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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: VII - THEORY EXAMINATION (2024 - 2025)

Subject: Autonomous vehicles

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A 20

1. Attempt all parts:-

1-a. The full form of NHTSA. (CO1) 1

(a) North-America Highway Traffic Security Administration

(b) National Highway Transportation Safety Agency

(c) National Highway Traffic Safety Administration

(d) National Highway Transportation Security Administration

1-b. The full form of (DOT). (CO1) 1

(a) Department of Transportation

(b) Department of Traffics

(c) Department of Travel

(d) Department of Trucks

1-c. V2N stands for? (CO2) 1

(a) Vehicle to Network.

(b) Vehicle to Neural-network

(c) Vehicle to New Technology

(d) Vehicle to Non-stop

1-d. Select the incorrect statement with respect to traffic rules. (CO2) 1

(a) You can take U-turn anytime on the road

(b) Always stop your vehicle before the stop line at an intersection during red light

(c) Proper distance should be maintained from the vehicle in front of you

(d) Avoid using horns in places like hospitals and schools unless absolutely necessary

1-e. Which actions should not be performed in the event of an accident by an autonomous vehicle? (CO3) 1

(a) Locking all doors
(b) Returning car to a safe state
(c) Securing fuel pumps
(d) Data recording to a black box

1-f. What is the primary purpose of Vehicle Dynamic Modeling? (CO3) 1

(a) Optimizing fuel efficiency
(b) Simulating vehicle movements and behaviors
(c) Adjusting tire pressure
(d) Managing lighting systems

1-g. Which parameter is crucial for modeling the vehicle's response to steering input in a dynamic model? (CO4) 1

(a) Engine displacement
(b) Tire pressure
(c) Steering ratio
(d) Brake fluid temperature

1-h. In a vehicle dynamic model, what does the term "yaw rate" represent? (CO4) 1

(a) Acceleration in the forward direction
(b) Rate of change of steering angle
(c) Side-to-side rotation around the vertical axis
(d) Tire grip coefficient

1-i. Which factor influences the natural frequency of a vehicle's suspension system? (CO5) 1

(a) Vehicle weight
(b) Engine horsepower
(c) Brake disc size
(d) Fuel tank capacity

1-j. What is the primary purpose of a PID controller in a control system? (CO5) 1

(a) To calculate fuel efficiency
(b) To adjust tire pressure
(c) To maintain a desired output by adjusting the input
(d) To control lighting systems

2. Attempt all parts:-

2.a. What are the requirements for Autonomy? (CO1) 2

2.b. What challenges do autonomous vehicles face in terms of safety and regulation? (CO2) 2

2.c.	What types of communication protocols are used in self-driving vehicle architectures? (CO3)	2
2.d.	How are human-machine interfaces designed to enhance safety in self-driving cars? (CO4)	2
2.e.	What role does advanced control systems play in improving vehicle dynamics? (CO5)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Write about SAE? (CO1)	6
3-b.	Write about RADAR in detail and its application in autonomous vehicles? (CO1)	6
3-c.	How do insurance models need to adapt to accommodate autonomous vehicles? (CO2)	6
3-d.	How do autonomous vehicles handle adverse weather conditions? (CO2)	6
3.e.	How do self-driving systems prioritize and interpret various sensor inputs? (CO3)	6
3.f.	What role does tire modeling play in vehicle dynamic simulations? (CO4)	6
3.g.	How is adaptive cruise control different from traditional cruise control? (CO5)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	How do autonomous vehicles navigate their surroundings? Explain in detail. (CO1)	10
4-b.	How do autonomous vehicles communicate with each other? Explain the architecture. (CO1)	10

5. Answer any one of the following:-

5-a.	What role does machine learning play in self-driving software? State with the examples. (CO2)	10
5-b.	How is real-time decision-making achieved in self-driving software? (CO2)	10

6. Answer any one of the following:-

6-a.	What are Industry methods for safety assurance and testing in autonomous vehicles? (CO3)	10
6-b.	What measures are in place to address cybersecurity concerns in autonomous vehicles? (CO3)	10

7. Answer any one of the following:-

7-a.	How do road surface conditions influence vehicle dynamic models? (CO4)	10
7-b.	What are the challenges in accurately modeling real-world driving scenarios? (CO4)	10

8. Answer any one of the following:-

8-a.	How does predictive modeling contribute to longitudinal control strategies? (CO5)	10
8-b.	What role does sensor technology play in adaptive braking systems? (CO5)	10