

INSTITUTE	FACULTY OF TECHNOLOGY
PROGRAM	MASTER OF TECHNOLOGY in ELECTRICAL ENGINEERING
SEMESTER	2
COURSE TITLE	SMART GRID INTERFACE OF EV
COURSE CODE	01EV1206
COURSE CREDITS	4

Objective:

- 1 The objective of the course is to study the possible methods of integration of Electric Vehicle (EV) in smart grid networks and its effect on the system.

Course Outcomes: After completion of this course, student will be able to:

- 1 Determine the role of Plug-in Electrical Vehicle(PEV) as source in smart grid
- 2 Analyze Impact of EV on smart grid
- 3 Assess the performance of EV parking lot on smart distribution system
- 4 Evaluate the role of EV as ancillary service

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Introduction to smart grid and PEV Introduction to smart grid and microgrid, Impact of PEVs on Distributed Energy Resources in the Smart Grid, V2G Technology and PEVs Charging Infrastructures	10
2	Impact of EV and V2G on the Smart Grid and Renewable Energy Systems Types of Electric Vehicles, Motor Vehicle Ownership and EV Migration, Impact of Estimated EVs on Electrical Network, Impact on Drivers and the Smart Grid, Standardization and Plug-and-Play	12
3	Power Control and Monitoring of the Smart Grid with EVs Impacts of EV Penetration on Grid Power Profile, Requirements of Its Control and Monitoring, Hybrid EV Power train Architectures, Control, Monitoring and Management Strategies of EV, V2G Communication System, System model of EV, Case study of three phase fault and its impact	6

Contents : Unit	Topics	Contact Hours
4	Planning, Control, and Management Strategies for Parking Lots for PEVs Introduction to PEV Charging Facility, Long-Term Planning for PEV Parking Lots, Control and Management of PEV Parking Lots - stages of implementation	8
5	PEV as ancillary service in Smart grid Introduction to Ancillary Services, PEV Charger Optimization, PEV as ancillary source, Control Strategies for PEVs to Follow the Individual Operation Values, Systems and Control Algorithm for Smart PEV Chargers, Avoiding the Harmonic Propagation Within the Grid, Case stud	6
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment No. 01 Simulation of EV Charging and Discharging Using Smart Grid Management System	2
2	Experiment No. 02 Vehicle-to-Grid (V2G) Technology Demonstration	2
3	Experiment No. 03 Smart Charging Algorithms for Optimized EV Charging	2
4	Experiment No. 04 Impact of EVs on Grid Stability and Load Management	2
5	Experiment No. 05 Real-Time Data Monitoring and Control for EVs in Smart Grids	2
6	Experiment No. 06 Integration of Renewable Energy Sources with EV Charging Stations	2
7	Experiment No. 07 Energy Storage and Battery Management for EVs in Smart Grids	4
8	Experiment No. 08 Case Study: EV Integration with Smart Grid in Urban vs. Rural Areas	4
Total Hours		20

Textbook :

- 1 Vehicle-to-grid: linking electric vehicles to the smart grid, Junwei Lu and Jahangir Hossain, Institution of Engineering and Technology, 2015
- 2 Plug In Electric Vehicles in Smart Grids: Integration Techniques, Rajakaruna, S., Shahniah, F. and Ghosh, A. eds., Springer, 2014

References:

- 1 Introduction to the Smart Grid: Concepts, Technologies and Evolution (Vol. 94), Introduction to the Smart Grid: Concepts, Technologies and Evolution (Vol. 94), Salman, S.K., IET, 2017

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
5.00	10.00	15.00	30.00	20.00	20.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and classroom.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

- 1 <https://archive.nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee42/>
- 2 https://onlinecourses.nptel.ac.in/noc23_ee60/preview
- 3 <https://www.coursera.org/learn/bridging-the-gap-ev-grid-integration--v2g-systems>