CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **BACHELOR OF TECHNOLOGY (Electronics and Communication)**

Semester: **VI**

Course Code: **202060605**

Course Title: **Intelligent Learning Systems**

Course Group: **Professional Elective Course**

Course Objectives: To introduce students to the basic concepts and techniques of intelligent learning. Further develop skills using recent machine learning software for solving practical problems and design intelligent systems. This helps experience of doing independent study and research.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50/18	50/17	25/9	25/9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction:** Motivation and applications of learning systems, Importance of Data Visualization, Classification of learning: supervised, unsupervised and reinforcement learning, Aspects of developing a learning system: training data, concept representation & function approximation.	5
2	**Supervised learning:** Artificial Neural Networks - Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, Multilayer Perceptron Network, Back-propagation Neural Networks, Competitive Neural Networks. **Unsupervised learning:** Hierarchical Agglomerative Clustering, k-means Algorithm, Self-Organizing Maps.	12
3	**Classification Techniques:** Naïve Bayes Classification, Fitting Multivariate Bernoulli Distribution, Gaussian Distribution and Multinomial Distribution, K Nearest Neighbours, Decision trees.	10

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4	**Regression Techniques:** Basic concepts and applications of Regression, Simple Linear Regression – Gradient Descent and Normal Equation Method, Multiple Linear Regression, Non-Linear Regression, Linear Regression with Regularization, Hyper-parameters tuning, Loss Functions, Evaluation Measures for Regression Techniques.	**10**
5	**Advanced Concepts of learning:** Basics of Semi-Supervised and Reinforcement Learning, Q-learning. Value function approximation, Policy search, Linear Discriminant Analysis, Introduction to Deep Learning.	**08**
		45

List of Practicals / Tutorials:

1	Introduction to MATLAB Toolbox for Machine Learning Applications, Neural Network (NN) Toolbox, NN Simulink Demos.
2	Introduction to Python Tool for Machine Learning Applications.
3	MATLAB simulation: Artificial Neural Network (ANN) implementation.
4	MATLAB simulation: Various structure of NN algorithms implementation.
5	Study and Implement the Naive Bayes learner using WEKA (The datasets taken can be: Breast Cancer data file or data sets from UCI ML Repository).
6	Study and Implement the Decision Tree learners using WEKA (The datasets taken can be: Breast Cancer data file or data sets from UCI ML Repository).
7	Select two datasets. Each dataset should contain examples from multiple classes. For training purposes assume that the class label of each example is unknown (if it is known, ignore it). Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameter k.
8	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.
9	MATLAB simulation: Support Vector Machine (SVM) implementation (use IRIS dataset and carry out classification).
10	Case Study 1: Write a program using Bayes algorithm for email classification (spam or non-spam) for the open- sourced data set from the UC Irvine Machine Learning Repository.
11	Case Study 2: Write a program for artificial neural network for recognition of handwritten digits available in MNIST database.

Reference Books:

1	Tom M Mitchell, **Machine Learning**, McGraw-Hill Education.
2	Bishop, C., **Pattern Recognition and Machine Learning**, Springer-Verlag r.
3	Saikat Dull, S. Chjandramouli, Das, **Machine Learning**, Pearson.

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4	Ethem Alpaydin, **Introduction to Machine Learning** (Adaptive Computation and Machine Learning), The MIT Press, 2004.
5	Duda, Richard, Peter Hart, and David Stork., **Pattern Classification,** 2nd Edition, New York: Wiley-Interscience.
6	Bishop, Christopher, **Neural Networks for Pattern Recognition,** New York: Oxford University Press, 1995.
7	S. N. Sivanandam and S.N.Deepa, **Principles of Soft Computing**, 3rd Edition, Wiley India Pvt. Limited.
8	Anuradha Srinivasaraghavan, Vincy Joseph, **Machine Learning**, Wiley.
9	U Dinesh Kumar Manaranjan Pradhan, **Machine Learning with Python**, Wiley.

Supplementary learning Material:	
1	NPTEL / Coursera courses on Machine Learning
2	MATLAB / Python Software study materials.
3	Machine learning for dummies, IBM Limited ed, by Judith Hurwitz and Daniel Kirsch
4	Introduction to Machine Learning with Python A guide for data scientists, Andreas, C. Muller & Sarah Guido, O'Reilly

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
15	15	20	15	15	20	

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Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Recognize the characteristics of learning systems that make it useful to real-world problems.	**20**
CO-2	Understand the concept behind neural networks for learning non-linear functions.	**30**
CO-3	Understand and apply supervised and unsupervised algorithms for designing intelligent systems.	**30**
CO-4	Study advanced learning algorithms and its practical applications.	**20**

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June -2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025

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