

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK



VII SEMESTER

PEE606-SOLAR AND WIND ENERGY ENGINEERING

Regulation – 2023

Academic Year 2026 – 2027 ODD

Prepared by

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SUBJECT: PEE606-SOLAR AND WIND ENERGY ENGINEERING

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UNIT I - SOLAR ENERGY RADIATION AND SOLAR THERMAL COLLECTORS				
SYLLABUS: Solar energy - Introduction-Solar constant- Solar Radiation at the Earth's surface-measurements of solar radiation-pyranometer- pyrheliometer- sunshine recorder- – Solar collectors - Flat plate collectors - collector efficiency - absorber plate – types – selective surfaces. Solar water heaters - types- their performance. Solar driers – types – heat transfer- performance of solar driers – agro industrial applications.				
PART - A				
Q.No	Questions	BT Level	Competence	CO
1	Define solar energy.	BTL-1	Remembering	CO1
2	What is the solar constant?	BTL-1	Remembering	CO1
3	State the factors affecting solar radiation reaching the Earth's surface.	BTL-2	Understanding	CO1
4	Define global solar radiation.	BTL-2	Understanding	CO1
5	What is meant by air mass?	BTL-1	Remembering	CO1
6	List the instruments used for measuring solar radiation.	BTL-1	Remembering	CO1
7	What is a pyranometer? State its function.	BTL-2	Understanding	CO1
8	What is a pyrheliometer?	BTL-1	Remembering	CO1
9	Differentiate between a pyranometer and a pyrheliometer.	BTL-4	Analyzing	CO1
10	What is a sunshine recorder?	BTL-1	Remembering	CO1
11	Define a solar collector.	BTL-1	Remembering	CO1
12	List the components of a flat plate solar collector.	BTL-2	Understanding	CO1
13	Define collector efficiency.	BTL-1	Remembering	CO1
14	What is the purpose of an absorber plate in a solar	BTL-2	Understanding	CO1
15	What are selective surfaces?	BTL-1	Remembering	CO1
16	State the advantages of selective coating on absorber	BTL-2	Understanding	CO1
17	What are the different types of solar water heaters?	BTL-1	Remembering	CO1
18	What is the thermosiphon principle used in solar water	BTL-2	Understanding	CO1
19	Define a solar dryer.	BTL-1	Remembering	CO1
20	Classify solar dryers.	BTL-2	Understanding	CO1
21	What modes of heat transfer occur in a solar dryer?	BTL-2	Understanding	CO1
22	List the factors affecting the performance of solar dryers.	BTL-2	Understanding	CO1
23	Mention two agro-industrial applications of solar dryers.	BTL-1	Remembering	CO1
24	Explain why solar thermal collectors are preferred for low-temperature heating applications.	BTL-4	Analyzing	CO1
PART - B				

1	Explain the nature of solar radiation and the concept of the solar constant.	BTL-2	Understanding	CO1
2	Describe the various components of solar radiation reaching the Earth's surface.	BTL-2	Understanding	CO1
3	Explain the working principle and construction of a pyranometer and pyr heliometer with neat sketches.	BTL-2	Understanding	CO1
4	Compare pyranometer, pyr heliometer, and sunshine recorder with suitable applications.	BTL-4	Analyzing	CO1
5	Explain the construction and working principle of a flat plate solar collector.	BTL-2	Understanding	CO1
6	Derive the expression for the efficiency of a flat plate solar collector and discuss the factors affecting it.	BTL-3	Applying	CO1
7	Discuss the different types of absorber plates and selective surfaces used in solar collectors.	BTL-4	Analyzing	CO1
8	Explain the construction, working, advantages, and limitations of thermosiphon and forced circulation solar water heaters.	BTL-2	Understanding	CO1
9	Compare different types of solar water heaters based on construction, performance, and applications.	BTL-4	Analyzing	CO1
10	Explain the classification, construction, and working principle of different types of solar dryers.	BTL-2	Understanding	CO1
11	Discuss the heat transfer mechanisms involved in solar drying processes.	BTL-4	Analyzing	CO1
12	Analyze the factors affecting the performance of solar dryers and suggest methods to improve efficiency.	BTL-5	Evaluating	CO1
13	Design a solar drying system suitable for agricultural products and justify the design considerations.	BTL-6	Creating	CO1
14	Explain the agro-industrial applications of solar dryers with suitable examples.	BTL-2	Understanding	CO1
15	Evaluate the performance of a flat plate collector under different climatic conditions.	BTL-5	Evaluating	CO1
16	Discuss the advantages, limitations, and future prospects of solar thermal collectors in renewable energy applications.	BTL-5	Evaluating	CO1
17	Design a domestic solar water heating system for a residential building and explain the selection of major components.	BTL-6	Creating	CO1

UNIT II - SOLAR CONCENTRATING COLLECTORS

SYLLABUS: Concentrating collectors – types – reflectors - solar thermal power stations – principle and applications - Solar energy storage systems – thermal - sensible and latent heat, chemical, electrical, electro-magnetic energy storage – Solar distillation – application - Solar stills – types - Solar pond - performance – characteristics - applications – Solar refrigeration.

Q.No	Questions	BT	Competence	COs
1	Define a concentrating solar collector.	BTL-1	Remembering	CO2
2	List the different types of concentrating collectors.	BTL-1	Remembering	CO2
3	What is the function of a reflector in a concentrating	BTL-2	Understanding	CO2
4	State the principle of solar energy concentration.	BTL-2	Understanding	CO2
5	What is the concentration ratio of a solar collector?	BTL-1	Remembering	CO2
6	Mention any two applications of concentrating collectors.	BTL-1	Remembering	CO2
7	Define a solar thermal power station.	BTL-1	Remembering	CO2
8	State the working principle of a solar thermal power plant.	BTL-2	Understanding	CO2
9	What are the major components of a solar thermal power station?	BTL-2	Understanding	CO2
10	Why is thermal energy storage required in solar power	BTL-2	Understanding	CO2
11	Define sensible heat storage.	BTL-1	Remembering	CO2
12	Define latent heat storage.	BTL-1	Remembering	CO2
13	Differentiate between sensible and latent heat storage.	BTL-4	Analyzing	CO2
14	What is chemical energy storage?	BTL-2	Understanding	CO2
15	Mention two electrical energy storage systems used in solar applications.	BTL-1	Remembering	CO2
16	What is electromagnetic energy storage?	BTL-2	Understanding	CO2
17	Define solar distillation.	BTL-1	Remembering	CO2
18	What is a solar still?	BTL-1	Remembering	CO2
19	List the different types of solar stills.	BTL-1	Remembering	CO2
20	What is a solar pond?	BTL-1	Remembering	CO2
21	State the characteristics of a solar pond.	BTL-2	Understanding	CO2
22	Mention any two applications of solar ponds.	BTL-1	Remembering	CO2
23	Define solar refrigeration.	BTL-1	Remembering	CO2
24	Explain the need for energy storage in solar thermal applications.	BTL-4	Analyzing	CO2
PART – B				
1	Explain the construction and working principle of concentrating solar collectors with neat sketches.	BTL-2	Understanding	CO2
2	Compare different types of concentrating collectors based on construction, performance, and applications.	BTL-4	Analyzing	CO2
3	Explain the role of reflectors in concentrating solar collectors and discuss the different types of reflectors.	BTL-2	Understanding	CO2

4	Describe the construction, working principle, and applications of solar thermal power stations.	BTL-2	Understanding	CO2
5	Analyze the performance of a solar thermal power station and discuss the factors affecting its efficiency.	BTL-4	Analyzing	CO2
6	Explain the various thermal energy storage techniques used in solar energy systems.	BTL-2	Understanding	CO2
7	Compare sensible heat and latent heat energy storage systems with suitable examples.	BTL-4	Analyzing	CO2
8	Discuss chemical, electrical, and electromagnetic energy storage methods for solar energy applications.	BTL-2	Understanding	CO2
9	Design a thermal energy storage system for a solar thermal power plant and justify the selection of storage medium.	BTL-6	Creating	CO2
10	Explain the principle, construction, and working of solar distillation systems.	BTL-2	Understanding	CO2
11	Compare different types of solar stills and discuss their advantages and limitations.	BTL-4	Analyzing	CO2
12	Explain the construction, performance characteristics, and applications of solar ponds.	BTL-2	Understanding	CO2
13	Evaluate the factors affecting the performance of a solar pond and suggest suitable improvements.	BTL-5	Evaluating	CO2
14	Discuss the principle, working, advantages, and applications of solar refrigeration systems.	BTL-2	Understanding	CO2
15	Analyze the advantages and limitations of solar thermal power generation over conventional thermal power generation.	BTL-5	Evaluating	CO2
16	Evaluate different solar energy storage techniques and recommend the most suitable method for large-scale solar power plants.	BTL-5	Evaluating	CO2
17	Design a solar thermal energy system incorporating concentrating collectors, thermal energy storage, and solar refrigeration for a remote location.	BTL-6	Creating	CO2

UNIT III - SOLAR PV TECHNOLOGY

SYLLABUS: Solar photovoltaic technology –introduction – solar cell basics – Types of solar cells and modules – encapsulation – Design of solar PV system – load estimation. Batteries – invertors – operation - system controls. Standalone and grid connected systems - PV powered water pumping - Hybrid system - Solar technologies in green buildings.

PART – A

Q.No	Questions	BT Level	Competence	COs
1	Define a solar photovoltaic (PV) system.	BTL-1	Remembering	CO3
2	State the principle of photovoltaic energy conversion.	BTL-2	Understanding	CO3
3	What is a solar cell?	BTL-1	Remembering	CO3
4	List the basic components of a solar PV system.	BTL-1	Remembering	CO3
5	Mention the different types of solar cells.	BTL-1	Remembering	CO3
6	Differentiate between monocrystalline and polycrystalline solar cells.	BTL-4	Analyzing	CO3
7	What is a solar PV module?	BTL-1	Remembering	CO3
8	Define encapsulation in a PV module.	BTL-2	Understanding	CO3
9	Why is encapsulation important in solar PV modules?	BTL-2	Understanding	CO3
10	What is load estimation in PV system design?	BTL-2	Understanding	CO3
11	List the steps involved in designing a solar PV system.	BTL-1	Remembering	CO3
12	What is the function of a battery in a solar PV system?	BTL-2	Understanding	CO3
13	Name the different types of batteries used in solar PV systems.	BTL-1	Remembering	CO3
14	What is an inverter?	BTL-1	Remembering	CO3
15	State the function of a charge controller in a PV system.	BTL-2	Understanding	CO3
16	Differentiate between a standalone PV system and a grid-connected PV system.	BTL-4	Analyzing	CO3
17	What is net metering?	BTL-2	Understanding	CO3
18	Define a hybrid solar PV system.	BTL-1	Remembering	CO3
19	State the principle of a PV-powered water pumping system.	BTL-2	Understanding	CO3
20	List the applications of solar PV-powered water pumping.	BTL-1	Remembering	CO3
21	Mention any two system control devices used in solar PV systems.	BTL-1	Remembering	CO3
22	What are green buildings?	BTL-1	Remembering	CO3
23	List any two solar technologies used in green buildings.	BTL-2	Understanding	CO3
24	Explain the importance of solar PV technology in sustainable energy generation.	BTL-4	Analyzing	CO3

PART – B

1	Explain the principle of photovoltaic energy conversion and the construction and working of a solar cell.	BTL-2	Understanding	CO3
2	Describe the different types of solar cells and compare their characteristics and applications.	BTL-4	Analyzing	CO3
3	Explain the construction, encapsulation process, and performance characteristics of solar PV modules.	BTL-2	Understanding	CO3
4	Design a standalone solar PV system for a residential load based on load estimation.	BTL-6	Creating	CO3
5	Explain the procedure for load estimation and sizing of a solar PV system.	BTL-3	Applying	CO3

6	Discuss the construction, operation, and selection of batteries used in solar PV systems.	BTL-2	Understanding	CO3
7	Explain the construction, operation, and performance of inverters used in solar photovoltaic systems.	BTL-2	Understanding	CO3
8	Describe the functions and importance of system controllers in solar PV installations.	BTL-2	Understanding	CO3
9	Compare standalone and grid-connected solar PV systems with suitable block diagrams.	BTL-4	Analyzing	CO3
10	Explain the working principle and design considerations of a PV-powered water pumping system.	BTL-3	Applying	CO3
11	Discuss the configuration, advantages, and applications of hybrid solar PV systems.	BTL-4	Analyzing	CO3
12	Design a hybrid solar PV system incorporating battery storage and grid support for a commercial building.	BTL-6	Creating	CO3
13	Analyze the performance of a grid-connected solar PV system under varying environmental conditions.	BTL-5	Evaluating	CO3
14	Explain the applications of solar technologies in green buildings and their contribution to sustainable development.	BTL-2	Understanding	CO3
15	Evaluate the advantages and limitations of standalone, grid-connected, and hybrid solar PV systems.	BTL-5	Evaluating	CO3
16	Discuss the design considerations for integrating solar photovoltaic systems into modern green buildings.	BTL-5	Evaluating	CO3
17	Design a complete rooftop solar PV system for an educational institution, including load estimation, battery sizing, inverter selection, and system controls.	BTL-6	Creating	CO3

UNIT IV- WIND ENERGY

SYLLABUS: Nature of the wind – power in the wind – factors influencing wind – wind energy potential and installation in India- wind speed monitoring - wind resource assessment - wind power laws - velocity and power duration curves - Betz limit - site selection.

PART – A

Q.No	Questions	BT Level	Competence	COs
1	Define wind energy.	BTL-1	Remembering	CO4
2	What is meant by the nature of wind?	BTL-2	Understandin	CO4
3	State the expression for power available in the wind.	BTL-1	Remembering	CO4
4	List the factors influencing wind energy.	BTL-2	Understandin	CO4
5	Define wind power density.	BTL-1	Remembering	CO4
6	What is wind energy potential?	BTL-2	Understandin	CO4
7	Mention any two states in India with high wind energy	BTL-1	Remembering	CO4
8	What is wind speed monitoring?	BTL-2	Understandin	CO4
9	Name the instruments used for measuring wind speed and direction.	BTL-1	Remembering	CO4
10	Define wind resource assessment.	BTL-2	Understandin	CO4
11	What is the importance of wind resource assessment?	BTL-2	Understandin	CO4
12	State the wind power law.	BTL-1	Remembering	CO4
13	What is the wind shear exponent?	BTL-1	Remembering	CO4
14	Define the velocity duration curve.	BTL-2	Understandin	CO4
15	What is a power duration curve?	BTL-2	Understandin	CO4
16	Differentiate between velocity duration curve and power duration curve.	BTL-4	Analyzing	CO4
17	State Betz limit.	BTL-1	Remembering	CO4
18	What is the maximum theoretical efficiency of a wind turbine according to Betz law?	BTL-1	Remembering	CO4
19	Why is site selection important for wind power generation?	BTL-2	Understandin	CO4
20	List the factors considered in selecting a wind farm site.	BTL-2	Understandin	CO4
21	What is the significance of hub height in wind energy conversion?	BTL-2	Understandin	CO4
22	Mention two applications of wind energy.	BTL-1	Remembering	CO4
23	Explain the relationship between wind speed and wind power.	BTL-4	Analyzing	CO4
24	Why does wind power vary with the cube of wind speed?	BTL-4	Analyzing	CO4

PART – B

1	Explain the nature of wind and derive the expression for power available in the wind.	BTL-2	Understandin g	CO4
2	Discuss the various factors influencing wind energy generation and their effects on turbine performance.	BTL-4	Analyzing	CO4
3	Explain the wind energy potential in India and discuss the status of wind power installations.	BTL-2	Understandin g	CO4
4	Describe the methods and instruments used for wind speed monitoring and wind data collection.	BTL-2	Understandin g	CO4
5	Explain the procedure for wind resource assessment and its importance in wind farm development.	BTL-3	Applying	CO4
6	Derive the wind power law and discuss the influence of wind speed on power generation.	BTL-3	Applying	CO4
7	Explain the velocity duration curve and power duration curve with suitable examples.	BTL-2	Understandin g	CO4

8	Compare velocity duration curves and power duration curves and explain their significance in wind resource assessment.	BTL-4	Analyzing	CO4
9	Derive Betz limit and explain its significance in wind energy conversion systems.	BTL-3	Applying	CO4
10	Analyze the factors affecting the efficiency of wind turbines beyond the Betz limit.	BTL-5	Evaluating	CO4
11	Explain the criteria for selecting a suitable site for wind power generation.	BTL-2	Understanding	CO4
12	Design a wind resource assessment plan for establishing a wind farm at a proposed site.	BTL-6	Creating	CO4
13	Evaluate the wind energy potential of a selected location using wind speed data and resource assessment techniques.	BTL-5	Evaluating	CO4
14	Discuss the challenges and opportunities for wind energy development in India.	BTL-5	Evaluating	CO4
15	Explain the environmental and economic considerations involved in wind farm site selection.	BTL-4	Analyzing	CO4
16	Compare the wind energy potential of different regions in India and recommend suitable locations for wind farm installation.	BTL-5	Evaluating	CO4
17	Design a conceptual wind farm by considering wind resource assessment, Betz limit, power duration curves, and site selection criteria.	BTL-6	Creating	CO4

UNIT V - TYPES OF WIND POWER AND ITS APPLICATIONS

SYLLABUS: Wind energy conversion devices - classification, characteristics, applications – Design of horizontal axis wind mill rotor diameter - Wind energy storage - wind farms – wheeling and banking - testing and certification procedures. Water pumping - Hybrid systems – Wind mill safety and environmental aspects.

PART – A

Q.No	Questions	BT Level	Competence	C
1	Define a Wind Energy Conversion System (WECS).	BTL-1	Remembering	CO5
2	Classify wind energy conversion devices.	BTL-1	Remembering	CO5
3	What are the characteristics of a horizontal-axis wind turbine?	BTL-2	Understanding	CO5
4	List the applications of wind energy conversion systems.	BTL-1	Remembering	CO5
5	Define rotor diameter of a wind turbine.	BTL-1	Remembering	CO5
6	State the importance of rotor diameter in wind energy conversion.	BTL-2	Understanding	CO5
7	What is wind energy storage?	BTL-1	Remembering	CO5
8	List the different methods of wind energy storage.	BTL-1	Remembering	CO5
9	Define a wind farm.	BTL-1	Remembering	CO5
10	What is meant by wheeling in wind energy systems?	BTL-2	Understanding	CO5
11	Define banking in wind power generation.	BTL-2	Understanding	CO5
12	Why are testing and certification required for wind turbines?	BTL-2	Understanding	CO5
13	Name any two international standards used for wind turbine testing.	BTL-1	Remembering	CO5
14	What is a wind-powered water pumping system?	BTL-1	Remembering	CO5
15	List the applications of wind-powered water pumping.	BTL-2	Understanding	CO5
16	Define a wind-solar hybrid system.	BTL-1	Remembering	CO5
17	State the advantages of hybrid renewable energy systems.	BTL-2	Understanding	CO5
18	What are the major safety measures followed in wind turbines?	BTL-2	Understanding	CO5
19	Mention two environmental impacts of wind farms.	BTL-1	Remembering	CO5
20	Differentiate between horizontal-axis and vertical-axis wind turbines.	BTL-4	Analyzing	CO5
21	Explain the purpose of pitch control in wind turbines.	BTL-2	Understanding	CO5
22	What is the role of braking systems in wind turbines?	BTL-2	Understanding	CO5
23	Explain the importance of wind turbine certification.	BTL-4	Analyzing	CO5
24	Why are hybrid wind energy systems preferred for remote areas?	BTL-4	Analyzing	CO5

PART – B

1	Explain the classification, characteristics, and applications of wind energy conversion devices.	BTL-2	Understanding	CO5
2	Compare horizontal-axis and vertical-axis wind turbines with suitable diagrams.	BTL-4	Analyzing	CO5
3	Design a horizontal-axis wind turbine by determining the rotor diameter for a specified power output.	BTL-6	Creating	CO5
4	Explain the factors affecting the design of horizontal-axis wind turbine rotor diameter.	BTL-3	Applying	CO5

5	Discuss the various wind energy storage methods and their applications.	BTL-2	Understanding	CO5
6	Explain the layout, operation, and performance of a wind farm.	BTL-2	Understanding	CO5
7	Discuss the concepts of wheeling and banking in wind power projects with suitable examples.	BTL-4	Analyzing	CO5
8	Explain the testing and certification procedures for wind turbines with reference to international standards.	BTL-2	Understanding	CO5
9	Analyze the significance of testing and certification in improving the reliability of wind energy systems.	BTL-5	Evaluating	CO5
10	Explain the construction, working, and applications of wind-powered water pumping systems.	BTL-2	Understanding	CO5
11	Discuss the configuration, operation, and advantages of wind-solar hybrid systems.	BTL-4	Analyzing	CO5
12	Design a hybrid wind-solar energy system for electrification of a remote village.	BTL-6	Creating	CO5
13	Evaluate the performance of a wind farm considering energy storage, wheeling, and banking.	BTL-5	Evaluating	CO5
14	Discuss the safety requirements and protection systems used in modern wind turbines.	BTL-2	Understanding	CO5
15	Analyze the environmental impacts of wind farms and suggest suitable mitigation measures.	BTL-5	Evaluating	CO5
16	Compare standalone wind energy systems and hybrid renewable energy systems based on performance and	BTL-4	Analyzing	CO5
17	Design a complete wind energy conversion system including rotor sizing, energy storage, hybrid integration, and safety	BTL-6	Creating	CO

Course Outcomes:

Cos	Course Outcome
CO1	Gain insight into solar and wind energy resources
CO2	Learn about the applications of solar and wind energy systems.
CO3	Acquired skills on the choice of energy conversion technique for specific applications.
CO4	Identify pros and cons of energy resources.
CO5	Gain insight into the operation of wind farms and the economics of power generation.