# 17CS017 PATTERN RECOGNITION

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | - | 4 |

**Course Description and Objectives:**
This course deals with automated classification, identification, and/or characterization of unknown systems. The objective of the course is to enable the student to understand driven field, identification of pathological disorders from various biological indicators, hand written character recognition, finger print analysis, face recognition, iris scan based recognition and financial data predictions.

**Course Outcomes:**
The student will be able to:
- ✓ Understand the theoretical issues involved in pattern recognition system design such as the curse of dimensionality.
- ✓ Familiarize with major approaches in statistical and syntactic pattern recognition.
- ✓ Implement pattern recognition techniques.
- ✓ Design and develop a pattern recognition system.

**Skills**:
- ✓ Partition data objects by using different classification techniques.
- ✓ Group the data objects by applying different clustering techniques.
- ✓ Identify the data objects by using different feature selection approaches.
- ✓ Reduce the data objects by applying dimensionality reduction techniques.

**Activities:**
- ✓ Students are able to do different Estimation Techniques in real time applications\
- ✓ Students are able to apply different classification techniques
- ✓ Students are able to apply different dimensionality reduction techniques

## UNIT - I
**Introduction and Mathematical Preliminaries:** What is pattern recognition?, Clustering vs. Classification, Applications, Linear Algebra, Vector spaces, Probability theory, Estimation techniques.

## UNIT - II
**Bayes Decision Theory:** Discriminant Functions and Services, the Normal Distribution, Bayesian Classification, Estimating Probability Density Functions, Nearest Neighbor Rules, Bayesian Networks, Linear Classifiers: the Perceptron Algorithm, Least-Squares Methods

## UNIT - III
**Nonlinear Classifiers:** Multilayer Perceptron's, Back Propagation Algorithm, Decision Trees, Combinations of Classifiers, Boosting.
**Clustering:** Sequential Algorithms, Hierarchical Algorithms, Functional Optimization-Based Clustering, Graph Clustering, Learning Clustering, Clustering High Dimensional Data: Subspace Clustering

## UNIT - IV
**Feature Selection:** Data Preprocessing, ROC Curves, Class Separability Measures, Feature Subset Selection, Bayesian Information Criterion

**UNIT - V**

**Dimensionality Reduction:** Basis Vectors, Singular Value Decomposition, Independent Component Analysis, Kernel PCA, Wavelets

**Additional Features And Template Matching:** Texture, Shape and Size Characterization, Fractals, Features For Audio, Template Matching Using Dynamic Time Warping and Edit Distance

**TEXT BOOKS :**
1. S Theodoridis and K Koutroumbas, "Pattern Recognition", 4th edition, Academic Press, 2009.
2. K Fukunaga, "Statistical pattern Recognition", 1st edition, Academic Press, 2000.

**REFERENCE BOOKS:**
1. Christopher M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
2. Marsland S, "Machine Learning: An Algorithmic Perspective", 1st edition, CRC Press, 2009.
3. Bishop C M, "Neural Networks for Pattern Recognition",1st edition,Oxford University Press,1995.
4. Hastie T, Tibshirani R and Friedman J, "The Elements of Statistical Learning", Springer, 2001.
5. Koller D and Friedman N, "Probabilistic Graphical Models", 1st edition, MIT Press, 2009.
6. R O Duda, P E Hart and D G Stork, "Pattern Classification", 1st edition, John Wiley, 2001.