SCHOOL
OF
INFORMATION AND COMMUNICATION TECHNOLOGY

COURSE STURCTURE

M. TECH. ICT

SPECIALIZATION:

INTELLIGENT SYSTEMS AND ROBOTICS

GAUTAMBUDDHAUNIVERSITY
GAUTAM BUDH NAGAR, GREATER NOIDA
2014-2015

M. Tech. ICT **Effective from 2014-2015**

SEMESTER – I

Sr. No.	Courses Code	Courses	L-T-P	Credits
1	CS521	Advanced Data Base Management System	3-1-0	4
2	CS523	Advanced Computer Architecture	3-1-0	4
3	CS525	Intelligent System Design	3-1-0	4
4	CS527	Research Techniques in ICT	3-0-0	3
5	SS101	Human Values & Buddhist Ethics	2-0-0	2
6	CS581	Advanced Data Base Management System Lab	0-0-3	2
7	CS585	Intelligent System Design Lab	0-0-3	2
8	GP521	General Proficiency	------	1
		Total Credits		**22**
		Total Contact Hours	**14-3-6 =**	**23**

SEMESTER II

Sr. No.	Courses Code	Courses	L-T-P	Credits
1	MA402	Simulation & Modeling	3-1-0	4
2	CS562	Knowledge Engineering	3-0-0	3
3	CS 564	Soft Computing Techniques	3-0-0	3
4	CS 572	Introduction to Embedded System	3-0-0	3
		Elective-1	3-0-0	3
6	CS584	Soft Computing lab	0-0-3	2
7	CS592	Major Project	0-0-10	5
8	GP532	General Proficiency	------	1
		Total Credits		**24**
		Total Contact Hours	**15-1-13 =**	**29**

Electives (1)		
1	CS568	Machine Translation and Learning
2	CS 570	Speech Processing
3	EC477	Digital Image Processing
4	CS 566	Natural Language Processing

SEMESTER III

Sr. No.	Courses Code	Courses	L-T-P	Credits
1	CS661	Expert System Design	3-0-0	3
2	CS699	Robotics	3-0-0	3
3		**Elective 2**		
4		**Elective 3**		
5	CS683	Expert System Design Lab	0-0-3	2
6	CS691	Dissertation Part - I	0-0-14	7
7	GP631	General Proficiency	------	1
		Total Credits		**22**
		Total Contact Hours	**12-0-17 =**	**29**

Electives (2&3)		
1	CS663	Intelligent Information Retrieval
2	CS665	Pattern Matching
3	CS 667	Evolutionary Computation
4	CS669	Fuzzy Set Theory
5	CS671	Multimedia and Computer Graphics

SEMESTER IV

Sr. No.	Courses Code	Courses	L-T-P	Credits
1	CS690	Dissertation Part – II	------	21
2	GP632	General Proficiency	------	1
		Total Credits		**22**

GRAND TOTAL CREDITS = 90

INTELLIGENT SYSTEMS AND ROBOTICS

(SEMESTER - I)

M. Tech. ICT **Effective from 2014-2015**

ADVANCED DATA BASE MANAGEMENT SYSTEM			
Course Code:	**CS521**	**Credits:**	**4**
No. of Lectures (Hrs/Week):	**3+1**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45+15**	**End Sem Exam Hours:**	**3**

UNIT I INTRODUCTION TO DATABASE DESIGN

Entities, Attributes, Entity Sets, Relationships, Key Constraints, Participation Constraints, Weak Entities, UML Class Diagrams, Subclasses, Superclasses, Inheritance,Specialization, Generalization, Constraints and Characteristics of Specialization and Generalization Hierarchies, Modeling of UNION Types Using Categories, Representing Specialization and Generalization In UML Class Diagrams, Data Abstraction, Knowledge Representation and Ontology Concepts.

UNIT II DATABASES DESIGN THEORY

Problems Caused by Redundancy, Decompositions, Problems Related to Decomposition, Reasoning About FD's, FIRST, SECOND, THIRD Normal Form, BCNF, Forth Normal Form, Lossless Join Decomposition, Dependency Preserving Decomposition, Schema Refinement in Data Base Design, Multi Valued Dependencies.

UNIT III OBJECT- ORIENTED, PARALLEL AND DISTRIBUTED DATABASES

Overview of Object-Oriented Concepts, Object Identity, Object Structure, Type Constructor, Encapsulation of Operations, Methods and Persistence; Architectures For Parallel Databases, Parallel Query Evaluation, Parallelizing Individual Operations, Sorting Joins, Distributed Database Concepts, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Query Processing in Distributed Databases, Concurrency Control and Recovery in Distributed Databases.

UNIT IV DATABASES ON THE WEBANDSEMI–STRUCTURED DATA

Web interface, XML, structure of XML data, querying XML data, storage of XML data, XML applications, semi-structured data model, indexes for text data.

UNIT V ENHANCED DATA MODELS FOR ADVANCED APPLICATIONS

Active database concepts, temporal database concepts, spatial databases: concept and architecture, deductive databases and query processing, mobile databases, Geographic Information Systems (GIS).

Text Books:

1. Elmsari and Navathe, Fundamentals of Database Systems,
2. Ramakrishnan and Gehrke, Database Management Systems,

References Books:

3. Korth, Silberschatz, Sudarshan, Database System Concepts,
4. Rob and Coronel, Database Systems: Design, Implementation and Management,
5. Date and Longman, Introduction to Database Systems,

ADVANCED COMPUTER ARCHITECTURE			
Course Code:	**CS523**	**Credits:**	**4**
No. of Lectures (Hrs/Week):	**3+1**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45+15**	**End Sem Exam Hours:**	**3**

UNIT I

Introduction to parallel processing: parallelism in uniprocessor system, basic uniprocessor architecture, parallel processing mechanism, balancing of sub system bandwidth, multiprogramming and time sharing, parallel computer structures, pipeline computers, array computers, multiprocessor systems, dataflow computer concept, architectural classification scheme: multiplicity of instruction-data streams, serial versus parallel processing, parallelism versus pipelining, parallel processing applications, productive modeling simulation, engineering design and automation.

UNIT II

Principles of pipelining and vector processing: pipelining- an overlapped parallelism, principles of linear pipelining, clock period, efficiency, throughput, classification of pipeline processors, general pipeline and reservation tables.

UNIT III

Principles of designing pipeline processors: effect of branching, data buffering and bussing structures, internal forwarding and register tagging, hazard detection and resolution, job sequencing and collision prevention, reservation and latency analysis, collision free scheduling, state diagram, greedy cycle, pipeline schedule optimization, pipeline throughput, pipeline efficiency.

UNIT IV

Structure and algorithm for array processors: SIMD array processor, SIMD computer organization, inter –PE communication, SIMD interconnection network, static versus dynamic networks, cube interconnection network, shuffle-exchange omega networks, parallel algorithms and SIMD matrix multiplication.

UNIT V

Multiprocessor architecture and scheduling: functional structure, loosely coupled and tightly coupled multiprocessor, deterministic scheduling strategy, deterministic scheduling model, control flow versus data flow computer, data flow graphs and languages.

References Books:

1. Kai Hwang, “Advanced Computer Architecture”, Tata McGrawHill Edition
2. Kai Hwang and Faye A. Briggs, “Computer Architecture and Parallel Processing”, McGraw-Hill International Edition
3. Richard Y. Kain, “Advanced Computer Architecture: a Systems Design”, Prentice Hall.
4. James M. Feldman, Charles T. Retter, “Computer architecture: a designer's Text Based on a generic RISC”, McGraw-Hill
5. Jurij Silc, Borut Robic, Theo Ungerer, “Processor Architecture: From Dataflow to Superscalar and Beyond”, Springer.
6. Hennessy and Patterson, “Computer Architecture: A Quantitative Approach”, Elsevier.
7. Dezso and Sima, “Advanced Computer Architecture”, Pearson.
8. Quinn, “Parallel Computing: Theory & Practice”, TMH.
9. Quinn, “Parallel Programming in C with MPI and Open MP”, TMH

INTELLIGENT SYSTEM DESIGN			
Course Code:	**CS525**	**Credits:**	**4**
No. of Lectures (Hrs/Week):	**3+1**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45+15**	**End Sem Exam Hours:**	**3**

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Basic concept of artificial intelligence (AI), history of AI, AI and consciousness, weak and strong AI, physical symbol system hypothesis, comparison of computer and human skills, practical systems based on AI, development of logic, components of AI.

UNIT II PROBLEM SOLVING THROUGH AI

Defining problem as state space search, analyzing the problem, representing the problems from AI viewpoint, production system, developing production rules, characteristics of production system, algorithm for problem solving using AI technique.

UNIT III SEARCH TECHNIQUES

Use of search in AI problem solution, blind search techniques, heuristic search techniques, concept of heuristic knowledge, designing of the heuristic function, types of heuristic search techniques: generate and test, best first search, problem reduction using AND – OR graph, local search technique, branch and bound search, memory bounded search technique, local beam search, properties of heuristic search techniques, overestimation and underestimation of heuristic function, hill climbing search, simulated annealing search, constraint satisfaction, means ends analysis.

UNIT IV INTRODUCTION TO LOGIC

Introduction, propositional calculus, syntax of propositional calculus, semantics of propositional calculus, well formed formula, properties of statements, inferencing of propositional logic, predicate logic, syntax of predicate logic, semantics of predicate logic, representation of facts First Order Predicate Logic (FOPL), inferencing in predicate logic, concept of resolution, resolution algorithm, skolemization, Types of resolution, unit resolution, binary resolution.

UNIT V PROLOG and LISP

Basic concept of programming languages related to artificial intelligence problems, concept of programming in Logic, basic prolog constructs, atoms, defining the rules, writing small programs in prolog, concept of list processing, basic LISP constructs, writing functions in LISP, some simple programs of LISP.

Reference books:

1. Artificial Intelligence, Elanie Reich: Tata mcgraw Hill publishing house, 2008.
2. Artificial intelligence, Peterson, TataMcGraw Hill, 2008.
3. Artificial intelligence, Russel and Norvig, Pearson Printice Hall Publication, 2006.
4. Artificial Intelligence, Winston, PHI publication, 2006.

RESEARCH TECHNIQUES IN ICT			
Course Code:	**CS527**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I INTRODUCTION TO RESEARCH TECHNIQUES

Meaning of research, objectives of research, motivation in research, types of research (Introduction to experimental test bed, algorithmic research, simulation research, mathematical modeling approach), characteristics and prerequisites of research, significance of research, research process, sources of research problem, criteria of identifying the problem, necessity of defining the problem, errors in selecting research problem, technique involved in defining the problem, report and paper writing.

UNIT II DATA ANALYSIS ANDSTATISTICAL TECHNIQUES

Data and their analyses, quantitative methods and techniques, Measure of central tendency, measures of variation, frequency distribution, analysis of variance, methods, Correlation analysis, regression analysis, time series and forecasting, introduction to discriminant analysis, factor analysis, cluster analysis, conjoint analysis, probability distribution, binomial distribution, poisson distribution, uniform distribution, exponential distribution, and normal distribution, sampling methods, test of hypothesis.

UNIT III MATHEMATICAM MODELING

Steps of modeling, operations research models like queuing theory, stochastic processes, application of models, conceptual framework development and validation techniques, optimization techniques.

UNIT IV ALGORITHMIC RESEARCH

Algorithmic research problems, types of algorithmic research, types of solution procedure, steps of development of algorithm, steps of algorithmic research, design of experiments,

UNIT V SIMULATION ANDSOFT COMPUTING TECHNIQUES

Introduction to soft computing, artificial neural network, genetic algorithm, fuzzy logic and their applications, tools of soft computing, need for simulation, types of simulation, simulation language, fitting the problem to simulation study, simulation models, output analysis, data simulation packages like MATLAB, NS2, ANSYS, Cadence.

Reference Books:

1. Research Methodologies, R. Panneerselvam, Prentice Hall, 2007.
2. Research in Education, Best John V. and James V Kahn, Wiley eastern, 2005.
3. Elements of Educational Research, Sukhia, S.P., P.V. Mehrotra, and R.N. Mehrotra, PHI publication, 2003.
4. Methodology of Research Education, K. Setia, IEEE publication, 2004.
5. Research methodology, Methods and Techniques, Kothari, C.R., 2000.

ADVANCED DBMS LAB			
Course Code:	**CS581**	**Credits:**	**2**
No. of Lectures (Hrs/Week):	**3**		
Total No. of Lectures:	**10**	**End Sem Exam Hours:**	**2**

Programs/Experiments List:

1. Introduction to MySQL, Postgre Sql, Microsoft Sql softwares.
2. An exercise of data types in PostGresql & Data Definition Language Commands
3. Exercise on Data Manipulation Language and Transaction Control Commands using PostgreSql.
4. Exercise on Types of Data Constraints using PostgreSql.
5. Exercise on JOINS (Single-Table) Using Normalization
6. Exercise on JOINS (Multiple-Table) Using Normalization
7. Exercise on GROUP BY/ORDER BY Clause and Date Arithmetic using PostgreSql.
8. Exercise on different Functions (Aggregate, Math and String)
9. Exercise on different types of sub queries
10. Procedures
11. View
12. Triggers

Intelligent System Design Lab			
Course Code:	**CS585**	**Credits:**	**2**
No. of Lectures (Hrs/Week):	**3**		
Total No. of Lectures:	**10**	**End Sem Exam Hours:**	**2**

1. Write a program for depth first search.
2. Write a program for best first search.
3. Write a program to generate the output for a* algorithm.
4. Write a lisp program to solve water jug problem using heuristic function.
5. Write a program to show the tic tac toe game for 0 and x.
6. Write a program for expert system by using forward chaining.
7. Write a program for expert system by using backward chaining.
8. Write a program for branch and bound searching technique.
9. Write a program for travelling-salesman problem.
10. Write a program for tower of hanoi problem.

INTELLIGENT SYSTEMS AND ROBOTICS

(SEMESTER - II)

KNOWLEDGE ENGINEERING			
Course Code:	**CS562**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I FUNDAMENTALS OF KNOWLEDGE

Concept of knowledge, types of knowledge, declarative knowledge, procedural knowledge, inheritable knowledge, inferential knowledge, relational knowledge, heuristic knowledge, commonsense knowledge, explicit knowledge, tacit knowledge, uncertain knowledge.

UNIT II KNOWLEDGE REPRESENTATION

The need of knowledge representation, levels of knowledge representation, granularity of knowledge representation, granularity vs. size of knowledgebase, techniques of knowledge representation, frames, reasoning with frames, frame based knowledge representation, semantic network, partitioned semantic nets, conceptual graphs, scripts.

UNITIII KNOWLEDGE STORAGE AND ACQUISITION

Need of knowledge storage, characteristic of good knowledge representation, knowledge acquisition, indexing techniques, fuzzy distance calculation, issues in knowledge acquisition, requirements of knowledge acquisition techniques, issues in knowledge acquisition in organization, knowledge organization and management, consistency of knowledge representation.

UNIT IV KNOWLEDGEORGANISATION AND MANAGEMENT

Need of organizing the knowledge, techniques of knowledge organization, forward reasoning and backward reasoning, combination of forward and backward chaining, matching, conflict resolution, information retrieval from knowledge base, indexing, matching, RETE matching algorithm.

UNIT V APPLICATIONS OF KNOWLEDGE

Knowledge reuse technique in the designing of expert systems, components of knowledge engineering based problem solution methodology: identification of task, assembly of relevant knowledge, identification of lexicon, encoding general and domain specific knowledge, choosing inference procedure, identifying the bugs, rule based systems, blackboard architectures.

Text Books:

1. Artificial Intelligence and Knowledge Engineering, Winston, PHI publication , 2004.
2. Conceptual Information Processing, R.C Schank, Amsterdum North Holland, 2003.

Reference Books:

1. The basic concepts of knowledge engineering by Shank and J.G. Carbonell, PHI publication, 2003.
2. Principles of Artificial intelligence, Nillson, N.J., Morgan Kaufmann publication, 2004.
   Knowledge Management, by Shelda Debowski, John Wiley & Sons publication,

SOFT COMPUTING TECHNIQUES			
Course Code:	**CS564**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I FUZZY LOGIC

Introduction to fuzzy logic, classical and fuzzy sets, overview of fuzzy sets, membership function, fuzzy rule generation, operations on fuzzy sets: compliment, intersection, union, combinations on operations, aggregation operation.

UNIT II FUZZY ARITHMETIC

Fuzzy numbers, linguistic variables, arithmetic operations on intervals & numbers, uncertainty based information, information and uncertainty, no specificity of fuzzy and crisp sets, fuzziness of fuzzy sets.

UNIT III NEURAL NETWORK

Overview of biological neurons, computational neuron, mathematical model of neurons, ANN architecture, single layer and multilayer architectures, activation function, threshold value, self learning and forced learning algorithms, feed forward and feedback architectures.

UNIT IV LEARNING FUNDAMENTALS

Learning paradigms, supervised and unsupervised learning, reinforced learning, ANN
training, algorithms perceptions, training rules, delta, back propagation algorithm, multilayer perception model, Hopfield networks, associative memories, applications of artificial neural networks,

UNIT V GENETIC ALGORITHMS

History of genetic algorithm, terminology of genetic algorithm, biological background, creation of offspring, working principles of genetic algorithms, fitness function, reproduction: Roulette wheel selection, Boltzmann selection, cross over mutation, inversion, deletion, and duplication, generation cycle.

UNIT VI CONCEPT OF UNCERTAINTY

Presence of uncertainty in real world problems, handling uncertain knowledge, degree of belief, degree of disbelief, uncertainty and rational decisions, decision theory, utility theory, concept of independent events, Bay's rule, using Bay's rule for combining events.

Text Books:

1. Artificial Neural Networks: An introduction to ANN Theory and Practice, Peteus J. Braspenning, PHI publication, 2005.
2. Fuzzy Logic: A spectrum of Theoretical and Practical issues, Paul P. Wang, pearson publication 2004.

Reference Books:

3. Fuzzy Sets, Fuzzy logic, and Fuzzy Systems: Selected Papers- Lotfi Asker Zadeh, George J. Kilr, Bo yuan, 2005.
4. Foundations of Fuzzy logic and Soft Computing: 12th International Fuzzy conference proceeding, 2005.
5. Neural Networks Theory, Particia Melin, Oxford University press, 2003
6. Neural Networks Theory and Application, Oscar Castillo, Wiley Eastern publication

Introduction to Embedded System			
Course Code:	**CS572**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT -I:

Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT -II:

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT -III:

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV:

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT -V:

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

TEXT BOOKS:

1.Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

REFERENCE BOOKS:

1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013
4. An Embedded Software Primer - David E. Simon, Pearson Education.

NATURAL LANGUAGE PROCESSING			
Course Code:	CS667	Credits:	3
No. of Lectures (Hrs/Week):	3	Mid Sem Exam Hours:	2
Total No. of Lectures:	45	End Sem Exam Hours:	3

UNIT I INTRODUCTION

Fundamental aspects of natural language processing, brief history of natural language processing, significance of natural language processing, some early natural language processing systems like ELIZA, LUNAR, SHRDLU, practical front ends, general NLP system, role of knowledge in language processing, fundamental aspects of English grammar

UNIT II PHASES OF NATURAL LANGUAGE PROCESSING

Various phases of natural language processing: phonological analysis, morphological analysis, lexical analysis, syntactic analysis, semantic analysis, pragmatic and discourse analysis, parsing techniques: top down parsing, bottom up parsing bidirectional parsing, deterministic parsing, non deterministic parsing, comparison of various parsing techniques.

UNITIII APPROACHES TO SYNTACTIC ANALYSIS

Word class and part of speech tagging, rule based part of speech tagging, stochastic part of speech tagging, HMM algorithm of tagging, basic parsing techniques, top down parsing, bottom up parsing, comparison of top down and bottom up parsing, problems of top down and bottom up parser, left recursion, ambiguity, repeated parsing of subtrees, Early algorithm.

UNIT IV APPROACHES TO SEMANTIC ANALYSIS

Syntax driven semantic analysis, lexical semantic approach, use of knowledge for language analysis, representation of knowledge for language analysis, first order predicate calculus, concept of pragmatic and discourse analysis, concept of anaphora, basic types of anaphora, some elementary anaphora resolution approaches.

UNIT V TRANSITION NETWORKS AND GRAMMARS

Concept of transition network, use of transition network for basic language analysis, recursive transition network, augmented transition network, fundamental aspects of grammars, context free grammars, feature and augmented grammars, unification grammar, Fillmore's grammar.

Text Books:

1. Natural language understanding, James Allen: Tata Mc Graw hill publishing house, 2004.
2. Language and speech processing, James Martin: PHI publication, 2003.

References:

1. Natural Language Processing, Gazdar, PHI publication, 2004.
2. Natural Language Processing, Sampson, Narosa publication, 2005.

Soft Computing Lab			
Course Code:	**CS 584**	**Credits:**	**2**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**15**	**End Sem Exam Hours:**	**3**

1. Implementation of operations on classical setsusing C/MATLAB
2. Implementation of Fuzzy operations using C/MATLAB.
3. Implementation of a fuzzy inference system on a given problem using MATLAB.
4. Implementing Simple perceptron model to show effect of inputs, weights and bias on decision boundary using MATLAB.
5. Train the simple perceptron to show its limitation to solve only linearly separable boundary problem using MATLAB.
6. To design, implement and train a feedforward ANN to solve a pattern recognition problemusing MATLAB.
7. To design, implement and train a linear adaptive filter using tapped delay line and ANNusing MATLAB.
8. Implementing SGA to solve function optimization problem in a given rangeusing MATLAB.
9. Implementation of ACO for Travelling Salesperson Problemusing MATLAB.
10. Using ANFIS to solve a given problemusing MATLAB.

INTELLIGENT SYSTEMS AND ROBOTICS

(ELECTIVE - 1)

MACHINE TRANSLATION AND LEARNING			
Course Code:	**CS568**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I OVERVIEW OF MACHINE TRANSLATION

Definition, fundamental concepts, applications, language similarities and differences, cross language information retrieval, computer aided human translation, sublanguage classification, concept of polysynthetic language, Sapir – Whorf hypothesis, concept of ontology, direct vs. indirect translation, statistical model of machine translation.

UNIT II DIFFERENT MACHINE TRANSLATION MODELS

Graphical models: belief networks, Bayesian networks, Hidden Markov models, incremental learning, reinforcement learning, machine learning applications.

UNITIII MACHINE TRANSLATION METHODOLOGIES

Decision trees, linear discrimination, Neural networks, support vector machines (SVMs), quantifying fluency and faithfulness, usability and system development, direct transfer, quantifying fluency and faithfulness, boosting and bagging, naive Bayes classifiers, gradient-descent, Q-learning.

UNIT IV MACHINE-LEARNING FUNDAMENTALS

Classification, regression and clustering; noisy, noise-free and incomplete data; supervised and unsupervised learning; hypothesis classes, model complexity, model selection, Ockham's razor and bias-variance dilemma, dynamic environments, reinforcement learning and the exploration-exploitation dilemma.

UNIT V BASIC LEARNING METHODS

Unsupervised learning: K-means, vector quantization, self-organizing neural networks. Supervised learning: K nearest neighbor, learning vector quantization, decision tree, supervised neural networks, the transfer metaphor, syntactic transformations, lexical transformations.

Text Books:

1. Machine Translation of Languages, Wilen Sky R. Planning and understanding, Addison Wisely, ReadingMA, 2003.
2. Artificial Neural Networks: An Introduction to ANN Theory and Practice by Peteus J. Braspenning, PHI publication, 2005.

References Books:

1. A New Approach to Machine Translation, Russel S, and Norvig P, Pearson education publication, 2003.
2. Evolutionary Language Understanding, Sampson G. Mc. Graw Hill publication, 2002.
3. The Machine Translation perspective, Schank, R.C., PHI publication 2000.

DIGITAL IMAGE PROCESSING			
Course Code:	**EC447**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

Unit I: Digital Image Processing (DIP)
Introduction, examples of fields that use DIP, fundamental Steps in DIP, components of an image processing System., Digital Image Fundamentals- elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels

Unit II: Image Transforms
Two-dimensional (2-D) impulse and its shifting properties, 2-D continuous Fourier Transform pair, 2-D sampling and sampling theorem,2-D Discrete Fourier Transform (DFT), properties of 2-D DFT.Other transforms and their properties:Cosine transform, Sine transform, Walsh transform, Hadamard transform, Haar transform, Slant transform, KL transform.

Unit III: Image Enhancement
Spatial domain methods-basic intensity transformation functions, fundamentals of spatial filtering, smoothing spatial filters (linear and non-linear), sharpening spatial filters (unsharp masking and highboost filters), combined spatial enhancement method.Frequency domain methods- basics of filtering in frequency domain, image smoothing filters (Butterworth and Guassian low pass filters), image sharpening filters (Butterworth and Guassian high pass filters), selective filtering.

Unit IV: Image Restoration
Image degradation/restoration, noise models, restoration by spatial filtering, noise reduction by frequency domain filtering, linear Position invariant degradations, estimation of degradation function, inverse filtering, Wiener filtering, image reconstruction from Projection.

Unit V: Image Compression
Fundamentals of data compression- basic compression methods: Huffman coding, Golomb coding, LZW coding, Run-Length coding, Symbol based coding. Digital Image Watermarking, Representation and Description- minimum perimeter polygons algorithm (MPP).

Text Books:
[1] R. C. Gonzalez and R. E. Woods: Digital Image Processing, 3rd Edition, Pearson Education.
[2] A. K. Jain: Fundamentals of Digital Image Processing, PHI Learning.
[3] S. Annadurai and R. Shanmugalakshmi: Fundamentals of Digital Image Processing, Pearson Education.

References:
[1] M. Sonka, V. Hlavac and R. Boyle: Digital Image Processing and Computer Vision: Cengage Learning.
[2] B. Chanda and D.D. Majumder: Digital Image Processing and Analysis, PHI Learning.
[3] S. Jayaraman, S. Esakkirajan and T. Veerakumar: Digital Image Processing, TMH.

SPEECH PROCESSING			
Course Code:	**CS570**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I INTRODUCTION AND OVERVIEW

Fundamentals of speech processing, ambiguity and uncertainty in speech processing, representation of speech signal in electrical format, manipulation of speech signal, acquisition of speech signal, storage of speech signal.

UNIT II WAVE SHAPING OF SPEECH SIGNAL

Basic concept of wave shaping, Fourier series, representation of signal using Fourier series, calculation of bandwidth, sending a signal through the limited bandwidth channel, multiplexing and de-multiplexing of a signal.

UNITIII STRING EDIT DISTANCE

Key algorithmic tool: dynamic programming, use of dynamic programming in optimal alignment of sequences, string edit operations, edit distance, and examples of use in spelling correction, and machine translation.

UNIT IV PROBABILITY

Introduction to probability theory, concepts related to modern speech processing, events and counting, joint and conditional probability, marginal's, independence, Bayes rule, combining evidence. application of probability in speech processing, **non-probabilistic methods of speech processing.**

UNIT V INFORMATION THEORY

Concept of information, measurement of information in bits, characteristics of noiseless and noisy channel. Entropy, cross-entropy, information gain, application of information theory to some language phenomenon, probabilistic language modeling and its applications.

INTELLIGENT SYSTEMS AND ROBOTICS

(SEMESTER - III)

EXPERT SYSTEM DESIGN			
Course Code:	**CS661**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I EXPERT SYSTEM AND KNOWLEDGE REPRESENTATION

Introduction, Advantages, General Concepts, Characteristics, Development of Expert System Technology, Applications and Domain, Language, Shells, Tools, Elements, Production Systems, Procedural Paradigms, Artificial Neural Systems, Meaning of Knowledge, Productions, Semantic Nets, Object-Attribute-Value Triples, Prolog and Semantic Nets, Difficulties With Semantic Nets, Schemata, Frames, Difficulties With Frames, Logic and Sets, Propositional Logic, First Order Predicate Logic, Universal Quantifier, Existential Quantifier and Limitations of Predicate Logic

UNIT II INFERENCE

Introduction, Trees , Lattice, Graphs, State and Problem Spaces, And-Or Trees and Goals, Deductive Logic Syllogisms, Rule of Inference, Limitations of Propositional Logic, Logic Systems, Resolution, Resolution System and Deduction, Shallow and Casual Knowledge, Forward and Backward Knowledge, Other Method of Inference, Metaknowledge, Hidden Markov Models.

UNITIII DESIGN OF EXPERT SYSTEM

Introduction, Selection of Appropriate Problem, Stages in the Development of Expert System, Errors in Development Stages, Software Engineering and Expert Systems, The Expert System Life Cycle, A Detailed Life Cycle Model.

UNIT IV REASONING UNDER UNCERTAINITY

Introduction, Uncertainty, Errors, Induction, Classical Probability, Experimental and Subjective Probabilities, Compound Probabilities, Conditional Probabilities, Hypothetical Reasoning and Backward Induction, Temporal Reasoning and Markov Chains, Odds of Belief, Sufficiency and Necessity, Uncertainty in Inference Chains, Combination of Evidence.

UNIT V INEXACT REASONING

Introduction, Uncertaininty and Rules, Ceratinity Factors, Dempster-Shafer Theory, Approximate Reasoning, The State of Uncertaininty, Commercial Applications of Fuzzy Logic.

Reference Books:

1. Measuring and Managing Knowledge for Expert System , Mc. Graw- hill Boston, 2001.
2. Dendral: Expert System, Feigenbaum et al, by PHI publication, 1992.
3. Modal Operators in expert systems, Berners Lee, Mc Garw hill publication, 2002.
4. The Frame Based Knowledge Representation in Expert Systems, Mc Carthy and Hays, PHI publication, 2003.
5. Decision Theoretic Expert Systems, Russel, Wiley Eastern publication, 2002.

ROBOTICS			
Course Code:	**CS699**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I THE KINEMATICS OF ROBOTICS

Forward and inverse kinematics, motion kinematics, low-level and high-level trajectory planning. static force and torque relations, internal sensory devices: position and velocity sensors, external sensory devices: force, tactile and proximity sensors, machine vision, robot programming: multi-level approach, programming techniques, world modeling, off-line programming and simulation.

UNIT II BASIC ROBOT FUNCTIONING

History of robots, types of robots, uses of robots, present status and future trends in robotics, overview of robot subsystems, Issues in designing and controlling robots: resolution, repeatability and accuracy, transmission, Robot configurations and concept of workspace, mechanisms and transmission, motion planning obstacle avoidance, configuration space, road map methods, graph search algorithms, potential field methods.

UNITIII SPATIAL DESCRIPTIONS

Descriptions, postings, orientations, and frames, mappings, operators : translations, rotations, and transformations, transformation arithmetic, transform equations, transformation of free vectors, computational considerations.

UNIT IV ROBOT ANATOMY

End effectors and actuators, Different types of grippers, vacuum and other methods of gripping. pneumatic, hydraulic and electric actuators, Sensors and controllers, internal and external sensors, position, velocity and acceleration sensors, proximity sensors, force sensors, laser range finder, camera, micro-controllers, centralized controllers, real time operating systems.

UNIT V TASK SPECIFICATION OF ROBOT

Point to point and continuous motion specifications for typical applications, joint interpolation, task space interpolation, executing user specified tasks, Robot analysis, position and orientation of rigid bodies, spatial mechanism description, Denavit-Hartenberg notation, homogenous transformation, forward and inverse position analysis, velocity mapping, static force analysis, singularities, acceleration mapping, robot control Independent joint control, PD and PID feedback, actuator models, nonlinearity of manipulator models, issues in nonlinear control, force feedback, hybrid control, Case studies: Robot in assembly (Puma). Mobile robot (Nataraj)

Reference Books:

1. Introduction to Robotics, Mechanics and control, John J. Craig, Pearson Education publication, 2004.
2. Robotic moments, S Mujtaba and R. Goldman , PHI publication, 2003.
3. An Advance Robotic Programming, A. Gilbert, American Robot corporation 1984.
4. Design of an Interactive Manipulator Programming environment, UMI Research Press, 1985.
5. Mechanical Engineering design, J Shigley, 3rd edition, Mc, Graw hill, New York 1977.

Expert System Design Lab			
Course Code:	**CS683**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

1. Design and Development of an expert system which incorporate following programs-

I. Feasibility study ; to be developed expert system.

II. Write the If-Then rules for the development of expert system.

III. Development of database and relations with proper data types.

IV. Write a program for forward chaining mechanism.

V. Write a program for backward chaining mechanism.

VI. Write a program for Hybrid chaining mechanism.

VII. Write a program for the connection establishment between front-end and back-end.

2. Study of different commercial expert system shells.

3. To Study JESS expert system

4. To Study RVD expert system

INTELLIGENT SYSTEMS AND ROBOTICS

(ELECTIVE–2 & 3)

INTELLIGENT INFORMATION RETRIEVAL			
Course Code:	**CS663**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I INFORMATION RETRIEVAL FUNDAMENTALS

Text based information retrieval, examples of information retrieval, need of maintain the global information base, use of information for planning, reliability of information storage, redundancy in information storage, report on 21st Century Intelligent Systems, role of intelligent systems in e-governance.

UNIT II INFORMATION RETRIEVAL MODELS

Information retrieval using the Boolean model, dictionary and postings, dictionary based approaches of information retrieval, lists, adhoc information retrieval method, Indexing, scoring and term weighting, random vs. sequential search methods, the content based information retrieval system, consistency of retrieved information, accuracy and precision of retrieved information.

UNITIII INTERNET BASED INFORMATION RETRIEVAL METHODS

Vector space retrieval, relevance feedback and query expansion, XML retrieval probabilistic information retrieval, language models for information retrieval, text classification and Naive Bayes, web search basics, web crawling and indexes, evaluating information retrieval methods, concept of precision and recall.

UNIT IV AGENT-BASED INFORMATION RETRIEVAL

Ontology-based web agents, searching for Information in unstructured knowledge domains, intelligent adaptive Information agents, designing of agent for information retrieval, incorporation of AI concepts for design of intelligent agent,

UNIT V INFORMATION RETRIEVAL TECHNIQUES

Intelligent systems for finding Genes in DNA, using Information content to evaluate semantic similarity in information taxonomy.

Text Books:

1. Machine Learning and Statistical Modeling Approaches to Image Retrieval, Chen, Li, and Wang, , Kluwer, 2004.
2. Information Representation and Retrieval in the Digital Age, ASIS, Chu, Heting, , 2003.

Reference Books:

1. The Modern Algebra of Information Retrieval, Dominich, Sandor, Springer 2008.
2. Feldman, R. and Sanger, J. The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data. CambridgeU. Press, 2006.
3. The Subject Approach to Information, Foskett, A. C., London, Lib. Assoc. Publ, 1996.

PATTERN MATCHING			
Course Code:	**CS665**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT I INTRODUCTION AND BAYESIAN DECISION THEORY

Introduction to pattern recognition, Systems, design cycles, learning and adaptation, Bayesian decision theory, minimum error-rate classification, classifiers, discriminate functions and decisions surfaces.

UNIT II MAXIMUM – LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION

Maximum – Likelihood estimation, Bayesian estimation, Bayesian parameter estimation, Gaussian case and general theory, problems of dimensionality, Hidden Markov models, rules for pattern matching, incremental forward chaining, matching with known facts, data complexity.

UNITIII NONPARAMETRIC TECHNIQUES

Density estimation, parazen windows, Kn – Nearest neighbor estimation, nearest neighbor node metric technique.

UNIT IV LINEAR DISCRIMINATE FUNCTIONS

Linear discriminate functions and decision surfaces, generalized linear discriminate functions, two category uniformly separate case, minimizing the perception criterion function, relaxation procedures, nonseperable behavior, minimum squared-error procedures, Ho–Kashyap Procedures, support vector machines, multicategory generalization.

UNIT V UNSUPERVISED LEARNING

Clustering mixture densities and identifiability, maximum, likelihood estimation, application to normal mixtures, unemperouses, Bayesian learning, Data descriptions and controls, criterion function for clustering, interface, optimization, hierarchical clustering, component analysis, low dimension representation and multidimensional scaling.

Text Books:

1. Pattern Classification Richard O. Duda, Peter E. Hart and David G. Stork," 2nd Edition, John Wiley, 2003.
2. Introduction to the theory of Neural Computation, John Hertz, Andres Krogh & Richard G. Palmer, Addison Wesley, 2004.

References:

1. "Learning from Data-Concepts, Theory and Methods, Cherkassky V., F. Kulier, John Wiley, New York, 1998.
2. Neurocomputing: Foundations of Research, MIT Press, CambridgeAnderson J.A., E. Rosenfield, MA, 1988.
3. Self-Organizing Maps, Kohonen T., 2nd Ed., Springer Verlag, Berlin, 1997.
   Pattern Recognition by Devrophi publication, 1996.

Evolutionary Computation			
Course Code:	**CS572**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**3**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:	**45**	**End Sem Exam Hours:**	**3**

UNIT-I–Fundamental Concepts and Dialects Metaheuristics; Requirements of metaheuristics in optimization problems; characteristics of problems suitable for applicability of metaheuristics; Evolutionary computing metaphor and Inspiration from biology; Applications, Pros, and cons of evolutionary computations; Components of evolutionary computation; example applications – eight queen problem, knapsack problem; various dialects of evolutionary computation.

UNIT-II–Genetic Algorithms Introduction; Canonical GA; Binary, integer, real-valued, and permutation representations and variation operators for them; Population Models; Parent Selection – Fitness proportionate selection, Rank based selection, implementing selection probabilities, tournament selection; Survivor strategy. Implementation issues, parameters' control and effect on GA dynamics.

UNIT-III–Theoretical Foundation of Genetic Algorithms Schemas and hyperplane sampling; Schemata theorem, limitations and building block hypothesis; Two-armed bandit problem; Deceiving a GA; Minimal deceptive problem; Royal Roads functions; SAHC; NAHC; RMHC; Hitchhiking; Exact Mathematical Models of SGA; Statistical-Mechanics Approaches.

UNIT-IV–Problem Solving Using EC Evolving computer programs – evolving LISP programs, evolving cellular automata; Data analysis and prediction – predicting dynamical system, predicting protein structure; Evolving Neural Networks – evolving weights, architecture(Direct encoding and Grammatical encoding), and learning rules; Baldwin effect and evolutionary reinforced learning.

UNIT-V– Parallel Implementation and Other Dialects of EC Parallel implementation of GA; Genetic Programming; Evolutionary Programming; Evolutionary Strategies; Learning Classifier Systems; Memetic Algorithms; Introduction to MOGA.

Reference Books:

1. An Introduction to Genetic Algorithms, Milanie Mitchell, MIT Press.
2. Genetic Algorithms, David E. Goldberg, Pearson Education.
3. Handbook of Genetic Algorithms, Lowrence Davis, Van Nostrand ReinholdMulti-Objective Optimization using Evolutionary Algorithms, Kalyanmoy Deb, Wiley

MULTIMEDIA AND COMPUTER GRAPHICS			
Course Code:	**CS 671 3**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**45**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:		**End Sem Exam Hours:**	**3**

UNIT- I

Introduction, Applications areas, Components of Interactive Computer Graphics System. Overview of Input devices, Output devices, raster scan CRT displays, random scan CRT displays. DDA and Bresenham's Line Drawing Algorithms, Bresenham's and Mid Point Circle Drawing Algorithms. Homogeneous Coordinate Systemfor 2D and 3D, Various 2D, 3D Transformations (Translation, Scaling, Rotation, Shear).

UNIT- II

Clipping Algorithms, Sutherland-Cohen line Clipping Algorithm Bezier Curves, B-Spline Curves. Parallel Projection, Perspective Projection, Illumination Model for diffused Reflection, Ambient light, Specular ReflectionModel, Reflection Vector.

UNIT- III

Shading Models, Flat shading, Gourard Shading, Phong Model. Visible surface detection, Back Face Detection,Depth Buffer (Z-Buffer, A-Buffer) Method. Overview of multimedia: Classification, basic concepts ofsound/audio MIDI: devices, messages, software. , Authoring tools, Video and Animation: controlling animation,display and transmission of animation

UNIT- IV

Data Compression: storage space, coding requirements, Basic compression techniques: run length code, Huffmancode, Lempel-Ziv JPEG: Image preparation, Lossy sequential DCT, expanded lossy DCT, Lossless mode,Hierarchical mode. MPEG, Media synchronization, Media Integration, Production Standards.

Text Books:

1. Introduction to Theory of Neural Computation, John Hertz, Andres Krogh & Richard G. Palmer, Addison Wesley, 2004.
2. A New Approach to Speech Processing, Russel S, and Norvig Prentice hall publication, 2003.

References:

1. Evolutionary speech processing by Sampson G, Mc. Graw Hill publication, 2004.
2.The Speech Translation, A New Perspective, Schank, R.C 2003.
3. "Mathematical Methods for Neural Network Analysis and Design", Golden R.M., MIT Press, Cambridge, MA, 1996.
4. Information Retrieval, Salton, Mc Graw Hill 1983.

FUZZY SET THEORY			
Course Code:	**CS6693**	**Credits:**	**3**
No. of Lectures (Hrs/Week):	**45**	**Mid Sem Exam Hours:**	**2**
Total No. of Lectures:		**End Sem Exam Hours:**	**3**

UNIT-I Introduction to Fuzzy Sets

Overview of crisp sets; crispness, vagueness, fuzziness and uncertainty; Fuzzy-sets – basic types and basic concepts; α-cuts, strong α-cuts, Representation of fuzzy sets; extension of fuzzy sets.

UNIT-II - Fuzzy Set Operations and Fuzzy Arithmatic

Fuzzy Complement; Fuzzy interaction, t-norms; Fuzzy unions, t-conorms; Combination of operations; Aggregation operation; Fuzzy numbers; Linguistic variables; Arithmatic operations on intervals; Arithmatic Operations on Fuzzy numbers;

UNIT-III - Fuzzy Relations and Fuzzy Logic

Crisp vs Fuzy relations; Projections and Cylindrical extansions; binary fuzzy relations; Binary relations on a single set; Fuzzy equivalence relations; Fuzzy Compatibility Relations; Fuzzy ordering Relations; Fuzzy Morphisms.Multivalued logics; Fuzzy propositions; Fuzzy quantifiers; Linguistic Hedges.

UNIT-IV - Possibility Theory and Uncertainity-Based Information

Fuzzy measures; Evidence Theory; Possibility Theory; Fuzzy Sets and Possibility Theory; Possibility Theory vs probability Theory.Information and uncertainty; Nonspecificity of Crisp Sets; Nonspecificity of Fuzzy Sets; Fuzziness of Fuzzy sets.

UNIT-V Fuzzy Systems and Applications

Membership Functions; Features of the Membership Functions; Fuzzification; Defuzzification to crisp sets; λ-cuts for Fuzzy Relations; Defuzzification to Scalars;Fuzzy inference systems; Mamdani's fuzzy models; Sugeno's fuzzy models; Tsukamoto's fuzzy models; other variants; Applications

Reference Books:

1. Fuzzy Sets and Fuzzy Logic: Theory and Applications – George J. Klir and Bo Yuan; PHI
2. Fuzzy Set Theory and Its Applications – H.J. Zimmermann; Kluwer Academic Publishers
3. Fuzzy Logic with Engineering Applications – T. J. Ross; Wiley