SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology
Instrumentation and Control

B.Tech. IV Semester – VII

Subject Name: Artificial Intelligence and Machine Learning Subject Code: BTIC14701

Type of course: Professional Elective Course

Prerequisite (if any): Knowledge of engineering mathematics, basics of algorithms, simulation know- how on Matlab, python or other equivalent programming language.

List of Courses where this course will be prerequisite:

Rationale:
AI ML is very useful in Industry 4.0. Machine Learning enables IT systems to recognize patterns on the basis of existing algorithms and data sets and to develop adequate solution concepts. This subject covers the supervised and unsupervised machine learning algorithms.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

BSC: basic science course /ESC: Engineering Science Course /HSM: Humanities and management /PCC: Professional Core course /PEC: professional Elective course /OEC: Open Elective course/ MD: mandatory noncredit course

Content:

Sr. No.	Content	Total Hrs	Weightage
1	**Artificial Intelligence** Overview, Supervised and unsupervised learning, Learning task, instances, features, labels, reward/loss, training, testing	3	7%
2	**Gradient Descent and Linear Algebra Model representation** cost function, mathematics of gradient descent, gradient descent intuition, gradient descent for linear regression, matrix, vector, transpose matrix, matrix multiplication, and matrix multiplication properties, inverse of matrix.	5	11%
3	**Multiple features gradient descent** Multiple features, gradient descent calculations for multiple features, features and polynomial regression, normal equations, linear regression with multiple variables.	5	11%
4	**Classification Problem Formulation and Solution:** setup, training, test, validation dataset, over fitting. Classification families: linear discriminative, non-linear discriminative, decision trees, probabilistic (conditional and generative), nearest neighbor and Logistic regression. confusion matrix. Precision, Recall and Specificity.	7	15%
5	**Support Vector Machine** Max margin motivation, Kernel function and Kernel SVM	7	15%
6	**Dimensionality Reduction** Curse of dimensionality, Principal Component Analysis, Latent Semantic Analysis	2	4%
7	**Artificial Neural Network** Model representation, working of neurons, back propagation algorithm, adjusting parameters, multiclass classification, Deep Learning network	7	15%

8	**Unsupervised learning** Mixture model and Expectation maximization, K-Means Clustering, Distance based clustering, Density based clustering techniques.	**5**	**11%**
9	**Ensemble learning** Random forest, Adaboost regression,an introduction to Bayesian learning and the naive Bayes algorithm	**5**	**11%**

Suggested Specification table with Marks (Theory): (For BTech only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	**10%**	**30%**	**20 %**	**15%**	**15%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

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.

Reference Books:

Sr no	**Title of book /article**	**Author(s)**	**Publisher and details like ISBN**	**Year of publication**	**Publication Edition**
1	Pattern Recognition and Machine Learning	Bishop, C.	Berlin: Springer-Verlag ISBN: 978-1-4939-3843-8	2006	**Softcover reprint of the original 1st ed.**
2	Machine Learning	Tom Mitchell	McGraw-Hill, ISBN-13 978-1259096952	1997	1st Edition
3	Introduction to Machine Learning	Ethem Alpaydin	PHI ,ISBN:97802623 58064	2005	4th Edition

Course Outcomes: After learning the course, students will be able to

Sr. No.	CO statement :	Marks % weightage
CO-1	Classify the artificial intelligence and its approaches and applications in different area.	5%
CO-2	Formulate hypothesis and cost function and to apply the gradient descent algorithm to minimize the cost function.	5%
CO-3	Discuss the svm, bpnn ,knn, bayse algorithm for machine learning.	40%
CO-4	Apply linear regression and logistic regression methods for problem solving.	37%
CO-5	Apply unsupervised learning methods for problem solving using different algorithms.	10%
CO-6	Demonstrate the steps for pca for dimension reduction of data.	3%

Mapping with POs:

	PO 1	**PO 2**	**PO 3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO 3**
CO1	**1**												**2**		
CO2	**3**	**3**		**3**											**3**
CO3		**3**		**3**										**3**	
CO4															**3**
CO5				**3**											**3**
CO6	**3**														

List of Open learning website:

Nptel course on Introduction to Machine learning by Sudeshna Sarkar, IITKGP

https://onlinecourses.nptel.ac.in/noc22_cs97/preview

List of Open Source Software:

FOR LAB SESSIONS:

List of Experiments:

1. Implementation of gradient descent with single variable
2. Implementation of gradient descent with multiple variables.
3. Implementation of linear and polynomial regression.
4. Implementation of logistic regression or binary classification.
5. Implementation of SVM with simple features.
6. Implementation of ANN using back propagation.
7. Implementing K-Means clustering algorithm.
8. Implementation of Principal component analysis.
9. Solve the practical problem arrhythmia classification using Neural Network.
10. Load breast cancer dataset and perform classification using Euclidean distance.
11. Perform the statistical analysis on database.
12. Predict the class using Naïve Bayes Classifier for dataset.

Major Equipment Needed:

PC, Matlab/Scilab Software, Python programming language