SRM VALLIAMMAI ENGINEERING COLLEGE

(Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

VII SEMESTER

1905702 – RENEWABLE ENERGY SYSTEMS

Regulation – 2019

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SUBJECT & SUBJECT CODE: 1905702 –RENEWABLE ENERGY SYSTEMS

SEM / YEAR: VII / IV

UNIT I - RENEWABLE ENERGY (RE) SOURCES				
Environmental consequences of fossil fuel use, Importance of renewable sources of energy, 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.	Compose the environmental impact of fossil fuels.	**BTL-4**	Analyze	CO1
2.	Name the various types of fossil fuel in the world	**BTL-1**	Remember	CO1
3.	Summarize the Renewable energy sources.	**BTL-2**	Understand	CO2
4.	Compare the conventional and non-conventional energy sources	**BTL-1**	Remember	CO1
5.	Write the disadvantages of conventional energy sources.	**BTL-3**	Apply	CO1
6.	Explain the importance of Renewable Energy Sources.	**BTL-2**	Understand	CO2
7.	What is Sustainable development?	**BTL-1**	Remember	CO3
8.	Discuss the role of renewable source.	**BTL-3**	Apply	CO1
9.	List the types of Renewable Energy (RE) sources.	**BTL-4**	Analyze	CO1
10.	Explain the limitation of Renewable (RE) sources.	**BTL-5**	Evaluate	CO1
11.	Define Sustainable Design.	**BTL-1**	Remember	CO3
12.	Point out the importance of solar energy in the present day energy crisis.	**BTL-3**	Apply	CO1
13.	Enumerate on total solar energy received in India.	**BTL-2**	Understand	CO1
14.	What is Geothermal Energy?	**BTL-2**	Understand	CO3
15.	Explain the merits and demerits of Geothermal Energy.	**BTL-5**	Evaluate	CO3
16.	Examine the Ocean Thermal Energy Conversion.	**BTL-1**	Remember	CO3
17.	Summarize the details of wind energy generation in our country	**BTL-6**	Create	CO3

18.	Explain the potential of various Renewable energy sources in India.	**BTL-1**	Remember	CO3
19.	Generalize the energy scenario of conventional energy sources.	**BTL-6**	Create	CO1
20.	Write about the availability of conventional energy sources in the world.	**BTL-4**	Analyze	CO1
21	What is the latest status of renewable energy in India?	**BTL-2**	Understand	CO3
22	What are the types of hybrid energy system?	**BTL-4**	Analyze	CO1
23	How does a hybrid power system work?	**BTL-2**	Understand	CO3
24	How does renewable energy affect the economy?	**BTL-1**	Remember	CO3
	PART – B			
1.	Explain in details about the fossil fuel usage and its crisis in the world. (13)	**BTL-2**	Understand	CO1
2.	Examine the impact of environmental consequences of fossil fuel usage. (13)	**BTL-1**	Remember	CO1
3.	Demonstrate the importance of renewable sources of energy. (13)	**BTL-3**	Apply	CO2
4.	(i) Explain about the different types of energy sources. (7) (ii) Discuss about the non-conventional energy Sources. (6)	**BTL-2**	Understand	CO2
5.	Summarize about the various types of non-conventional energy sources (13)	**BTL-5**	Evaluate	CO1
6.	Explain in detail the Sustainable Design and development. (13)	**BTL-6**	Create	CO3
7.	Explain about the different types of Renewable energy (RE) sources. (13)	**BTL-1**	Remember	CO1
8.	Explain in detail about the Solar Energy sources and also write about the merits and demerits of it. (13)	**BTL-1**	Remember	CO1
9.	With a neat diagram, explain the construction and working of Wind Energy Conversion systems. (13)	**BTL-4**	Analyze	CO3
10.	Analyze with neat sketch about the Ocean Thermal Energy Conversion (OTEC). (13)	**BTL-1**	Remember	CO3
11.	Summarize in details about different types of hydro Electric Energy systems with neat diagram. (13)	**BTL-5**	Evaluate	CO3
12.	Briefly explain the limitations of Renewable Energy (RE) sources. (13)	**BTL-1**	Remember	CO1
13.	Explain in details about the Geothermal Energy sources. (13)	**BTL-2**	Understand	CO3
14.	Explain about the various types of Ocean Thermal Energy Conversion (OTEC) systems. (13)	**BTL-3**	Apply	CO3
15	Explain five each merits and demerits of wave energy.	**BTL-4**	Analyze	CO3
16	Explain briefly about the different parameters that describes the amount of solar energy reaching the earth surface?	**BTL-5**	Evaluate	CO3

17	Explain briefly about the environmental impacts of OTEC?	**BTL-1**	Remember	CO1
	PART – C			
1.	Analyze the environmental consequences fossil fuel usage with case study. (15)	**BTL-5**	Evaluate	CO1
2.	Evaluate the important role of conventional and non-conventional energy sources. (15)	**BTL-5**	Evaluate	CO1
3.	Compose the necessity of sustainable design and development for the prosper growth of human life in the world. (15)	**BTL-6**	Create	CO3
4.	Generalize the present Indian and international energy scenario of conventional and RE sources. (15)	**BTL-6**	Create	CO1
5.	Enlist advantages and disadvantages of tidal power production. What are the problems faced in exploiting tidal energy?	**BTL-5**	Evaluate	CO1

UNIT II - WIND ENERGY

Power in the Wind – Types of Wind Power Plants(WPPs)–Components of WPPs-Working of WPPs-Siting of WPPs-Grid integration issues of WPPs.

PART – A

Q.No	Questions	BT Level	Competence	CO
1.	Define Wind Power.	**BTL-1**	Remember	CO4
2.	List main components of Wind power plant.	**BTL-1**	Remember	CO4
3.	Draw the block diagram of Wind power plant.	**BTL-1**	Remember	CO4
4.	Express the equation for the maximum output power (P_m) of wind turbine.	**BTL-2**	Understand	CO4
5.	List the two important wind turbine generator installations in India.	**BTL-2**	Understand	CO4
6.	Define Pitch angle.	**BTL-1**	Remember	CO4
7.	Explain vertical wind mills with neat sketch.	**BTL-4**	Analyze	CO4
8.	Classify different types of Wind power plant.	**BTL-3**	Apply	CO4
9.	What type of generator used in wind power plant?	**BTL-1**	Remember	CO4
10.	Interpret the mechanism of production of local winds.	**BTL-4**	Analyze	CO4
11.	Express the mechanism of Yaw control.	**BTL-2**	Understand	CO4
12.	Illustrate the site selection factor for wind turbine.	**BTL-3**	Apply	CO4
13.	Define tip speed ratio (TSR).	**BTL-1**	Remember	CO4
14.	Sketch the variable speed constant frequency WTG system.	**BTL-6**	Create	CO4
15.	Mention the advantages of grid tied wind power plant.	**BTL-3**	Apply	CO4
16.	Explain the grid tied WPP.	**BTL-4**	Analyze	CO4
17.	Deduce the grid integration issues of WPPs.	**BTL-5**	Evaluate	CO4
18.	Compare the VAWT and HAWT.	**BTL-5**	Evaluate	CO4
19.	Compose the constant speed constant frequency WTG unit.	**BTL-6**	Create	CO4

20.	Write about the availability of conventional energy sources in the world.	**BTL-2**	Understand	CO4
21	What is a wind farm? Why are many new wind farms built offshore?	**BTL-5**	Evaluate	CO4
22	For electricity generation by wind power into a utility grid network, why is a wind speed of less than 3 m/s of negligible benefit; yet a wind speed of 6 m/s is beneficial?	**BTL-6**	Create	CO4
23	Name two uses of wind power other than electricity generation.	**BTL-4**	Analyze	CO4
24	Why is DFIG preferable for large scale power conversion applications?	**BTL-6**	Create	CO4
	PART – B			
1.	What is Wind power and derive the equation of power in wind (13)	**BTL-3**	Apply	CO4
2.	(i) Define Tip speed ratio and write the necessary equation (6) (ii)What are the advantages of wind power systems? (7)	**BTL-4**	Analyze	CO4
3.	Explain in detail about the pitch control and yaw control (13)	**BTL-1**	Remember	CO4
4.	(i) Discuss principle used in the measurement of speed of the wind. (7) (ii)Tabulate the main applications of wind energy. (6)	**BTL-6**	Create	CO4
5.	Explain the construction and working of Vertical Axis Wind Turbine (VAWT). (13)	**BTL-3**	Apply	CO4
6.	Explain about the various types of Wind Power Plant (WPPs). (13)	**BTL-1**	Remember	CO4
7.	Explain about the components of WPPs with necessary diagram. (13)	**BTL-2**	Understand	CO4
8.	Describe with a neat sketch about Horizontal axis wind mills. (13)	**BTL-2**	Understand	CO4
9.	Summarize the working principle of Wind Energy Conversion System (WECS). (13)	**BTL-5**	Evaluate	CO4
10.	Distinguish the difference between vertical axis wind turbine and horizontal axis wind turbine. (13)	**BTL-4**	Analyze	CO4
11.	Explain in details about the various components present in the wind power plant with neat sketch. (13)	**BTL-1**	Remember	CO4
12.	Classify the various types of rotor used in the wind turbine. (13)	**BTL-4**	Analyze	CO4
13.	Generalize the factors to be consider for the site selection to install the wind power plant. (13)	**BTL-6**	Create	CO4
14.	Summarize the Grid integration issues of WPPs. (13)	**BTL-5**	Evaluate	CO4
15	Explain, with the use of sketch diagrams or a paper model, why the aerodynamic force on a blade has to be resolved twice to obtain the accelerating force on a wind turbine rotor.	**BTL-5**	Evaluate	CO4
16	Name three factors that you would expect to be considered in a planning application for a new wind farm.	**BTL-4**	Analyze	CO4
17	A wind turbine has a rated power of 100 kW and rated speed	**BTL-6**	Create	CO4

	of 12 m/s. Estimate its power output in a wind speed of (a) 9 m/s; (b) 18 m/s.			
PART C				
1.	Sketch the diagram of a HAWT and explain the functions of its main components (15)	**BTL-5**	Evaluate	CO4
2.	With the help of a diagram, discuss the power versus wind speed characteristics of a wind turbine (15)	**BTL-5**	Evaluate	CO4
3.	Generalize the most favorable sites for installing of wind turbines. (15)	**BTL-6**	Create	CO4
4.	Summarize the environmental impact due to installation of Wind power plant. (15)	**BTL-6**	Create	CO4
5.	A large wind turbine has blades 50 m long. In gale-force winds of 20 m/s, calculate the rotational rate if the blade tips were to equal the speed of sound. Is this likely to happen? (15)	**BTL-5**	Evaluate	CO4

UNIT III - SOLAR PV AND THERMAL SYSTEMS

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds.- Thermal Energy storage system with PCM- Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array ,PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.

PART – A

Q.No	Questions	BT Level	Competence	CO
1.	Define solar radiation.	**BTL-1**	Remember	CO6
2.	Infer solar azimuth angle and zenith angle.	**BTL-4**	Analyze	CO6
3.	Express the estimation of average solar radiation.	**BTL-3**	Apply	CO6
4.	Define solar constant.	**BTL-4**	Analyze	CO6
5.	State the principle involved in generating solar power.	**BTL-1**	Remember	CO6
6.	Examine the working principle of pyranometer.	**BTL-1**	Remember	CO6
7.	Describe the solar thermal power plant.	**BTL-1**	Remember	CO3
8.	Express the advantage of solar concentrators.	**BTL-2**	Understand	CO6
9.	Summarize the factor influencing solar power extraction.	**BTL-3**	Apply	CO6
10.	Define Solar Pond.	**BTL-1**	Remember	CO6
11.	Describe Energy storage system.	**BTL-2**	Understand	CO6
12.	Summarize phase change material (PCM).	**BTL-5**	Evaluate	CO6
13.	Explain the Solar Photovoltaic systems.	**BTL-4**	Analyze	CO6
14.	Express the basic principle of SPV conversion.	**BTL-2**	Understand	CO6
15.	Formulate the I-V Characteristics of PV System.	**BTL-6**	Create	CO6
16.	List the different types of PV Systems.	**BTL-5**	Evaluate	CO6
17.	Summarize the /effect of shadowing.	**BTL-2**	Understand	CO6

18.	Classify the application of solar PV System.	**BTL-3**	Apply	CO6
19.	List the advantages of solar PV system.	**BTL-1**	Remember	CO6
20.	Draw the equivalent circuit of practical solar cell.	**BTL-6**	Create	CO6
21	How much fresh water per day could be produced by a solar still of 10 m^2 area?	**BTL-5**	Evaluate	CO6
22	Name three types of solar concentrator. Which of these achieves the highest output temperature? Which is the easiest to keep clean?	**BTL-2**	Understand	CO6
23	Outline the principle of a Fresnel mirror.	**BTL-3**	Apply	CO6
24	Why is it important to dry crops soon after harvest?	**BTL-1**	Remember	CO6
	PART – B			
1.	Explain the in detail about the solar radiation phenomena. (13)	**BTL-3**	Apply	CO6
2.	Explain and derive expression for beam and diffuse radiation. (13)	**BTL-3**	Apply	CO6
3.	Tabulate the different types of solar energy measuring instruments. (13)	**BTL-1**	Remember	CO6
4.	What are the reasons for variation in the amount of solar energy reaching earth surface. (13)	**BTL-2**	Understand	CO6
5.	Discuss the construction and working principle of Central Receiver power plants. (13)	**BTL-2**	Understand	CO6
6.	Examine the environmental impact of solar power generation. (13)	**BTL-2**	Understand	CO6
7.	Explain the working of thermal energy storage system with PCM. (13)	**BTL-1**	Remember	CO3
8.	Discuss in detail about the principle of Solar Photo Voltaic (SPV) conversion. (13)	**BTL-4**	Analyze	CO6
9.	Explain the various types of Photo Voltaic (PV) Systems. (13)	**BTL-4**	Analyze	CO6
10.	Explain in detail about the construction of solar cell, solar module and solar array. (13)	**BTL-1**	Remember	CO6
11.	Describe in detail about the PV module equivalent circuit and its I-V characteristics. (13)	**BTL-1**	Remember	CO6
12.	Discuss about the working operation of Photovoltaic (PV) system in series and parallel connections. (13)	**BTL-4**	Analyze	CO6
13.	Explain in detail about the various MPPT controllers in the PV System. (13)	**BTL-4**	Analyze	CO6
14.	Formulate the application of photovoltaic system in various field. (13)	**BTL-6**	Create	CO6
15	Explain briefly why it is more difficult to predict diffuse irradiance than beam irradiance.	**BTL-4**	Analyze	CO6

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?	**BTL-4**	Analyze	CO6
17	The solar spectrum is said to be divided into three regions. Name these regions and explain their significance.	**BTL-6**	Create	CO6
	PART C			
1	Summarize in detail about the construction and working principle of Solar Thermal Power Plant. (15)	**BTL-6**	Create	CO3
2	With a neat sketch explain the construction and the principle operation of solar photovoltaic system (15)	**BTL-5**	Evaluate	CO6
3	Evaluate the series and parallel connection of Solar Photovoltaic system with neat sketch. (15)	**BTL-5**	Evaluate	CO6
4	Summarize the maximum power point tracking in the Solar Photo voltaic system and discuss the advantages and disadvantages. (15)	**BTL-6**	Create	CO6
5	By how much has the Global Mean Surface Temperature changed over the past 50 years? Indicate some physical effects that explain most of this change, and give supporting evidence for your answer. (15)	**BTL-6**	Create	CO6

UNIT IV BIOMASS ENERGY

SYLLABUS: Introduction-Bio mass resources –Energy from Bio mass: conversion processes-Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

Part-A

Q.No	Questions	BT Level	Competence	COs
1	What is Biomass?	**BTL-1**	Remember	CO5
2	Name the constituents of biogas.	**BTL-1**	Remember	CO5
3	Give some of the organic materials used in biomass plant	**BTL-2**	Understand	CO5
4	Illustrate commonly used bioenergy conversion processes.	**BTL-3**	Apply	CO5
5	Point out the factors affecting biogas generation.	**BTL-4**	Analyze	CO5
6	Summarize various biomass feedstock used for bioenergy generation.	**BTL-5**	Evaluate	CO5
7	What is geothermal energy?	**BTL-1**	Remember	CO5
8	What are the different sources of geothermal energy?	**BTL-1**	Remember	CO5
9	Summarize various types of geothermal power plants used.	**BTL-2**	Understand	CO5
10	Describe Geothermal gradient.	**BTL-2**	Understand	CO5
11	Illustrate the drawbacks of geothermal energy.	**BTL-3**	Apply	CO5
12	Explain the concept of wet steam geothermal system.	**BTL-4**	Analyze	CO5
13	Explain hot dry rocks resources of geothermal energy.	**BTL-5**	Evaluate	CO5
14	Prepare the list of various application of geothermal energy.	**BTL-6**	Create	CO5
15	Define hydroelectric power plant.	**BTL-1**	Remember	CO5
16	List various types of hydropower plants.	**BTL-1**	Remember	CO5
17	Give the necessity of surge tank in hydropower plant.	**BTL-2**	Understand	CO5
18	Classify the water turbines used in hydropower plant.	**BTL-3**	Apply	CO5

19	Explain the primary requirements for site selection of hydropower plant.	**BTL-4**	Analyze	CO5
20	Recommend a suitable water turbine for 10MW hydropower plant.	**BTL-6**	Create	CO5
21	Give a chemical explanation of the term 'biomass'	**BTL-3**	Apply	CO5
22	Explain two differences between carbon in CO2 from burning coal and from burning biomass.	**BTL-4**	Analyze	CO5
23	Compare the heat of combustion (MJ/kg) of dry wood and of petroleum oil.	**BTL-5**	Evaluate	CO5
24	What is a 'wood pellet' and how big is it likely to be?	**BTL-6**	Create	CO5
	Part-B			
1	List out the classification of biogas plants and explain any two with neat sketch. (13)	**BTL-1**	Remember	CO5
2	What is the meaning of biomass? Further, discuss its multipurpose utilization (13)	**BTL-1**	Remember	CO5
3	Describe in detail how biomass conversion takes place. (13)	**BTL-2**	Understand	CO5
4	Describe in detail the various factors affecting bio digestion of a gas. (13)	**BTL-3**	Apply	CO5
5	Differentiate between the following methods of biogas generation i. Pyrolysis (6) ii. Combustion (7)	**BTL-4**	Apply	CO5
6	Discuss the following methods of biogas generation i. Gasification (6) ii. Anaerobic Digestion (7)	**BTL-5**	Analyze	CO5
7	With a neat sketch explain the operation dry steam geothermal power plant. (13)	**BTL-1**	Remember	CO5
8	Describe in detail the operation dry binary cycle geothermal power plant. (13)	**BTL-2**	Understand	CO5
9	Explain the analysis of the energy content and its extraction for a hot dry rock type Geothermal resource. (13)	**BTL-4**	Analyze	CO5
10	With a neat sketch explain the operation impoundment hydro power plant. (13)	**BTL-1**	Remember	CO5
11	Describe in detail the operation pumped storage hydro power plant. (13)	**BTL-2**	Understand	CO5
12	Demonstrate the following Impulse turbine: i. Pelton (6) ii. Turgo turbine (7)	**BTL-3**	Apply	CO5
13	Explain the operation of the following Reaction turbines: i. Francis (6) ii.Kaplan (7)	**BTL-4**	Analyze	CO5
14	Discuss about selection of water turbine based on capacity of the power plan, head and water flow rate. (13)	**BTL-6**	Create	CO5
15	Identify two social advantages and two disadvantages of utilizing biofuels.	**BTL-3**	Apply	CO5
16	Which biomass energy crops and products are (i) most likely, and (ii) least likely to affect food supplies?	**BTL-4**	Analyze	CO5

17	Describe the impact of human food and energy consumption on the Earth's land ecosystem.	**BTL-6**	Create	CO5
	Part-C			
1	Explain the impacts of biomass construction, production and operation. (15)	**BTL-5**	Evaluate	CO5
2	Discuss with a neat sketch the bioenergy generation through fermentation. (15)	**BTL-6**	Create	CO5
3	Explain with a neat sketch explain the operation flashed steam geothermal power plant. (15)	**BTL-5**	Evaluate	CO5
4	Discuss the propeller type of turbine used for hydroelectric projects with diagram. (15)	**BTL-6**	Create	CO5
5	How is a carbon atom in biomass different in effect from a carbon atom in fossil fuel? (15)	**BTL-6**	Create	CO5

UNIT V OTHER ENERGY SOURCES

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- 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	CO4
2	Summarize the advantages of tidal power generation.	**BTL-2**	Understand	CO4
3	Illustrate the limitations of tidal power generation.	**BTL-3**	Apply	CO4
4	Explain the factors determines the maximum length and height of ocean waves.	**BTL-4**	Analyze	CO4
5	Define ocean thermal energy.	**BTL-1**	Remember	CO4
6	Give the overall efficiency of an OTEC power plant.	**BTL-2**	Understand	CO4
7	Illustrate various types of OTEC power plants.	**BTL-3**	Apply	CO4
8	Illustrate OTEC open cycle.	**BTL-6**	Create	CO4
9	Explain floating power plant.	**BTL-4**	Analyze	CO4
10	What is hydrogen energy?	**BTL-1**	Remember	CO4
11	List methods of Hydrogen Energy Storage.	**BTL-2**	Understand	CO4
12	Explain methods of hydrogen production technologies.	**BTL-4**	Analyze	CO4
13	Draw the schematic of fuel cell.	**BTL-1**	Remember	CO4
14	Describe various types of fuel cells.	**BTL-2**	Understand	CO4
15	Demonstrate the factors affecting the fuel cell performance.	**BTL-3**	Apply	CO4
16	List different methods of energy storage.	**BTL-1**	Remember	CO4
17	Explain compressed air storage.	**BTL-5**	Evaluate	CO4
18	Explain Electrochemical storage.	**BTL-6**	Create	CO4
19	Define hybrid energy systems.	**BTL-1**	Remember	CO4
20	Explain working of geo thermal-preheat hybrid.	**BTL-5**	Evaluate	CO4
21	Does the energy carried forward in a deep-water wave travel at the same speed as the wave?	**BTL-5**	Evaluate	CO4
22	Why do tides not propagate as tsunamis?	**BTL-6**	Create	CO4
23	Explain the difference between spring and neap tides.	**BTL-1**	Remember	CO4

24	A heat pump is reversed to become an air cooler; is its coefficient of performance unchanged? Explain your answer.	**BTL-5**	Evaluate	CO4
Part-B				
1	Explain the different economic and environmental considerations of tidal power plant. (13)	**BTL-1**	Remember	CO4
2	Describe in detail the operation of double basin type tidal power plant. (13)	**BTL-3**	Apply	CO4
3	Discuss, what is the minimum tidal range required for the working of tidal plant. Explain how much the potential in tides is. (13)	**BTL-6**	Create	CO4
4	Explain with a neat sketch the operation of OTEC plants. (13)	**BTL-1**	Remember	CO4
5	Discuss the following: i. OTEC open cycle. (6) ii. OTEC closed (Anderson) cycle. (7)	**BTL-3**	Apply	CO4
6	Explain the operation of hydrogen energy system with schematic diagram. (13)	**BTL-2**	Understand	CO4
7	Describe the future fuel of the world that is hydrogen obtained by electrolysis of water with the energy. (13)	**BTL-4**	Analyze	CO4
8	Discuss in detail the various fuel cells and its applications. (13)	**BTL-1**	Remember	CO4
9	Derive an expression for emf, free energy, potential, power output and efficiency of a fuel cell. (13)	**BTL-2**	Understand	CO4
10	Describe working principle of fuel cell with neat sketch and draw the performance characteristics of hydrogen-oxygen fuel cell. (13)	**BTL-6**	Create	CO4
11	Describe the different methods of energy storage system. (13)	**BTL-2**	Understand	CO4
12	Explain the necessity of energy storage in renewable power harnessing. Give the diagram and explain the operation of a pumped energy storage system. (13)	**BTL-4**	Analyze	CO4
13	Define hybrid system? Discuss the need for hybrid system, its range and its types. (13)	**BTL-1**	Remember	CO4
14	With the help of neat diagram, explain the working of geo thermal-preheat hybrid. (13)	**BTL-4**	Analyze	CO4
15	List three legal or planning issues that are important for the deployment of wave power devices.	**BTL-4**	Analyze	CO4
16	What are the basic differences between tidal-range power plant and tidal-current power plant?	**BTL-1**	Remember	CO4
17	What types of engine can operate from geothermal energy? Explain how they function.	**BTL-4**	Analyze	CO4
Part-C				
1	Explain the ‘single-basin’ and ‘two-basin’ systems of tidal power harnessing. Further, discuss their advantages and limitations. (15)	**BTL-5**	Analyze	CO4

2	Discuss the principle of operation of a simple single-effect tidal power plant and give a graph of sequential operating modes. (15)	**BTL-6**	Create	CO4
3	Explain the essential features of a hydrogen–oxygen cell. Draw a suitable diagram of this ell and give the reactions took place at the electrodes. (15) (15)	**BTL-5**	Analyze	CO4
4	How will you illustrate the performance of a fuel all by the cell voltage V and electrode current density? Draw a V ideal, V actual and I curve. (15)	**BTL-6**	Create	CO4
5	If both tidal-current and tidal-range power plant are connected into a utility electricity network, is the joint power more or less variable? Why? (15)	**BTL-6**	Create	CO4

Course Outcome

- Ability to create awareness about renewable Energy Sources and technologies.
- Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.
- Ability to recognize current and possible future role of renewable energy sources.
- Ability to explain the various renewable energy resources and technologies and their applications.
- Ability to understand basics about biomass energy.
- Ability to acquire knowledge about solar energy.