Course Code	21CSC305P	Course Name	MACHINE LEARNING	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*School of Computing*	Data Book / Codes / Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1:	*explore the fundamental mathematical concepts of machine learning algorithms*
CLR-2:	*apply linear machine learning model to perform regression and classification*
CLR-3:	*utilize mixture models to group similar data items*
CLR-4:	*develop machine learning models for time –series data prediction*
CLR-5:	*design ensemble learning models using various machine learning algorithms*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	*understand the basics of machine learning using probability theory*	-	*2*	-	-	-	-	-	-	-	-	-	-	*1*	-	-
CO-2:	*implement machine learning models using supervised learning algorithms*	-	*2*	-	*2*	-	-	-	-	-	-	-	-	-	-	*2*
CO-3:	*implement machine learning models using unsupervised learning algorithms*	-	*3*	-	*3*	-	-	-	-	-	-	-	-	-	-	*2*
CO-4:	*implement machine learning models for sequential data analysis and prediction*	-	*3*	-	*3*	-	-	-	-	-	-	-	-	-	-	*3*
CO-5:	*develop ensemble learning models for supervised and unsupervised learning*	-	*3*		*3*	-	-	-	-	-	-	-	-	-	-	*3*

Unit-1 - Introduction ***9 Hour***

machine learning what and why?, supervised and unsupervised learning, polynomial curve fitting, probability theory- discrete random variables, fundamental rules,Bayes rule, Independence and conditional independence, continuous random variables, Quantiles, Mean and variance, probability densities, Expectation and covariance.

Practice:

1. *Devise a program to import, load and view dataset*
2. *Create a program to display the summary and statistics of the dataset*

Unit-2 - Linear models for Regression ***9 Hour***

Maximum likelihood estimation – least squares, robust linear expression, ridge regression, Bayesian linear regression. Linear models for classification: Discriminant function – Probabilistic generative models, Probabilistic discriminative models, Laplacian approximation, Bayesian logistic regression, Kernels functions, using kernels in GLMs, Kernel trick, SVMs.

Practice:

1. *Implement linear regression to perform prediction*
2. *Implement Bayesian logistic regression and SVM for classification*

Unit-3 - Mixture Models and EM ***9 Hour***

K-means clustering, mixtures of Gaussians, An alternative view of EM, Factor analysis, PCA, choosing the number of latent dimensions. Clustering – measuring dissimilarity, evaluating the output of clustering methods, Hierarchical clustering.

Practice:

1. *Implement K-means clustering, mixtures of Gaussians and Hierarchical clustering algorithm to categorize data.*
2. *Create a program to perform PCA*

Unit-4 – Hidden Markov Models	**9 Hour**
Sequential data – Markov models, HMM – maximum likelihood for the HMM, The forward and Backward algorithm, the sum-product algorithm, scaling factors, Viterbi algorithm, linear dynamical systems.	
Practice:	
1. Implement HMM to predict the sequential data	
Unit-5 – Combining Models	**9 Hour**
Bayesian model averaging, Boosting, Adaptive basis function models, CART, generalized additive models, Ensemble learning.	
Practice:	
1. Implement CART learning algorithms to perform categorization	
2. Implement Ensemble learning models to perform classification	

Learning Resources	*1. Pattern Recognition and Machine Learning, Christopher M Bishop, Springer, 2006.*	*2. Machine Learning- A probabilistic perspective, Kevin P.Murphy, The MIT Press, 2012.*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*						*Final Examination (0% weightage)*	
		Formative CLA-1 Average of unit test (20%)		*Project Based Learning CLA-2 (60%)*		*Report and Viva Voce (20% weightage)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	*-*	*-*	*15%*	*-*	*15%*	*-*	*-*
Level 2	*Understand*	*25%*	*-*	*-*	*20%*	*-*	*20%*	*-*	*-*
Level 3	*Apply*	*30%*	*-*	*-*	*25%*	*-*	*25%*	*-*	*-*
Level 4	*Analyze*	*30%*	*-*	*-*	*25%*	*-*	*25%*	*-*	*-*
Level 5	*Evaluate*	*-*	*-*	*-*	*10%*	*-*	*10%*	*-*	*-*
Level 6	*Create*	*-*	*-*	*-*	*5%*	*-*	*5%*	*-*	*-*
	Total	*100 %*		*100 %*		*100 %*		*-*	

Course Designers

Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
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