III B.Tech – I Semester
(20EE5641) ELECTRIC VEHICLES IN SMART GRID

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	4	-	-	4

Pre-Requisites: DC Machines and Transformers, Synchronous and Asynchronous Machines.

Course Objectives

- Describe about vehicle electrification and impact of charging strategies.
- Describe the influence of EVs on power system
- Describe the frequency control and voltage reserve from EVs

UNIT–I: Introduction to EV Charging Systems

Introduction, Impact of charging strategies, EV charging options and infrastructure, energy, economic and environmental considerations, Impact of EV charging on power grid, effect of EV charging on generation and load profile, Smart charging technologies, Impact on investment.

UNIT-II: Influence of EVs on Power System

Introduction, identification of EV demand, EV penetration level for different scenarios, classification based on penetration level, EV impacts on system demand: dumb charging, multiple tariff charging, smart charging, case studies.

UNIT–III: Frequency Control Reserves & Voltage Support From EVs

Introduction, power system ancillary services, electric vehicles to support wind power integration, electric vehicle as frequency control reserves and tertiary reserves, voltage support and electric vehicle integration, properties of frequency regulation reserves, control strategies for EVs to support frequency regulation.

UNIT–IV: ICT Solutions To Support EV Deployment

Introduction, Architecture and model for smart grid & EV, ICT players in smart grid, smart metering, information & communication models, functional and logical models, technology and solution for smart grid: interoperability, communication technologies.

UNIT–V: EV Charging Facility Planning

Energy generation scheduling, different power sources, fluctuant electricity, centralized charging schemes, decentralized charging schemes, energy storage integration into Microgrid, Design of V2G Aggregator.

Course Outcomes:

After successful completion of the course, the students will be able to:

S.No	Course Outcome	BTL
1.	Demonstrate electrification of vehicles and the impact of charging strategies.	L3
2.	Illustrate the effect of electric vehicles on frequency and voltage of the grid	L3
3.	Summarize the architecture and communication protocols in smart grid	L2
4.	Develop the charging schemes for electric vehicles	L5

Correlation of COs with POs& PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			3	1					2				2	
CO2			3	1					2				2	
CO3			3	1					2				2	
CO4			3	1					2				2	
CO5			3	1					2				2	

Text Books:

1. J. Lu, and J. Hussain, "Vehicle-to-Grid: Linking electric vehicles to the smart grid", IET, 1st Edition, 2015
2. Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 2010.

Reference Books:

1. Tariq Muneer and Irene Illescas García, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017.
2. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", Springer, 2013