

SRM VALLIAMMAI ENGINEERING COLLEGE

(Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK



VII SEMESTER

EE3762 – RENEWABLE ENERGY SYSTEMS

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING QUESTION BANK

SUBJECT & SUBJECT CODE: EE3762 –RENEWABLE ENERGY SYSTEMS

SEMESTER / YEAR: VII / IV

UNIT I - RENEWABLE ENERGY (RE) SOURCES				
Environmental consequences of fossil fuel use, need for renewable energy sources, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources				
PART – A				
Q.No	Questions	BT Level	Competence	CO
1.	List the various types of fossil fuel.	BTL-1	Remember	CO1
2.	Write the Environmental impact of Fossil fuels.	BTL-2	Understand	CO1
3.	Write the various types of Renewable energy sources	BTL-1	Remember	CO1
4.	What are the disadvantages of conventional energy sources?	BTL-2	Understand	CO1
5.	Compare the conventional and non-conventional energy sources	BTL-1	Remember	CO1
6.	List the significance of Renewable Energy Sources.	BTL-2	Understand	CO1
7.	What is Sustainable development	BTL-1	Remember	CO1
8.	Discuss the role of renewable source.	BTL-2	Understand	CO1
9.	List the Types of Renewable Energy (RE) Sources.	BTL-1	Remember	CO1
10.	What are the limitation of Renewable (RE) Sources?	BTL-2	Understand	CO1
11.	Define Sustainable Design.	BTL-1	Remember	CO1
12.	Point out the importance of solar energy in the present day energy crisis?	BTL-2	Understand	CO1
13.	Enumerate on total solar energy received in India	BTL-1	Remember	CO1

14.	What is Geothermal Energy .	BTL-1	Remember	CO1
15.	List the merits and demerits of Geothermal Energy.	BTL-2	Understand	CO1
16.	Examine the Ocean Thermal Energy Conversion.	BTL-1	Remember	CO1
17.	Summarize the details of wind energy generation in our country	BTL-2	Understand	CO1
18.	What are the potential of various Renewable energy sources in India?	BTL-1	Remember	CO1
19.	Generalize the Energy scenario of conventional energy sources	BTL-2	Understand	CO1
20.	Write about the availability of conventional energy sources in the world.	BTL-2	Understand	CO1
21.	Define Energy Security and state its importance.	BTL-1	Remember	CO1
22.	What is the need for Sustainable Design in renewable energy systems?	BTL-2	Understand	CO1
23.	List any four advantages of renewable energy over fossil fuels.	BTL-1	Remember	CO1
24.	State the present trend of renewable energy adoption in India.	BTL-2	Understand	CO1
PART – B				
1.	Explain in details about the Fossil fuel usage and its crisis in the World (16)	BTL-4	Analyze	CO1
2.	Examine the impact of environmental consequences of fossil fuel usage (16)	BTL-4	Analyze	CO1
3.	Demonstrate the importance of renewable sources of energy (16)	BTL-3	Apply	CO1
4.	(i) Explain about the different types of Energy sources. (16) (ii) Discuss about the non-Conventional Energy Sources (16)	BTL-3	Apply	CO1
5.	Summarize about the various types of Non-Conventional energy sources (16)	BTL-4	Analyze	CO1
6.	Explain in detail the Sustainable Design and development. (16)	BTL-3	Apply	CO1
7.	Explain about the different types of Renewable energy (RE) sources. (16)	BTL-3	Apply	CO1
8.	Explain in detail about the Solar Energy Sources and also write about the merits and demerits of it. (16)	BTL-3	Apply	CO1
9.	With a neat diagram, explain the construction and working of Wind Energy Conversion systems. (16)	BTL-3	Apply	CO1
10.	Analyze with neat sketch about the Ocean Thermal Energy Conversion (OTEC). (16)	BTL-4	Analyze	CO1

11.	Summarize in details about different types of hydro Electric Energy systems with neat diagram. (16)	BTL-4	Analyze	CO1
12.	Briefly explain the Limitations of Renewable Energy (RE) sources (16)	BTL-4	Analyze	CO1
13.	Explain in details about the Geothermal Energy sources (16)	BTL-3	Apply	CO1
14.	Explain about the various types of Ocean Thermal Energy Conversion (OTEC) systems (16)	BTL-3	Apply	CO1
15.	Analyze the environmental consequences fossil fuel usage with case study. (16)	BTL-4	Analyze	CO1
16.	Evaluate the important role of Conventional and non-conventional energy sources (16)	BTL-4	Analyze	CO1
17.	Compose the Necessity of sustainable design and Development for the Prospers growth of human life in the world (16)	BTL-4	Analyze	CO1

UNIT II - WIND ENERGY

Wind energy, classification of wind turbines, extraction of wind turbine power, Types of Wind Power Plants (WPPs)–Components of WPPs, Working of WPPs- Siting of WPPs, modes of wind power generation – stand-alone and grid connected system.

PART – A

Q.No	Questions	BT Level	Competence	CO
1.	Define Wind Power	BTL-1	Remember	CO2
2.	List main Components of Wind Power Plant	BTL-1	Remember	CO2
3.	Draw the block diagram of Wind power plant	BTL-1	Remember	CO2
4.	Express the Equation for the Maximum output power (P_m) of wind turbine	BTL-2	Understand	CO2
5.	List the two important wind turbine generator installations in India.	BTL-2	Understand	CO2
6.	Define Pitch angle.	BTL-1	Remember	CO2
7.	Explain vertical wind mills with neat sketch	BTL-2	Understand	CO2
8.	Classify different types of Wind Power Plant.	BTL-2	Understand	CO2
9.	What type of generator used in wind power plant	BTL-1	Remember	CO2
10.	Interpret the Mechanism of production of local winds	BTL-2	Understand	CO2
11.	Express the mechanism of Yaw control.	BTL-2	Understand	CO2
12.	Illustrate the site selection factor for wind turbine	BTL-2	Understand	CO2
13.	Define tip speed ratio (TSR)	BTL-1	Remember	CO2
14.	Sketch the Variable speed constant frequency WTG system.	BTL-1	Remember	CO2
15.	Mention the advantages of grid tied wind power plant	BTL-2	Understand	CO2
16.	What is grid tied WPP?	BTL-2	Understand	CO2
17.	Deduce the Grid integration issues of WPPs	BTL-2	Understand	CO2
18.	Compare the VAWT and HAWT.	BTL-2	Understand	CO2
19.	Compose the Constant speed constant frequency WTG unit.	BTL-1	Remember	CO2

20.	Write about the availability of conventional energy sources in the world.	BTL-2	Understand	CO2
21.	Define Wind Energy Conversion System (WECS).	BTL-1	Remember	CO2
22.	List the classifications of wind turbines based on the axis of rotation.	BTL-1	Remember	CO2
23.	Define the Power Coefficient (C_p) of a wind turbine.	BTL-2	Understand	CO2
24.	State the factors affecting the power output of a wind turbine.	BTL-1	Remember	CO2
PART – B				
1.	What is Wind power and derive the equation of power in wind (16)	BTL-3	Apply	CO2
2.	(i) Define Tip speed ratio and write the necessary equation (8) (ii) What are the advantages of wind power systems? (7)	BTL-3	Apply	CO2
3.	Explain in detail about the pitch control and Yaw control (16)	BTL-3	Apply	CO2
4.	(i) Discuss Principle used in the measurement of speed of the wind. (8) (ii) Tabulate the main applications of wind energy. (6)	BTL-3	Apply	CO2
5.	Explain the construction and working of Vertical Axis Wind Turbine (VAWT). (16)	BTL-3	Apply	CO2
6.	Explain about the various Types of Wind Power Plant (WPPs). (16)	BTL-3	Apply	CO2
7.	Explain about the Components of WPPs with necessary diagram (16)	BTL-3	Apply	CO2
8.	Describe With a neat sketch about Horizontal axis wind mills. (16)	BTL-3	Apply	CO2
9.	Summarize the working principle of Wind Energy Conversion System (WECS) (16)	BTL-4	Analyze	CO2
10.	Distinguish the difference between vertical Axis Wind Turbine and Horizontal Axis Wind Turbine. (16)	BTL-4	Analyze	CO2
11.	Explain in details about the various components present in the wind power plant with neat sketch. (16)	BTL-3	Apply	CO2
12.	Classify the various types of rotor used in the wind turbine (16)	BTL-4	Analyze	CO2
13.	Generalize the factors to be consider for the site selection to install the wind power plant. (16)	BTL-4	Analyze	CO2
14.	Summarize the Grid integration issues of WPPs (16)	BTL-4	Analyze	CO2
15.	Sketch the diagram of a HAWT and explain the functions of its main components. (16)	BTL-3	Apply	CO2
16.	With the help of a diagram, discuss the power versus wind speed characteristics of a wind turbine (16)	BTL-4	Analyze	CO2
17.	Generalize the most favorable sites for installing of wind turbines. (16)	BTL-4	Analyze	CO2

UNIT III - SOLAR PV AND THERMAL SYSTEMS

Solar Radiation and its measurement, Solar collectors, Solar photovoltaic technology – introduction – solar cell basics – Types of solar cells and modules.

PV Module I-V Characteristics, Efficiency & Quality of the Cell, Design of solar PV system, series and parallel connections, maximum power point tracking, Applications.

PART – A

Q.No	Questions	BT Level	Competence	CO
1.	What is Solar Radiation?	BTL-2	Understand	CO3
2.	Define solar Azimuth angle and Zenith angle.	BTL-1	Remember	CO3
3.	Illustrate the solar radiation spectrum.	BTL-2	Understand	CO3
4.	Define Solar Constant.	BTL-1	Remember	CO3
5.	State the principle involved in generating solar power.	BTL-1	Remember	CO3
6.	Write the working principle of pyranometer.	BTL-2	Understand	CO3
7.	What is Solar Thermal Power Plant?	BTL-2	Understand	CO3
8.	List the advantages of solar concentrators.	BTL-1	Remember	CO3
9.	What are the factors influencing solar power extraction?	BTL-2	Understand	CO3
10.	Define Solar Pond.	BTL-1	Remember	CO3
11.	Define Energy storage system.	BTL-1	Remember	CO3
12.	What is phase change material (PCM)?	BTL-2	Understand	CO3
13.	Describe the Solar Photovoltaic systems.	BTL-2	Understand	CO3
14.	Define the basic principle of SPV conversion.	BTL-1	Remember	CO3
15.	Draw the I-V Characteristics of PV system.	BTL-1	Remember	CO3
16.	List the different types of PV Systems.	BTL-1	Remember	CO3
17.	What are the effects of shadowing?	BTL-2	Understand	CO3
18.	List the applications of solar PV System.	BTL-1	Remember	CO3
19.	What are the advantages of solar PV system?	BTL2	Understand	CO3
20.	Draw the equivalent circuit of solar cell.	BTL-1	Remember	CO3
21.	Name three types of solar concentrator.	BTL-1	Remember	CO3
22.	What is maximum power point tracking?	BTL-2	Understand	CO3
23.	List the applications of solar thermal system.	BTL-1	Remember	CO3
24.	What are the types of solar PV cell?	BTL-2	Understand	CO3

PART – B

1.	With a neat sketch explain in detail about the solar radiation Phenomena. (16)	BTL-3	Apply	CO3
2.	Explain and derive expression for beam and diffuse radiation (16)	BTL-3	Apply	CO3
3.	Explain in detail the different types of solar energy measuring instruments. (16)	BTL-3	Apply	CO3
4.	Explain variation of solar energy reaching earth surface. (16)	BTL-4	Analyze	CO3
5.	Discuss the construction and working principle of Central Receiver Power Plants (16)	BTL-3	Apply	CO3

6.	Examine the Environmental impact of solar power generation. (16)	BTL-4	Analyze	CO3
7.	Explain the working of Thermal Energy storage system with PCM (16)	BTL-3	Apply	CO3
8.	Discuss in detail about the principle of Solar Photo Voltaic (SPV) conversion. (16)	BTL-3	Apply	CO3
9.	Explain the various types of Photo Voltaic (PV) Systems. (16)	BTL-3	Apply	CO3
10.	Explain in detail about the construction of solar cell, solar module and solar array. (16)	BTL-3	Apply	CO3
11.	Describe in detail about the PV Module equivalent Circuit and its I-V Characteristics. (16)	BTL-4	Analyze	CO3
12.	Discuss about the working operation of Photovoltaic (PV) system in series and parallel connections (16)	BTL-3	Apply	CO3
13.	Explain in detail about the various MPPT controllers in the PV System (16)	BTL-3	Apply	CO3
14.	Formulate the application of Photovoltaic system in various field. (16)	BTL-3	Apply	CO3
15.	Explain briefly why it is more difficult to predict diffuse irradiance than beam irradiance. (16)	BTL-4	Analyze	CO3
16.	What is the approximate flux density of solar radiation? (insolation) in Wm^{-2} onto a collector facing the Sun on the Earth's surface on a sunny day? Approximately, what proportion of this radiation is visible to human eyes? (16)	BTL-3	Apply	CO3
17.	The solar spectrum is said to be divided into three regions. Name these regions and explain their significance. (16)	BTL-4	Analyze	CO3

UNIT IV BIOMASS ENERGY

Bio-Mass: Energy from biomass, Sources from biomass, Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

Part-A

Q.No	Questions	BT Level	Competence	COs
1.	What is Biomass?	BTL-2	Understand	CO4
2.	Name the constituents of biogas.	BTL-1	Remember	CO4
3.	Give some of the organic materials used in biomass plant.	BTL-2	Understand	CO4
4.	List the commonly used bioenergy conversion processes.	BTL-1	Remember	CO4
5.	Point out the factors affecting biogas generation.	BTL-2	Understand	CO4
6.	List various biomass feedstock used for bioenergy generation.	BTL-1	Remember	CO4
7.	What is geothermal energy?	BTL-2	Understand	CO4
8.	What are the different sources of geothermal energy?	BTL-2	Understand	CO4
9.	Give the various types of geothermal power plants used.	BTL-1	Remember	CO4
10.	Define Geothermal gradient.	BTL-1	Remember	CO4
11.	What are the drawbacks of geothermal energy?	BTL-2	Understand	CO4
12.	What is the basis of wet steam geothermal system?	BTL-2	Understand	CO4

13.	What is hot dry rocks resources of geothermal energy?	BTL-2	Understand	CO4
14.	List the various applications of geothermal energy.	BTL-1	Remember	CO4
15.	Define hydroelectric power plant.	BTL-1	Remember	CO4
16.	List various types of hydropower plants.	BTL-1	Remember	CO4
17.	What is the necessity of surge tank in hydropower plant?	BTL-2	Understand	CO4
18.	Classify the water turbines used in hydropower plant.	BTL-2	Understand	CO4
19.	What are the primary requirements for site selection of hydropower plant?	BTL-2	Understand	CO4
20.	Recommend a suitable water turbine for 10MW hydro power plant.	BTL-2	Understand	CO4
21.	List the essential components of hydroelectric system.	BTL-1	Remember	CO4
22.	Give the various feedstock used in anaerobic digestion.	BTL-1	Remember	CO4
23.	Define Pyrolysis.	BTL-1	Remember	CO4
24.	List the products obtained through alcohol fermentation in solid biomass technology.	BTL-1	Remember	CO4
Part-B				
1	List out the classification of biogas plants and explain any two with neat sketch. (16)	BTL-3	Apply	CO4
2	What is the meaning of biomass? Further, discuss its multipurpose utilization (16)	BTL-3	Apply	CO4
3	Describe in detail how does biomass conversion take place? (16)	BTL-3	Apply	CO4
4	Describe in detail the various factors affecting bio digestion of a gas? (16)	BTL-4	Analyze	CO4
5	Differentiate between the following methods of biogas generation i. Pyrolysis (8) ii. Combustion (7)	BTL-3	Apply	CO4
6	Discuss the following methods of biogas generation i. Gasification (8) ii. Anaerobic Digestion (7)	BTL-3	Apply	CO4
7	With a neat sketch explain the operation dry steam geothermal power plant. (16)	BTL-3	Apply	CO4
8	Describe in detail the operation dry binary cycle geothermal power plant. (16)	BTL-4	Analyze	CO4
9	Explain the analysis of the energy content and its extraction for a hot dry rock type Geothermal resource. (16)	BTL-3	Apply	CO4
10	With a neat sketch explain the operation impoundment hydro power plant. (16)	BTL-3	Apply	CO4
11	Describe in detail the operation pumped storage hydro power plant. (16)	BTL-3	Apply	CO4
12	Demonstrate the following Impulse turbine: i. Pelton (8) ii. Turgo turbine (7)	BTL-3	Apply	CO4
13	Explain the operation of the following Reaction turbines: i. Francis (8) ii. Kaplan (7)	BTL-4	Analyze	CO4
14	Discuss about selection of water turbine based on capacity of the power plan, head and water flow rate. (16)	BTL-4	Analyze	CO4

15	Explain the impacts of biomass construction, production and operation. (16)	BTL-4	Analyze	CO4
16	Discuss with a neat sketch the bioenergy generation through fermentation. (16)	BTL-3	Apply	CO4
17	Explain with a neat sketch the operation flashed steam geothermal power plant. (16)	BTL-4	Analyze	CO4

UNIT V OTHER ENERGY SOURCES

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Ocean Energy: Introduction, Principle of ocean thermal energy conversion (OTEC), Tidal power generation: Tidal energy technologies, Energy from waves, Wave energy conversion, Wave energy technologies, advantages and disadvantages. Fuel cell: Principle of working- various types - construction and applications. Energy Storage System- Hybrid Energy Systems.

Part-A

Q.No	Questions	BT Level	Competence	COs
1	What is tidal energy?	BTL-1	Remember	CO5
2	Summarize the advantages of tidal power generation.	BTL-2	Understand	CO5
3	Illustrate the limitations of tidal power generation.	BTL-2	Understand	CO5
4	List the factors determines the maximum length and height of ocean waves.	BTL-2	Understand	CO5
5	Define ocean thermal energy.	BTL-1	Remember	CO5
6	Give the overall efficiency of an OTEC power plant.	BTL-1	Remember	CO5
7	Illustrate various types of OTEC power plants.	BTL-2	Understand	CO5
8	Illustrate OTEC open cycle.	BTL-2	Understand	CO5
9	What is floating power plant?	BTL-2	Understand	CO5
10	What is hydrogen energy?	BTL-1	Remember	CO5
11	List methods of Hydrogen Energy Storage.	BTL-1	Remember	CO5
12	What are methods of hydrogen production technologies?	BTL-2	Understand	CO5
13	Draw the schematic of fuel cell.	BTL-1	Remember	CO5
14	Describe various types of fuel cells	BTL-2	Understand	CO5
15	Demonstrate the factors affecting the fuel cell performance.	BTL-2	Understand	CO5
16	List different methods of energy storage.	BTL-1	Remember	CO5
17	Define compressed air storage.	BTL-2	Understand	CO5
18	What is Electrochemical Storage?	BTL-2	Understand	CO5
19	Define Hybrid energy systems.	BTL-1	Remember	CO5
20	State the working of geo thermal-preheat hybrid.	BTL-2	Understand	CO5
21	Define wave energy.	BTL-1	Remember	CO5
22	List the advantages of hydrogen as an energy carrier.	BTL-1	Remember	CO5
23	Discuss the importance of energy storage in renewable energy systems.	BTL-2	Understand	CO5
24	List the applications of hybrid energy systems.	BTL-1	Remember	CO5

Part-B

1	Explain the different economic and environmental considerations of tidal power plant (16)	BTL-4	Analyze	CO5
2	Describe in detail the operation of double basin type tidal power plant. (16)	BTL-3	Apply	CO5

3	Discuss, what is the minimum tidal range required for the working of tidal plant. Explain how much is the potential in tides. (16)	BTL-4	Analyze	CO5
4	Explain with a neat sketch the operation of OTEC plants. (16)	BTL-3	Apply	CO5
5	Discuss the following: i. Illustrate OTEC open cycle. (8) ii. OTEC closed (Anderson) cycle-Discuss. (7)	BTL-4	Analyze	CO5
6	Explain the operation of hydrogen energy system with schematic diagram. (16)	BTL-3	Apply	CO5
7	Describe the future fuel of the world that is hydrogen obtained by electrolysis of water with the energy. (16)	BTL-3	Apply	CO5
8	Discuss in detail the various fuel cells and its applications. (16)	BTL-3	Apply	CO5
9	Derive an expression for emf, free energy, potential, power output and efficiency of a fuel cell. (16)			CO5
10	Describe working principle of fuel cell with neat sketch and draw the performance characteristics of hydrogen-oxygen fuel cell? (16)	BTL-4	Analyze	CO5
11	Describe the different methods of energy storage system. (16)			CO5
12	Explain the necessity of energy storage in renewable power harnessing? Give the diagram and explain the operation of a pumped energy storage system. (16)	BTL-4	Analyze	CO5
13	Define hybrid system? Discuss the need for hybrid system, its range and its types. (16)	BTL-3	Apply	CO5
14	With the help of neat diagram, explain the working of geo thermal-preheat hybrid (16)	BTL-3	Apply	CO5
15	Explain the 'single-basin' and 'two-basin' systems of tidal power harnessing. Further, discuss their advantages and limitations. (16)	BTL-4	Analyze	CO5
16	Discuss the principle of operation of a simple single-effect tidal power plant and give a graph of sequential operating modes. (16)	BTL-4	Analyze	CO5
17	Explain the essential features of a hydrogen-oxygen cell. Draw a suitable diagram of this cell and give the reactions took place at the electrodes. (16)	BTL-4	Analyze	CO5

Course Outcome

- Gain awareness about renewable Energy Sources and technologies.
- Explain and analyze the working principles and components involved in wind energy power generation.
- Apply and interpret the fundamental theory governing solar thermal and photovoltaic devices.
- Explain and evaluate the functioning and components of biomass energy systems.
- Compare and assess different forms of alternative energy sources including geothermal, ocean energy, hydropower, and fuel cells