Fifth Semester:

Course Title: **Artificial Intelligence**
Course Code: COM**45**1
Semester: V
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External (60)+ Internal (20+20)

Course Objectives:
The main objectives of this course are:
1. To provide basic knowledge of Artificial Intelligence
1. To familiarize students with different search techniques
2. To acquaint students with the fields related to AI and the applications of AI

Course Contents:

1. Introduction to AI
(4 hrs)

What is AI, importance of AI, AI and related fields, brief history of AI, applications of Artificial Intelligence, Definition and importance of Knowledge and learning.

1. Intelligent Agents (4 hrs)

Introduction of agents, Structure of Intelligent agent, Properties of Intelligent Agents
Configuration of Agents, PEAS description of Agents
Types of Agents: Simple Reflexive, Model Based, Goal Based, Utility Based.
Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent

3. Problem Solving (6 hrs)

Defining problems as a state space search, Problem formulation, Problem types, Well-defined problems, Constraint satisfaction problem, Game playing, Production systems.

4. Search Techniques (9 hrs)

Uninformed search techniques- depth first search, breadth first search, depth limit search, and search strategy comparison Informed search techniques-hill climbing, best first search, greedy search, A* search Adversarial search techniques-minimax procedure, alpha beta procedure

5. Knowledge Representation, Inference and Reasoning (10 hrs)

Formal logic-connectives, truth tables, syntax, semantics, tautology, validity, well-formed-formula, propositional logic, predicate logic, FOPL, interpretation, quantification, horn clauses, rules of inference, unification, resolution refutation system (RRS), answer extraction from RRS, rule based deduction system, Statistical Reasoning-Probability and Bayes' theorem and causal networks, reasoning in belief network

6. Structured Knowledge Representation (4 hrs)

Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, Semantic nets, frames, conceptual dependencies and scripts

7. Machine Learning (4 hrs)

Concepts of learning, learning from examples, explanation based learning, learning by analogy, learning by simulating evolution, learning by training neural nets, learning by training perceptions.

8. Applications of AI (4 hrs)

Expert Systems, Neural Network, Natural Language Processing, Machine Vision

Laboratory Works:

Laboratory exercises should be conducted in either LISP or PROLOG.

Laboratory exercises must cover the fundamental search techniques, simple question answering, inference and reasoning.

Text Book:

- E. Rich and Knight, *Artificial Intelligence*, McGraw Hill, 2010.
- Stuart Russel and Peter Norvig, *Artificial Intelligence A Modern Approach*, Pearson

References:

- D. W. Patterson, *Artificial Intelligence and Expert Systems*, Prentice Hall, 2009.
- Ivan Bratko, *PROLOG Programming for Artificial Intelligence*, Addison Wesley, 2012.
- Leon Sterling, Ehud Shapiro, *The Art of PROLOG: Advanced Programming Techniques*, Prentice Hall, 2012.
- P. H. Winston, *Artificial Intelligence*, Addison Wesley.

Course Title: **System Analysis and Design**
Course Code: COM**4**52
Semester: V
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, **Tutorial:** 3**Hrs**)
Evaluation: External(60)+ Internal(20+20)

Course Objectives:

This course covers the concepts related to the development of information systems in a systematic approach including foundations, planning, analysis, design, implementation and maintenance.

Course Contents:

1. Foundations for Systems Development (8 hrs)

1.1. The Systems Development Environment: Introduction, A Modern Approach to Systems Analysis and Design, Developing Information Systems and the Systems Development Life Cycle, The Heart of the Systems Development Process, The Traditional Waterfall SDLC, Different Approaches to Improving Development, CASE Tools, Rapid Application Development, Service-Oriented Architecture, Agile Methodologies,extreme Programming, Object-Oriented Analysis and Design

1.2. The Origins of Software: Introduction, System Acquisition, Reuse

1.3. Managing the Information Systems Project: Introduction, Managing the Information Systems Project, Representing and Scheduling Project Plans, Using Project Management Software

2. Planning (7 hrs)

2.1. Identifying and Selecting Systems Development Projects

Introduction, Identifying and Selecting Systems Development Projects, Corporate and Information Systems Planning

2.2. Initiating and Planning Systems Development Projects

Introduction, Initiating and Planning Systems Development Projects, the Process of Initiating and Planning IS Development Projects, Assessing Project Feasibility, Building and Reviewing the Baseline Project Plan

3. Analysis (12 hrs)

3.1. Determining System Requirements:Introduction, Performing Requirements Determination, Traditional Methods for Determining Requirements, Contemporary Methods for Determining System Requirements, Radical Methods for Determining System Requirements, Requirements Management Tools, Requirements Determination Using Agile Methodologies

3.2. Structuring System Process Requirements

Introduction, Process Modeling, Data Flow Diagramming Mechanics, Using Data Flow Diagramming in the Analysis Process, Modeling Logic with Decision Tables

3.1. Structuring System Data Requirements: Introduction, Conceptual Data Modeling; Gathering Information for Conceptual Data Modeling, Introduction to E-R Modeling, Conceptual Data Modeling and the E-R Model, Representing Supertypes and Subtypes, Business Rules, Role of Packaged Conceptual Data Models – Database Patterns

4. Design (10 hrs)

4.1. Designing Databases

Introduction, Database Design, Relational Database Model, Normalization, Transforming E-R Diagrams Into Relations, Merging Relations, Physical File and Database Design, Designing Fields, Designing Physical Tables

4.2. Designing Forms and Reports

Introduction, Designing Forms and Reports, Formatting Forms and Reports, Assessing Usability

4.3. Designing Interfaces and Dialogues

Introduction, Designing Interfaces and Dialogues, Interaction Methods and Devices, Designing Interfaces, Designing Dialogues, Designing Interfaces and Dialogues in Graphical Environments

5. Implementation and Maintenance (8 hrs)

5.1. System Implementation

Introduction, System Implementation, Software Application Testing, Installation, Documenting the System, Training and Supporting Users, Organizational Issues in Systems Implementation

5.2. Maintaining Information Systems

Introduction, Maintaining Information Systems, Conducting Systems Maintenance

Text Book:

- Jeffrey L. Whitten, Lonnie Bentley, *System Analysis and Design methods,* 7th Edition, Mc-Graw Hill
- Joseph S. Valacich, Joey F. George, Jefferey A. Hoffer, *Essentials of System Analysis and Design*, 5th Edition, Pearson Education.

Reference:

- Jeffrey L. Whitten, Lonnie Bentley, System analysis and design methods, 5th Edition, Mc-Graw Hill.
- Jefferey A. Hoffer, Joey F. George, Joseph S. Valacich, Modern Systems Analysis and Design, 7th Edition, Pearson Education.
- Gary B. Shelly, Harry J. Rosenblatt, System Analysis and Design, 9th Edition, Shelly Cashman Series.
- Alan Dennis, Barbara Haley Wixom, Roberta M. Roth System Analysis and Design, 4th Edition, Wiley Publication.

  V. Rajaraman, Analysis and Design of Information System, 2nd Edition, Prentice Hall

Course Title: **Design and Analysis of Algorithms**
Course Code: COM**4**53
Semester: V
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Tutorial: 3 Hrs)
Evaluation: External (60)+Internal(20+20)

Course Objectives:
Methods and tools for analyzing different algorithms. Different approaches of designing efficient algorithms like divide and conquer paradigm, greedy paradigm, dynamic programming. Algorithms pertainig various problems like sorting, searching, shortest path, spanning trees, geometric problems etc. NP-complete problems.

Course Contents:

1. **Algorithm Analysis (5 hrs)**

Worst, Best and Average Cases, Space and Time Complexities. Mathematical Background: Asymptotic Behavior, Solving Recurrences.

2. **Data Structures Review (5hrs)**

Linear Data Structures, Hierarchical Data Structures, Data Structures for Representing Graphs and their Properties. Search Structures: Heaps, Balanced Trees, Hash Tables.

3. **Algorithm Design Techniques (14 hrs)**

3.1 Divide and Conquer: Concepts, Applications, Sorting Problems (Quick, Merge), Searching (Binary), Median Finding Problem and General Order Statistics, Matrix Multiplications.

3.2 Greedy Paradigm: Concepts, Applications, Knapsack Problem, Job Sequencing, Huffman Codes.

3.3 Dynamic Programming: Concepts, Applications, Knapsack Problem, Longest Common Subsequence, Matrix Chain Multiplications.

4. **Graph Algorithm (21 hrs)**

4.1. Elementary Graph Algorithm**:** Breadth-first and Depth-first Search and its Applications

4.2 Minimum Spanning Trees: Prim's and Kruskal's Algorithms

4.3 Shortest Path Problems: Dijkstra's and Flyod's Algorithms, Algorithm for Directed Acyclic Graphs (DAGs).

4.4 Geometric Algorithms: Concepts, Polygon Triangulation, Convex Hull Computation.

4.5 NP Completeness: Introduction, Class P and NP, Cooks Theorem, NP Complete Problems: Vertex Cover Problem.

4.6 Approximation Algorithm: Approximation Algorithms Concepts, Randomized Algorithms Concepts Randomized Quick Sort, Vertex Cover Problem.

Text Book:

- T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, *Introduction toAlgorithms,* 2nd Edition, MIT Press, 2011.

References:

- G. Brassard and P. Bratley, *Fundamentals of Algorithmis*, Prentice-Hall, 2012.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "*Introduction to algorithms*", Third Edition.. The MIT Press, 2009.
- Kleinberg, Jon, and Eva Tardos, " *Algorithm Design"* , Addison-Wesley, First Edition, 2005

Course Title: **Compiler Design**
Course Code: COM**4**54
Semester: V
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Practical**:** 3 **Hrs**)
Evaluation: External (60)+Internal(20+20)

Course Objectives:
To be familiar with the basic techniques in the design of a compiler.

Course Contents:

1. Introduction (7hrs)
Introduction to Compilers, compilers and Interpreters, Phases of Compiler: Lexical analysis, Syntax analysis, Intermediate code generation, Code optimization, Object code generation, Symbol table management, Error handling, Multi-pass compilers, Cross compiler

2. Lexical Analysis (8 hrs)
Role of lexical analyzer, Design of lexical analyzer, Finite state machine, Transition diagram, Regular expression, Conversion of NDFSM to DFSM, Regular expression to FSM

3. Syntax Analysis (10 hrs)
Syntactic specification of programming language, Context free grammar, Derivation of parser tree, Basic parsing techniques, Types of parser, Shift reduce parser, Operator grammar, Operator precedence grammar, Operator precedence parsing, LL(1) grammar, Predictive parser

4. Intermediate Code Generation (10 hrs)
4.1 Syntax directed translation schemes, Implementation of SDTS, Intermediate codes: Polish notation, Abstract syntax tree, Three address codes, Quadruples, Triples, indirect triples, Translation of assignment statement, Boolean expression, Declarative statement.

4.2 Symbol table and error handling: Data structure of symbol table, Types of errors, lexical and semantic errors.

5. Code Optimization (10 hrs)
Sources of code optimization, Loop optimization, Identification of loops, DAG representation, Object code generation: Problem of code generation, Simple code generation, Register allocation and object code generation, Peep hole optimization

Laboratory Works:

1 Writing a complier, optimization techniques, comparing the compilers.
2. Construction of Lexical Analyzer.
3. Construction of Parser
4. Development of Code Generator
5. Write a code to show the function of symbol table.
6. Implement the parsing techniques.
7. Show the application of different types of grammar.
8. Implement the lexical analyzer generator.
9. Implement the type conversation.
10. The course instructor is allowed to create a group two students.
    a. Assign them to write a small compiler.

Text Book:

- Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers Principles, Techniques, and Tools,; Pearson Education
- Aho& Ullman, Principles of Compiler Design, (Narosa)

References:

- Compiler Design, Sandeep Saxena, Rajkumar Singh Rathore, S.Chand
- Compiler Design: Theory and Practice by Burrett (McGraw Hill)
- Introduction to Automata Theory, Languages, and Computation, Johne E. Hopcroft, Rajeev Motwani, Jeffrey D. Ulman, Pearson Education

Elective (Any One)
Course Title: Management Information System
Course Code: COM**4**55A
Course Title: Neural Network
Course Code: **COM455B**
Semester: V
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Practical: **3 Hrs**)
Evaluation: External (60) +Internal (20+20)

Course Title: **Management Information System**
Course Code: **COM455A**
Semester:**V**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Tutorial: **3 Hrs)**
Evaluation: External (60) + Internal (20+20)

Course Objectives:

1. To introduce the knowledge of computer based information systems,
2. To enable the students in applying knowledge of computer based information system,
3. To help designing and setting up complex information system to the student,
4. To highlight information systems and their effectiveness in organization success
5. To provide concepts of new ethical issues, security threats, information system development process
6. To select and design MIS systems appropriate to meet management requirements.
7. To evaluate critically MIS contributions to the strategic management of organizations

Course Contents:

I. Introduction to Management Information System (7 hrs)

1.1 Data and Information
1.1 Information system and Information Technology
1.2 Sources and Dimensions of IS
1.3 Manual and Computer based IS
1.4 Contemporary approaches to IS
1.5 MIS and its components
1.6 MIS Characteristics
1.7 Strategic MIS

2. Structure and Classification of MIS (8hrs)
2.1 Structure of MIS
2.1.1 MIS Structure Based on Physical Components
2.1.2 Information System Processing Functions

2.1.3 Decision Support
2.1.4 Levels of Management Activities
2.2 MIS Classification: Transaction Processing System, Management Information System, Decision Support System, Executive Support System, Office Automation System, Business Expert System

3. MIS for Different Functional Area Business (5hrs)
3.1 Accounting Information System
3.2 Geographical Information System
3.3 Human Resource Information System
3.4 Manufacturing and Production Systems

4. Decision Support System in Business (5 hrs)
4.1 Decision and types
4.2 Decision making process
4.3 Decision Making and MIS
4.4 DSS and characteristics
4.5 Group Decision Support System (GDSS)

5. Technical Requirement for MIS (4hrs)
5.1 Computer and its anatomy
5.2 Memory and types
5.3 Input /Output devices
5.4 Storage Devices
5.5 Software and Computer Languages

6. Ethical and Social Issues in Information System (4hrs)

6.1 Ethics in Information Society
6.2 Moral Dimension of Information System
6.3 Accountability, Liability and Control

7. E-commerce (12hrs)
7.1 E-commerce and E-business
7.2 E-commerce Framework
7.3 Types of E-commerce
7.4 Benefits and Limitations of E-commerce
7.5Payment systems in E-commerce and its threats
7.6 Network for E-commerce: Needs of Network, I-way and its components
7.7 E-commerce Vs. E-governance
7.8 Electronic business system: Enterprise Resource Planning, Customer Relationship, Management, Supply Chain Management

Field Visit/Case Study

First, each student will join a group. The student or student group (at most 4 students) needs to finish a written case study report (2000 – 3000 words) on the effectiveness and limitations of some existing information system. The Field Visit/Case study report must reflect your understanding on basic concepts taught in the course and capability of using them to analyze practical cases. The case study should be outlined tentatively as follows:

a) Abstract
b) Introduction and purpose of Information System
c) Categorization of the IS
d) Infrastructures required for the IS
    - Hardware Infrastructure
    - Software Infrastructure
    - Network Infrastructure
e) Data Sources and Data Analysis required for the IS
f) Effectiveness of the IS and its Assistance to Management
g) Conclusion, Limitations of the IS and Recommendations for Enhancements

Text Book:

- James A. O'Brien, GeorgeMarakas,*Management Information Systems*, 7th Edition McGraw-Hill Companies, 2006

References:

- Kanter, J.,*Managing with Information System*, 4th Edition, New Delhi: Prentice Hall of India Limited,2004
- Laudon, K. C. &Laudon, J. P.*, Management Information Systems*, 12th Edition Pearson, 2013
- R. Kelly Rainer, Efraim Turban, Richard E.Potter,*Introduction to Information Systems: Supporting and Transforming Business*, Wiley, 1st Edition, 2006

Course Title: **Neural Network**
Course Code: **COM455B**
Semester:**V**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Practical: **3 Hrs)**
Evaluation: External (60) + Internal (20+20)

Objectives:

This course introduces the fundamental concepts of neural networks and essentials of artificial neural networks with single layer and multilayer Networks.

Theobjectives of the course are:

1. Introduce the neural networks as means for computational learning
2. Present the basic neural network architectures
3. Give design methodologies for artificial neural networks
4. Introduce learning theories used in neural networks
5. Demonstrate neural network applications on real-world tasks.
6. Explore use of fuzzy system in neural networks

Contents:

I.Introduction (6 hrs)

1.1. Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological Neuron Model, Artificial Neuron Models, Artificial Network Networks (ANN)

1.2. History of neural network research, characteristics of neural networks, Applications of ANN

2. Basics of Artificial Neural Networks(8 hrs)

1.1.2. Artificial Neuron Model and its Mathematical model

1.2.2. Activation Function, Types of Neuron Activation Function: Linear, Threshold, Sigmoid, Tangent

1.3.2. Models of neuron Mc Culloch –Pitts model, Perceptron, Adaline model, Madaline Model

1.4.2. ANN Architectures: Single-layer, Multilayer Feed Forward, Recurrent

1.5.2. Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic)

3. Learning Process (7 hrs)

3.1. Learning, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

3.2. Error-Correction Learning, Memory-Based Learning, Hebbian Learning, Competitive Learning, Boltzman Learning

4.Single Layer Perceptrons(8 hrs)

4.1. Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks

4.2. Least Mean Square Algorithm

1.3 Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications

5.Single and Multilayer Feed forward Neural Networks(7 hrs)

5.1. Basic Concepts of single layered networks, Hopfield Networks
5.2. Multilayer Feed Forward Networks, Feedback Networks,
5.3. Discrete Hopfield Network
5.4. Gradient Descent, Delta Rule
5.5. Derivation of Back-propagation (BP) Training, Summary of Back-propagation Algorithm, Selection of tuning parameters in Back-propagation

6. Radial Basis Function Networks (5 hrs)

1.1. Pattern separability and Interpolation
1.2. Regularization Theory
1.3. Regularization and Radial Basis Function (RBF) Networks
1.4. RBF network design and training
1.5. Approximation properties of RBF

7. Fuzzy Neural Networks (4hrs)

7.1. Neuro-fuzzy systems
7.2. Background of fuzzy sets and logic, Design of fuzzy systems
7.3. Design of fuzzy neural networks, applications of neuro-fuzzy systems

Laboratory Works:

The students should simulate different programs constructing neural networks for solving real world problems. The environments can be decided by the instructor, however it is highly recommended to use MATLAB, Java.

Text Book:

1. S. Haykin, *Neural Networks – A Comprehensive Foundation*, Prentice Hall

References:

1. C. M. Bishop, *Neural Networks* for *Pattern Recognition*, Clarendon Press Oxford
2. B.Yegnanarayana, *Artificial Neural Networks*, Prentice Hall of India
3. Satish Kumar, *Neural Networks – A Classroom Approach*, Tata McGraw-Hill
4. Robert J. Schalkoff, *Artificial Neural Networks*, McGraw-Hill InternationalEditions
5. Jeff Heaton **,** *Introduction to Neural Networks for Java,*Heaton Research