COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC467	PATTERN RECOGNITION	3-0-0-3	2016

Prerequisite: NIL

Course objectives:

- To introduce the fundamental algorithms for pattern recognition
- To instigate the various classification and clustering techniques

Syllabus: Review of Probability Theory and Probability distributions, Introduction to Pattern Recognition and its applications, Bayesian decision theory, Bayesian estimation: Gaussian distribution, ML estimation, EM algorithm, Supervised and unsupervised learning, Feature selection, Linear Discriminant Functions, Non-parametric methods, Hidden Markov models for sequential data classification, Linear models for regression and classification, Clustering

Expected outcome:

The students will be able to

i. Design and construct a pattern recognition system
ii. Know the major approaches in statistical and syntactic pattern recognition.
iii. Become aware of the theoretical issues involved in pattern recognition system design such as the curse of dimensionality.
iv. Implement pattern recognition techniques

Text Books

1. C M Bishop, Pattern Recognition and Machine Learning, Springer
2. R O Duda, P.E. Hart and D.G. Stork, Pattern Classification and scene analysis, John Wiley

References

1. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.
2. Robert J. Schalkoff, Pattern Recognition : Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 2007.
3. S.Theodoridis and K. Koutroumbas, Pattern Recognition, 4/e, Academic Press, 2009.
4. Tom Mitchell, Machine Learning, McGraw-Hill
5. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.

Course Plan

Module	Course content	Hours	End Sem Exam Marks
I	**Introduction:** Basics of pattern recognition system, various applications, Machine Perception, classification of pattern recognition systems	3	15%
	Design of Pattern recognition system, Pattern recognition Life Cycle	2	

	Statistical Pattern Recognition: Review of probability theory, Gaussian distribution, Bayes decision theory and Classifiers, Optimal solutions for minimum error and minimum risk criteria, Normal density and discriminant functions, Decision surfaces	4	
II	Parameter estimation methods: Maximum-Likelihood estimation, Expectation-maximization method, Bayesian parameter estimation	2	15%
	Concept of feature extraction and dimensionality, Curse of dimensionality, Dimension reduction methods - Fisher discriminant analysis, Principal component analysis Hidden Markov Models (HMM) basic concepts, Gaussian mixture models.	6	
FIRST INTERNAL EXAM			
III	Non-Parameter methods: Non-parametric techniques for density estimation - Parzen-window method, K-Nearest Neighbour method.	3	15%
	Non-metric methods for pattern classification: Non-numeric data or nominal data Decision trees: Concept of construction, splitting of nodes, choosing of attributes, overfitting, pruning	3	
IV	Linear Discriminant based algorithm: Perceptron, Support Vector Machines	5	15%
SECOND INTERNAL EXAM			
V	Multilayer perceptrons, Back Propagation algorithm, Artificial Neural networks	4	20%
	Classifier Ensembles: Bagging, Boosting / AdaBoost	3	
VI	Unsupervised learning: Clustering - Criterion functions for clustering, Algorithms for clustering: K-means and Hierarchical methods, Cluster validation	5	20%
END SEMESTER EXAM			

Question Paper Pattern

The question paper shall consist of three parts. Part A covers modules I and II, Part B covers modules III and IV, and Part C covers modules V and VI. Each part has three questions uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 70% for theory and 30% for logical/numerical problems, derivation and proof.