Program :	**Diploma in Automobile Engineering**
Course Code : **6052C**	Course Title: **Automotive Safety**
Semester : **6**	Credits: **4**
Course Category: **Open Elective**	
Periods per week: **4 (L:3, T:1, P:0)**	Periods per semester: **60**

Course Objectives:

- To introduce vehicle structural crashworthiness and crash testing
- To introduce pedestrian safety
- To get the knowledge in sensors provided in the vehicle to avoid the crash and to detect the obstacles around the vehicle.
- To understand the fundamentals of sensor data fusion as it relates to ADAS.
- To understand the concept of the connected vehicle and its role in ADAS and automated vehicles.

Course Prerequisites:

Topic	Course code	Course name	Semester
Basics of electrical and electronic systems in Automobiles		Automobile electrical and electronics systems	3
Chassis and transmission components.		Automobile chassis and Transmission	5

Course Outcomes:

On completion of the course, the student will be able to:

COn	Description	Duration (Hours)	Cognitive Level
CO1	Explain the basic concept of automobile safety	15	Understanding
CO2	Illustrate various passive safety systems used in automobiles	14	Understanding
CO3	Illustrate various active safety systems used in automobiles	15	Understanding
CO4	Explain vehicle navigation system and various SAE levels of driving automation	14	Understanding
	Series Test	2	

CO – PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2	2						
CO3	2						
CO4	2						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Explain the basic concept of automobile safety**		
M1.01	Explain the active safety in Automobiles	3	Understanding
M1.02	Explain the passive safety in Automobiles	3	Understanding
M1.03	Explain the design of automotive body for safety	4	Understanding
M1. 04	Outline the concept of crumple zone	5	Understanding

Contents:

Concepts Of Automotive Safety

Automotive safety: Introduction and Types. Active safety: driving safety, conditional safety, Perceptibility safety, operating safety. Passive safety: Design of body for safety. Concept of crumble zone, Safety Cage. Optimum crash pulse, deceleration on impact with stationary and movable obstacles. Design for Crashworthiness. NCAP.

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO2	**Illustrate various passive safety systems used in automobiles**		
M2.01	Illustrate the function and working of seatbelt.	2	Understanding
M2.02	Illustrate the working of collapsible steering column	3	Understanding
M2.03	Illustrate the working of air bags	3	Understanding
M2.04	Explain automotive bumpers.	3	Understanding
M2.05	Illustrate the working of central locking system	2	Understanding
M 2.06	Illustrate the working of automated wiper system	1	Understanding
	Series Test – I	1	

Contents:

Passive safety equipments and convenience system

Seat belt, Seat belt tightener system and importance, collapsible steering column. Air bags and its activation. Designing aspects of automotive bumpers and materials for bumpers. Steering and mirror adjustment, central locking system, Tire pressure control system, rain sensor system, Automated wiper system.

CO3	**Illustrate various Active safety systems used in automobiles**		
M3.01	Explain the antilock braking system	5	Understanding
M3.02	Explain the adaptive cruise control	5	Understanding
M3.03	Explain various active safety features	5	Understanding

Contents:

Active safety

Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection System. ADAS

CO4	**Explain vehicle navigation system and various SAE levels of driving automation**		
M4.01	Explain intelligent vision system.	4	Understanding
M4.02	Explain vehicle navigation system	5	Understanding
M4.03	Explain SAE levels of driving automation	5	Understanding
	Series Test – II	1	

Contents:

Vehicle navigation system and autonomous vehicle

Looking out sensors and Looking in sensors, Intelligent vision system, Vehicle Integration system. Global Positioning System. Vehicle Navigation System. Road Network.V2V (Vehicle -To- Vehicle Communication system).

SAE Levels of Driving Automation, Level 0 - No Driving Automation, Level 1 - Driver Assistance, Level 2 - Partial Driving Automation, Level 3 - Conditional Driving Automation, Level 4 - High Driving Automation, Level 5 - Full Driving Automation.

Text / Reference:

T/R	Book Title/Author
T1	Automobile Engineering Vol-I, II, Dr. Kirpal Singh, Standard Publishers and Distributor, New Delhi
R1	ARAI Safety standards
R2	Bosch, "Automotive HandBook", 6th edition, SAE, 2004. Applications" -Butterworth-Heinemann, 2001
R3	LjuboVlacic, Michel Parent, Fumio Harashima – "Intelligent Vehicle Technologies Theory and
R4	Marek. J, H.-P. Trah, Y. Suzuki, I. Yokomori - "Sensors for Automotive Applications" WILEY-VCH, Verlag GmbH & Co. 2003
R5	Robert Bosch GmbH - "Safety, Comfort and Convenience Systems"- Wiley; 3rd edition, 2007
R1	Surface Vehicle Recommended Practice - SAE J 3016-2018 , SAE International, 2018

Online Resources:

Sl.No	Website Link
1	http://toolkit.irap.org/default.asp?page=treatment&id=43
2	https://www.consumerreports.org/cro/2012/04/guide-to-safety-features/index.htm
3	https://www.researchgate.net/publication/324336253_Automobile_safety_technology_and_its_improvement
4	https://www.britannica.com/technology/vehicular-safety-devices
5	https://www.bosch-mobility-solutions.com/en/products-and-services/passenger-cars-and-light-commercial-vehicles/driving-safety-systems/integrated-safety-systems/