

**SRM VALLIAMMAI ENGINEERING COLLEGE**

**(An autonomous Institution)**

**SRM Nagar, Kattankulathur – 603203**

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**



**QUESTION BANK**

**Academic Year 2025-2026 EVEN**

**PEE404 DESIGN OF ELECTRIC VEHICLE CHARGING SYSTEM  
(Regulation 2023)**

**Prepared By**

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## Department of Electrical and Electronics Engineering

### QUESTIONBANK

**SUBJECT: PEE404 DESIGN OF ELECTRIC VEHICLE CHARGING SYSTEM**

**SEM / YEAR : III / VI - Academic Year 2025–2026 EVEN**

#### UNIT-I: CHARGING STATIONS AND STANDARDS

**Introduction-Charging technologies- Conductive charging, EV charging infrastructure, International standards and regulations - Inductive charging, need for inductive charging of EV, Modes and operating principle, Static and dynamic charging, Bidirectional power flow, International standards and regulations.**

#### PART-A

Q. No	Questions	BT Level	Competence	Course Outcome
1	Define an Electric Vehicle charging system.	BTL-1	Remembering	CO 1
2	List any two EV charging levels.	BTL-1	Remembering	CO 1
3	Summarize the role of EV charging infrastructure in EV adoption.	BTL-2	Understanding	CO 1
4	State the meaning of conductive charging.	BTL-1	Remembering	CO 1
5	Distinguish between AC charging and DC charging.	BTL-2	Understanding	CO 1
6	Identify two components of an EV charging station.	BTL-1	Remembering	CO 1
7	Classify EV charging stations based on application.	BTL-2	Understanding	CO 1
8	Interpret the need for smart charging in EV infrastructure.	BTL-2	Understanding	CO 1
9	Identify safety requirements in EV charging systems.	BTL-1	Remembering	CO 1
10	Identify two international standards for EV charging.	BTL-1	Remembering	CO 1
11	Interpret the importance of charging standards in EV systems.	BTL-2	Understanding	CO 1
12	Define inductive charging for electric vehicles.	BTL-1	Remembering	CO 1
13	Summarize the advantages of inductive charging.	BTL-2	Understanding	CO 1
14	Compare conductive charging and inductive charging.	BTL-2	Understanding	CO 1
15	Describe the function of a power electronic converter in EV chargers.	BTL-2	Understanding	CO 1
16	Define static wireless charging.	BTL-1	Remembering	CO 1
17	Define dynamic wireless charging.	BTL-1	Remembering	CO 1
18	Differentiate between static and dynamic charging.	BTL-2	Understanding	CO 1
19	Compare static and dynamic wireless charging methods.	BTL-2	Understanding	CO 1
20	Define bidirectional power flow.	BTL-1	Remembering	CO 1
21	Define Vehicle-to-Grid (V2G).	BTL-1	Remembering	CO 1
22	Define Vehicle-to-Home (V2H).	BTL-1	Remembering	CO 1

23	Interpret the role of bidirectional charging in grid support.	BTL-2	Understanding	CO 1
				CO 1
<b>PART-B</b>				
1	Illustrate the operation of a conductive EV charging system with a neat block diagram.	BTL-3	Applying	CO 1
2	Select a suitable EV charger for residential applications based on charging levels.	BTL-3	Applying	CO 1
3	Analyze the challenges involved in EV charging infrastructure development.	BTL-4	Analyzing	CO 1
4	Apply international EV charging standards to ensure interoperability.	BTL-3	Applying	CO 1
5	Analyze the role of international standards in EV charging interoperability.	BTL-4	Analyzing	CO 1
6	Illustrate the operating principle of inductive charging for electric vehicles.	BTL-3	Applying	CO 1
7	Analyze performance issues in inductive charging systems.	BTL-4	Analyzing	CO 1
8	Apply static wireless charging to public parking stations.	BTL-3	Applying	CO 1
9	Demonstrate the use of dynamic wireless charging for highway applications.	BTL-3	Applying	CO 1
10	Compare static and dynamic wireless charging based on efficiency and cost.	BTL-4	Analyzing	CO 1
11	Apply bidirectional power flow in an EV-based microgrid.	BTL-3	Applying	CO 1
12	Analyze the impact of Vehicle-to-Grid operation on power system stability.	BTL-4	Analyzing	CO 1
13	Analyze benefits and limitations of Vehicle-to-Home and Vehicle-to-Building systems.	BTL-4	Analyzing	CO 1
14	Analyze safety and electromagnetic compatibility issues in wireless EV charging.	BTL-4	Analyzing	CO 1
15	Analyze the advantages and limitations of conductive charging systems.	BTL-4	Analyzing	CO 1
16	Compare IEC, SAE, CCS, and CHAdeMO EV charging standards.	BTL-4	Analyzing	CO 1
17	Analyze future trends in EV charging technologies with respect to smart grids.	BTL-4	Analyzing	CO 1

**UNIT-II: POWER ELECTRONICS FOR EV CHARGING**

**Layouts of EV Battery Charging Systems-AC charging-DC charging systems- Power Electronic Converters for EV Battery Charging- AC-DC converter with boost PFC circuit, with bridge and without bridge circuit - Bidirectional DC-DC Converters- Non-isolated DC-DC bidirectional converter topologies- Half-bridge bidirectional converter.**

**PART-A**

Q. No	Questions	BT Level	Competence	Course Outcome
1	Define EV battery charging system layout.	BTL-1	Remembering	CO 2

2	Identify the major blocks in an EV battery charging system.	BTL-1	Remembering	CO 2
3	Summarize the purpose of different charging system layouts in EVs.	BTL-2	Understanding	CO 2
4	Define AC charging system for electric vehicles.	BTL-1	Remembering	CO 2
5	Distinguish between AC charging and DC charging systems.	BTL-2	Understanding	CO 2
6	Identify the power electronic stages used in AC charging systems.	BTL-1	Remembering	CO 2
7	Define DC charging system for electric vehicles.	BTL-1	Remembering	CO 2
8	Summarize the advantages of DC fast charging systems.	BTL-2	Understanding	CO 2
9	Identify the role of power electronic converters in EV battery charging.	BTL-1	Remembering	CO 2
10	Classify power electronic converters used in EV chargers.	BTL-2	Understanding	CO 2
11	Define AC-DC converter used in EV charging applications.	BTL-1	Remembering	CO 2
12	Summarize the need for power factor correction in EV chargers.	BTL-2	Understanding	CO 2
13	Define boost power factor correction (PFC) circuit.	BTL-1	Remembering	CO 2
14	Compare AC-DC converters with and without bridge rectifier.	BTL-2	Understanding	CO 2
15	Identify the advantages of bridgeless PFC converters.	BTL-1	Remembering	CO 2
16	Summarize the operating concept of bridgeless PFC circuits.	BTL-2	Understanding	CO 2
17	Define bidirectional DC-DC converter.	BTL-1	Remembering	CO 2
18	Identify applications of bidirectional DC-DC converters in EVs.	BTL-2	Understanding	CO 2
19	Define non-isolated bidirectional DC-DC converter topology.	BTL-1	Remembering	CO 2
20	Classify non-isolated bidirectional DC-DC converter topologies.	BTL-2	Understanding	CO 2
21	Define half-bridge bidirectional DC-DC converter.	BTL-1	Remembering	CO 2
22	Identify the main components of a half-bridge bidirectional converter.	BTL-1	Remembering	CO 2
23	Summarize the advantages of half-bridge bidirectional converters.	BTL-2	Understanding	CO 2
24	Interpret the role of bidirectional converters in EV charging and discharging.	BTL-2	Understanding	CO 2
<b>PART-B</b>				
1	Illustrate the operation of a conductive EV charging system with a neat block diagram.	BTL-3	Applying	CO 2
2	Select a suitable EV charger for residential applications based on charging levels.	BTL-3	Applying	CO 2
3	Analyze the challenges involved in EV charging infrastructure development.	BTL-4	Analyzing	CO 2
4	Apply international EV charging standards to ensure interoperability.	BTL-3	Applying	CO 2
5	Analyze the role of international standards in EV charging interoperability.	BTL-4	Analyzing	CO 2
6	Illustrate the operating principle of inductive charging for electric vehicles.	BTL-3	Applying	CO 2
7	Analyze performance issues in inductive charging systems.	BTL-4	Analyzing	CO 2

8	Apply static wireless charging to public parking stations.	BTL-3	Applying	CO 2
9	Demonstrate the use of dynamic wireless charging for highway applications.	BTL-3	Applying	CO 2
10	Compare static and dynamic wireless charging based on efficiency and cost.	BTL-4	Analyzing	CO 2
11	Apply bidirectional power flow in an EV-based microgrid.	BTL-3	Applying	CO 2
12	Analyze the impact of Vehicle-to-Grid operation on power system stability.	BTL-4	Analyzing	CO 2
13	Analyze benefits and limitations of Vehicle-to-Home and Vehicle-to-Building systems.	BTL-4	Analyzing	CO 2
14	Analyze safety and electromagnetic compatibility issues in wireless EV charging.	BTL-4	Analyzing	CO 2
15	Analyze the advantages and limitations of conductive charging systems.	BTL-4	Analyzing	CO 2
16	Compare IEC, SAE, CCS, and CHAdeMO EV charging standards.	BTL-4	Analyzing	CO 2
17	Analyze future trends in EV charging technologies with respect to smart grids.	BTL-4	Analyzing	CO 2

### UNIT-III:EV CHARGING USING RENEWABLE AND STORAGE SYSTEMS

**Introduction- - EV charger topologies , EV charging/discharging strategies - Integration of EV charging-home solar PV system , Operation modes of EVC-HSP system , Control strategy of EVCHSP system - fast-charging infrastructure with solar PV and energy storage.**

#### PART-A

Q.No	Questions	BT Level	Competence	Course Outcome
1	Define EV charging using renewable energy sources.	BTL-1	Remembering	CO 3
2	Identify the objectives of integrating renewable energy with EV charging.	BTL-1	Remembering	CO 3
3	Summarize the importance of renewable-based EV charging systems.	BTL-2	Understanding	CO 3
4	Define EV charger topology.	BTL-1	Remembering	CO 3
5	Classify EV charger topologies.	BTL-2	Understanding	CO 3
6	Identify major components in renewable-integrated EV chargers.	BTL-1	Remembering	CO 3
7	Define EV charging strategy.	BTL-1	Remembering	CO 3
8	Distinguish between EV charging and discharging strategies.	BTL-2	Understanding	CO 3
9	Summarize the benefits of coordinated EV charging strategies.	BTL-2	Understanding	CO 3
10	Define EV charging-home solar PV (EVC-HSP) system.	BTL-1	Remembering	CO 3
11	Identify components of a home solar PV integrated EV charging system.	BTL-1	Remembering	CO 3
12	Summarize the need for integrating EV charging with home solar PV.	BTL-2	Understanding	CO 3
13	Define operating modes of EVC-HSP system.	BTL-1	Remembering	CO 3
14	Classify operating modes of EVC-HSP system.	BTL-2	Understanding	CO 3
15	Summarize the significance of different operating modes in EVC-	BTL-2	Understanding	CO 3

	HSP.			
16	Define control strategy for EVC-HSP system.	BTL-1	Remembering	CO 3
17	Identify objectives of control strategy in EVC-HSP system.	BTL-1	Remembering	CO 3
18	Summarize the role of control strategy in renewable-based EV charging.	BTL-2	Understanding	CO 3
19	Define fast-charging infrastructure using solar PV.	BTL-1	Remembering	CO 3
20	Identify components of solar PV based fast-charging infrastructure.	BTL-1	Remembering	CO 3
21	Summarize the role of energy storage systems in fast EV charging.	BTL-2	Understanding	CO 3
22	Classify energy storage systems used in EV charging infrastructure.	BTL-2	Understanding	CO 3
23	Interpret the benefits of integrating storage with renewable EV charging.	BTL-2	Understanding	CO 3
24	Summarize the challenges in renewable-integrated EV charging systems.	BTL-2	Understanding	CO 3
<b>PART-B</b>				
1	Illustrate the architecture of an EV charging system integrated with renewable energy sources.	BTL-3	Applying	CO 3
2	Apply suitable EV charger topology for renewable-based EV charging.	BTL-3	Applying	CO 3
3	Analyze different EV charging and discharging strategies for renewable integration.	BTL-4	Analyzing	CO 3
4	Illustrate the integration of EV charging with home solar PV system.	BTL-3	Applying	CO 3
5	Analyze operating modes of EVC-HSP system.	BTL-4	Analyzing	CO 3
6	Apply appropriate control strategy for EVC-HSP system operation.	BTL-3	Applying	CO 3
7	Analyze the effectiveness of control strategies in renewable-integrated EV charging systems.	BTL-4	Analyzing	CO 3
8	Illustrate fast-charging infrastructure integrated with solar PV and energy storage systems.	BTL-3	Applying	CO 3
9	Apply energy storage systems for peak load management in EV fast charging stations.	BTL-3	Applying	CO 3
10	Analyze the role of energy storage in improving fast-charging performance.	BTL-4	Analyzing	CO 3
11	Illustrate coordination of EV charging with renewable generation and storage.	BTL-3	Applying	CO 3
12	Analyze grid impact of renewable-integrated EV fast-charging infrastructure.	BTL-4	Analyzing	CO 3
13	Apply renewable-based EV charging strategies for residential applications.	BTL-3	Applying	CO 3
14	Analyze techno-economic aspects of renewable-integrated EV charging systems.	BTL-4	Analyzing	CO 3
15	Illustrate control architecture for EV charging using renewable and storage systems.	BTL-3	Applying	CO 3
16	Analyze challenges and solutions in large-scale renewable EV	BTL-4	Analyzing	CO 3

	charging deployment.			
17	Analyze future trends in renewable-integrated EV charging infrastructure.	BTL-4	Analyzing	CO 3

**UNIT-IV: WIRELESS POWER TRANSFER**

**Introduction - Inductive, Magnetic Resonance, Capacitive types. Wireless Chargers for Electric Vehicles - Types of Electric Vehicles - Battery Technology in EVs -Charging Modes in EVs - Benefits of WPT. - WPT Operation Modes - Standards for EV Wireless Chargers, SAE J2954, IEC 61980. ISO 19363.**

**PART-A**

Q.No	Questions	BT Level	Competence	Course Outcome
1	Define Wireless Power Transfer (WPT).	BTL-1	Remembering	CO 4
2	Identify the basic principle of inductive power transfer.	BTL-1	Remembering	CO 4
3	Distinguish between inductive and magnetic resonance WPT.	BTL-2	Understanding	CO 4
4	Define magnetic resonance based wireless power transfer.	BTL-1	Remembering	CO 4
5	Compare magnetic resonance and capacitive WPT.	BTL-2	Understanding	CO 4
6	Define capacitive wireless power transfer.	BTL-1	Remembering	CO 4
7	Identify applications of wireless chargers in electric vehicles.	BTL-1	Remembering	CO 4
8	Summarize the need for wireless chargers in EVs.	BTL-2	Understanding	CO 4
9	Identify different types of electric vehicles.	BTL-1	Remembering	CO 4
10	Classify electric vehicles based on propulsion and energy source.	BTL-2	Understanding	CO 4
11	Identify battery technologies used in electric vehicles.	BTL-1	Remembering	CO 4
12	Summarize the role of battery technology in EV charging.	BTL-2	Understanding	CO 4
13	Identify charging modes used in electric vehicles.	BTL-1	Remembering	CO 4
14	Classify EV charging modes.	BTL-2	Understanding	CO 4
15	Identify benefits of wireless power transfer for EV charging.	BTL-1	Remembering	CO 4
16	Summarize advantages of WPT over conductive charging.	BTL-2	Understanding	CO 4
17	Define WPT operation mode.	BTL-1	Remembering	CO 4
18	Classify WPT operation modes.	BTL-2	Understanding	CO 4
19	Identify standards applicable to EV wireless chargers.	BTL-1	Remembering	CO 4
20	Summarize the significance of SAE J2954 standard.	BTL-2	Understanding	CO 4
21	Identify the scope of IEC 61980 standard.	BTL-1	Remembering	CO 4
22	Summarize the relevance of IEC 61980 for EV wireless charging.	BTL-2	Understanding	CO 4
23	Identify the purpose of ISO 19363 standard.	BTL-1	Remembering	CO 4
24	Summarize the importance of international standards in EV wireless charging.	BTL-2	Understanding	CO 4

**PART-B**

1	Illustrate the working principle of inductive wireless power transfer system.	BTL-3	Applying	CO 4
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2	Illustrate the operation of magnetic resonance based WPT system.	BTL-3	Applying	CO 4
3	Analyze the differences between inductive, magnetic resonance, and capacitive WPT methods.	BTL-4	Analyzing	CO 4
4	Illustrate wireless charger architecture for electric vehicles.	BTL-3	Applying	CO 4
5	Analyze the performance requirements of wireless EV chargers.	BTL-4	Analyzing	CO 4
6	Apply suitable WPT technique for different types of electric vehicles.	BTL-3	Applying	CO 4
7	Analyze the influence of battery technology on wireless EV charging.	BTL-4	Analyzing	CO 4
8	Apply appropriate charging mode for wireless EV charging applications.	BTL-3	Applying	CO 4
9	Analyze the benefits of wireless power transfer in EV charging.	BTL-4	Analyzing	CO 4
10	Illustrate different WPT operation modes for EV applications.	BTL-3	Applying	CO 4
11	Analyze efficiency and misalignment issues in WPT systems.	BTL-4	Analyzing	CO 4
12	Apply SAE J2954 standard requirements to wireless EV charging design.	BTL-3	Applying	CO 4
13	Analyze the role of IEC 61980 standard in ensuring safety and interoperability.	BTL-4	Analyzing	CO 4
14	Apply ISO 19363 guidelines for EV wireless charging systems.	BTL-3	Applying	CO 4
15	Analyze electromagnetic compatibility issues in wireless EV charging.	BTL-4	Analyzing	CO 4
16	Analyze safety challenges in wireless power transfer systems for EVs.	BTL-4	Analyzing	CO 4
17	Analyze future developments in wireless power transfer for electric vehicles.	BTL-4	Analyzing	CO 4

#### **UNIT-V: POWER FACTOR CORRECTION IN CHARGING SYSTEM**

**Need for power factor correction- Boost Converter for Power Factor Correction, Sizing the Boost Inductor, Average Currents in the Rectifier and calculation of power losses.**

#### **PART-A**

<b>Q. No</b>	<b>Questions</b>	<b>BT Level</b>	<b>Competence</b>	<b>Course Outcome</b>
1	Define power factor in electrical systems.	BTL-1	Remembering	CO 5
2	State the need for power factor correction in EV charging systems.	BTL-1	Remembering	CO 5
3	Summarize the impact of poor power factor on the utility grid.	BTL-2	Understanding	CO 5
4	Define power factor correction (PFC).	BTL-1	Remembering	CO 5
5	Identify benefits of power factor correction in charging systems.	BTL-1	Remembering	CO 5
6	Summarize objectives of power factor correction in EV chargers.	BTL-2	Understanding	CO 5
7	Define boost converter used for power factor correction.	BTL-1	Remembering	CO 5
8	Identify main components of a boost PFC converter.	BTL-1	Remembering	CO 5
9	Distinguish between passive and active PFC techniques.	BTL-2	Understanding	CO 5
10	Classify PFC techniques used in EV charging systems.	BTL-2	Understanding	CO 5

11	Define boost inductor in PFC circuits.	BTL-1	Remembering	CO 5
12	Identify parameters affecting boost inductor sizing.	BTL-1	Remembering	CO 5
13	Summarize the importance of proper inductor sizing in PFC circuits.	BTL-2	Understanding	CO 5
14	Define average current in a rectifier circuit.	BTL-1	Remembering	CO 5
15	Identify current paths in a rectifier feeding a boost PFC converter.	BTL-1	Remembering	CO 5
16	Summarize current waveform characteristics in PFC rectifiers.	BTL-2	Understanding	CO 5
17	Define power loss in power electronic devices.	BTL-1	Remembering	CO 5
18	Identify sources of power loss in boost PFC converters.	BTL-1	Remembering	CO 5
19	Summarize the effect of power losses on PFC system efficiency.	BTL-2	Understanding	CO 5
20	Define conduction loss in power electronic converters.	BTL-1	Remembering	CO 5
21	Define switching loss in power electronic converters.	BTL-1	Remembering	CO 5
22	Distinguish between conduction and switching losses.	BTL-2	Understanding	CO 5
23	Summarize methods used to reduce power losses in PFC circuits.	BTL-2	Understanding	CO 5
24	Interpret the role of power factor correction in improving charger efficiency.	BTL-2	Understanding	CO 5
<b>PART-B</b>				
1	Illustrate the need for power factor correction in EV charging systems.	BTL-3	Applying	CO 5
2	Apply boost converter for power factor correction in EV chargers.	BTL-3	Applying	CO 5
3	Analyze the operation of a boost PFC converter in EV charging applications.	BTL-4	Analyzing	CO 5
4	Illustrate the design steps for sizing the boost inductor in a PFC circuit.	BTL-3	Applying	CO 5
5	Analyze the impact of inductor sizing on PFC performance.	BTL-4	Analyzing	CO 5
6	Apply average current calculations for rectifiers used in PFC circuits.	BTL-3	Applying	CO 5
7	Analyze current waveforms in rectifier-fed boost PFC converters.	BTL-4	Analyzing	CO 5
8	Apply power loss calculation methods for boost PFC converters.	BTL-3	Applying	CO 5
9	Analyze conduction and switching losses in PFC circuits.	BTL-4	Analyzing	CO 5
10	Illustrate techniques for reducing power losses in PFC converters.	BTL-3	Applying	CO 5
11	Analyze efficiency improvement in EV chargers using PFC techniques.	BTL-4	Analyzing	CO 5
12	Apply PFC design considerations to meet grid standards in EV charging.	BTL-3	Applying	CO 5
13	Analyze thermal performance of power devices in PFC circuits.	BTL-4	Analyzing	CO 5
14	Apply loss minimization strategies in boost PFC converter design.	BTL-3	Applying	CO 5
15	Analyze the effect of PFC on harmonic reduction in EV charging systems.	BTL-4	Analyzing	CO 5
16	Analyze practical challenges in implementing PFC in high-power EV chargers.	BTL-4	Analyzing	CO 5

17	Analyze future trends in power factor correction techniques for EV charging systems.			CO 5
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**COURSE OUTCOMES:**

At the end of this course, learners will be able to:

- CO1. Ability to illustrate various charging techniques and to know charging standards and regulations.
- CO2. Ability to demonstrate the working o DC-DC converters used for charging systems and principles.
- CO3. Ability to illustrate the advantages of renewable system based charging systems.
- CO4. Ability to demonstrate the principles of wireless power transfer and analyze the standards for wireless charging.
- CO5. Ability to design and simulate boost converter based power factor correction.