NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B Tech Electronics and Instrumentation Engineering
Semester:	VI
Course Code:	
Course Title:	AI for Automation
Course Type:	Core
Year of Introduction:	2025-26

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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. understand the basic need of AI in automation **(BL2)**
2. apprehend machine learning and deep learning techniques **(BL3)**
3. simulate AI techniques for different applications **(BL4)**
4. design AI based real life automation applications. **(BL6)**

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Introduction** Introduction to AI, Automation and domains of applications, Basics of supervised and unsupervised learning, Applications.	06
Unit-II	**Automation domain** Factory Automation, Process control, manufacturing, food and beverage, pharmaceutical, Automotive, Building Automation, and others.	05
Unit-III	**Regression, classification and clustering techniques** Basic concepts and applications of Regression, Simple Linear & Multiple Regression, Gradient Descent, Hyper-parameters tuning, Evaluation Measures for Regression Techniques, Naïve Bayes Classification, K-Nearest Neighbours, Classification Trees, Support Vector Machines, Evaluation Measures for Classification Techniques, k-means Clustering.	10
Unit- IV	**Artificial neural networks** Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, Error Functions, Multilayer Perceptron, Back-propagation Neural Networks.	06
Unit-V	**Deep learning algorithms** Basics of deep learning, different types of deep learning algorithms, basic components of a convolutional neural network (CNN), CNN architecture, data preparation, performance estimation, network improvements, hyperparameter tuning, overfitting and underfitting, object detection, transfer learning, object classification, popular CNN architectures.	10
Unit-VI	**Applications and case studies** Industrial Applications, Commercial Applications, Predictive Maintenance, Smart Sensors, Soft Sensors, Quality Inspection, Smart Automation, Advances in AI for Automation, Case Studies.	08

Self Study:
The self -study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Suggested Readings/References:

1. M. Elgendy, Deep learning for vision systems, Manning publications.
2. I. Goodfellow, Y. Bengio, A. Courville, Deep learning, The MIT press publications.
3. T. M. Mitchell, Machine Learning, Tata McGraw Hill Publications
4. J. Patterson, A. Gibson, Deep learning: A practitioner's approach, Shroff/O'Reilly publications

Suggested List of experiments:
Laboratory work will be based on the above syllabus with a minimum 09 experiments/exercises to be incorporated. The students in a suitable group size will design and perform one experiment as a part of laboratory work.

(Only for Information)

Sr No.	Name of Experiments/Exercises	Hours
1.	Perform optimization using Gradient Descent algorithm	**(02 Hrs)**
2.	Implement linear regression algorithm on a dataset	**(02 Hrs)**
3.	Perform logistic regression on a dataset	**(02 Hrs)**
4.	Perform classification using k-Nearest Neighbours algorithm	**(02 Hrs)**
5.	Implement Decision Trees algorithm for a classification application	**(02 Hrs)**
6.	Implement Support Vector Machines algorithm on a dataset	**(02 Hrs)**
7.	Perform clustering using k-means clustering algorithm	**(02 Hrs)**
8.	Implement Naive Bayes classification algorithm for a dataset	**(02 Hrs)**
9.	Develop a Neural Network for an application	**(02 Hrs)**
10.	Implement the activation functions and error functions	**(02 Hrs)**
11.	Implement the back-propagation and feed-forward process	**(02 Hrs)**
12.	Develop a simple CNN application	**(02 Hrs)**