MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2019-2023)		
SCHOOL OF ELECTRICAL ENGINEERING			**W.E.F.**	**:**	2020-21
THIRD YEAR BACHLOR OF TECHNOLOGY			**COURSE NAME**	**:**	Soft Computing
			COURSE CODE	**:**	ET363
			COURSE CREDITS	**:**	04
RELEASE DATE	**:**	**01/07/2020**	**REVISION NO.**	**:**	1.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**PRESENTATION/ DEMONSTRATION**	**TOTAL**
		ICE	**ECE**	**IA**			
3	2	35	35	30	Nil	50	150

PRE-REQUISITE:

CS102: Applications Programming-Python

COURSE OBJECTIVES:

1. ET361.CEO.1: To illustrate the basic concepts and techniques of machine learning.
2. ET361.CEO.2: To explore supervised and unsupervised learning paradigms of machine learning for regression and classification
3. ET361.CEO.3: To develop a deeper understanding of several algorithms in machine learning.
4. ET361.CEO.4: To evaluate and interpret the results of the machine learning algorithms for solving practical problems.

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ET361.CO.1: Explain fundamentals of machine learning.
2. ET361.CO.2: Describe supervised and unsupervised learning.
3. ET361.CO.3: Analyze mathematically various machine learning approaches and paradigms.
4. ET361.CO.4: Implement machine learning solutions for classification, regression, and clustering problems.
5. ET361.CO.5: Compare various machine learning techniques and to get an insight of when to apply a particular machine learning approach.

THEORY:

Unit I	**Machine Learning Fundamentals**	**8 Hours**
Introduction to Machine Learning, Types of Learning, Linear Regression, Logistic Regression, Concept of Underfitting and Overfitting, Bias-Variance Tradeoff, Model assessment, Cross Validations, Accuracy and Error measures, Confusion metric, Precision, Recall, F1 Score, Analysis of ROC, AUC.		
Unit II	**Statistics and Probabilistic Learning**	**8 Hours**
Probability Concept, Decision Trees, Random Forest, Naïve Bayes, Introduction to Ensemble Methods.		
Unit III	**Supervised Machine Learning Algorithm**	**6 Hours**
K Nearest Neighbors (KNN.) Support Vector Machine, Optimization Objective of SVM, Maximum Margin Principle, Lagrangian Multipliers for SVM and Kernel Function.		
Unit IV	**Artificial Neural Network**	**8 Hours**
Neural Network Representation, Perceptron, Activation Function and Types, Multilayer Network and Backpropagation Algorithm.		
Unit V	**Unsupervised Learning**	**8 Hours**
Feature Space, Dimensionality Reduction, Principal Components Analysis (PCA), Principal of Clustering, K-Means, Hierarchical Agglomerative clustering, Case Study Using Clustering Algorithm.		

THEORY:		
Unit VI	**Open CV for Computer Vision:**	**6 Hours**
Introduction to OpenCV, Installation, Image Operations eg. read, display, writing, reading and setting image properties. opening video, Capture Video/Frame from Camera, applying functions on frame, Drawing geometric shapes on frame eg. line, rectangle, circle, ellipse, polygon, text. Arithmetic Operations on Image, ROI, RBG and HSV Color Space. Case Study on Computer Vision using Machine Learning Algorithm		

PRACTICAL:		
Practical No. 1	**Title: Experimental Data Analysis: Perform following operations on any open dataset available in Python/Kaggle**	**2 Hours**
• Load data into a data frame from a csv or any other file format. • Identification of variables and data types. • Find Missing Values. • Replace/eliminate missing values • Drop unessential columns. • Find average/min/max of numeric columns. • Display summary of data frame. • Bivariate analysis using plots through seaborn functions, cleaning the data, plotting graphs.		
Practical No. 2	**Title: Liner Regression and Logistic Regression Model Implementation on Given Dataset.**	**4 Hours**
• Build a Linear Regression Model using Real estate price prediction dataset. • Developed a Logistic regression model for classification.		
Practical No. 3	**Title: Implementation of Decision Tree, Random Forest, KNN, Naïve Bayes with hyperparameter tunning**.	**4 Hours**
• Developed Supervised Learning Model on selected Dataset.		
Practical No. 4	**Title: Machine Learning for Image Classification**	**2 Hours**
• Use of SVM for Image Classification. • Implementation of PCA		
Practical No. 5	**Title: Implementation of Unsupervised Machine Learning**	**2 Hours**
Implement both the k-means algorithm and the Hierarchical Agglomerative Clustering (HAC) algorithm.		

Practical No. 6	**Title: Implementation of IOT Solution using Machine Learning**	**4 Hours**
• Data Collection. • Data Cleaning, Filtering and Feature Extraction • Evaluation and Identification of ML Model • Training the ML Model • Outcome Predication • ML Model Deployment.		
Practical No. 7	**Title: ANN for Computer Vision**	**2 Hours**
• Creating Simple Neural Network. • Implement ANN for Image Classification.		
Practical No. 8	**Title: Open CV for Computer Vision**	**2 Hours**
• Use Open CV Library for Image Processing		

TEXTBOOKS:

1. Ethem Alpaydin, Introduction to Machine Learning, Second Edition, MIT Press, (ISBN: 978-0-262-01243-0).
2. Christopher Bishop, Pattern Recognition and Machine Learning, Second Edition, Springer. 2006, (ISBN-13: 978-0387310732).
3. Andreas C. Müller and Sarah Guido, “Introduction to Machine Learning with Python: A Guide for Data Scientists”, First Edition, O'Reilly Media, ISBN 978-14-4936-941-5
4. Tom Mitchell, Machine Learning, First Edition, McGraw-Hill Science/Engineering/Math, 1997, (ISBN: 0070428077).

REFERENCES:

1. Trevor Hastie, Robert Tibshirani and Jerome Friedman, The Elements of Statistical Learning, Second Edition, Springer-Verlag,2009,(ISBN: 978-0-387-84857-0)
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012, (ISBN: 9780262018029).
3. Simon Haykin, Neural Networks: A comprehensive foundation, Prentice Hall International Inc. 1999, (ISBN: 0132733501).