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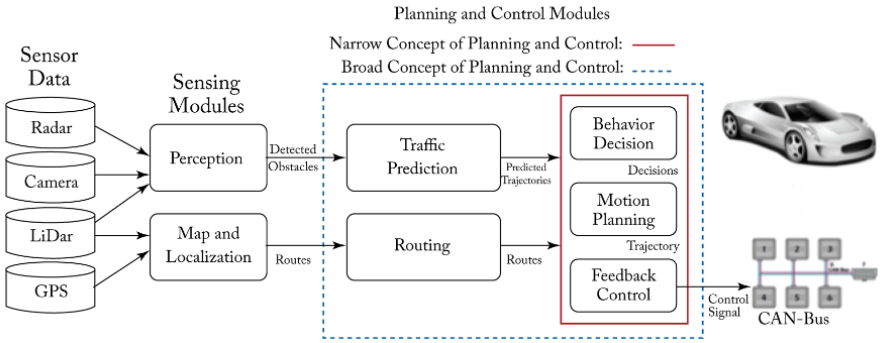
RV College of Engineering®,
(Autonomous Institution affiliated to VTU)
Bengaluru-560 059
Course Title: ARTIFICIAL INTELLIGENCE IN AUTONOMOUS VEHICLES

Model Question Paper

COURSE CODE:21AI73GI	**SEM**: VII
COURSE TITLE : ARTIFICIAL INTELLIGENCE IN AUTONOMOUS VEHICLES	
Duration of Paper: 03 Hrs	

Instructions to Candidates:
1. Answer all questions from Part A
2. Any 5 Full questions from Part B choosing one from each side. (Question No.2 is compulsory)

Q.No	PART A	Marks	BTL	CO
1.1	Analyze the concept of autonomous vehicle localization, explore its key techniques, and evaluate the challenges faced in real-world applications.	02	4	2
1.2	What is the role of sensor fusion in autonomous vehicles?	02	2	1
1.3	What factors affect GNSS (Global Navigation Satellite System) accuracy in autonomous vehicles localization.	02	3	2
1.4	Name two applications of deep learning in autonomous vehicle perception.	02	1	1
1.5	Justify, how visual odometry is used in autonomous vehicles to estimate their position and movement.	02	2	1
1.6	List two challenges in traffic prediction for autonomous driving.	02	1	1
1.7	What are 'behavioral decisions' in motion planning.	02	1	1
1.8	Evaluate the use of reinforcement learning in autonomous vehicles, weighing its strengths and limitations.	02	2	1
1.9	Mention two cloud-based technologies used in autonomous vehicles.	02	1	3
1.10	What are HD maps, and why are they important for autonomous driving?	02	1	3
	PART B			
2(a)	With a neat sketch describe the autonomous driving system architecture and its key components.	08	2	1
2(b)	Scenario: A fleet of autonomous delivery vehicles operates in an urban environment with complex road networks. The vehicles use high-definition maps for localization and navigation. During a pilot project, several issues arise, including: 1. Mismatches between the map and real-world conditions due to construction activities. 2. Delays in updating HD maps, causing reduced localization accuracy in certain areas. 3. High maintenance costs for continuously updating the HD map database.	08	4	1

	Question: Evaluate the role of high-definition maps in ensuring accurate localization for the autonomous delivery fleet. Propose alternative strategies to address the identified issues while maintaining cost-efficiency and system reliability. Discuss the potential trade-offs of your proposed solutions.			
3(a)	A perception system for an autonomous vehicle uses stereo flow, optical flow, and scene flow to navigate dynamic urban environments. During testing, the vehicle struggles with accurately tracking fast-moving pedestrians crossing the road and fails to detect depth in poorly textured regions such as plain walls. 1. Analyze how each of these techniques (stereo flow, optical flow, and scene flow) contributes to the observed performance issues. Suggest a combination of techniques or improvements to address these limitations while ensuring real-time processing and system reliability.	10	4	1
3(b)	Identify and discuss the various applications of convolutional neural networks (CNNs) in detecting road objects.	06	2	4
	OR			
4(a)	Evaluate the effectiveness of stereo vision in autonomous driving systems, considering its strengths and limitations in various driving environments (e.g., urban, rural, night, and adverse weather conditions). Compare stereo vision with other perception technologies such as LiDAR and radar in terms of depth perception, real-time processing, and robustness.	10	3	2
4(b)	What are the datasets used for training autonomous vehicle perception systems? Provide examples.	06	2	2
5(a)	 Fig. 5a. Using the provided diagram, evaluate the effectiveness of the planning and control modules in autonomous driving systems. Consider the integration between the sensing modules and the planning components, particularly in the following scenarios: 1. A sudden pedestrian crossing the road. 2. Dynamic traffic flow changes requiring route recalibration. 3. Propose modifications or alternative approaches to enhance the decision-making process and improve overall system reliability in handling such real-time events. Support your evaluation with relevant justifications based on system architecture.	10	3	2
5(b)	Describe the methods of lane-level routing in autonomous driving.	06	2	2
	OR			
6(a)	Explain the role of feedback control in motion planning.	08	2	2

6(b)	Compare and contrast behavioral decisions with motion planning in autonomous vehicles.	08	3	2
7(a)	Evaluate the application of reinforcement learning (RL) in autonomous vehicle planning and control. Specifically, assess its effectiveness in scenarios such as adaptive route planning, decision-making under uncertain traffic conditions, and obstacle avoidance. Consider the advantages and limitations of using RL compared to traditional planning methods. Propose potential strategies to enhance RL algorithms for autonomous vehicles, focusing on real-time performance, safety, and the ability to generalize to diverse driving environments.	10	4	2
7(b)	Explain the components of an operating system for autonomous driving.	06	2	2
	OR			
8(a)	Examine the challenges and propose solutions for integrating client systems in autonomous driving platforms.	08	4	2
8(b)	With a neat sketch explain the computing stack for autonomous driving system.	08	2	3
9(a)	Outline the infrastructure of cloud platforms supporting autonomous driving.	08	3	3
9(b)	How can autonomous delivery vehicles ensure safety and security in complex traffic conditions?	08	2	3
	OR			
10(a)	Describe the process of model training for autonomous vehicle systems with suitable diagrams.	08	2	3
10(b)	Analyze the strategies for deploying autonomous delivery vehicles in production environments, considering factors such as scalability, safety, regulatory compliance, and operational efficiency. Discuss how these strategies can be adapted to different environments (e.g., urban vs rural settings) and what challenges might arise when integrating these vehicles into existing transportation systems.	08	4	2

Name of the Scrutinizer

Name of the BoE Chairperson

Signature of Scrutinizer

Signature of the BoE Chairperson