SRM VALLIAMMAI ENGINEERING COLLEGE

(An autonomous Institution)

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DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

1905712-RENEWABLE ENERGY SYSTEMS

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SUBJECT: 1905712 - RENEWABLE ENERGY SYSTEMS

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UNIT I –INTRODUCTION		
SYLLABUS: Environmental aspects o f electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.		
PART – A		
Q.No	**Questions**	**BT Level**	**Competence**

Q.No	Questions	BT Level	Competence
1.	Give any two environmental aspects of electric energy conversion.	BTL-2	Understanding
2.	Discuss about GHG emission? List the factors influencing the amount of GHG emissions.	BTL-1	Remembering
3.	List various renewable energy resources.	BTL-1	Remembering
4.	Explain the principle of power generation using tides.	BTL-3	Applying
5.	Discuss how to use hydrogen energy to generate electric power.	BTL-2	Understanding
6.	Mention some types of fuel used in biomass plant.	BTL-1	Remembering
7.	Summarize the factors influencing solar power extraction.	BTL-5	Evaluating
8.	Identify the limitation of solar power.	BTL-1	Remembering
9.	Explain about NOCT and STC of a solar cell.	BTL-4	Analyzing
10.	Discuss about fuel cell and mention its specification.	BTL-2	Understanding
11.	Justify how fuel cell becomes renewable	BTL-3	Applying

	energy source.		
12.	Classify the types of fuel cell.	BTL-3	Applying
13.	Write the principle of operation of wind turbine.	BTL-4	Analyzing
14.	Explain how to assess the wind energy pattern for a particular Location.	BTL-4	Analyzing
15.	List the wind turbine used for domestic application.	BTL-1	Remembering
16.	Formulate the current equation of solar array.	BTL-6	Creating
17.	Define specific rated capacity of wind turbine.	BTL-6	Creating
18.	List the factors involved in biomass conversion.	BTL-1	Remembering
19.	State the merits of renewable energy source.	BTL-2	Understanding
20.	Mention some of the organic materials used in bio-mass plant.	BTL-5	Evaluating
21.	Discuss about shadow flickering.	BTL-2	Understanding
22.	Write about NER.	BTL-3	Applying
23.	Mention about pollutants during geothermal energy conversion.	BTL-1	Remembering
24.	Write in detail about land usage in geo thermal energy.	BTL-4	Analyzing
PART –B			
1.	(i). Discuss the impact of renewable energy generation on environment. (8)	BTL-2	Understanding
	(ii). What is Hydrogen energy? Explain the operation of hydrogen energy system with schematic diagram. (5)	BTL-2	Understanding
2.	Discuss the qualitative study of different renewable energy Resources.	BTL-2	Understanding
3.	Describe various biomass energy conversion	BTL-1	Remembering

	techniques.		
4.	How does environment get affected by the use of the renewable Energy?	BTL-2	Understanding
5.	Explain the working principle of various types of concentrating solar collectors with neat sketch.	BTL-4	Analyzing
6.	Describe the principle of generation of Bio gas and mention the factors affecting its generation.	BTL-1	Remembering
7.	Describe the operation and control strategy of solar power conversion systems.	BTL-1	Remembering
8.	Illustrate the design and principle of operation of general Fuel cell and Fossil Fuel cell.	BTL-6	Creating
9.	(i). Show the different types of ocean thermal energy conversion power plants? (8)	BTL-3	Applying
	(ii). Illustrate in detail the Anderson OTEC cycle. (5)	BTL-3	Applying
10.	List out the available renewable energy sources. Explain how solar and wind energy sources plays significant role of electric power generation.	BTL-5	Evaluating
11.	Explain the following with neat schematic. (i)Biomass energy system. (8) (ii)Energy from the Ocean. (5)	BTL-4	Analyzing
12.	Explain the construction, working and different characteristics of solar array in detail.	BTL-4	Analyzing
13.	Discuss the impact of following renewable energy generation on environment. (i)Ocean energy. (7) (ii)Wind energy system. (6)	BTL-3	Applying

14.	What is a fuel cell? Mention the different types of fuel cell and explain any three of them in detail with neat diagrams.	BTL-1	Remembering
15.	Describe in detail about geothermal energy systems and its impacts on environment.	BTL-1	Remembering
16.	Explain about environmental impacts of tidal and hydrogen-based energy systems.	BTL-4	Analyzing
17.	Illustrate on hybrid energy systems.	BTL-3	Applying
PART C			
1.	Enumerate the availability of renewable energy sources in India.	BTL-5	Evaluating
2.	Explain the power generation cycle of a Tidal power.	BTL-4	Analyzing
3.	Discuss the influence of different renewable energy sources with special reference to the global warming and climate change context.	BTL-6	Creating
4.	Analyze the difficulties encountered in commercializing the renewable energy sources.	BTL-4	Analyzing
5.	Compare the land facility used by renewable energy and non-renewable for per unit generation of energy.	BTL-3	Applying

UNIT II - ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION			
SYLLABUS: Reference theory fundamentals-principle of operation and analysis: IG, PMSG.			
PART – A			
Q.No	Questions	BT Level	Competence
1.	Define reference theory and write its significance.	BTL-1	Remembering
2.	Show the merits of squirrel cage induction generators for wind energy conversion.	BTL-3	Applying

3.	Define Clarke transformation.	BTL-1	Remembering
4.	Define Park transformation.	BTL-1	Remembering
5.	Name any four types of generators used in wind energy conversion systems.	BTL-2	Understanding
6.	Why are induction generators preferred over dc generators in WECS, Justify?	BTL-5	Evaluating
7.	Give the advantages of IG used in WECS.	BTL-2	Understanding
8.	Label the slip-torque characteristics of PMSG.	BTL-1	Remembering
9.	Illustrate the principle of SCIG.	BTL-3	Applying
10.	Show the merits of DFIG for WECS.	BTL-3	Applying
11.	Express the steady state equation of a PMSG.	BTL-2	Understanding
12.	Explain briefly, the rotor construction of DFIG.	BTL-4	Analyzing
13.	Compose the characteristics of DFIG.	BTL-6	Creating
14.	Differentiate between SCIG and DFIG.	BTL-4	Analyzing
15.	Draw the Speed-torque curve of induction generator.	BTL-1	Remembering
16.	Draw the angular relationship of abc and dq winding in an induction generator.	BTL-2	Understanding
17.	What are the advantages of permanent magnet synchronous generator?	BTL-4	Analyzing
18.	What is doubly fed induction generator?	BTL-5	Evaluating
19.	List the merits of synchronous generator-based wind energy conversion system.	BTL-1	Remembering
20.	Draw the equivalent circuit model of a PMSG.	BTL-6	Creating
21.	Illustrate on slip importance in induction generator.	BTL-3	Applying
22.	Define sub-synchronous mode in IG.	BTL-1	Remembering

23.	Give out torque equation of induction generator.	BTL-2	Understanding
24.	Examine about space vector modulation in IG.	BTL-4	Analyzing
PART –B			
1.	Describe the following (i).Clarks Transformation. (7) (ii).Parks Transformation. (6)	BTL-1	Remembering
2.	(i). Explain construction, principle of working and characteristics of IG with neat sketches. (8) (ii). Analyze the merits and demerits of the above. (5)	BTL-4 BTL-4	Analyzing Analyzing
3.	(i). Explain with a neat diagram the operation of an induction generator. (8) (ii). Compose the merits and demerits of mains excited and capacitor excited induction-generator. (5)	BTL-4 BTL-6	Analyzing Creating
4.	Draw the equivalent circuit and show the steady state analysis of Permanent magnet Synchronous Generator (PMSG). Explain the merits and demerits of PMSG for wind energy conversion systems. (13)	BTL-2	Understanding
5.	Explain the analysis of Induction Generator used for Wind Energy Conversion System. (13)	BTL-4	Analyzing
6.	Discuss the working and operation of PMSG with neat diagram. (13)	BTL-2	Understanding
7.	Illustrate the working and principle of grid connected PMSG in wind power plant. (13)	BTL-5	Evaluating

8.	Draw and describe the characteristics of DFIG. (13)	BTL-2	Understanding
9.	(i). Explain the operating principle of squirrel cage Induction Generator coupled with wind turbine. (7)	BTL-3	Applying
	(ii). Show the relative merits of wind energy conversion system with Permanent Magnet Synchronous Generator (PMSG) and IG. (6)	BTL-3	Applying
10.	(i). Discuss the principle and construction of SCIG. (8)	BTL-2	Understanding
	(ii) Discuss the operation of SCIG in details with proper analysis. (5)	BTL-2	Understanding
11.	Discuss about DFIG based energy conversion system. (13)	BTL-2	Understanding
12.	Describe the principle of operation of DFIG with neat diagram used for renewable energy conversion. (13)	BTL-1	Remembering
13.	(i). Compose briefly construction, principle of working of SCIG with neat sketches. (7)	BTL-6	Creating
	(ii). Draw and explain the characteristics of SCIG. (6)	BTL-4	Analyzing
14.	Explain the construction and working of PMSG and analyze the system using steady state equation with phasor diagram. (13)	BTL-1	Remembering
15.	Discuss speed versus torque and torque versus speed characteristics of induction generator. (13)	BTL-2	Understanding
16.	Explain in detail about modelling of induction generator. (13)	BTL-3	Applying
17.	Draw and describe about equivalent circuit of induction generator. (13)	BTL-2	Understanding

PART C			
1.	Demonstrate the self-excited induction generator with external capacitor. (15)	BTL-6	Creating
2.	Design the modeling of permanent magnet synchronous generator. (15)	BTL-6	Creating
3.	Illustrate the Dynamic d-q equivalent circuit of DFIG. (15)	BTL-5	Evaluating
4.	Compose the equivalent electrical circuit of induction machine for performance calculations. (15)	BTL-4	Evaluating
5.	Sketch scalar control scheme of induction generator. (15)	BTL-5	Evaluating

UNIT III - POWER CONVERTERS			
SYLLABUS: Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers.			
PART – A			
Q.No	Questions	BT Level	Competence
1.	Label the block diagram of solar photovoltaic system.	BTL-1	Remembering
2.	Explain inversion mode of operation of line commutated inverter.	BTL-4	Analyzing
3.	List the advantages of dc link inverters.	BTL-1	Remembering
4.	Generalize the significance of buck boost converter.	BTL-6	Creating
5.	Draw the I-V and P-V characteristics of solar cell.	BTL-2	Understanding
6.	What is the function of boost converter in	BTL-2	Understanding

	solar photovoltaic system?		
7.	Explain the various aspects of battery sizing	BTL-4	Analyzing
8.	Define array sizing.	BTL-1	Remembering
9.	Identify the factors to be considered for the selection of inverter and batteries for solar energy conversion.	BTL-1	Remembering
10.	Identify limitations of AC voltage controller.	BTL-1	Remembering
11.	Mention the factors considered in the selection of inverter and battery sizing.	BTL-3	Applying
12.	Explain grid interactive inverter.	BTL-5	Evaluating
13.	Explain matrix converters. Compose its merits.	BTL-6	Creating
14.	Show the limitations in the operation of matrix converter.	BTL-3	Applying
15.	Explain where are matrix converters can be used.	BTL-4	Analyzing
16.	What is the need for DC-DC converter in solar power system?	BTL-2	Understanding
17.	Give the schematic diagram of boost converter.	BTL-3	Applying
18.	Mention about SOC and its methods.	BTL-4	Analyzing
19.	Specify about power conversion ratio.	BTL-2	Understanding
20.	What is the function of boost converter in solar photovoltaic system?	BTL-1	Remembering
21.	Define stand-alone systems.	BTL-1	Remembering
22.	Illustrate on line commutated converter.	BTL-3	Applying
23.	Explain continuous conduction mode in converters.	BTL-4	Analyzing
24.	Discuss control scheme in inverter.	BTL-2	Understanding
PART –B			

1.	Draw the block diagram of the solar PV system and describe the principle of operation in detail. (13)	BTL-1	Remembering
2.	Draw the schematic diagram of standalone solar photovoltaic system. What are the main components used in it? Explain their functions. (13)	BTL-6	Creating
3.	(i).Explain with neat diagram the philosophy of operation of a solar source fed boost converter. (8)	BTL-4	Analyzing
	(ii). Point out the delicacies involved in sizing the solar arrays. (5)	BTL-4	Analyzing
4.	Draw the schematic diagram of Buck-Boost converter and explain the operation in detail. (13)	BTL-5	Evaluating
5.	Describe in detail about non isolated PV power conditioning system. (13)	BTL-2	Understanding
6.	Interpret double diode configuration for PV cell. (13)	BTL-3	Applying
7.	Describe the following in detail: (i). AC voltage controller. (8) (ii). Voltage control in PWM inverters. (5)	BTL-2	Understanding
8.	(i). Explain the working of AC-DC-AC converter with circuit and wave form for wind energy conversion. (6)	BTL-4	Analyzing
	(ii). Analyze the principle of working of buck-boost converter with time ratio and current limit control. Draw the circuit and necessary waveforms. (7)	BTL-4	Analyzing
9.	Discuss the following (i). Selection of inverters. (6) (ii). Battery sizing and Array sizing. (7)	BTL-2	Understanding

10.	(i). Discuss the three phase uncontrolled rectifiers in details. (8)	BTL-2	Understanding
	(ii). Give short notes on inverters. (5)	BTL-2	Understanding
11.	(i). Describe the principle and operation of line commutated converters in inverse mode. (8) (ii). Describe principle of operation of PWM inverter and describe how it is used for wind energy conversion. (5)	BTL-1	Remembering
12.	Draw the power circuit of grid interactive inverters and explain its operation in detail. (13)	BTL-1	Remembering
13.	Illustrate the working and operation of a matrix converter with a neat diagram and explain its limitations. (13)	BTL-3	Applying
14.	Explain the different modes of operation of PV fed Buck-Boost converter in detail. (13)	BTL-1	Remembering
15.	Illustrate with a neat diagram, a power electronic circuit to interface wind electrical system to the grid. (13)	BTL-3	Applying
16.	Describe any two power conditioning schemes used in photovoltaic systems. (13)	BTL-4	Analyzing
17.	Discuss on line commutated inverter in detail. (13)	BTL-2	Understanding
PART-C			
1.	Design a suitable grid interactive inverter for distributed generation system. (15)	BTL-6	Creating
2.	A DC-DC converter has an input voltage of 200V and a load of 20 ohm resistance. When converter is on, its voltage drop is 1.5V and the chopping frequency is 10 KHz. If the duty cycle is 80%, find (i) average	BTL-6	Creating

	output voltage (ii) RMS output voltage, and (iii) chopper on time. (15)		
3.	A single phase fully controlled convener is used for obtaining a regulated D.C output voltage. The RMS value of the A.C input voltage is 230 V, and the firing angle is maintained at 60° so that the load current is 4A. (i) Calculate D.C output voltage and active and reactive power input. (ii) Calculate the above quantities if a freewheeling diode are used at the output. The firing angle is maintained at 60° assuming the same load with resistance. (15)	BTL-5	Evaluating
4.	Design and implement a suitable converter for a 20 kW wind turbine generator. The converter should consists of a phase controlled rectifier and a DC/DC boost converter. Assume suitable data and components necessary for design and implementation. (15)	BTL-5	Evaluating
5.	Discuss the Sizing of Photovoltaic System. (15)	BTL-5	Evaluating

UNIT IV - ANALYSIS OF WIND AND PV SYSTEMS			
SYLLABUS: Standalone operation of fixed and variable speed wind energy conversion systems and solar system- Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system.			
PART – A			
Q.No	Questions	BT Level	Competence
1.	Label the basic block diagram of WECS.	BTL-1	Remembering
2.	Illustrate about slip concept used in wind energy conversion system.	BTL-3	Applying

3.	Why pitch angle control is used for WECS? Justify.	BTL-5	Evaluating
4.	Discuss stand-alone operation of fixed speed WECS? State its advantages.	BTL-2	Understanding
5.	Distinguish between fixed speed and variable speed wind energy conversion system.	BTL-2	Understanding
6.	Discuss some of the standards used for grid integration.	BTL-2	Understanding
7.	List few grid connection requirement of renewable power System.	BTL-1	Remembering
8.	Show how the power quality issues that affect wind power integration.	BTL-3	Applying
9.	What are the major problems associated with grid interconnections of WECS.	BTL-4	Analyzing
10.	Mention some of the issues in stand- alone solar system.	BTL-1	Remembering
11.	Point out the issues created in grid integrated PMSG based WECS.	BTL-4	Analyzing
12.	Show the schematic diagram of grid integrated SCIG based WECS.	BTL-3	Applying
13.	Define grid integrated solar system.	BTL-1	Remembering
14.	Point out the problems in grid integrated solar system.	BTL-4	Analyzing
15.	Classify the types of WECS based on the rotational speed of turbines.	BTL-6	Creating
16.	What are the advantages of variable speed wind turbine conversion system?	BTL-2	Understanding
17.	What are the classifications in wind energy conversion system based on electrical power output?	BTL-4	Analyzing
18.	List out the problems involved in grid connection.	BTL-1	Remembering
19.	List out the functions of a charge controller in PV system.	BTL-1	Remembering

20.	Why solar tracking / orientation is needed in concentrating type of solar collectors?	BTL-3	Applying
21.	Give the structure of solar energy conversion system	BTL-1	Remembering
22.	What is limited variable speed WECS	BTL-1	Remembering
23.	Discuss the use of battery storage system in standalone WECS	BTL-2	Understanding
24.	Name the types of charge controller used in PV system	BTL-2	Understanding
PART –B			
1.	Draw the general structure of variable speed wind energy conversion for standalone system. Explain the functions of components used. Mention the merits and demerits of variable speed wind energy conversion. (13)	BTL-1	Remembering
2.	Explain stand-alone operation of fixed and variable speed solar energy. (13)	BTL-4	Analyzing
3.	Give a short notes on (i). Grid integrated PMSG (8) (ii). SCIG based WECS (5)	BTL-2	Understanding
4.	Explain the standalone operation of (i). Fixed speed wind energy conversion system. (5) (ii). Variable speed wind energy conversion system. (5) (iii). State the advantages of fixed speed system over Variable speed systems. (3)	BTL-5	Evaluate
5.	Show the various grid connected issues and its impact on system stability. (13)	BTL-3	Applying
6.	Explain the operation of solar model in grid integrated system with and without battery backup. (13)	BTL-4	Analyzing
7.	Write a brief note on stand – alone operation of fixed and fully variable speed	BTL-4	Analyzing

	WECS. (13)		
8.	Discuss the need for Grid integrated of wind energy system? With power electronic interface circuit, explain how grid integration is done for Permanent Magnet Synchronous Generator (PMSG) based wind energy conversion system. (13)	BTL-2	Understanding
9.	Describe about SCIG based WECS. (13)	BTL-1	Remembering
10.	Describe standalone operation of solar energy conversion system. (13)	BTL-1	Remembering
11.	Discuss in detail the grid system characteristics and explain with a neat diagram the standalone and grid integrated solar system. (13)	BTL-2	Understanding
12.	Explain about grid integrated PMSG based WECS. (13)	BTL-4	Analyzing
13.	Explain the operation of fixed speed and semi variable mode of wind energy conversion system with neat sketch (13)	BTL-1	Remembering
14.	(i). Discuss the factors that affects the output of the PV System.(7) (ii). Compare standalone system and grid connected system with respect to operation issues (6)	BTL-6	Creating
15.	Explain the stand alone operation of fixed speed wind energy conversion system (13)	BTL-1	Remembering
16.	Explain the Components of Wind Turbine (13)	BTL-1	Remembering
17.	Explain the operation of variable speed wind energy conversion system with neat diagram (13)	BTL-1	Remembering
PART- C			
1.	Explain the design of controller for a DFIG based WECS. (15)	BTL-6	Creating
2.	Explain in detail about grid integrated solar system. (15)	BTL-4	Analyzing

3.	Specify the IEEE standards for grid connection of WECS. (15)	BTL-5	Evaluate
4.	Explain the grid related problems in wind farms and refer the performance improvements of generator controls. (15)	BTL-5	Evaluate
5.	Explain the Grid integration PV and Wind Energy Systems (15)	BTL-5	Evaluate

UNIT V - HYBRID RENEWABLE ENERGY SYSTEMS			
SYLLABUS: Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).			
PART - A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	Define hybrid systems.	BTL-1	Remembering
2.	Compose the need for hybrid energy systems.	BTL-6	Creating
3.	Explain the range of hybrid systems.	BTL-4	Analyzing
4.	Summarize the advantage of the hybrid energy Systems.	BTL-5	Evaluating
5.	List out some of the hybrid systems used in industries.	BTL-1	Remembering
6.	Classify the types of hybrid system.	BTL-4	Analyzing
7.	Point out the merits of wind-diesel hybrid system.	BTL-4	Analyzing
8.	Label the schematic diagram of PV-Diesel hybrid system.	BTL-1	Remembering
9.	Show the advantages of PV-Diesel hybrid system.	BTL-3	Applying
10.	Define charge controller used for wind energy conversion system.	BTL-1	Remembering
11.	Explain MPPT.	BTL-5	Evaluating
12.	Show the need for maximum power point tracking.	BTL-3	Applying
13.	What will happen if no load is connected to a solar PV system?	BTL-6	Creating

14.	List the merits of Hybrid RES over the isolated RES.	BTL-1	Remembering
15.	Define smart power tracker.	BTL-2	Understanding
16.	Label the schematic diagram of grid interactive solar PV system.	BTL-1	Remembering
17.	Summarize the importance of MPPT in the operation of a photovoltaic system.	BTL-2	Understanding
18.	Discuss the major features of hybrid system.	BTL-2	Understanding
19.	Classify the types of pumps used for solar water pumping Applications.	BTL-3	Applying
20.	What is MPPT in PV system?	BTL-2	Understanding
21.	Write the concept of MPPT	BTL-1	Remembering
22.	List out the need for hybrid renewable energy systems	BTL-1	Remembering
23.	List the advantages of PV diesel energy systems	BTL-2	Understanding
24.	What are the characteristics of Distributed energy systems	BTL-2	Understanding
PART –B			
1.	Explain the hybrid energy conversion system with neat sketch. (13)	BTL-4	Analyzing
2.	Explain MPPT techniques for WECS. (13)	BTL-4	Analyzing
3.	(i). Summarize the importance of MPPT in the operation of photovoltaic system. (8) (ii). Explain various strategies used for the operation of an MPPT. (5)	BTL-5 BTL-5	Evaluating Evaluating
4.	Discuss different hybrid systems configurations consisting of wind turbine and solar power plant. (13)	BTL-1	Remembering
5.	Show the power electronic system used for hybrid solar photovoltaic and wind energy system and explain its operation. Discuss the technical challenges associated in it. (13)	BTL-3	Applying

6.	Discuss and classify the working of MPPT in a solar PV system. (13)	BTL-2	Understanding
7.	Discuss with case study how to get maximum power generation in wind energy conversion system. (13)	BTL-2	Understanding
8.	Show with case study how to get maximum power generation in solar energy conversion system. (13)	BTL-3	Applying
9.	With a neat sketch, describe the operation of PV-Diesel hybrid System. (13)	BTL-1	Remembering
10.	Draw and describe the operation of Wind-PV hybrid system. (13)	BTL-1	Remembering
11.	What is called Maximum Power Point Tracking (MPPT)? List out the different types of MPPT algorithm used for solar photovoltaic system with its salient features. Explain the use of MPPT for hybrid wind and photovoltaic energy system. (13)	BTL-1	Remembering
12.	Explain the factors to be considered for placing the wind PV system. Discuss its plant details, operating period and environmental aspects for assumed residential load. (13)	BTL-6	Creating
13.	List the different types of MPPT algorithm. Explain the Incremental conductance MPPT algorithm with a neat flow chart. (13)	BTL-4	Analyzing
14.	Describe the importance of hybrid renewable energy systems with neat sketch (13)	BTL-1	Remembering
15.	Define hybrid system? Discuss the need for hybrid system and its range and type. (13)	BTL-2	Understanding
16.	Explain the configuration switched hybrid energy systems with neat sketch (13)	BTL-2	Understanding

17.	Explain the role of MPPT technique used for PV power generation System. (13)	BTL-4	Analyzing
PART – C			
1.	Design solar PV pump and clearly explain the accessories required. Also justify the importance of implementing MPPT for the pump system. (15)	BTL-6	Creating
2.	Illustrate the economic aspects of hybrid energy systems. (15)	BTL-5	Evaluating
3.	Summarize the Micro hydro – PV hybrid system. (15)	BTL-5	Evaluating
4.	Illustrate the types of PV-Diesel Hybrid Systems. (15)	BTL-6	Creating
5.	Design the MPPT Controller for PV System. (15)	BTL-6	Creating