Cummins College of Engineering for Women

(An autonomous institute affiliated to Savitribai Phule pune university)
Karve Nagar, Pune - 411 052.

Vision
**To be globally renowned engineering institute for imparting holistic education
and developing professional women leaders in engineering and technology**

B.Tech. (Hons) Mechanical Engineering

With specialization in

Electric Vehicles

2023 Pattern [R0]

List of Abbreviations

Abbreviation	Title
PCC	Programme Core Course
BSC	Basic Science Course
ESC	Engineering Science Course
PE	Programme Elective Course
OE	Open Elective
VSEC	Vocational and Skill Enhancement Course
CC	Co-curricular Courses / Liberal Learning Course
IKS	Indian Knowledge System
VEC	Value Education Course
RM	Research Methodology
INTR	Internship
PROJ	Project
CEP	Community Engagement Project
RM	Research Methodology
Mm	Multidisciplinary Minor
AEC	Ability Enhancement course

MKSSS's Cummins College of Engineering for Women, Pune

(An Autonomous Institute Affiliated to SavitribaiPhule Pune University)

Autonomous Program Structure of

B. Tech. in Mechanical Engineering with

Honors Degree Program in

ELECTRIC VEHICLES
Academic Year: 2025-26 Onwards

Course Code	Course Title	Teaching Scheme Hours / Week			Cr	Examination Scheme			Total Marks
		L	T	P		ISE	ESE	Pr/Or	
23HEV501	Introduction to EV Systems	3	1	0	4	50	50	-	100
23HEV501L	Introduction to EV Systems Lab	0	0	2	1	25	-	25	50
23HEV601	EV Energy Storage Systems	3	1	0	4	50	50	-	100
23HEV601L	EV Energy Storage Systems Lab	0	0	2	1	25	-	25	50
23HEV701	EV Sensors and Controls	3	0	0	3	50	50	-	100
23HEV801	EV Motor Drives and Transmissions	3	1	0	4	50	50	-	100
23HEV801L	EV Motor Drives and Transmissions Lab	0	0	2	1	25	-	25	50
Total		**12**	**03**	**06**	**18**	**275**	**200**	**75**	**550**

APPROVED BY
Secretary Academic Council
MKSSS's Cummins College of Engineering
For Women, Pune-411052

APPROVED BY
Chairman Academic Council
MKSSS's Cummins College of Engineering
For Women, Pune-411052

Course Code	Introduction to EV Systems	L	T	P
23HEV501		3	1	-
Pre-requisite	Thermodynamics, Mathematics, Mechanics			

Course Objectives: To make students

1. Understand the fundamental architectures of Battery Electric Vehicles (BEVs), Hybrid Electric Vehicles
2. Analyze vehicle dynamics specific to EVs, including tractive forces, power requirements, and drive cycles (NEDC, WLTP, FTP-75)
3. Evaluate lateral and vertical dynamics of EVs, including understeer/oversteer behavior and ride comfort
4. Analyze active safety and stability systems

Course Outcomes: Students will be able to

1. Analyze and compare architectures of BEVs, HEVs, and ICEVs, evaluating their energy efficiency, emissions
2. Model tractive forces and power requirements for EVs using drive cycles (NEDC, WLTP, FTP-75)
3. Assess lateral and vertical dynamics of EVs, including stability (understeer/oversteer) and ride comfort
4. Design and validate active safety systems (ABS, ESC, traction control)
5. Develop ADAS and autonomous driving functionalities

Unit: 1	Introduction to Hybrid and Electric vehicles:	

BEV, HEV, Architecture, ICEV and EV Comparison, Environmental Considerations, Policies, Standards

Unit: 2	Fundamentals of Vehicle Dynamics

Vehicle Dynamics of EV: Tractive forces, Power Requirement, Drive Cycles,

Unit: 3	Lateral and Vertical Dynamics of EV

Lateral and Vertical Dynamics of EV

Unit: 4	Suspension and Stability Control

Suspension Systems, Electronic Stability Control (ESC) & Active Systems, ABS, traction control, and adaptive suspension to enhance dynamics.

Unit: 5	Electronic Systems

Electronic Systems: advanced Driver Assistance Systems (ADAS) & Autonomous Driving, Radar, LiDAR, cameras, and ultrasonic sensors for autonomous functions., Adaptive Cruise Control (ACC), Lane Keeping Assist (LKA), AEB (Automatic Emergency Braking). Infotainment & Telematics

Reference Books:

1.	Electric Vehicle Engineering, Per Enge et al., McGraw Hill Publications
2.	Mehrdad Ehsani, Yimin Gao, Sebastian E.Gsay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell vehicles-Fundamentals - Theory and Design", CRC Press
3.	Intelligent Vehicle Technologies, Ljubo Vlacic et al.
4.	Vehicle Dynamics and Control, Rajesh Rajamani
5.	Automotive Control Systems ,Uwe Kiencke & Lars Nielsen

Course Code	Introduction to EV Systems Lab	L	T	P
23HEV501L				**2**
Pre-requisite	Thermodynamics, Mathematics, Mechanics			

Course Objectives: To make students

1. Understand the fundamental architectures of Battery Electric Vehicles (BEVs), Hybrid Electric Vehicles
2. Analyze vehicle dynamics specific to EVs, including tractive forces, power requirements, and drive cycles (NEDC, WLTP, FTP-75)
3. Evaluate lateral and vertical dynamics of EVs, including understeer/oversteer behavior and ride comfort
4. Investigate active safety and stability systems

Course Outcomes: Students will be able to

1. Compare ICEV, BEV, and HEV architectures by analyzing energy efficiency, emissions, and lifecycle environmental impact
2. Model and simulate EV tractive forces, power requirements, and vehicle dynamics by applying drive cycles (NEDC, WLTP, FTP-75)
3. Design and evaluate active safety systems (ABS, ESC, traction control) through simulations and test rig experiments, demonstrating their role in improving EV stability and performance.
4. Develop and test ADAS functionalities (LiDAR/camera fusion, ACC) using Raspberry Pi/Arduino and Simulink,

List of Experiments:

1. Comparative Analysis of ICEV, BEV, and HEV and Life Cycle Assessment (LCA) of EVs vs. ICEVs using MATLAB and openLCA
2. Tractive Force & Power Calculation for Different Drive Cycles (NEDC, WLTP, FTP-75) for EVs
3. Lateral Stability Analysis of an EV (Understeer/Oversteer Simulation) using CarSim/Python
4. Vertical Dynamics – Ride Comfort Analysis of an EV
5. ABS & Traction Control Simulation (Demonstration of ABS system components and MATLAB simulations)
6. Electronic Stability Control (ESC) Testing using a test rig
7. LiDAR/Camera Sensor Fusion for Object Detection using Raspberry Pi/Arduino and sensors
8. Adaptive Cruise Control (ACC) Simulation with Simulink