	Title of the Subject: Electric Vehicles	Sem:6			Code: UAU642N				Credits: 3				PSO		
													1	2	3
	Programme Outcomes / Course Outcomes	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:	Apply engineering basic knowledge with modern computing tools in solving problems of design, production and servicing domains	Mould and develop engineers to serve in industries as professionals or entrepreneur	Prepare engineers to undertake research and higher learning
1	Ability to classify EVs through understanding the operational and control features.	3	2	1	1	1	1	1					1	2	2	2
2	Ability to classify the automotive batteries, understand the working principles and applications.	3	2	1	1	1	1	1					1	2	2	2
3	Ability to classify the drives for EVs by realising the working and control principles, speed-torque characteristics and applications.	3	2	1	1	1	1	1					1	2	2	2
4	Ability to classify HEVs through understanding the power trains and compare the operating conditions.	3	2	1	2	2	1	1					1	2	2	2
5	Understand the force dynamics for an automobile and apply the same for selection of EV components	3	2	1	2	2	1	1					1	2	2	2

Common to All Branches

Open Elective
Electric Vehicles (UAU642N)
3 Credits (L-T-P: 3-0-0)

UNIT-I

Electric Vehicles History: Basics of Electric Vehicles, components of Electric Vehicle, General Layout of EV, EV classification: Battery Electric Vehicles (BEVs), Fuel-Cell Electric Vehicles (FCEVs), Comparison with Internal Combustion Engine: Technology, Advantages & Disadvantages of EVs, National Policy for adoption of EVs, Batteries: Types, working, merits and demerits **10 Hours**

UNIT-II

Drives and controls: Drive classification: Principle and working of PMDC motor, BLDC motor and PMSM motors. Characteristics (Speed torque characteristics) and control features of PMDC motor, BLDC motor and PMSM motors. Comparison and advantages. Converters: AC-DC, DC-AC, DC-DC and AC-AC. Four quadrant operation**.** **10 Hours**

UNIT-III

Hybrid Powertrains: Series HEVs, Parallel HEVs, Series–Parallel HEVs, Complex HEVs, Operating Modes, Degree of Hybridization, Comparison of HEVs, Plug-in Hybrid Electric Vehicles (PHEVs). Compare and contrast the performance of ICE vehicles, HEVs and BEVs.

10 Hours

UNIT-IV

Vehicle dynamics: Vehicle resistance, Types: Rolling Resistance, Grading resistance, Aerodynamic drag, Vehicle performance, Calculating the Acceleration Force, Maximum speed, Total Tractive Effort and Torque Required On The Drive Wheel. Transmission: Differential, clutch & gear box, Braking performance and regenerative braking.

10 Hours

Text books:

1. **Modern Electric, Hybrid Electric, and Fuel Cell Vehicles by Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, and Ali Emadi, CRC Press 2005**
2. **Electric and Hybrid Vehicles- Design Fundamentals by Iqbal Husain, CRC Press, 2005**
3. **Electrical Vehicle Technology by Sunil R Pawar, Notion Press Publications, Second edition, 2021**
4. **Automobile Mechanics by N.K.Giri, Khanna Publishers, 2008**