SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRONICS & INSTRUMENTATION ENGINEERING

QUESTION BANK

III SEMESTER M.E (Control and Instrumentation)
1913310 RENEWABLE ENERGY SYSTEMS

Regulation – 2019

Academic Year 2020 – 2021 (ODD)

Prepared by

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SEM / YEAR: III / II M.E (C&I)

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UNIT I - SOLAR ENERGY				
Solar energy – The Sun – Production and transfer of solar energy- - Solar radiation at the earth's surface – Sun-Earth angles – Availability and limitations of solar energy – Measuring techniques and estimation of solar radiation – Solar thermal collectors General description and characteristics – Flat plate collectors solar thermal applications - heating, cooling, desalination, drying, cooking, etc – solar thermal electric power plant - principle of photovoltaic conversion of solar energy, types of solar cells - Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping etc - solar PV power plant – Net metering concept.				
PART-A				
Q.No	Questions	BT Level	Competence	COs
1	List out the Components of radiation	BTL-1	Remembering	CO1
2	Evaluate the Techniques to measure various components of solar radiation	BTL-5	Evaluating	CO1
3	Infer the definition of daily insolation H	BTL-4	Analysing	CO1
4	Summarize the factors causing seasonal variation in daily insolation	BTL-1	Remembering	CO1
5	For the collector surface define :Slope , Surface azimuth angle	BTL-2	Understanding	CO1
6	Evaluate the Effects of the Earth's atmosphere on solar energy	BTL-5	Evaluating	CO1
7	list the commonest instruments used for measuring solar radiation	BTL-3	Applying	CO1
8	Analyse the need of Estimation of solar radiation.	BTL-1	Remembering	CO1
9	State the principle of Estimation of solar radiation using satellites.	BTL-6	Creating	CO1
10	Define collector efficiency.	BTL-1	Remembering	CO2
11	Evaluate how Efficiency of flat plate collector at high temperatures, can be improved?	BTL-1	Remembering	CO2
12	Differentiate active and passive solar energy systems	BTL-4	Analysing	CO2
13	List out the features of different arrangements of solar water heaters.	BTL-2	Understanding	CO2

14	Draw the physical diagram and circuit analogue of black bag solar water heater.	BTL-5	Evaluating	CO3
15	Analyse the features of improved solar heaters.	BTL-4	Analysing	CO3
16	What is meant by absorption refrigerator?	BTL-2	Understanding	CO3
17	How solar energy is applied to get energy efficient buildings?	BTL-3	Applying	CO3
18	Comment on the application of solar energy in water desalination	BTL-1	Remembering	CO3
19	Draw the basic structure of PN junction solar cell and give the materials used for the construction.	BTL-6	Creating	CO3
20	List out various losses that account for reduction of efficiency in solar cells.	BTL-2	Understanding	CO3
	PART-B			
1	Explain the contrast between renewable and finite energy supplies. (13)	BTL-1	Remembering	CO1
2	(i) Explain the spectral distribution of solar radiation (7) (ii) Discuss on components of solar radiation. (6)	BTL-6	Creating	CO1
3	Discuss about the geometry of collector and the solar beam and derive for angle of incidence. (13)	BTL-2	Understanding	CO1
4	Describe the need and measurement principles of solar radiation. (13)	BTL-2	Understanding	CO1
5	Analyse the effects of earth's atmosphere on solar radiation. (13)	BTL-4	Analysing	CO1
6	Discuss and derive for the equation for output power of collector. (13)	BTL-1	Remembering	CO1
7	Evaluate the principles of various improved solar water heaters. (13)	BTL-5	Evaluating	CO1
8	Analyse the functions of Active and passive systems of solar water heaters. (13)	BTL-4	Analysing	CO1
9	Discuss the role of air heaters and brief about energy efficient buildings (13)	BTL-1	Remembering	CO1
10	(i) Write short notes on space cooling (7) (ii) Describe about water desalination using solar energy. (6)	BTL-1	Remembering	CO1
11	Discuss the construction and working of solar cells. (13)	BTL-3	Applying	CO1
12	Discuss the losses that affect efficiency in solar cell and suggest methods to improve it. (13)	BTL-1	Remembering	CO1
13	Describe the following applications of solar PV cell (i) Water pumping (7) (ii) Lighting (6)	BTL-3	Applying	CO1

14	Elaborate the use of solar energy in (i) Drying (7) (ii) Cooking (6)	BTL-2	Understanding	CO1
	PART-C			
1	Evaluate the functions and features of pyranometer in the field of solar radiation measurement. (15)	BTL-5	Evaluating	CO1
2	Calculate the temperature rise of the water in a 100 litre capacity thermosyphon solar water heating system during a typical day of operation. Estimate also the electricity saved because of the use of a solar water heater and the corresponding reduction in the monthly electricity bill. Assumptions can be made suitably. (15)	BTL-6	Creating	CO2
3	Compose the observations and conclusions related to the need for alternatives in energy production. (15)	BTL-6	Creating	CO1
4	Evaluate the performance of various collectors and storage systems of solar energy. (15)	BTL-5	Evaluating	CO1

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SEM / YEAR: III / II M.E (C&I)

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UNIT II - Wind Energy
Nature of the wind – power in the wind – factors influencing wind – wind data and energy estimation - wind speed monitoring - wind resource assessment - Betz limit - site selection - Types of wind power conversion systems –wind energy conversion devices - classification, characteristics, applications – offshore wind energy - Hybrid systems - safety and environmental aspects – wind energy potential and installation in India - Repowering concept- Wind power plantdesign

PART-A

Q.No	Questions	BT Level	Competence	COs
1	Comment on the nature of wind in different terrains of earth.	BTL-1	Remembering	CO1
2	Evaluate the factors that determine the output from a wind energy converter.	BTL-5	Evaluating	CO1

3	Discover the terms involved in the equation of available wind power.	BTL-4	Analysing	CO1
4	Define the two types of forces acting on the blades.	BTL-1	Remembering	CO1
5	Summarize the factors which affect the nature of the wind.	BTL-2	Understanding	CO1
6	Assess some considerations for site selection of wind energy systems.	BTL-5	Evaluating	CO1
7	Identify the classifications of wind energy conversion systems.	BTL-3	Applying	CO1
8	Give the general Classification of wind turbine generators and compare.	BTL-1	Remembering	CO1
9	Compile the functions of control systems in wind turbine generators.	BTL-6	Creating	CO1
10	List out basic components of a wind electric system.	BTL-1	Remembering	CO2
11	What are the different types of schemes used for electric generation?	BTL-1	Remembering	CO2
12	Analyse the performances of wind machines in terms of power coefficient.	BTL-4	Analysing	CO2
13	Interpret the characteristics and advantages of savonious rotor	BTL-2	Understanding	CO2
14	Evaluate the significance of TSR.	BTL-5	Evaluating	CO3
15	Point out the meaning of hybrid system in wind energy systems.	BTL-4	Analysing	CO3
16	Define isovents, isodynes also comment on wind data related to India.	BTL-2	Understanding	CO3
17	Justify the need of energy storage in wind energy systems and give some methods.	BTL-3	Applying	CO3
18	What is meant by offshore wind energy?	BTL-1	Remembering	CO3
19	Formulate the principle of repowering.	BTL-6	Creating	CO3
20	Name some applications of wind energy apart from power generation.	BTL-2	Understanding	CO3
	PART-B			
1	(i) Explain about the nature of wind. (7) (ii) Write short notes on the power in the wind. (6)	BTL-1	Remembering	CO1
2	Derive the expression for the power developed due to the wind.	BTL-6	Creating	CO1
3	(i) Discuss the advantages and disadvantages of wind energy conversion systems. (7) (ii) Interpret the performance of wind machines. (6)	BTL-2	Understanding	CO1
4	Discuss about wind data and energy estimation. (13)	BTL-2	Understanding	CO1
5	Explain the working of vertical axis machines and give its merits and demerits. (13)	BTL-4	Analysing	CO1

6	Examine the working of horizontal axis type aerogenerators. (13)	BTL-1	Remembering	CO1
7	With neat sketch evaluate the working of a wind energy system(WECS) with main components. (13)	BTL-5	Evaluating	CO1
8	Analyse how are WEC systems are classified? and discuss in brief. (13)	BTL-4	Analysing	CO1
9	Describe the main considerations in selecting a site for wind generators. (13)	BTL-1	Remembering	CO1
10	i) Write short notes on safety systems of wind turbines. (7) ii) Discuss the effects of wind turbines on environment. (6)	BTL-1	Remembering	CO1
11	Illustrate different control schemes of wind generators.	BTL-3	Applying	CO1
12	Discuss in brief about the following. (i) savonius rotor (7) (ii) Darrius rotor (6)	BTL-1	Remembering	CO1
13	Illustrate the different schemes for wind electric generation. (13)	BTL-3	Applying	CO1
14	Describe different applications of wind energy, giving neat sketches. (13)	BTL-2	Understanding	CO1
	PART-C			
1	Evaluate the condition when maximum power can be obtained for horizontal axis wind turbine. (15)	BTL-5	Evaluating	CO1
2	Wind at 1 standard atmospheric pressure and 15^0C has velocity of 15 m/s calculate: (i) The total power density in the wind stream, (ii) The maximum obtainable power density, (iii) A reasonably obtainable power density , (iv) The total power, and (v) The torque and axial thrust. (5 X 3)	BTL-6	Creating	CO2
3	Compile the applications of wind energy and wind energy storage systems. (15)	BTL-6	Creating	CO1
4	Evaluate the advantages of vertical axis machines over horizontal type? Recommend a rotor for relatively low velocity wind. (15)	BTL-5	Evaluating	CO1

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UNIT III–BIO ENERGY				
Energy from biomass – Sources of biomass – Different species – Conversion of biomass into fuels – Energy through fermentation – Pyrolysis, gasification and combustion – Aerobic and anaerobic bio-conversion – Properties of biomass – Biogas plants – Types of plants – Design and operation – Properties and characteristics of biogas- alcohol production from biomass – bio diesel production – Urban waste to energy conversion - Biomass energy programme in India.				
PART-A				
Q.No	**Questions**	**BT Level**	**Competence**	**COs**
1	Define biomass and identify the biomass resources category.	BTL-1	Remembering	CO1
2	Compare the heat contents of various fuels.	BTL-5	Evaluating	CO1
3	Point out the benefits of energy plantation	BTL-4	Analysing	CO1
4	Name some of the species contribute for bio energy	BTL-1	Remembering	CO1
5	Identify various forms of bio conversion	BTL-2	Understanding	CO1
6	Assess the functions of fermentation	BTL-5	Evaluating	CO1
7	Discover what is meant by anaerobic digestion?	BTL-3	Applying	CO1
8	Define pyrolysis.	BTL-1	Remembering	CO1
9	Compile the differences between dry and wet processes	BTL-6	Creating	CO1
10	Examine the process of gasification	BTL-1	Remembering	CO2
11	Write the chemical equations which relates photosynthesis.	BTL-1	Remembering	CO2
12	Analyze the conditions which are necessary for photosynthesis.	BTL-4	Analysing	CO2
13	Summarize the factors which affect biodigestion.	BTL-2	Understanding	CO2
14	Assess what is meant by community biogas plant?	BTL-5	Evaluating	CO3
15	Classify types of biogas plants	BTL-4	Analysing	CO3
16	Give a list of materials used for biogas generation.	BTL-2	Understanding	CO3

17	Show how ethanol can be used as fuel?	BTL-3	Applying	CO3
18	List out some methods to produce ethanol	BTL-1	Remembering	CO3
19	Formulate the factors to be considered for site selection for biogas plant.	BTL-6	Creating	CO3
20	What is meant by biodiesel and mention about its production?	BTL-2	Understanding	CO3
	PART-B			
1	Describe in detail about bio mass conversion technologies. (13)	BTL-1	Remembering	CO1
2	(i) Write a short note on fermentation (7) (ii) Compile the processes involved in gasification.(6)	BTL-6	Creating	CO1
3	Describe the process photosynthesis and brief on necessary conditions for it. (13)	BTL-2	Understanding	CO1
4	Describe the constructional detail and working of KVIC digester. (13)	BTL-2	Understanding	CO1
5	Discriminate in detail about dry and wet processes of biomass conversion. (13)	BTL-4	Analysing	CO1
6	How are biogas plants Classified? Explain them briefly. (13)	BTL-1	Remembering	CO1
7	Evaluate the procedure of digester design. (13)	BTL-5	Evaluating	CO1
8	Analyse the techniques suggested for maintaining the biogas production. (13)	BTL-4	Analysing	CO1
9	(i) Describe how pyrolysis is helpful in bioenergy. (7) (ii) Sketch a small scale pyrolysis unit and brief its working. (6)	BTL-1	Remembering	CO1
10	Describe the process of ethanol from sugarcane. (13)	BTL-1	Remembering	CO1
11	Illustrate the concept of energy plantation and prepare a list of plants proposed for energy plantation. (13)	BTL-3	Applying	CO1
12	Examine the variety of applications of gasifier. (13)	BTL-1	Remembering	CO1
13	Discover various problems related to bio gas plants and prepare a report on starting a bio gas plant. (13)	BTL-3	Applying	CO1
14	Discuss about the following (i) Urban waste to energy conversion (7) (ii) Biomass energy programme in India (6)	BTL-2	Understanding	CO1
	PART-C			
1	Assess the performance of different types of biogas plants. (15)	BTL-5	Evaluating	CO1
2	The following data are given for a family biogas digester suitable for the output of five cows: the retention time is	BTL-6	Creating	CO2

	20 days, temperature 30^0C, dry matter consumed per day=2 Kg, biogas yield is 0.24 m^3 per Kg. the efficiency of burner is 60%, methane proportion is 0.8, Heat of combustion of methane = 28 MJ/ m^3 . Calculate (i) the volume of biogas digester, and (ii) the power available from the digester. (15)			
3	Modify the spark ignition(SI) engine to operate on biogas, Illustrate it with necessary sketches. (15)	BTL-6	Creating	CO2
4	Sketch the chart for describing all the possible energy conversion routes and products from biomass and summarize. (15)	BTL-5	Evaluating	CO1

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UNIT IV – OTHER TYPES OF ENERGY				
Ocean energy resources - principle of ocean thermal energy conversion (OTEC) - ocean thermal power plants - ocean wave energy conversion - tidal energy conversion – small hydro - geothermal energy - geothermal power plants – hydrogen production and storage - Fuel cell – principle of working - various types - construction and applications- Introduction to integrated energy systems				
PART-A				
Q.No	**Questions**	**BT Level**	**Competence**	**COs**
1	List out ocean sources of energy.	BTL-1	Remembering	CO1
2	Summarize the principle of OTEC.	BTL-5	Evaluating	CO1
3	Classify the main types of OTEC power plants.	BTL-4	Analysing	CO1
4	State what is meant by on shore OTEC and give requirements.	BTL-1	Remembering	CO1
5	Interpret the function of heat exchangers in OTEC.	BTL-2	Understanding	CO1

6	Compare open cycle and closed cycle system in OTEC.	BTL-5	Evaluating	CO1
7	Choose materials used for heat exchangers.	BTL-3	Applying	CO1
8	Examine the factors in site selection for OTEC.	BTL-1	Remembering	CO1
9	Compile the effects of biofouling.	BTL-6	Creating	CO1
10	Quote the features of Hybrid cycle.	BTL-1	Remembering	CO2
11	State the principle behind generation of energy from tides.	BTL-1	Remembering	CO2
12	Analyse some points about tidal phenomenon.	BTL-4	Analysing	CO2
13	Identify the components required for tidal power plants.	BTL-2	Understanding	CO2
14	Evaluate the limitations of tidal power generation.	BTL-5	Evaluating	CO3
15	Define and classify fuel cells.	BTL-4	Analysing	CO3
16	List the five categories of geothermal resources.	BTL-2	Understanding	CO3
17	Discover the differences between vapour dominated system and liquid dominated system.	BTL-3	Applying	CO3
18	State some of the prime-movers used for geothermal Energy conversions.	BTL-1	Remembering	CO3
19	Formulate the principle of hydrogen as energy source.	BTL-6	Creating	CO3
20	Summarize the advantages and disadvantages of fuel cells.	BTL-2	Understanding	CO3
	PART-B			
1	Describe any two types of OTEC power plants with neat sketches. (13)	BTL-1	Remembering	CO1
2	Rewrite the working principle of closed cycle OTEC system, and compile its advantages over open cycle system. (13)	BTL-6	Creating	CO1
3	Explain with sketches the various methods of tidal power generation and give limitations of each. (13)	BTL-2	Understanding	CO1
4	(i) Explain the application of heat exchangers in OTEC. (7) (ii) Estimate the energy and power in a simple single basin tidal system. (6)	BTL-2	Understanding	CO2
5	Compare the working and features of single basin and double basin arrangements of tidal energy conversion. (13)	BTL-4	Analysing	CO1
6	(i) Write a short note on wave energy conversion machines. (7) (ii) Give the advantages and limitations of wave energy conversion. (6)	BTL-1	Remembering	CO1
7	Evaluate the different types of turbines are in use for small scale hydroelectric plants. (13)	BTL-5	Evaluating	CO2

8	Describe a binary cycle system for liquid dominated system and analyse the features over other systems. (13)	BTL-4	Analysing	CO1
9	(i) Give brief note on prospects of geothermal energy in context to India. (7) (ii) Brief about the applications of geothermal energy. (6)	BTL-1	Remembering	CO1
10	Explain in detail about hydrogen production and elaborate how it is used as energy source. (13)	BTL-1	Remembering	CO1
11	Illustrate various methods of hydrogen storage. (13)	BTL-3	Applying	CO1
12	Examine the features of different types of fuel cells. (13)	BTL-1	Remembering	CO1
13	Illustrate the design and working principle of fuel cell. (13)	BTL-3	Applying	CO1
14	(i) Write short notes on applications of fuel cell. (7) (ii) Discuss in brief about electrodes for fuel cell. (6)	BTL-2	Understanding	CO1
PART-C				
1	Summarize the role of main components of tidal power plants. (15)	BTL-5	Evaluating	CO1
2	A tidal power plant of simple single basin type, has a basin area of 30 x 10^6 m^2. The tide has a range of 12 m. The turbine, however, stops operating when the head on it falls below 3 m. Calculate the energy generated in one filling(or emptying) process, in kilowatt hours if the turbine generator efficiency is 0.73. (15)	BTL-6	Creating	CO2
3	Write the significances of various components of hydroelectric power generation schemes. (15)	BTL-6	Creating	CO1
4	Evaluate the working of different wave energy conversion machines. (15)	BTL-5	Evaluating	CO2

UNIT V – DIRECT CONVERSION OF THERMAL TOELECTRICALENERGY				
Conventional energy conversion cycles - Reversible and irreversible cycles – Thermodynamics analysis of Carnot – Stirling – Ericsson – Otto – Diesel – Dual – Lenoir – Atkinson – Brayton - Rankine.ThermoelectricConverters–Thermionicconverters–MHD–Ferroelectricconverter-Nernst effect generator				
PART-A				
Q.No	**Questions**	**BT Level**	**Competence**	**COs**
1	Define closed system, open system, isolated system and adiabatic system.	BTL-1	Remembering	CO3
2	Compare homogeneous and heterogeneous system and give examples.	BTL-5	Evaluating	CO3
3	Point out the conditions for thermodynamic equilibrium.	BTL-4	Analysing	CO3
4	Define enthalpy and entropy.	BTL-1	Remembering	CO3

5	Interpret the meaning of heat engine and reversed heat engine.	BTL-2	Understanding	CO3
6	Relate Stirling cycle and Carnot cycle.	BTL-5	Evaluating	CO3
7	Sketch and interpret the temperature –entropy diagram for steam.	BTL-3	Applying	CO3
8	Give the qualitative performance comparison of various thermodynamic cycles.	BTL-1	Remembering	CO3
9	Compile the meaning of open cycle system and closed cycle system of MHD generation.	BTL-6	Creating	CO3
10	State the advantages and limitations of MHD generation.	BTL-1	Remembering	CO3
11	Analyse how conductivity is rendered to the working fluid of MHD generator.	BTL-4	Analysing	CO3
12	What is the basic principle behind thermoelectric power generator? And state that.	BTL-1	Remembering	CO3
13	Analyse the factors which defines the maximum power generated in thermoelectric power generation.	BTL-4	Analysing	CO3
14	Estimate the usefulness of some of the materials used for thermoelectric conversion.	BTL-2	Understanding	CO3
16	Evaluate the merits of thermionic generators.	BTL-5	Evaluating	CO3
17	On what parameters do the output voltage and current depend in thermionic convertors?	BTL-2	Understanding	CO3
18	Discover the potential applications of thermionic convertors.	BTL-3	Applying	CO3
19	Define ferroelectric convertor and list some ferroelectric materials.	BTL-1	Remembering	CO3
20	Formulate the principle of Nernst effect generator.	BTL-6	Creating	CO3
	PART-B			
1	(i) Write short notes on different types of system in thermodynamics. (7) (ii) Describe joule's law. (6)	BTL-1	Remembering	CO3
2	(i) Formulate the first law and second law of thermodynamics and discuss the limitations of first law. (7) (ii) Discuss about the performance of heat engine and reversed heat engine. (6)	BTL-6	Creating	CO3
3	Explain Carnot cycle by giving its neat sketch of engine cycle. (13)	BTL-2	Understanding	CO3
4	Describe with relevant sketch the Rankine cycle, Also discuss about its efficiency improvement. (13)	BTL-2	Understanding	CO3
5	Analyze Brayton cycle of mechanical power generation by giving all the processes involved. (13)	BTL-4	Analysing	CO3
6	Evaluate the working of Stirling cycle and comment on the similarity with Carnot cycle. (13)	BTL-5	Evaluating	CO3

7	Analyze the principle of Magneto Hydro Dynamic(MHD) power generation. Derive expressions for maximum power generation per unit volume of generator. (13)	BTL-4	Analysing	CO3
8	With the help of schematic diagram, explain the operation of closed cycle MHD generating system. (13)	BTL-1	Remembering	CO3
9	Explain thermo electric power conversion principles. Derive expressions for maximum output power. (13)	BTL-1	Remembering	CO3
10	Discuss about the working of thermo electric power generator and brief about different elements used for that. (13)	BTL-1	Remembering	CO3
11	(i) Illustrate the principle of thermionic power conversion. (7) (ii) Discover the application possibilities of thermionic converters. (6)	BTL-3	Applying	CO3
12	Discuss in detail about materials for thermoelectric generation and its selection criteria. (13)	BTL-1	Remembering	CO3
13	Illustrate the working of ferroelectric convertor and analyse various ferroelectric materials. (13)	BTL-3	Applying	CO3
14	Describe the working of Nernst effect generator with necessary sketches and equation. (13)	BTL-2	Understanding	CO3
	PART-C			
1	Compare open cycle system and closed cycle system of MHD generation systems. (15)	BTL-5	Evaluating	CO3
2	(i) Calculate the open circuit voltage and maximum power output for nan MHD generator having the following data: (10 marks) Plate area =0.25m^2 Distance between the electrodes =0.50 m Flux density = 1.8 Wb/ m^2 Average gas velocity =1200m/s Gaseous conductivity =10 mho/m (ii) Compile the merits and demerits of MHD systems. (5 marks)	BTL-6	Creating	CO3
3	Prepare a case study on working of any four cycles of mechanical power generation and compare the performances. (15)	BTL-6	Creating	CO3
4	Evaluate the performance of thermoelectric and thermionic convertors and compare different materials used in that. (15)	BTL-5	Evaluating	CO3