M.Tech. (Full Time) - KNOWLEDGE ENGINEERING
CURRICULUM & SYLLABUS
2013 – 2014

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY
SRM NAGAR, KATTANKULATHUR – 603 203
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Total credits to be earned for the award of M.Tech degree – 71

CONTACT HOUR/CREDIT: L: Lecture Hours per week T: Tutorial Hours per week P: Practical Hours per week C: Credit
### PROGRAM ELECTIVES

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### SUPPORTIVE COURSES

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NOTE:

Students have to register for the courses as per the following guidelines:

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SEMESTER I

CS2021  ARTIFICIAL INTELLIGENCE AND INTELLIGENT SYSTEMS  L  T  P  C

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PURPOSE

The purpose of this course is to give students a comprehensive understanding of Artificial Intelligence and Intelligent Systems in the context of Knowledge Engineering.

INSTRUCTIONAL OBJECTIVES

1. To provide a strong foundations of fundamental concepts in Artificial Intelligence
2. To get familiar with the various applications of these techniques in Intelligent Systems

UNIT I - AI INTRODUCTION  (10 hours)

UNIT II - KNOWLEDGE AND REASONING  (17 hours)
Logical Agents - First-Order Logic - Inference in First-Order Logic - Classical Planning - Planning and Acting in the Real World - Knowledge Representation.

UNIT III - UNCERTAIN KNOWLEDGE AND REASONING  (20 hours)

UNIT IV - LEARNING  (17 hours)
Learning from Examples - Knowledge in Learning - Learning Probabilistic Models - Reinforcement Learning - Communicating, Perceiving, and Acting - Natural Language Processing - Natural Language for Communication - Perception
UNIT V - EXPERT SYSTEM

(11 hours)
Defining Expert Systems – Expert system architecture-Robot Architectures

REFERENCES

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<tr>
<th>CS2022</th>
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PURPOSE
To learn the Knowledge based system design techniques.

INSTRUCTIONAL OBJECTIVES
1. To learn the concepts of knowledge base and inference engine.

UNIT I – INTRODUCTION

(12 hours)

UNIT II – PROBLEM SOLVING

(12 hours)

UNIT III- EXPERT SYSTEMS

(12 hours)

UNIT IV EXPERT SYSTEM ARCHITECTURE AND PROGRAMMING

(12 hours)
UNIT V - MACHINE LEARNING (12 hours)

REFERENCES

CS2023 DATA & KNOWLEDGE MINING

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<th>CS2023</th>
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PURPOSE
This course provides a complete overview of Data mining and knowledge mining techniques.

INSTRUCTIONAL OBJECTIVES
1. To understand the concepts of Data Mining.
2. To understand Classification and prediction and cluster analysis techniques.
3. To understand Applications of Data and knowledge mining.

UNIT I - INTRODUCTION (12hours)

UNIT II - MINING FREQUENT PATTERNS (12hours)
Mining Frequent Patterns: Associations And Correlations - Basic Concepts – Frequent Item Set Mining Methods – Mining Various Kinds Of Association Rules – Correlation Analysis – Constraint Based Association Mining.
UNIT III - CLASSIFICATION AND PREDICTION (12hours)
Classification and Prediction: Issues Regarding Classification And Prediction – Decision Tree Induction Classification – Bayesian, Rule Based Classification – Support Vector Machine -Prediction: Linear, Non-Linear Regression – Accuracy and Error Measures.

UNIT IV - CLUSTER ANALYSIS (12hours)

UNIT V - APPLICATIONS AND TRENDS IN DATA MINING (12hours)
Applications and Trends in Data Mining: Data Mining Applications – Products And Research Prototypes – Additional Themes on Data Mining – Social Impacts of Data Mining – Trends in Data Mining..

REFERENCES

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PURPOSE
This course provides a complete overview of semantic Web and its Applications

INSTRUCTIONAL OBJECTIVES
1. To understand the concepts of Semantic Web.
2. To understand the characteristics of the agents.
3. To understand design and implementation of Agents.
4. To understand the implementation described in the architecture level.

UNIT I - INTRODUCTION (12 hours)
The world of the semantic web-WWW-meta data-Search engine-Search engine for traditional web-Semantic web-Search engine for semantic web-Traditional web to semantic web.

UNIT II - SEMANTIC WEB TECHNOLOGY (12 hours)
RDF-Rules of RDF-Aggregation-Distributed information-RDFS-core elements of RDFS-Ontology-Taxonomy-Inferencing based on RDF schema

UNIT III - OWL (12 hours)
OWL-Using OWL to define classes-Set operators-Enumerations-Define properties-ontology matching-Three faces of OWL-Validate OWL.

UNIT IV- SWOOGLE (12 hours)

UNIT V - SEMANTIC WEB SERVICES (12 hours)
Semantic web services-OWL-S-Upper ontology-WSDL-S,OWL-S to UDDI mapping ,Design of the search engine,implementations.
REFERENCES

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PURPOSE
The purpose of this course is to impart the various techniques for integrating knowledge into Neural Networks.

INSTRUCTIONAL OBJECTIVES
1. To be familiar with the various architectures and Techniques of Knowledge-Based Neural Computing.
2. To learn the methods for extracting rules from recurrent neural networks.
3. To apply Data mining Techniques for Information Extraction from Neural Networks.
4. To develop Hybrid Intelligent Systems.

UNIT I – ARCHITECTURES AND TECHNIQUES FOR KNOWLEDGE-BASED NEURO COMPUTING (15 Hours)

UNIT II – SYMBOLIC KNOWLEDGE REPRESENTATION IN RECURRENT NEURAL NETWORKS (15 Hours)
Introduction and Theoretical Aspects of Neural Networks – Recurrent Architecture and models of Computation – Representation of Symbolic Knowledge in Neural Networks – Computational Models as Symbolic Knowledge – Mapping Automata
into Recurrent Neural Networks – Extraction of rules from Recurrent Neural Networks – Implementation of Recurrent Neural Network Architecture.

UNIT III – STRUCTURAL LEARNING AND RULE DISCOVERY (18 Hours)

UNIT IV – INTEGRATION OF HETEROGENEOUS SOURCES OF PARTIAL DOMAIN KNOWLEDGE AND DATAMINING TECHNIQUES (12 Hours)

UNIT V – EXTRACTION OF DECISION TREES AND LINGUISTIC RULES FROM ANN (15 Hours)

REFERENCES

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PURPOSE
The course gives a comprehensive understanding on software agents.

INSTRUCTIONAL OBJECTIVES
1. The characteristics of the agents.
2. The design and implementation of Agents
3. The implementation described in the architecture level.

UNIT I – INTRODUCTION (12 hours)
Introduction about Agents - Interacting with Agents – How Might people interact with Agents - Agent from Direct Manipulation to Delegation - Interface Agent Metaphor with Character.

UNIT II – AGENT DESIGN AND COORDINATION (12 hours)
Designing Agents - Direct Manipulation versus Agent Path to Predictable - Agents for Information Sharing and Coordination.

UNIT III – AGENT IMPLEMENTATION

UNIT IV - INFORMATION INTEGRATION (12 hours)
Overview of Agent Oriented Programming - Agent Communication Language - Agent Based Framework of Interoperability - Agents for Information Gathering - Open Agent Architecture – Communicative Action for Artificial Agent.

UNIT V – MOBILE AGENT (12 hours)
Mobile Agent Paradigm - Mobile Agent Concepts -Mobile Agent Technology - Case Study: Tele Script, Agent Tel.

REFERENCES
### SEMESTER III

**ELECTIVE - III**

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Students to choose one Elective course from the list of courses mentioned in the curriculum.

### INTERDISCIPLINARY ELECTIVE

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Students to choose one Elective course from the list of Post Graduate courses specified under the Faculty of Engineering and Technology other than courses under M.Tech (CSE) curriculum either in I, II or III semester.

**SUPPORTIVE COURSE**

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Students to choose one course from the list of supportive courses mentioned in the curriculum either in I, II or III semester.
CS2047

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<td>To train the students in preparing and presenting technical topics.</td>
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**Instructional Objective**

The student shall be capable of identifying topics of interest related to the program of study and prepare and make presentation before an enlightened audience.

The students are expected to give at least two presentations on their topics of interest which will be assessed by a committee constituted for this purpose. This course is mandatory and a student has to pass the course to become eligible for the award of degree. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

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**Purpose**

To undertake research in an area related to the program of study

**Instructional Objective**

The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.

M.Tech projects should be socially relevant and research oriented ones. Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. Phase II of the project work shall be in continuation of Phase I only. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project. The method of assessment for both Phase I and Phase II is shown in the following table:
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Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.

PROGRAM ELECTIVES

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<th>CS2104</th>
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PURPOSE
The purpose of this course is to impart knowledge on various Digital Image Processing Techniques and their Applications

INSTRUCTIONAL OBJECTIVES
1. To learn Image Fundamentals and Processing Techniques
2. To be familiar with Image Transformations in Spatial Domain and Frequency Domain
3. To learn various Filters for Image Restoration
4. To study various Image Compression and Segmentation Techniques

UNIT I – DIGITAL IMAGE FUNDAMENTALS (8 hours)

UNIT II – IMAGE ENHANCEMENT (9 hours)
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain:
Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

UNIT III – IMAGE RESTORATION (9 hours)

UNIT IV – IMAGE COMPRESSION (9 hours)

UNIT V – IMAGE SEGMENTATION AND REPRESENTATION (10 hours)

REFERENCES
CS2108

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<th>PATTERN RECOGNITION TECHNIQUES</th>
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PURPOSE
To study the Pattern Recognition techniques and its applications.

INSTRUCTIONAL OBJECTIVES

1. To learn the fundamentals of Pattern Recognition techniques.
2. To learn the various Statistical Pattern recognition techniques.
3. To learn the various Syntactical Pattern recognition techniques.
4. To learn the Neural Pattern recognition techniques.

UNIT I – PATTERN RECOGNITION OVERVIEW (9 hours)
Pattern recognition, Classification and Description—Patterns and feature Extraction with Examples—Training and Learning in PR systems—Pattern recognition Approaches

UNIT II – STATISTICAL PATTERN RECOGNITION (9 hours)
Introduction to statistical Pattern Recognition—supervised Learning using Parametric and Non Parametric Approaches.

UNIT III – LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING (9 hours)
Introduction—Discrete and binary Classification problems—Techniques to directly Obtain linear Classifiers -- Formulation of Unsupervised Learning Problems—Clustering for unsupervised learning and classification.

UNIT IV – SYNTACTIC PATTERN RECOGNITION (9 hours)
Overview of Syntactic Pattern Recognition—Syntactic recognition via parsing and other grammars–Graphical Approaches to syntactic pattern recognition—Learning via grammatical inference.

UNIT V – NEURAL PATTERN RECOGNITION (9 hours)
Introduction to Neural networks—Feedforward Networks and training by Back Propagation—Content Addressable Memory Approaches and Unsupervised Learning in Neural PR.
REFERENCES
2. Earl Gose, Richard johnsonbaugh, Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India, Pvt Ltd, new Delhi, 1996

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<th>CS2109</th>
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PURPOSE
This course provides in-depth knowledge about data warehousing techniques

INSTRUCTIONAL OBJECTIVES
1. To understand the fundamental concepts of data warehousing technology
2. To learn step-by-step approach to designing and building a data warehouse
3. To learn case-studies to bring out practical aspects of building a data warehouse

UNIT I - INTRODUCTION TO DATA WAREHOUSING (8 hours)
Introduction to data warehousing-data Warehouse: Defining features-Architecture of data warehouse-Gathering the business requirements. Planning and project management.

UNIT II - DATA WAREHOUSE SCHEMA (8 hours)
Data Warehouse schema-Dimensional modeling-ETL Process-Testing, Growth and Maintenance-OLAP in the Data warehouse.
UNIT III - BUILDING A DATA WAREHOUSE  (10 hours)
Building a data warehouse-Introduction-critical success factors-Requirement analysis-Planning for the data warehouse-The data warehouse design stage-Building and implementing data marts-Building data warehouses-backup and Recovery-Establish the data quality framework-Operating the Warehouse-Recipe for a successful warehouse-Data warehouse pitfalls.

UNIT IV - DATA MINING BASICS  (8 hours)
Data Mining basics-Moving into data mining-Introduction to Web Mining, Text Mining Temporal Data Mining and Spatial Data mining-Issues in Data Mining.

UNIT V - CASE STUDY  (11 hours)
Data Warehousing in the Tamilnadu Government-Data Warehouse for the Ministry of commerce- Data Warehouse for the government of Andhra Pradesh- Data Warehousing in Hewlett –Packard- Data Warehousing in Levi Strauss- Data Warehousing in the World Bank-HARBOR, A Highly available Data Warehouse-A typical Business data Warehouse for a Trading company-Customer data warehouse of the world’s first and largest online Bank in the united Kingdom-A German super market EDEKA’s Data Warehouse.

REFERENCES

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PURPOSE
The purpose of this course is to impart knowledge on various elements and techniques of machine vision and to expose the students to its practical applications

INSTRUCTIONAL OBJECTIVES
1. To learn about Image formation concepts in computers  
2. To be familiar with earlier approaches of machine vision  
3. To explore the middle level approaches in machine vision
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**UNIT I - IMAGE FORMATION**  
(9 hours)  
Image formation Introduction-Cameras with lenses-Modelling pixel brightness-Radio metric calibration and high dynamic range Images-photometric stereo-human color perception-color representation-Inference from color

**UNIT II - EARLY VISION**  
(9 hours)  
Linear filters and convolution-Edge effects in discrete convolution-Sampling and aliasing-Applications of scaled representations-Computing image gradients-gradient based edge detection-neighbourhoods with SIFT and HOG features-local texture representations using filters-Image denoising.

**UNIT III - MIDDLE LEVEL VISION**  
(9 hours)  

**UNIT IV - HIGH LEVEL VISION**  
(9 hours)  
Registering rigid objects-Koenderink’s theorem –local and multi local visual events-object recognition using Spin images-decision trees and random forests-classification and its strategies (histogram, naïve bayes, ada boost and SVM)-detecting objects using slide window.

**UNIT V - APPLICATIONS**  
(9 hours)  
Image based modeling and rendering of Visual Hulls-patch based multi view Stereopsis –ranking documents-tracking people-3D from 2D.

**REFERENCES**

CS2123

HUMAN INTERFACE SYSTEM DESIGN

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PURPOSE
This course on user Interface Design provides a basic understanding of interface design and principles.

INSTRUCTIONAL OBJECTIVES
1. To Learn the basic fundamentals of the HISD
2. To Learn the various aspects of managing the human interface design
3. To Understand the various aspects involved in virtual environment and manipulation
4. To be familiar with various interfaces available

UNIT I - INTRODUCTION
(9 hours)
Goals of System Engineering - Goals of User Interface Design - Motivations of Human factors in Design - High Level Theories - Object - Action Interface Design - Three Principles - Guidelines for Data Display and Data Entry

UNIT II - MANAGING DESIGN PROCESS
(9 hours)

UNIT III - MANIPULATION AND VIRTUAL ENVIRONMENTS
(9 hours)

20

UNIT IV - INTERACTION DEVICES (9 hours)

UNIT V - WINDOWS STRATEGIES AND INFORMATION SEARCH (9 hours)

REFERENCES

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<th>CS2124</th>
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PURPOSE
This course presents a detailed knowledge of Reasoning Under Uncertainty and various models to represent it.

INSTRUCTIONAL OBJECTIVES
1. To understand Reasoning Under Uncertainty
2. To understand various models to represent Reasoning Under uncertainty
3. To understand various inference mechanisms in Reasoning Under uncertainty

UNIT I - INTRODUCTION (9 Hours)
Motivation and background - Qualitative and quantitative approaches to reasoning under uncertainty - Probabilistic reasoning- Probabilistic representation of uncertainty - Probability distributions-Prior and conditional probability-Inference using joint distributions-Conditional independence and Bayes' rule - The semantic of Bayesian networks-Conditional independence relations - Efficient representation of conditional distributions.

UNIT II - DEPENDENCY MODELS AND MAPS (9 Hours)
Qualitative reasoning about independence relationships-Dependency models and dependency maps- Bayesian networks- The semantic of Bayesian networks-Efficient representation of conditional distributions-Reasoning with Bayesian networks.

UNIT III - INFERENCE IN BNS (9 Hours)
The complexity of exact inference-Inference by enumeration-Pearl's message passing algorithm-The variable elimination algorithm-Clustering methods - Junction trees- Approximate inference in BNs- Approximate inference with stochastic simulation-Direct sampling methods, rejection sampling and likelihood weighting-Markov Chain Monte Carlo (MCMC).

UNIT IV - CAUSAL INFERENCE (9 Hours)
Reasoning about cause and effect Causes and explanations- Decision networks - The basis of utility theory-Decision trees and influence diagrams-The value of perfect and imperfect information-Evaluating influence diagrams.

UNIT V - PROBABILISTIC REASONING OVER TIME (9 Hours)
Inference in temporal models -Dynamic Bayesian networks-Inference algorithms for DBNs- Applications of BNs and knowledge engineering - Knowledge engineering with BNs -Evaluation and validation methods.

REFERENCES

<table>
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<th>CS2125</th>
<th>SPEECH AND LANGUAGE PROCESSING</th>
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**PURPOSE**
To expose the students to the basic principles of speech and language processing and typical applications of natural language processing systems.

**INSTRUCTIONAL OBJECTIVES**
1. To provide a general introduction including the use of state automata for language processing.
2. To provide the fundamentals of syntax including a basic parse.
3. To explain advanced feature like feature structures and realistic parsing methodologies.
4. To give details about a typical natural language processing applications.

**UNIT I – INTRODUCTION** (9 hours)

**UNIT II – SYNTAX** (9 hours)
Parsing as search - A Basic Top-Down parser - Problems with the basic Top-Down parser - The early algorithm - Finite-State parsing methods.

UNIT III – ADVANCED FEATURES AND SYNTAX (9 hours)

UNIT IV – SEMANTIC (9 hours)

UNIT V – APPLICATIONS (9 hours)

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<th>DEDUCTIVE AND INDUCTIVE REASONING</th>
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**PURPOSE**
This course presents a detailed knowledge of the principles of deductive and inductive reasoning, fallacies and their applications.

**INSTRUCTIONAL OBJECTIVES**
1. To understand the definitions and approaches to deductive reasoning.
2. To comprehend the inductive methods and fallacies.
3. To learn the applications of inductive and deductive reasoning.

**UNIT I – FORMAL LANGUAGE CONCEPTS**
(9 hours)
Some definitions of formal logical concepts- Classical symbolic logic – symbolic representation of language statements – formal logical rules of inference – semantics in formal logic – provability relation – does formal logic model

**UNIT II – HUMAN REASONING**
(9 hours)

**UNIT III – HEURISTICS**
(9 hours)
The representativeness heuristics and the availability heuristics – Atmosphere effect – effects of negation - Introduction – Affirming the consequent and denying the antecedent – errors in the interpretation of standard form categorical propositions – fallacies due to ambiguity of language - language nuances associated with conditional statements – conditional inferences made of ‘only if’ statements - ordinary languages Vs formal language definitions of quantifiers.

**UNIT IV – INDUCTIVE INFERENCE**
(9 hours)
UNIT V - FALLACIES OF INDUCTIVE REASONING (9 hours)
Fallacies of generalization – Fallacies of non-observation – False analogy – interpreting asymmetries of projection in Children’s inductive reasoning - use of single or multiple categories in category based induction – abductive inference from philosophical analysis to neural mechanisms.

REFERENCES

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PURPOSE
This course provides an overview of bioinformatics from a computer science perspective which makes the computer science aspects of bioinformatics more understandable for life scientists.

INSTRUCTIONAL OBJECTIVES
1. To understand Fundamental concepts and state-of-the-art tools
2. To learn about very large biological databases: object-oriented database methods, data mining/warehousing and knowledge management.
3. To explore the inner workings of biological structures.
4. To study advanced pattern matching techniques, including microarray research and gene prediction.

UNIT I - INTRODUCTORY CONCEPTS (9 hours)
UNIT II - SEARCH ENGINES AND DATA VISUALIZATION (9 hours)

UNIT III - STATISTICS AND DATA MINING (9 hours)

UNIT IV - PATTERN MATCHING (9 hours)

UNIT V - MODELING AND SIMULATION (9 hours)

REFERENCES
CS2128

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**PURPOSE**
This course presents a detailed knowledge of Spatial and temporal based reasoning techniques and their applications.

**INSTRUCTIONAL OBJECTIVES**
1. To understand Spatial reasoning and representations
2. To understand temporal problems and solutions
3. To understand applications of spatio-temporal reasoning

**UNIT - I SPATIAL REPRESENTATION** (9 hours)
Aspects of Spatial Representation - What is knowledge representation – what is so special about spatial – Qualitative, quantitative and hybrid approaches – frame of reference – points vs. extended objects- Points of view on spatial relations – granularity and vagueness – overview of extant approaches.

**UNIT - II TOPOLOGY AND APPLICATIONS OF GIS** (9 hours)

**UNIT - III TEMPORAL PROBLEMS AND ALGORITHMS** (9 hours)

**UNIT - IV TCSP, DTP AND ALGORITHMS** (9 hours)
UNIT – V SPATIAL INFORMATION SYSTEMS  (9 hours)
Improvements Applications - A generic model for spatio-bi-temporal geographic Information – process dynamics, temporal extent and casual propagation as the basis for linking space and time – relationship between geographic scale, distance and time as expressed in natural discourse – acquiring spatio-temporal knowledge from language – analyzing temporal factors in urban morphology development-The cognitive atlas – using GIS as a metaphor for Memory.

REFERENCES

3. Daniel Hernandez and Amitava Mukherjee, Leon Planken , “Reference notes”.

SUPPORTIVE COURSES

<table>
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<tr>
<th>MA2013</th>
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PURPOSE
To impart analytical ability and to solve real life problems pertaining to branches of Computer Science and Engineering.

INSTRUCTIONAL OBJECTIVES
1. To be exposed with logic.
2. To be thorough in mathematical induction.
3. To understand algebraic systems such as relations.
4. To be familiar with the basic concepts of lattices.

UNIT I – LOGIC  (9 Hours)
Logic - Statements - Connectives - Truth tables - Normal forms - Predicate calculus - Inference Theory for Statement calculus and predicate calculus.
UNIT II – COMBINATORICS (9 Hours)
Combinatory - Mathematical Induction - Pigeonhole principle - Principle of inclusion and exclusion.

UNIT III- RECURSIVE FUNCTIONS (9 Hours)
Recursive Functions- Recurrence relation - Solution of recurrence relation using characteristic polynomial and using generating function - Recursive functions - Primitive recursive functions, Computable and non computable functions.

UNIT IV- ALGEBRAIC STRUCTURES (9 Hours)
Algebraic Structures - Groups - Definition and examples only - Cyclic groups - Permutation group (Sn and Dn) - Subgroups - Homomorphism and Isomorphism - Cosets - Lagrange's Theorem - Normal subgroups - Cayley's representation theorem.

UNIT V – LATTICES (9 Hours)
Lattices - Partial order relations, Poset - Lattices, Hasse diagram - Boolean algebra.

REFERENCES

MA2010

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**PURPOSE**

To develop analytical capability and to impart knowledge in graphs, linear programming problem and statistical methods and their applications in Engineering & Technology and to apply their concepts in engineering problems they would come across.

**INSTRUCTIONAL OBJECTIVES**

1. student should be able to understand graphs, linear programming problems and statistical concepts.
2. Students should be able to apply the concepts in solving the Engineering problems.

**UNIT I - BASICS OF GRAPH THEORY** (9 hours)

Graphs - Data structures for graphs - Subgraphs - Operations on Graphs

**UNIT II - CLASSES OF GRAPHS** (9 hours)

Eulerian graphs and Hamiltonian graphs - Standard theorems - Planar graphs - Euler's formula - Five colour theorem - Coloring of graphs - Chromatic number (vertex and edge) properties and examples - Directed graphs.

**UNIT III - GRAPH ALGORITHM** (9 hours)

Computer Representation of graphs - Basic graph algorithms - Minimal spanning tree algorithm - Kruskal and Prim's algorithm - Shortest path algorithms - Dijsktra's algorithm - DFS and BFS algorithms.

**UNIT IV - OPTIMIZATION TECHNIQUES** (9 hours)

Linear programming – Graphical methods – Simplex method (Artificial variables not included) – Transportation and assignment problems.

**UNIT V – STATISTICS** (9 hours)

Tchebyshiev’s inequality – Maximum likelihood estimation – Correlation – Partial correlation – Multiple correlations.
REFERENCES

1. Narsingh Deo, “Graph Theory with Applications to Engineering and Computer Science”, PHI, 1974.

<table>
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<th>MA2011</th>
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PURPOSE

To impart knowledge on probability concepts to study their applications in stochastic processes & queueing theory.

INSTRUCTIONAL OBJECTIVES

1. Compute the characteristics of the random variable given the probabilities
2. Understand and apply various distribution
3. Solve cases of different Stochastic processes along with their properties.
4. Use discrete time finite state Markov chains
5. Gain sufficient knowledge in principles of queueing theory

UNIT I - RANDOM VARIABLES

One dimensional and two dimensional Random Variables – Characteristics of Random Variables: Expectation, Moments.

UNIT II - THEORETICAL DISTRIBUTIONS


UNIT III - STOCHASTIC PROCESSES

Classification of Stochastic Processes – Bernoulli process – Poisson process – Pure birth process – Birth and Death process.

UNIT IV - MARKOV CHAINS

UNIT V - QUEUING THEORY (9 hours)
Introduction – Characteristics of Markovian Single server and Multi server queuing models [(M/M/1) : (∞ / FIFO), (M/M/1) : (N / FIFO), (M/M/s) : (∞ /FIFO)] – M/G/1 Queuing System – Pollaczek Khinchin formula.

REFERENCES

## AMENDMENTS

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