INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<u>INTRODUCTION OF NEW COURSE</u>

Course Title	**AI for Autonomous Vehicles**	Course Code				
Dept./ Specialization	Computer Science and Engineering	Structure (LTPC)	3	1	0	4
To be offered for	B.Tech, M.Tech, Ph.D. - CSE, ECE, Mechanical	Status	Core ☐		Elective ■	
Faculty Proposing the course	Dr. Ram Prasad Padhy, CSE	Type	New ■		Modification ☐	
Recommendation from the DAC (Attached)		Date of DAC	17/01/2023			
External Expert(s)	1. Prof. C Krishna Mohan, Department of Computer Science and Engineering, IIT Hyderabad 2. Prof. Pankaj Kumar Sa, Department of Computer Science and Engineering, NIT Rourkela **Recommendations given by the external experts (attached)**					
Pre-requisite	Artificial Intelligence, Python/C++ Programming, Probability and Stochastic Process, COT	Submitted for approval	YES			
Learning Objectives	● This course is designed to get the basic understanding of autonomous systems, to discuss the need and application of autonomous vehicles (AV) in our society, and how AI can be useful (particularly from the computer science view point)					
Learning Outcomes	● Students will learn about basic functioning of AV and how the navigation is carried out with the help of sensors. Students will also learn how to develop algorithms for putting intelligence into AV.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	1. **Introduction:** Introduction to Artificial Intelligence and Autonomous Vehicles, Need for AI in Advanced Driver Assistance systems (ADAS), Machine Learning Workflow, Linear Regression, Backpropagation, Gradient Descent, Feedforward Neural Networks, Deep Learning Concepts and Techniques (6L) 2. **Computer vision for Autonomous Vehicles:** Sensor and Camera Calibration, Image Classification with Convolutional Neural Networks, Object Detection in Images, Semantic Segmentation in Images (6L, 1T) 3. **Sensor Fusion:** Introduction to Perception and Sensor Fusion, The Lidar Sensor, Detecting Objects in Lidar, Kalman Filters, Extended Kalman Filters, Camera-Lidar External Calibration, Multi Sensor Fusion, Multi Object Tracking (9L, 2T) 4. **Localization:** Introduction to Localization, Markov Localization, Creating Scan Matching Algorithms, Utilizing Scan Matching in 3D, Simultaneous Localization and Matching (SLAM) (9L, 2T) 5. **Planning:** Behavior Planning, TrajectoryGeneration, Motion Planning (6L, 2T) 6. **Control:** PID Control, CARLA simulator, open source ADAS stacks, such as Autoware, Apollo etc. (6L, 1T) 7. **Hands-on experience with ADAS systems:** 2D/3D Object Detection, Semantic Segmentation, Camera-Lidar Fusion, Multi-object Tracking, Trajectory Generation, Critical Scenario Identification (6T)					

Text Book	1. Sumit Ranjan, Dr. S. Senthamilarasu, Applied Deep Learning and Computer Vision for Self-Driving Cars, Packt Publishing, 1st Edition, 2020. ISBN: 9781838646301 2. Hanky Sjafrie, Introduction to Self-Driving Vehicle Technology, CRC Press, Taylor and Francis Group, 1st Edition, 2020. ISBN: 9780429316777
Reference Books	1. Patrick Lin, Keith Abney, Ryan Jenkins, Robot Ethics 2.0: From Autonomous Cars to Artificial Intelligence, Oxford University Press, Edited version, 2017. ISBN: 9780190652951 2. S Russell & P Norvig, Artificial Intelligence – A Modern Approach, Pearson, 4th Edition, 2021. ISBN: 978-0-13-461099-3 3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer Nature Switzerland,2nd Edition, 2011. ISBN: 978-3-030-34371-2