Branch: Computer Science and Engineering

Course Code	CS 503
Course Title	**ARTIFICIAL INTELLIGENCE**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Discrete Structures (CS 303), Analysis and Design of Algorithms (CS 401)
Course Objectives (CO)	1. To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state. 2. To introduces different knowledge representation methods in AI Programs. 3. To introduce different design techniques for Game Playing Programs. 4. To introduce the AI Agents their design, planning and learning techniques. 5. To introduce the natural language processing and expert systems.
Course Outcome	1. Understand fundamental AI concepts and and identify a range of symbolic and non-symbolic AI techniques. 2. Demonstrate an understanding of various searching algorithms such as adversarial search and game-playing commonly used in artificial intelligence software. 3. Use different knowledge representation techniques used in AI Applications. 4. Demonstrate an understanding of agent-based AI architectures and an understanding of Planning and logic-based agents.

SYLLABUS

Note for Examiner- *Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Introduction:
Artificial Intelligence and its applications, Artificial Intelligence Techniques, criteria of success.

(4 hours)

Problem solving techniques:

State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, AO* search, Constraint satisfaction problem, Agenda Driven Search, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Iterative Deepening.

(9 hours)

Knowledge representation:

Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Weak and Strong filler structures, semantic nets, frame, conceptual dependency, scripts.

(8 hours)

SECTION-B

Non Monotonic and Statistical Reasoning

Non monotonic Logic, Default Logic, Circumscription, Bayes Theorem, Bayesian Network, Dempster Shafer Theory, Fuzzy sets, Fuzzy Logic, Defuzzification.

(8 hours)

Planning and Learning Agents:

Intelligent Agents, Nature and structure of Agents, Learning Agents, Introduction to different Forms of Learning,

The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

(9 hours)

Introduction to Learning and Expert system:

Expert systems, Expert system examples, Expert System Architectures, Rule base Expert systems, Non Monotonic Expert Systems, Decision tree base Expert Systems.

(7 hours)

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1.	AI: A Modern Approach	Stuart J. Russel, Peter Norvig	Pearson Education Latest Edition, 2012
2	Artificial Intelligence	Elaine Rich, Knight	McGraw Hill Third Edition2010
3	Artificial Intelligence,	Saroj Kaushik	Cengage Learning, First Edition2011
4	Artificial Intelligence,	Partick Henry Winston	Addison Wesley Latest Edition2012
5	Artificial Intelligence	George Luger	Pearson Education Latest Edition2010
6	Introduction to AI and Expert Systems, ,	DAN, W. Patterson	PHI Latest Edition2011
7	Principles of AI,	A.J. Nillson	Narosa publications Latest Edition, 2010

Branch: Computer Science and Engineering

Course Code	CS 553
Course Title	**ARTIFICIAL INTELLIGENCE (Practical)**
Type of Course	Core
L T P	0 0 3
Credits	1
Course Assessment Methods End Semester Assessment Continuous Assessment	 50

SYLLABUS

Practical should be covered based on the following directions:

1. Program Related to Problem Solving techniques of AI
   - Breadth First Search
   - Depth First Search
   - Heuristic Search
   - Best Search
   - Min-Max Search with alpha-beta pruning
   - Tic-Tac-Toe problem
   - N-Queens and N-Knight problem
   - Unification Algorithm
2. Introduction To AI Languages such as LISP, PROLOG
3. Representing Knowledge using RuleML
4. Using semantic Web
5. Knowledge of using Neural Networks, Fuzzy logic, genetic algorithms
6. Other new AI Techniques

Branch: Computer Science and Engineering

Course Code	**CS 602**
Course Title	**LINEAR ALGEBRA AND PROBABILITY THEORY**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	None
Course Objectives (CO)	1. To introduce the concept of Linear equations and vector spaces. 2. To introduces the use of Eigen vectors and Linear transformations. 3. To introduce random variables and probability theory. 4. To introduce the use of 2-d random variables.
Course Outcome	1. Understand the use of linear algebra and linear transformations. 2. Design solutions using matrices and eigen vectors 3. Apply probability theory in different engineering problems. 4. Understand the use of random variables in different applications.

SYLLABUS

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SECTION-A

Systems of Linear equations:
Introduction, Linear equations, solutions, Linear equations in two unknowns, Systems of linear equations, equivalent systems, Elementary operations, Systems in Triangular and echelon form, Reduction Algorithm, Matrices, Row equivalence and elementary row operations, Systems of Linear equations and matrices, Homogeneous systems of Linear equations. (Scope as in Chapter 1, Sections 1.1-1.10 of Reference 1).
(5 hours)

Vector Spaces:
Introduction, Vector spaces, examples of vector spaces, subspaces, Linear combinations, Linear spans, Linear dependence and Independence, Basis and Dimension, Linear equations and vector spaces. (Scope as in Chapter 5, Sections 5.1-5.8 of Reference 1).

(5 hours)

Eigenvalues and Eigenvectors, Diagonalization:
Introduction, Polynomials in matrices, Characteristic polynomial, Cayley-Hamilton theorem, Eigen-values and Eigen-vectors, computing Eigen-values and Eigen-vectors, Diagonalizing matrices.(Scope as in Chapter 8, Sections 8.1-8.5 of Reference 1).

(4 hours)

Linear Transformations:
Introduction, Mappings, Linear mappings, Kernel and image of a linear mapping, Rank- Nullity theorem (without proof), singular and non-singular linear mappings, isomorphisms.(Scope as in Chapter 9, Sections 9.1-9.5 of Reference 1).

(5 hours)

Matrices and Linear transformations:
Introduction, Matrix representation of a linear operator, Change of basis and Linear operators.(Scope as in Chapter 10, Sections 10.1-10.3 of Reference 1).

(5 hours)

SECTION-B

Probability
Sample Space and Events, the Axioms of probability, some elementary theorems, Conditional probability, Baye's Theorem, Random Variables-Discrete and Continuous, Independent random variables, Expectation, Variance and Covariance, Means and variances of linear combinations of random variables, Chebyshev's inequality

(7 hours)

Probability Distributions
Joint Probability distributions, Marginal and Conditional distributions, Binomial, Poisson, Uniform and Normal distributions, Normal and Poisson approximations to Binomial, Moments, Moment generating function.

(7 hours)

Two Dimensional Random Variables
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Regression – function of a random variable-Transformation of random variables - Central limit theorem.

(7 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Shaum's Outline of Theory and Problems of Linear Algebra	Seymour Lipschutz	2nd edition, McGraw-Hill, 1991.
2	Linear Algebra	VivekSahai, VikasBist	Narosa Publishing House, 2002
3	Introduction to Probability and Statistics	J. S. Milton and J.C. Arnold	4th edition, McGraw Hill, 2007
4	Probability and Statistics for Engineers	R.A. Johnson and C.B. Gupta	7th edition, Pearson Education, 2007
5	Fundamentals of Mathematical Statistics	S. C. Gupta and V.K. Kapoor	Sultan Chand and Sons

Branch: Computer Science and Engineering

Course Code	**CS 605C**
Course Title	**DATA MINING AND ANALYSIS**
Type of Course	Elective
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Database Systems (CS 302)
Course Objectives (CO)	1. To learn various data mining techniques and different ways to analyze different data sets.
Course Outcome	1. Understand different ways to manage the large data set using data warehousing techniques. 2. Analyze various multi dimensional techniques to represent data for effective retrieval. 3. Identify different data analysis techniques like frequent pattern analysis, classification and clustering 4. Demonstrate the use of various data mining techniques on different datasets.

SYLLABUS

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SECTION-A

Introduction: Introduction to RDBMS, Data Warehouse, Transactional Databases, Data Mining Functionalities, Interestingness of pattern, classification of data mining system, major issues
(6 hours)

Data Warehouse and OLAP: Difference from traditional databases, Multidimensional data model, Schema for Multi dimensional model, measures, concept hierarchies, OLAP operations, starnet query model, Data Warehouse architecture, ROLAP, MOLAP, HOLAP, Data Warehouse Implementation, Data Cube, Metadata Repositories, OLAM

(6 hours)

Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept hierarchy generation

(2 hours)

Data Mining Architecture: Data Mining primitives, Task relevant data, interestingness measures, presentation and visualization of patterns, Data Mining Architecture, Concept Description, Data Generalization and Summarization, Attributed oriented induction, Analytical characterization, Mining class comparisons

(6 hours)

SECTION-B

Association Rules: Association rules mining, Mining Association rules from single level, multilevel transaction databases, multi dimensional relational databases and data warehouses, Correlational analysis, Constraint based association mining

(6 hours)

Classification and Clustering: Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbor classification, Cluster analysis, Types of data in clustering, categorization of clustering methods

(6 hours)

Introduction of Mining Complex Data: Complex data objects, Mining spatial databases, Multimedia databases, Time Series and sequence databases, Text databases and World Wide Web

(7 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Data Mining: Concepts and Techniques	J.Han and M. Kamber	Latest edition, Morgan Kaufman publishers, Harcourt India pvt. Ltd
2	Data Mining Introductory and Advance Topics	Dunham	Latest edition, Pearson Education

Branch: Computer Science and Engineering

Course Code	**CS 655C**
Course Title	**DATA MINING AND ANALYSIS (Practical)**
Type of Course	Elective
L T P	0 0 3
Credits	1
Course Assessment Methods End Semester Assessment Continuous Assessment	 50

SYLLABUS

Practical should be covered based on the following directions:

Students are required to perform practicals in Oracle/MS SQL Server and STATISTICA Data Miner.

1. Building a Database Design using ER Modeling and Normalization Techniques
2. Implementation of functions, Procedures, Triggers and Cursors
3. Load Data from heterogeneous sources including text files into a predefined warehouse schema.
4. Design a data mart for a bank to store the credit history of customers in a bank .Use this credit profiling to process future loan applications.
5. Feature Selection and Variable Filtering (for very large data sets)
6. Association Mining in large data sets
7. Interactive Drill-Down, Roll up, Slice and Dice operations
8. Generalized EM & k-Means Cluster Analysis
9. Generalized Additive Models (GAM)
10. General Classification and Regression Trees (G Trees)
11. General CHAID (Chi-square Automatic Interaction Detection) Models
12. Interactive Classification and Regression Trees
13. Goodness of Fit Computations

Branch: Computer Science and Engineering

Course Code	**CS 705B**
Course Title	**NEURAL NETWORKS**
Type of Course	Elective
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Data Communication and Networks (CS 501), Web Technologies (CS 402), Database Systems (CS 302)
Course Objectives (CO)	1. To introduce concepts of artificial neural networks and principles of leaning and regression. 2. To learn various types of neural networks and their working principles 3. To understand role of neural network in various applications and apply it to multi-class classification etc.
Course Outcome	1. Understand basic concepts of neural networks. 2. Use neural networks to perform classification for single class and multiclass problems. 3. Learn and apply the concept of self organizing maps.

SYLLABUS

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SECTION-A

Neural Network Basics

Classical AI and Neural Networks, characteristics of neural networks, Historical perspective, The biological inspiration, models of artificial neuron & activation functions, Artificial Neuron Model and Linear Regression, Nonlinear Activation Units and Training of artificial neural networks.
(6 hours)

Learning Mechanisms: Gradient Descent Algorithm, Learning Mechanisms-Hebbian, Competitive, Boltzmann , Universal function approximation.

(6 hours)

Single Layer and Multi layerPerceptrons:

Representation of perceptron, Linear separability, Perceptron Learning, Single-Layer Perceptions , Unconstrained Optimization: Gauss-Newton's Method, Linear Least Squares Filters, Least Mean Squares Algorithm , Perceptron Convergence Theorem , Back Propagation Algorithm, Practical Consideration in Back Propagation Algorithm Training of single layer and multi-layer, back propagation training algorithm, Applications of back propagation,

Solution of Non-Linearly Separable Problems Using MLP, Heuristics For Back-Propagation, Multi-Class Classification Using Multi-layered Perceptrons

(12 hours)

SECTION-B

Associative Memory Networks:- Associative Memory Model, Conditions for perfect Recall in Associative memory.

Radial Basis Function Networks: Introduction ,Separability and Interpolation, Learning Mechanisms in RBF, Comparison Between MLP and RBF

(5 hours)

Introduction to Principal Components and Analysis, Dimensionality reduction Using PCA, Hebbian-Based Principal Component Analysis

(5 hours)

Self OrganizingMaps : Introduction to Self Organizing Maps, Cooperative and Adaptive Processes in SOM, Vector-Quantization Using SOM, Competitive learning, Maxican Hat networks

(6 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Neural Networks, fuzzy Logic, and Genetic Algorithms	Rajasekaran&Vijayalakhmi Pai	Pearson, 2011
2	Principles of Soft Computing	Sivanandam, Deepa	Wiley, 2014
3	Neural Networks – A Classroom Approach	Satish Kumar	Tata Mcgraw, 2010

Branch: Computer Science and Engineering

Course Code	**CS 755B**
Course Title	**NEURAL NETWORKS (Practical)**
Type of Course	Elective
L T P	0 0 3
Credits	1
Course Assessment Methods End Semester Assessment Continuous Assessment	 50

SYLLABUS

Practical based on Neural Networks syllabus.