EC809 **ADVANCED MULTI SENSOR DATA FUSION** **3-0-0-3**

Learning Objectives (LO)

LO1: To introduce the sensing methods available for autonomous driving systems.
LO2: To impart an understanding of data fusion architectures for autonomous driving systems.
LO3: To provide the insights into state estimation and localization for autonomous applications.

Course Outcomes (CO)

CO1: Ability to understand the benefits and shortcomings of various sensing systems used for automotive applications.
CO2: Ability to apply appropriate data fusion techniques to problems in automotive applications.
CO3: Ability to analyse the intelligent fusion algorithms for automotive applications.
CO4: Ability to create fusion models for state estimation and localization for automotive applications.

CO-PO Mapping

CO-PO Mapping CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	-	-	3	-	-
CO 2	-	-	3	-	-
CO 3	-	-	3	3	3
CO4	-	-	3	3	-

Skills Development Acquired: Design of sensor-fusion algorithms for Advanced Driver Assistance Systems

Syllabus

Unit 1: (15 Hours)

Sensors and Automated Driving Technologies: Basics of Camera, LIDAR, RADAR sensors – Sensor Positioning – Sensor Calibration – Sensing Algorithms – Automated Driving Systems – Mapping – Connectivity – Use of Artificial Intelligence for Autonomous Driving

Unit 2: (15 Hours)

Data fusion models- Configurations and architectures – Probabilistic Data Fusion- Dempster-Shafer Method- Maximum Likelihood – Least-squares method – Maximum Entropy methods – Bayesian- Recursive Bayesian methods

Unit 3: (15 Hours)

State Estimation and Localization for Self-driving cars: Use of Kalman filter variants – Information filtering – $H\infty$ filtering – GNSS/INS sensing for position and orientation estimation – Basics of LIDAR sensing – Fusion of sensor data for an autonomous Vehicle State Estimator

References

1. Jitendra R Raol, Data Fusion Mathematics: Theory and Practice, CRC Press, 2016.

2. David L. Hall, Sonya A.H. McMullen, Mathematical Techniques in Multisensor Data Fusion, Second Edition, Artech House, Boston, 2004.
3. R. Brooks and S.S. Iyengar, Multisensor Fusion: Fundamentals and Applications with Software, Prentice Hall Inc., New Jersey, 1998.
4. Thor I. Fossen, Kristin Y. Pettersen, Henk Nijmeijer: Sensing and Control for Autonomous Vehicles: Applications to Land, Water and Air Vehicles, Springer, The Netherlands, 2017.
5. Tom Denton : Automated Driving And Driver Assistance Systems, IMI, NY, 2020

Evaluation Pattern:

Periodical 1 (P1): 15
Periodical 2 (P2): 15
Continuous Assessment (CA) Quizzes/ Assignments/ Term projects/ Reports: 20
End Semester: 50