GUJARAT TECHNOLOGICAL UNIVERSITY

Level: PG

Branch: Electric Vehicle Technology

Subject Code: ME02064071

Subject Name : Artificial Intelligence for Autonomous Vehicles

WEF Academic Year :	2024 – 25
Semester :	2
Category of the Course :	Professional Elective Course

Objective :

The main objective is to understand the fundamental concepts related to Artificial Intelligence and machine learning, to learn and to use the main methods of classification, and cauterization. This course combines fundamental aspects from AI with practical aspects that can be encountered in Electric Vehicles systems.

Teaching and Examination Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content :

Sr. No.	Content	Total Hrs.
1	**INTRODUCTION TO AI AND ARTIFICIAL NEURAL NETWORK :** Introduction to AI, Introduction to Expert systems, History of neural network research, Basic concepts of Neural Networks, Human brain, Model of Artificial Neuron, Neural Network architectures, Perceptron, Single layer feed forward Network, Multi-layer feed forward network, Recurrent networks, Feedback networks and Radial Basis Function Networks, Characteristics of NN, Learning Methods, Error Correction Learning, LMS and Back Propagation Algorithm, Statistical Nature of the Learning Process, Training Examples of models.	**16**

2	**FUZZY LOGIC SYSTEM :** Introduction, Introduction, Comparison between Fuzzy and crisp logic, Fuzzy sets, Membership function, Basic fuzzy set operations, properties of Fuzzy set, fuzzy relations, Fuzzy interference system, Mamdani, Sugeno, Fuzzy rule based system, Defuzzification methods, Fuzzy Neural Networks.	**08**
3	**AI IN EV SAFETY (AUTOMATIVE DIAGNOSTICS AND INTERFACE) :** Various faults in Electric Vehicles, Battery faults, motor faults, mechanical faults, Wiring faults, AI application for various fault identification.	**06**
4	**AUTONOMOUS DRIVER ASSISTANT SYSTEM :** Introduction to Autonomous Driver Assistance System (ADAS), Distributed vs Centralized Processing, Integration of ADAS Technology into Vehicle Electronics, Sensors and Data acquisition in ADAS, LiDAR, RADAR, Camera, GNSS, GPS, IMU. Introduction to Machine Learning and Deep Learning in ADAS Human Machine Interaction, HMI for Advanced Driver Assistance Systems, Physical and Cognitive Factors Related with HMI Present ADAS Technology Examples like intelligent head light control, evasive steering support Adaptive cruise control, rear cross traffic alert, front cross traffic alert, vehicle exit alert, forward collision warning, vehicle turn assistance, blind spot detection, parking assistance system, traffic sign recognition lane assist system, driver monitoring system, driver drowsiness system, 360 view system, intelligent braking systems.	**12**

Suggested Specification table with Marks (Theory) :

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**25**	**30**	**15**	**5**	**5**

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 the above table.

Reference Books :

1. H. Sjafrie, "Introduction to Self-Driving Vehicle Technology", Chapman &

Hall/CRCArtificial Intelligence and Robotics Series, ISBN-10 0367321254, ISBN-13 978-0367321253, Dec 2019.
2. "Introduction to Self-Driving Vehicle Technology" Hanky Sjafrie, Chapman and Hall/CRC, 1st Edition, 2019, https://doi.org/10.1201/9780429316777
3. "S. Liu, L. Li, J. Tang, S. Wu, J-L Gaudiot, "Creating Autonomous Vehicle Systems", 216 pages, ISBN-10 1681739356, ISBN-13 978-1681739359, Morgan & Claypool, 2nd edition, Sept 2020.
4. J M Zurada , "An Introduction to ANN",Jaico Publishing House
5. Simon Haykins, "Neural Networks", Prentice Hall
6. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall
7. Neural Networks, Fuzzy logic and Genetic algorithms By S. Rajasekaran, G. A. Vijayalakshmi Pai PHI publication,

Course Outcomes :

S. No.	CO STATEMENT	Bloom's taxonomy level	Marks % weightage
CO1	Evaluate Artificial Intelligence (AI) methods and describe their foundations.	**Remember L1 , Understand L2, Evaluate L5,**	**35%**
CO2	Apply the different supervised and unsupervised learning methods of AI for various problems.	**Remember L1 , Understand L2, Evaluate L5,**	**15%**
CO3	Recognize the characteristics of basic AI Techniques to be used in safety of the vehicle	**Remember L1 , Understand L2, Evaluate L5**	**15%**
CO4	Analyze and illustrate how AI play vital role in EV problem solving, inference, perception, knowledge representation and learning using ADAS.	**Remember L1 , Understand L2, Evaluate L5 Create L6**	**35%**

Suggestive List of Experiments :

- To design a fuzzy logic controller.
- To develop back-propagation network and training algorithm.
- To design artificial neural network to predict the performance of electric vehicles.
- To study various faults in EV systems.
- To study the LiDAR system used in EV.

- To study the RADAR system used in EV.
- To study the Camera system used in EV.
- To study the GNSS system used in EV.
- To study the GPS system used in EV.
- To study the IMU system used in EV.
- To understand Human Machine Interaction system.
- To study various inter-vehicle instrumentation and its applications in generating various alerts.
- To study various vehicle control systems.

List of Software/learning website :

https://in.mathworks.com/discovery/adas.html
https://dewesoft.com/blog/types-of-adas-sensors
https://www.analytixlabs.co.in/blog/fundamentals-of-neural-networks/
https://in.mathworks.com/videos/getting-started-with-neural-networks-using-matlab-1591081815576.html
https://in.mathworks.com/discovery/neural-network.html
https://in.mathworks.com/help/fuzzy/fuzzylogicdesigner-app.html

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