOR MODERN DATA MODELS

Core/Elective: **Core** Semester: **1** Credits: **4**

Course Description

This course describes the techniques for the design and analysis of efficient algorithms, giving emphasis on methods useful in practice. Topics include graph algorithms; divide-and-conquer algorithms and recurrences; dynamic programming; greedy algorithms; amortized analysis; network flow; randomized and approximation algorithms.

Course Objectives

To know problem solving techniques

To understand techniques for the design and analysis of efficient algorithms To be able to design algorithms for new problems with volume of data

Course Content

1. Algorithms - Problem Solving and Important problem types-Fundamental Data Structures-Asymptotic Notations and Basic Efficiency classes-Analysis of Recursive and Non-Recursive Algorithms-Probability-Random Variables and Expectations, Moments and Deviations, distributions, conditional probability, Bayes Theorem- Tail Bounds, Chernoff Bound .

2. Problem Solving Techniques- Brute force, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, greedy technique.

3. Limitations of Algorithm power -P, NP and NP complete problems- Back tracking , branch and bound and approximations algorithms- probabilistic analysis , Randomized algorithms, Birthday Paradox, Quick sort, bucket sort, mini-cut, median finding- Random graphs, Ramsey number, Hamiltonian cycles.

4. Modern Algorithms- Markov chain, stochastic process, page rank- Components of evolutionary algorithms, ACO,PCO, TSP problem solving.

5. Algorithms in evolving data streams- Sampling, sketching, data stream models, read-write streams, stream-sort, map-reduce -Large Graph and Social Networks, Parallel Clustering algorithm for large Data sets with Applications.

REFERNCES

1. Introduction to Algorithms (3rd Ed):Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, MIT Press (2009)
2. Algorithm Design: Jon Kleinberg and Eva Tardos, AW (2005)
3. Anany V. Levitin. Introduction to the Design & Analysis of Algorithms (2nd Ed): A W (2006)
4. Randomized Algoritms: Rajeev Motwani and Prabhakar Raghavan, Cambridge University Press; Reprint edition (2010)
5. Data Streams: Algorithms and Applications: S. Muthukrishnan, Now Publishers (2005)
6. Data Streams: Models and Algorithms: Charu C. Aggarwal, Springer (2006)
7. Introduction to evolutioary computing: Agoston E. Eiben, J.E. Smith, Springer (2010)

CSC3104: WIRELESS COMMUNICATIONS & NETWORKING

Core/Elective:**Elective** Semester: **1** Credits: **3**

COURSE DESCRIPTION

This course focuses on imparting knowledge about the practical aspects of wireless network systems with the required basic principles behind them, along with some practical assignments. The course examines the conceptual framework for specifying a wireless network and the related protocols

COURSE OBJECTIVES

Comprehend and demonstrate command in the principles of wireless networking. Describe the networking technologies including Cellular networks, WLANs and WWANs. Understand the functions of TCP/IP and the organization of the Internet.

Design and evaluate a wireless network in terms of cost, performance, privacy and security.

Plan and design a small and practical network for home or small business applications under a specified set of constraints

To understand new trends and emerging technologies

COURSE CONTENT

1. Overview of wireless systems – teletraffic engineering – Radio propagation – Pathloss models – Digital communication over radio channels – Modeling of a Wireless Channel - Capacity of wireless channels – AWGN channel -Fading channels

2. Cellular concepts – Multiple access and interfernce management- Narrowband and Wideband systems- GSM, CDMA and OFDM - Channel reuse analysis- spread spectrum and CDMA systems – Random access and Wireless LANs
– Data and voice sessions over 802.11 – Association in WLANs

3. Wide-Area Wireless Networks – GSM evolution for data – UMTS architeture – QoS in UMTS – HSDPA – FOMA - CDMA evolution

4. Design of a wireless network – radio design for a cellular network – Link budget for GSM and CDMA

5. Beyond 3G – HSPA+, WiMAX and LTE – Cognitive radio networks

REFERNCES

1. Wireless Communications & Networking (1st Ed): Vijay K Garg, Morgan Kaufmann (2007)
2. Wireless Networks: Anurag Kumar, D. Manjunath, Joy Kuri, (1st Ed.), Morgan Kaufman (2008)
3. An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications (2nd Ed): Christopher Cox, Wiley (2012)
4. Web Resources: ieee.org

CSC3105: VIRTUALIZED SYSTEMS

Core/Elective:**Elective** Semester: **1** Credits: **3**

COURSE DESCRIPTION

Virtualization provides the benefit of reducing the total cost of ownership and improving the business agility. This course systematically introduces the concepts and techniques used to implement the major components of virtual servers behind the scene. It discusses the details on hypervisor, CPU scheduling, memory management, virtual I/O devices, mobility, and etc.

COURSE OBJECTIVES

The course introduces the concepts and principles of virtualization, the mechanisms and techniques of building virtualized systems, as well as the various virtualization-enabled computing paradigms.

COURSE CONTENT

1. Overview: Why server virtualization –History and re-emergence –General structures. Architectures comparison. Commercial solutions –VMWare, Xen.

2. Virtual machines: CPU virtualization -Privileged instructions handling -Hypervisor -Paravirtualization. Hardware-assisted virtualization. Booting up. Time keeping. CPU scheduling. Commercial examples .

3. Memory management in virtualization: partitioning –reclamation –ballooning. Memory sharing. OS-level virtualization –VMWare –Red Hat Enterprise Virtualization.

4. I/O virtualization: Virtualizing I/O devices -monolithic model -virtual I/O server. Virtual networking – tunneling – overlay networks. Commercial examples. Virtual storage: Granularity -file system level – blocks level.

5. Virtualized computing: Virtual machine based distributed computing, elastic cloud computing, clustering, cold and hot migration. Commercial examples. Challenges and future trends.

REFERNCES

1. Virtual Machines: Versatile Platforms for Systems and Processes (1st Ed): Jim Smith, Ravi Nair; Morgan Kaufmann (2005)

2. Applied Virtualization Technology - Usage models for IT professionals and Software Developers (1st Ed): Sean Campbell Intel Press (2006).

CSC3106: PARALLEL COMPUTER ARCHITECTURE

Core/Elective:**Elective** Semester: **1** Credits: **3**

COURSE DESCRIPTION

The key objective of this course is to provide fundamental knowledge in the design principles for general-purpose parallel computers. Students will gain fknowledge and understanding of principles and practice in parallel computer architecture and computing, emphasizing both hardware and software challenges and the interactions between them.

COURSE OBJECTIVES

Get a broad understanding of parallel computer architecture and different models for parallel computing

To understand concepts related to memory consistency models, cache coherence, interconnection networks, and latency tolerating techniques.

To learn about strategies for how algorithms that were originally developed for single-processor systems can be converted to run efficiently on parallel computers

To know about current practical implementations of parallel architectures

COURSE CONTENT

1. Introduction to parallel processing - Overview of pipelining – pipelined data paths and control – Data hazards – Control hazards – Instruction level parallelism – Instruction level parallelism (ILP)– Reducing branch costs – exploiting ILP using static and dynamic scheduling – Data level parallelism

2. Exploiting memory hierarchy – virtual machines – Cache coherence – Cache controllers – Parallelism and I/O

3. Shared memory Multiprocessors – Clusters and message passing processors – Hardware multithreading – SISD, MIMD, SIMD, SPMD and Vector – Computing GPUs

4. Thread level parallelism – Centralised shared memory architectures – Distributed shared memory and directory based coherence – Synchronisation – Models of memory Consistency – multicore processors and their performance

5. Parallel programming – GPU programming - CUDA Architecture – CUDA programming – OpenCL

REFERNCES

1. Computer Organization and Design (4th Ed): David A Patterson and John L. Hennessy, Morgan Kaufmann (2011)
2. Computer Architecture-A Quantitative Approach (5th Ed): John L. Hennessy and David A Patterson, Morgan Kaufmann (2011)
3. Programming massively parallel processors: A hands-on approach (1st Ed): David B. Kirk and Wen-mei W. Hwu, Morgan Kaufmann (2010)

CSC3107: INTELLIGENT SYSTEMS

Core/Elective:**Elective** Semester: **1** Credits: **3**

COURSE DESCRIPTION

The field of artificial intelligence (AI) is concerned with the design and analysis of autonomous agents. These are software systems and/or physical machines, with sensors and actuators, embodied; for example with in a robot or an autonomous spacecraft. An intelligent system has to perceive its environment, to act rationally towards its assigned tasks, to interact with other agents and with human beings. These capabilities are covered by topics such as computer vision, planning and acting, robotics, multiagent systems, speech recognition, and natural language understanding. They rely on a broad set of general and specialized knowledge representations and reasoning mechanisms, on problem solving and search algorithms, and on machine learning techniques.

COURSE OBJECTIVES

Explain the basic knowledge representation, problem solving, and learning methods of Artificial Intelligence Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems Develop intelligent systems by assembling solutions to concrete computational problems
Understand the role of knowledge representation, problem solving, and learning in intelligent-system engineering

COURSE CONTENT

1. Overview of AI – AI problems, techniques – Characteristics of AI applications – General problem solving – Production systems – Control Strategies: Forward and backward chaining – Exhaustive searches: Depth first, breadth first search

2. Heuristic Techniques – Hill Climbing – Branch and bound techniques – AND/OR graphs – Problem reduction & AO* algorithm – Constant satisfaction problems

3. Knowledge representation – First order predicate calculus – Resolution principle and unification – Inference mechanism – Horn's clauses – Semantic networks – Frame systems and value inheritance – Conceptual dependency

4. Natural Language Processing – Parsing techniques – Context free grammar – Recursive transition nets – Augmented transition nets – Case and logic grammars – Semantic analysis

5. Introduction to Neural Networks - Neural networks concepts – Learning process – Network architectures – The perceptron – Multilayer perceptrons- Back propagation algorithm – Training modes

REFERNCES

1. Artificial Intelligence: A Modern Approach (3rd Ed): Stuart Russell and Peter Norvig, PHI (2009).
2. Neural Network Learning (1st Ed): Martin Anthony, Peter L. Bartlett, Cambridge University Press (2009)
3. Artificial Intelligence: A Systems Approach (1st Ed): M. Tim Jones, Jones and Bartlett Publishers (2008)

CSC3108: NUMBER THEORY AND CRYPTOGRAPHY

Core/Elective:**Elective** Semester: **1** Credits: **3**

COURSE DESCRIPTION

The course provides an introduction to basic number theory, where the focus is on computational aspects with applications in cryptography. Applications to cryptography are explored including symmetric and public-key cryptosystems. Modern cryptographic methods are also discussed.

COURSE OBJECTIVES

To understand the number theoretic foundations of modern cryptography To implement and analyze cryptographic and number theoretic algorithms To understand public key cryptosystems

To understand modern cryptographic techniques

COURSE CONTENT

1. Divisibility, Division Algorithm, Euclidean Algorithm, Congruences, Complete Residue systems, Reduced Residue systems, Fermat’s little theorem, Euler’s Generalization, Wilson's Theorem, Chinese Remainder Theorem, Euler Phi-function, multiplicative property, Finite Fields, Primitive Roots, Quadratic Residues, Legendre Symbol, Jacobi Symbol, Gauss's lemma, Quadratic Reciprocity Law

2. Primality Tests, Pseudoprimes, Carmichael Numbers, Fermat’s pseudoprimes, Euler pseudoprimes, Factorization by Pollard’s Rho method, Simple Continued Fraction, simple infinite continued fractions, Approximation to irrational numbers using continued fractions, Continued Fraction method for factorization.

3. Traditional Cryptosystem, limitations, Public Key Cryptography Diffie-Hellmann key exchange, Discrete Logarithm problem, One-way functions, Trapdoor functions, RSA cryptosystem, Digital signature schemes, Digital signature standards, RSA signature schemes, Knapsack problem, ElGamal Public Key Cryptosystem, Attacks on RSA Cryptosystem: Common modulus attack, Homomorphism attack, timing attack, Forging of digital signatures, Strong primes, Safe primes, Gordon's algorithm for generating strong primes.

4. Cubic Curves, Singular points, Discriminant, Introduction to Elliptic Curves, Geometry of elliptic curves over reals, Weierstrass normal form, point at infinity, Addition of two points, Bezout's theorem, associativity, Group structure, Points of finite order

5. Elliptic Curves over finite fields, Discrete Log problem for Elliptic curves, Elliptic Curve Cryptography, Factorization using Elliptic Curve, Lenstra's algorithm, ElGamal Public Key Cryptosystem for elliptic curves

REFERNCES

1. A Course in Number Theory and Cryptography,Â Neal Koblitz, (Springer 2006).
2. An Introduction to Mathematical Cryptography, Jill Pipher, Jeffrey Hoffstein, Joseph H. Silverman (Springer, 2008)
3. An Introduction to theory of numbers, Niven, Zuckerman and Montgomery, (Wiley 2006)

CSC3201: ADVANCED DATA MINING

Core/Elective: **Core** Semester: **2** Credits: **4**

Course Description

Data mining is the science of extracting hidden information from large datasets. This course offers clear and comprehensive introduction to both data mining theory and Practice. All major data mining techniques will be dealt with and how to apply these techniques in real problems are explained through case studies.

Course Objectives

Introduce the fundamental concepts of data and data analysis

Case based study of specific data mining tasks like Clustering, Classification, Regression, Pattern Discovery and Retrieval by Content.

Introduce algorithms for temporal data mining and spatial data mining.

Course Content

1. Classification and prediction- decision tree induction-bayesian classification-rule-based classification- neural networks-support vector machines-lazy learners-genetic algorithms-prediction-accuracy and error measures-ensemble methods- model selection

2. Cluster analysis- portioning methods- hierarchical methods- density based methods-grid based-model based-constraint based-clustering high dimensional data-outlier analysis

3. Mining Sequence patterns in transactional databases-scalable methods for mining sequential patterns-constrained based methods-HMM for biological sequence data

4. Temporal data types and pre processing-time series similarity measures-time series representation and summarization methods- time series classification and clustering techniques

5. Spatial data mining-spatial data cube construction-mining spatial association and co-location patterns-spatial clustering and classification methods-spatial trend analysis

REFERNCES

1.Temporal Data mining –Theophano Mitsa, CRC Press 2010
2. Data mining concepts and techniques- Jiawei Han & Micheline Kamber , Elsevier (2008)
3. Data mining methods and Techniques: A B M Showkat Ali, Saleh A Wasimi, Cengage Learning (2009)
4. Introduction to Data mining with case studies: G.K Gupta PHI (2008)

CSC3202: COMPUTER VISION

Core/Elective: **Core** Semester: **2** Credits: **4**

Course Description

This course introduces concepts and applications in computer vision. Starting with image formation the course covers image processing methods such as filtering and edge detection, segmentation and classification. It includes vision tasks like; object detection, recognition and human motion detection. The content of the course also includes practical exercises to help the students formulating and solving computer vision problems.

Course Objectives

To understand processing of digital images

To familiarise different mathematical structures To study detailed models of image formation

To study image feature detection, matching, segmentation and recognition To understand classification and recognition of objects.
To familiarize state-of-the-art problems in computer vision

Course Content

1. Image formation –Geometric primitives and transformations – singular value decomposition – Harr,Walsh and Hadamard transforms – Discrete Fourier Transform - Photometric image formation – Statistical description of images.

2. Feature detection and matching – Digital morphology - Segmentation – Mean shift and mode finding – K-means and mixture of Gaussians – Graph cuts and energy-based methods – feature based alignment

3. Image restoration – Inverse filtering – Classification – Minimum distance classifiers – Cross validation – SVM – Ensembles – Bagging and boosting

4. Recognition – Object classification and detection – Face recognition – Instance recognition – Category recognition
– Context and scene understanding – Human motion recognition

5. State-of-the-art and the future - Content based Search – Computation Photography - Image & video annotation

REFERNCES

1. Computer vision: Algorithms and Applications (1st Ed): Richard Szeliski , Springer (2010)
2. Algorithms for Image Processing and Computer Vision (2nd Ed): J. R. Parker, Wiley (2010)
3. Learning OpenCV: Computer Vision with the OpenCV Library (1st Ed): Gary Bradski, O'Reilly (2008)
4. Image Processing: The Fundamentals (2 edition): Maria Petrou and Costas Petrou, Wiley (2010)
5. Mathematical Elements of Computer Graphics (1st Ed): David F. Rogers and J. Alan Adams, McGraw Hill (1989)

CSC3203: SEMINAR

Core/Elective: **Core** Semester: **2** Credits: **1**

Course Description

The student has to prepare and deliver a presentation on a research topic suggested by faculty member before the peer students and staff. They also have to prepare a comprehensive report of the seminar presented

Course Objectives

Review and increase their understanding of the specific topics tested. Inculcating presentation and leadership skills among students
Offering the presenter student an opportunity of interaction with peer students and staff

CSC3204: BIOINFORMATICS

Core/Elective: **Elective** Semester: **2** Credits: **3**

Course Description

Present fundamental concepts from molecular biology, computational problems in molecular biology and some efficient algorithms that have been proposed to solve them.

Course Objectives

To familiarize computational problems in biology To understand models of DNA and DNA mapping To study structure prediction

Course Content

1. Basic concepts of molecular Biology-Proteins-Nucleic acids– genes and genetic synthesis –translation-transcription- protein Synthesis- Chromosomes- Maps and sequences- human genome project-sequence data bases

2. Strings-Graphs-Algorithms- Comparing 2 sequences- Global & Local comparison-General Gap Penalty Function-Affix gap penalty function-comparing multiple sequences-Star alignments-Tree alignments-Database Search-PAM matrices BLAST-FAST –Issues

3. Fragment Assembly of DNA-Biological Background –Models-Algorithms-Heuristics-Physical Mapping of DNA-Restriction site Mapping-site models-Internal Graph Models –Hybridization Mapping-Heuristics

4. Phylogenic Trees –Binary Character States-Parsimony and Compatibility in Phylogenies-Algorithm for Distance Matrices-Additive Trees- Genome rearrangements-Oriented Blocks-unoriented Blocks

5. Molecular Structure Prediction- RNA secondary structure prediction-Protein Folding problems-Protein threading-Computing with DNA-Hamilton Path Problems. –Satisfiability

REFERNCES

1. Computational Molecular Biology-An introduction (1st Ed): Peter Clote and Rolf Backofen, Wiley Series (2000)
2. An introduction to Bioinformatics Algorithms (1st Ed): Neil James and Pavel A Pevzner, MIT Press (2004)

CSC3205: COMPUTATIONAL LINGUISTICS

Core/Elective: **Elective** Semester: **2** Credits: **3**

Course Description

Computational Linguistics deals with statistical and rule based modelling of natural languages from a computational point of view. This course is intended to give a comprehensive coverage of language processing fundamentals like morphology, Syntax, Semantics and pragmatics. Application of various computational models in application domains like Machine translation, information retrieval etc. is also dealt with.

Course Objectives

To familiarise the fundamentals of speech and written language processing

To study the applications of these techniques in real world problems like spell-checking, Parts-of Speech Tagging, Corpus development, Wordnet, speech recognition, pronunciation modelling, dialogue agents, document retrieval etc To gather information about widely used language processing resources

Course Content

1. Words- Regular Expressions and Finite Automata-Morphology and Finite State Transducers-Probabilistic Models of Pronunciation and Spelling -N grams

2. Word Classes and Part-of-Speech Tagging-MM Taggers- probabilistic Context Free Grammars for English Syntax-Parsing with Context Free Grammars- probabilistic parsing- Features and Unification-Language and Complexity

3. Semantics-Representing Meaning-canonical forms-FOPC-ambiguity resolution-scoping phenomena-Semantic Analysis-syntax driven semantic analysis-Lexical Semantics-Word Sense Disambiguation and Information Retrieval

4. Discourse-Reference Resolution -Text Coherence -Dialog and Conversational Agents-Dialogue acts-dialogue structure

5. Statistical alignment and machine translation-clustering- text categorization

REFERNCES

1. Foundations of statistical natural language processing (1st Ed): Christopher D. Manning and HinRich Schutze, MIT press (1999)
2. Speech and Language Processing (2nd Ed): Daniel Jurafsky and James Martin, PH (2008)
3. Natural Language Understanding (2nd Ed): James Allen, The Benajmins/Cummings Publishing Company Inc. (1994)

CSC3205: COMPUTATIONAL LINGUISTICS

Core/Elective: **Elective** Semester: **2** Credits: **3**

Course Description

Computational Linguistics deals with statistical and rule based modelling of natural languages from a computational point of view. This course is intended to give a comprehensive coverage of language processing fundamentals like morphology, Syntax, Semantics and pragmatics. Application of various computational models in application domains like Machine translation, information retrieval etc. is also dealt with.

Course Objectives

To familiarise the fundamentals of speech and written language processing

To study the applications of these techniques in real world problems like spell-checking, Parts-of Speech Tagging, Corpus development, Wordnet, speech recognition, pronunciation modelling, dialogue agents, document retrieval etc To gather information about widely used language processing resources

Course Content

1. Words- Regular Expressions and Finite Automata-Morphology and Finite State Transducers-Probabilistic Models of Pronunciation and Spelling -N grams

2. Word Classes and Part-of-Speech Tagging-MM Taggers- probabilistic Context Free Grammars for English Syntax-Parsing with Context Free Grammars- probabilistic parsing- Features and Unification-Language and Complexity

3. Semantics-Representing Meaning-canonical forms-FOPC-ambiguity resolution-scoping phenomena-Semantic Analysis-syntax driven semantic analysis-Lexical Semantics-Word Sense Disambiguation and Information Retrieval

4. Discourse-Reference Resolution -Text Coherence -Dialog and Conversational Agents-Dialogue acts-dialogue structure

5. Statistical alignment and machine translation-clustering- text categorization

REFERNCES

1. Foundations of statistical natural language processing (1st Ed): Christopher D. Manning and HinRich Schutze, MIT press (1999)
2. Speech and Language Processing (2nd Ed): Daniel Jurafsky and James Martin, PH (2008)
3. Natural Language Understanding (2nd Ed): James Allen, The Benajmins/Cummings Publishing Company Inc. (1994)

CSC3206: AD HOC NETWORKS

Core/Elective: Elective Semester: 2 Credits: 3

Course Description

The course examines wireless cellular, ad hoc and sensor networks, covering topics such as wireless communication fundamentals, medium access control, network and transport protocols, unicast and multicast routing algorithms, mobility and its impact on routing protocols, application performance, quality of service guarantees, and security. Energy efficiency and the role of hardware and software architectures may also be presented for sensor networks

Course Objectives

- To know the constraints of the wireless physical layer that affect the design and performance of ad hoc and sensor network, protocols, and applications;
- To understand MAC, Routing protocols that have been proposed for ad hoc and sensor network
- To understand the energy issues in sensor network and how they can be addressed using scheduling, media access control, and special hardware;
- To explain various security threats to ad hoc networks and describe protocol solutions

Course Content:

1. Overview of Wireless LAN, PAN – IEEE 802.11 – Bluetooth – Wireless WANs and MANs – Cellular Architecture – WLL – IEEE 802.16 – Wireless Internet – IP and TCP in Wireless domin
2. AD HOC Wireless Networks – Cellular and Ad hoc networks – Applications of Ad hoc networks – Issues in Ad hoc networks MAC protocols for Ad hoc networks
3. Routing Protocols for Ad hoc Networks – Classification – Table driven, On demand, Hierarchical Routing Protocols-Energy Management in Ad hoc Networks
4. Wireless Sensor Networks – Architecture – Data Dissemination and Gathering – Location Discovery – Applications of WSNs – Operating system and programming for Sensor Network
5. Emerging trends in Ad hoc Networks – Mobility models for Ad hoc Networks – Security – Ultra Wideband Systems – Hybrid Wireless Networks

REFERENCE:

1. Wireless Networks: Anurag Kumar, D. Manjunath, Joy Kuri, (1st Ed), Morgan Kaufman (2008)
2. Ad hoc Wireless Networks: Architectures and Protocols, C. Siva Ram Murthy And B. S. Manoj, (2nd Ed), Pearson Education(2005)
3. Ad hoc & Sensor Networks: Theory And Applications, Carlos de Morais Cordeiro and Dharma Prakash Agrawal, (1st Ed), World Scientific (2007)
4. Algorithms and Protocols for Wirelss Sensor Networks: Azzedine Boukerche (Edited Volume), Wiley – IEEE press (2008)