Mechanical Engineering Department
B. Tech. Semester VII

Course Name: **Smart Systems in Automobile** **Course Code: BTME19751**
Type of course: **Minors -Advances in Automobile Engineering**
Prerequisite: Passion for Automobile Technologies and new trends in it.
Rationale of Course: The basics of automotive electronics, fundamentals of electronic control Systems. The most recent advancements in automotive advanced driver support systems, such as lane keeping, collision avoidance, automatic emergency braking, and autonomous vehicles, are explored in detail.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in the course.

Contents:

Sr. No.	Content	Total Hrs	Module Weightage
1	**Introduction:** Introduction to Automated, Connected, and Intelligent Vehicles Introduction to the Concept of Automotive Electronics, Automotive Electronics Overview, History & Evolution, Infotainment, Body, Chassis, and Powertrain Electronics, Advanced Driver Assistance Electronic Systems	9	20%
2	**Connected and Autonomous Vehicle Technology:** Basic Control System Theory applied to Automobiles, Overview of the Operation of ECUs, Basic Cyber-Physical System Theory and Autonomous	9	20%

	Vehicles, Role of Surroundings Sensing Systems and Autonomy, Role of Wireless Data Networks and Autonomy		
3	**Sensors and Actuators:** Introduction to Sensors and Actuators, Fundamentals of Time and Frequency, Sensor and Actuator Characteristics, Sensors, Linear and Rotational Sensors, Acceleration Sensors, Force Measurement, Torque and Power Measurement, Flow Measurement ,Temperature Measurements, Distance Measuring and Proximity Sensors, Light Detection, Image, and Vision Systems, Integrated, Micro-sensors, Actuators, Electromechanical Actuators, Electrical Machines, Piezoelectric Actuators, Hydraulic and Pneumatic Actuation Systems, MEMS: Micro transducers Analysis, Design and Fabrication.	**9**	**20%**
4	**Sensor Technology for Advanced Driver Assistance Systems:** Basics of Radar Technology and Systems, Ultrasonic Sonar Systems, Lidar Sensor Technology and Systems, Camera Technology, Night Vision Technology, Other Sensors, Use of Sensor Data Fusion, Integration of Sensor Data to On-Board Control Systems	**9**	**20%**
5	**Autonomous Vehicles :** Driverless Car Technology, Moral, Legal, and Roadblock Issues, Technical Issues, Security Issues	**9**	**20%**

Percentage Distribution of Marks as per Bloom's Taxonomy (Theory/Practical):

Percentage Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	**30**	**20**	**10**	**5**	**5**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyse, **E:** Evaluate **C:** Create and above Levels

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr no	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Wireless Telecommunications Systems and Networks	G. Mullett	Delmar Learning	2006	-
2	Basic Telecommunications : The Physical Layer	G. Mullett	Delmar Learning	2003	-
3	Introduction to Automotive Sensors and Actuators: Components, Working principle and Applications	Sreeraj S.	LAP LAMBERT Academic Publishing	2019	-
4	Vehicle Sensors, Actuators, and Diagnostics	-	Society of Automotive Engineers	2004	-
5	Autonomous Vehicles: Opportunities, Strategies and Disruptions	Michael E. McGrath	Independently published	2019	-

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Extend knowledge of evolution of automotive electronics.	20
CO-2	Associate the fundamental theory of operation of electronic control systems.	20
CO-3	Summaries with the concept of fully autonomous vehicles.	20
CO-4	Apply the concept of remote sensing and the types of sensor technology.	20
CO-5	Examine the various types of advanced driver assistance systems.	20

Mapping with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO-1	3	0	2	0	2	2	3	0	0	0	0	3
CO-2	3	3	2	2	3	1	3	0	3	3	3	3
CO-3	2	3	3	1	3	1	1	0	2	3	0	3
CO-4	3	3	3	2	3	3	3	1	2	1	0	3
CO-5	2	3	3	2	3	3	3	2	3	3	3	3
Rationale*	**13**	**12**	**13**	**7**	**14**	**10**	**13**	**3**	**10**	**10**	**6**	**15**

***Rationale of CO-PO-PSO mapping*:** This course highly maps with Program outcomes 1, 2, 3, 5, 7 and 12. It states that the course will develop Engineering knowledge, Problem analysis, Design / development of solutions, Modern tool usage, Environment and sustainability, Life-long learning. Finally it will lead to convert conceptual knowledge of mechanical engineering to real life application and apply their technical, managerial and other soft skills in their professional life.

List of Practical:

1. System Design of Unmanned Aerial Vehicle (UAV) System
2. System Design of Battery Operated Electric Vehicle
3. System Design of Automated Robotic arm
4. System Design of Underwater Vehicle
5. Study of Battery parameters of batteries for electric vehicle.

Major Equipment:

1. UAV Models
2. Electric vehicle Model
3. Robotic Arm model
4. Computational facilities