

UNIT– I
INTRODUCTION TO RENEWABLE ENERGY SYSTEMS

PART – A				
Q. No.	Questions	CO Mapping	BT Level	Complexity
1	What are the two main classifications of energy sources?	CO1	Remember	Low
2	Differentiate between renewable and non-renewable energy sources.	CO1	Understand	Medium
3	Why is it important to promote non-conventional energy sources?	CO1	Understand	Low
4	List two advantages of using conventional energy sources.	CO1	Remember	Low
5	Mention any two non-conventional energy sources and their significance.	CO1	Remember	Low
6	State two disadvantages of conventional energy sources.	CO1	Remember	Low
7	How do fossil fuels impact the environment?	CO1	Understand	Low
8	Mention any two environmental concerns related to energy production.	CO1	Remember	Low
9	Name one positive and one negative environmental impact of using renewable energy.	CO1	Remember	Low
10	How does wind energy generation affect the environment?	CO1	Understand	Low
11	What is ocean energy and how is it harnessed?	CO1	Understand	Low
12	Define biomass energy and give one example of its source.	CO1	Remember	Low
13	What is hydrogen energy and what is its primary application?	CO1	Understand	Low
14	State the basic operating principle of a solar photovoltaic cell.	CO1	Remember	Low
15	What are fuel cells and what is their major advantage over conventional batteries?	CO1	Understand	Low

PART – B				
Q. No.	Questions	CO Mapping	BT Level	Complexity
1	Discuss the classification of energy sources with suitable examples. Explain the key differences between renewable and non-renewable energy sources.	CO1	Understand	Medium
2	Why non-conventional energy sources are considered the future of energy? Discuss their importance with reference to sustainability and environmental preservation.	CO1	Understand	Medium
3	Analyze the advantages and disadvantages of conventional energy sources. How do these affect their continued use in modern energy systems?	CO1	Analyze	Medium
4	Examine the environmental impacts of energy generation and consumption. How can energy practices be improved to minimize these effects?	CO1	Analyze	High
5	Assess the environmental impacts of renewable energy generation. Compare the ecological footprint of at least three renewable energy sources.	CO1	Analyze	High
6	Describe the qualitative study of ocean energy, biomass energy, and hydrogen energy. Discuss their principles, potential, and challenges in implementation.	CO1	Understand	Medium
7	Explain the operating principle of a solar photovoltaic system. Discuss its characteristics, efficiency factors, and applications in various sectors.	CO1	Understand	Medium

8	Describe the working principle of a fuel cell. Compare different types of fuel cells based on materials, efficiency, and applications.	CO1	Understand	Medium
9	Describe the nature of wind and how it is harnessed for energy. Explain different types of wind turbines, their control strategies, and operating areas	CO1	Understand	Medium
10	Compare and contrast various renewable energy sources in terms of availability, cost, efficiency, and environmental impact. Suggest the best mix of renewable sources for a sustainable energy future.	CO1	Evaluate	High

UNIT– II

ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS

PART – A				
Q. No.	Questions	CO Mapping	BT Level	Complexity
1	What is the principle of operation of a Squirrel Cage Induction Generator?	CO2	Understand	Low
2	Mention two key features of the construction of a SCIG.	CO2	Remember	Low
3	Why is SCIG commonly used in constant-speed wind energy systems?	CO2	Understand	Low
4	What is the main advantage of using a Doubly Fed Induction Generator in wind turbines?	CO2	Understand	Low
5	What are the two windings involved in a DFIG and where are they connected?	CO2	Understand	Low
6	State one advantage and one disadvantage of DFIG-based systems.	CO2	Remember	Low
7	What role do permanent magnets play in the working of a PMSG?	CO2	Understand	Low
8	How does PMSG differ from a conventional synchronous generator in terms of excitation?	CO2	Understand	Low
9	Why is PMSG preferred for direct-drive wind turbines?	CO2	Understand	Low
10	Compare SCIG and PMSG in terms of maintenance requirements and efficiency	CO2	Evaluate	Medium

PART – B				
Q. No.	Questions	CO Mapping	BT Level	Complexity
1	Explain the construction and working principle of a Squirrel Cage Induction Generator (SCIG). Illustrate with a neat diagram and discuss its application in wind energy systems.	CO2	Analyze	High
2	Analyze the operational characteristics of SCIG under different loading conditions. Include torque-slip characteristics and the need for reactive power compensation.	CO2	Analyze	High
3	Describe the construction and working of a Doubly Fed Induction Generator (DFIG). Explain how power is transferred through both stator and rotor windings.	CO2	Understand	Medium
4	Discuss the advantages of DFIG in variable-speed wind turbines. Explain the role of the back-to-back converters in controlling the rotor side.	CO2	Understand	Medium
5	Perform a comparative analysis of SCIG and DFIG in terms of cost, efficiency, grid integration, and control flexibility	CO2	Evaluate	High
6	Explain the working principle and construction of a Permanent Magnet Synchronous Generator (PMSG). Discuss the role of permanent magnets and how excitation is achieved.	CO2	Understand	Medium
7	What are the advantages and limitations of using PMSG in wind turbine applications? Support your answer with examples and performance parameters	CO2	Understand	Medium

8	Compare SCIG, DFIG, and PMSG with respect to their suitability in different wind energy generation systems (fixed-speed vs. variable-speed).	CO2	Evaluate	High
9	Explain how control strategies differ between DFIG and PMSG-based wind generators. Include the role of power electronic converters in each case.	CO2	Understand	Medium
10	Demonstrate a detailed analysis of the efficiency, maintenance requirements, and grid compatibility of SCIG, DFIG, and PMSG. Which generator type is most suitable for offshore wind farms, and why?	CO2	Create	High

UNIT– III

POWER CONVERTERS AND ANALYSIS OF SOLAR PV SYSTEMS

PART – A				
Q. No.	Questions	CO Mapping	BT Level	Complexity
1	What is the function of a line-commutated converter in inversion mode?	CO3	Understand	Low
2	Differentiate between rectification and inversion in line-commutated converters.	CO3	Understand	Low
3	What is the primary purpose of a boost converter in a solar PV system?	CO3	Understand	Low
4	State one application of a buck-boost converter in renewable energy systems.	CO3	Remember	Low
5	How does the output voltage of a buck-boost converter relate to the input voltage?	CO3	Understand	Low
6	What factors should be considered when selecting an inverter for a solar PV system?	CO3	Understand	Low
7	Define battery sizing and why it is important in stand-alone PV systems.	CO3	Remember	Low
8	What is array sizing in solar PV systems and what parameters influence it?	CO3	Remember	Low
9	Mention one software commonly used for simulating line-commutated converters.	CO3	Remember	Low
10	Why is simulation important before implementing buck or boost converters in real systems?	CO3	Understand	Low
11	Draw and label the basic block diagram of a solar PV system.	CO3	Create	High
12	Differentiate between a stand-alone PV system and a grid-integrated PV system.	CO3	Understand	Medium

13	What are the typical loads supported by stand-alone PV systems?	CO3	Understand	Low
14	List two common issues faced during grid integration of solar PV systems.	CO3	Remember	Low
15	What is islanding in the context of grid-connected PV systems?	CO3	Understand	Low

PART – B				
Q. No.	Questions	CO Mapping	BT Level	Complexity
1	Explain the working of line-commutated converters in inversion mode. Discuss their applications in renewable energy systems with circuit diagrams and waveforms.	CO3	Understand	Medium
2	Describe the operating principles of boost and buck-boost converters. Derive the voltage conversion ratios and explain their relevance in solar PV systems.	CO3	Create	High
3	Compare boost and buck-boost converters in terms of design, efficiency, and typical applications in solar power systems.	CO3	Evaluate	High
4	Discuss the factors influencing inverter selection in solar PV systems. Include types of inverters and their roles in stand-alone and grid-tied systems.	CO3	Understand	Medium
5	Explain the methodology for battery sizing in a solar PV system. Include the impact of depth of discharge, autonomy, and system voltage.	CO3	Understand	Medium
6	Discuss the process of solar array sizing for both stand-alone and grid-connected PV systems.	CO3	Understand	Medium
7	Describe the steps involved in the simulation of line-commutated converters using any simulation software. Discuss expected outputs and practical considerations.	CO3	Understand	Medium
8	Explain how buck and boost converters are modeled and simulated. Discuss how simulation helps in optimizing converter performance before hardware implementation.	CO3	Understand	Medium

9	Draw and explain the block diagram of a typical solar PV system. Describe the function of each component and its role in energy conversion and delivery.	CO3	Create	High
10	Compare stand-alone and grid-integrated solar PV systems in terms of structure, control strategy, and applications. Discuss major grid connection issues like synchronization, islanding, and power quality.	CO3	Evaluate	High

UNIT– IV

POWER CONVERTERS FOR WIND SYSTEMS

PART – A				
Q. No.	Questions	CO Mapping	BT Level	Complexity
1	What is the function of a three-phase AC voltage controller?	CO4	Understand	Low
2	Name two applications of three-phase AC voltage controllers	CO4	Remember	Low
3	What is an AC-DC-AC converter and where is it used?	CO4	Understand	Low
4	List the major components of a typical AC-DC-AC converter.	CO4	Remember	Low
5	What is an uncontrolled rectifier? Mention one drawback.	CO4	Understand	Low
6	Differentiate between controlled and uncontrolled rectifiers.	CO4	Understand	Low
7	What does PWM stand for in PWM inverters and why is it used?	CO4	Understand	Low
8	State one advantage of PWM inverters over square-wave inverters.	CO4	Remember	Low
9	What is the primary role of a grid-interactive inverter in renewable energy systems?	CO4	Understand	Low
10	Mention one feature that distinguishes grid-interactive inverters from standard inverters.	CO4	Remember	Low

PART – B				
Q. No.	Questions	CO Mapping	BT Level	Complexity
1	Explain the construction, working principle, and applications of a three-phase AC voltage controller. Support your explanation with circuit diagrams and waveforms	CO4	Understand	Medium
2	Describe the working of an AC-DC-AC converter. Explain each stage in detail and discuss its applications in variable speed drives and renewable energy systems.	CO4	Understand	Medium
3	With a neat block diagram, explain the conversion process in an AC-DC-AC converter. Highlight the role of each component and energy flow in the system.	CO4	Understand	Medium
4	Explain the operation of a single-phase and three-phase uncontrolled rectifier. Discuss the output characteristics and performance limitations.	CO4	Understand	Medium
5	Compare uncontrolled and controlled rectifiers based on circuit structure, control ability, output voltage, and applications.	CO4	Evaluate	High
6	Describe the working of a PWM inverter. Explain the need for pulse-width modulation and how it improves output voltage quality.	CO4	Understand	Medium
7	Draw and explain the circuit of a single-phase full-bridge PWM inverter. Include output waveforms and switching strategy	CO4	Create	High
8	Discuss the working and control features of a grid-interactive inverter. Explain how it synchronizes with the grid and handles bidirectional power flow.	CO4	Understand	Medium

9	What are the key protection and control strategies in a grid-interactive inverter? Explain their importance in maintaining grid stability and safety.	CO4	Understand	Medium
10	What are the key protection and control strategies in a grid-interactive inverter? Explain their importance in maintaining grid stability and safety.	CO4	Understand	Medium

UNIT– V

HYBRID RENEWABLE ENERGY SYSTEMS

PART – A				
Q. No.	Questions	CO Mapping	BT Level	Complexity
1	Why are hybrid energy systems preferred over single-source renewable systems?	CO5	Understand	Low
2	List two key benefits of using hybrid energy systems in remote areas	CO5	Remember	Medium
3	Mention any two common types of hybrid renewable energy systems.	CO5	Remember	Low
4	What is meant by a 'hybrid renewable energy system'?	CO5	Understand	Low
5	What are the major components of a Diesel-PV hybrid system?	CO5	Understand	Medium
6	List one advantage and one disadvantage of Wind-PV hybrid systems.	CO5	Remember	Low
7	Why is a Micro-hydel–PV hybrid system suitable for hilly regions?	CO5	Understand	Low
8	How does a Biomass-Diesel hybrid system help in rural electrification?	CO5	Understand	Low
9	What is the purpose of Maximum Power Point Tracking in solar PV systems?	CO5	Understand	Low
10	Name two common MPPT techniques used in PV systems.	CO5	Remember	Low

PART – B				
Q. No.	Questions	CO Mapping	BT Level	Complexity
1	Explain the need for hybrid energy systems in the context of energy reliability, sustainability, and remote area electrification. Discuss with suitable examples	CO5	Understand	Medium
2	Describe the various types of hybrid renewable energy systems. Explain the working principle and integration approach of any two combinations.	CO5	Understand	Medium
3	Classify hybrid systems based on energy sources and configuration. Discuss their suitability in different geographical and climatic conditions	CO5	Analyze	High
4	With the help of a block diagram, explain the configuration and operation of a Diesel-PV hybrid system. Discuss its advantages and challenges.	CO5	Understand	Medium
5	Explain the working of a Wind-PV hybrid system. Compare its performance under varying weather conditions and discuss control strategies.	CO5	Evaluate	Medium
6	Describe the setup of a Micro Hydel–PV hybrid system. What are the advantages of combining these sources in hilly or mountainous regions?	CO5	Understand	Medium
7	Analyze the design and benefits of a Biomass-Diesel hybrid system. How does it contribute to rural energy solutions and agricultural waste management?	CO5	Analyze	High
8	Define MPPT and explain its significance in solar PV systems. Discuss the impact of temperature and irradiance on power output and MPPT efficiency.	CO5	Understand	Medium

9	Compare and contrast common MPPT algorithms such as Perturb and Observe (P&O), Incremental Conductance, and Constant Voltage methods.	CO5	Evaluate	High
10	Describe the implementation of MPPT in a hybrid system with a PV array and battery storage. Discuss how MPPT integrates with power converters to improve efficiency.	CO5	Understand	Medium