SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur– 603203.

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

VII SEMESTER

PME305- RENEWABLE ENERGY TECHNOLOGIES

Regulation–2023

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Prepared by

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PME305- RENEWABLE ENERGY TECHNOLOGIES

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UNIT-I ENERGY SCENARIO

Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status- Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans. Give 25 two marks and 18 sixteen marks questions

PART-A (2 Marks)

Q.No.	Questions	BT Level	Competence
1.	Define energy scenario.	BT-1	Remembering
2.	What is meant by primary energy and secondary energy?	BT-2	Understanding
3.	List the major energy-consuming sectors in India.	BT-1	Remembering
4.	What are conventional energy sources?	BT-1	Remembering
5.	What are renewable energy sources?	BT-2	Understanding
6.	State any four conventional sources of energy used in India.	BT-1	Remembering
7.	Mention any four renewable energy resources available in India.	BT-2	Understanding
8.	What is meant by energy conservation?	BT-1	Remembering
9.	Define energy efficiency.	BT-1	Remembering
10.	What is meant by per capita energy consumption?	BT-1	Remembering
11.	State the importance of energy security.	BT-1	Remembering
12.	What are the major energy demands in the domestic sector?	BT-1	Remembering
13.	List the major energy requirements of the industrial sector.	BT-1	Remembering
14.	Mention the major energy applications in the agricultural sector.	BT-2	Understanding
15.	What are the major energy sources used in the transportation sector?	BT-2	Understanding
16.	What is the role of the commercial sector in energy	BT-2	Understanding

	consumption?		
17.	Define energy mix.	BT-1	Remembering
18.	What is meant by carbon footprint?	BT-1	Remembering
19.	Mention the advantages of renewable energy sources.	BT-1	Remembering
20.	List any four barriers to renewable energy development.	BT-1	Remembering
21.	What are the objectives of India's National Energy Policy?	BT-2	Understanding
22.	State the importance of solar energy in India.	BT-1	Remembering
23.	Mention the potential of wind energy in India.	BT-1	Remembering
24.	Compare conventional and renewable energy sources.	BT-1	Remembering
25.	What are India's future energy plans?	BT-1	Remembering

PART-B (16 Marks)

Q.No	Questions	Marks	BT Level	Competence
1	Explain the Indian energy scenario with respect to the domestic, industrial, commercial, agricultural, transportation, and other sectors.	16	BT-6	Creating
2	Discuss the present status of conventional energy resources in India, including coal, petroleum, natural gas, hydroelectric power, and nuclear energy.	16	BT-5	Evaluating
3	Explain the present status of renewable energy resources in India with suitable statistics and applications.	16	BT-3	Applying
4	Describe the potential of various renewable energy resources such as solar, wind, biomass, small hydro, geothermal, tidal, and ocean energy in India.	16	BT-2	Understanding
5	Discuss the global energy scenario and compare it with the Indian energy scenario.	16	BT-3	Applying
6	Explain the concept of per capita energy consumption. Compare India's per capita energy consumption with that of developed countries.	16	BT-5	Evaluating
7	Discuss India's future energy plans and strategies for achieving sustainable energy development.	16	BT-2	Understanding
8	Explain the energy consumption pattern in different sectors of the Indian economy with suitable charts and	16	BT-4	Analyzing

	statistics.			
9	Compare conventional and renewable energy resources based on availability, environmental impact, economics, and sustainability.	16	BT-4	Analyzing
10	Explain the importance of renewable energy in reducing greenhouse gas emissions and achieving sustainable development.	16	BT-2	Understanding
11	Discuss the challenges faced by India in meeting its growing energy demand and suggest suitable solutions.	16	BT-3	Applying
12	Explain the Government of India's initiatives and policies for promoting renewable energy development.	16	BT-5	Evaluating
13	Describe the role of renewable energy in ensuring energy security and environmental protection.	16	BT-2	Understanding
14	Discuss the energy demand projections of India and explain the measures required to meet future energy requirements.	16	BT-5	Evaluating
15	Explain the advantages, limitations, and future prospects of renewable energy resources in India.	16	BT-3	Applying
16	Describe the importance of energy conservation and energy efficiency in achieving sustainable development.	16	BT-6	Creating
17	Explain the contribution of different energy sources to India's total installed power generation capacity and discuss future trends.	16	BT-2	Understanding
18	Discuss the opportunities and challenges of India's transition from conventional energy to renewable energy, highlighting technological, economic, and environmental aspects.	16	BT-4	Analyzing

UNIT-II SOLAR ENERGY

Solar radiation – Measurements of solar radiation and sunshine – Solar spectrum - Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.

PART-A (2 Marks)

Q.No.	Questions	BT Level	Competence
1.	Define solar radiation.	BT-1	Remembering
2.	What is the solar constant?	BT-2	Understanding
3.	Define beam (direct) solar radiation.	BT-1	Remembering
4.	What is diffuse solar radiation?	BT-1	Remembering
5.	Define global solar radiation.	BT-2	Understanding
6.	What is air mass (AM)?	BT-1	Remembering
7.	What is meant by solar spectrum?	BT-2	Understanding
8.	List the different regions of the solar spectrum.	BT-1	Remembering
9.	What are the instruments used for measuring solar radiation?	BT-1	Remembering
10.	What is a pyranometer?	BT-2	Understanding
11.	What is a pyrheliometer?	BT-1	Remembering
12.	Define sunshine duration.	BT-2	Understanding
13.	What is a sunshine recorder?	BT-2	Understanding
14.	Define a solar thermal collector.	BT-2	Understanding
15.	What is a flat plate collector?	BT-2	Understanding
16.	What is a concentrating solar collector?	BT-2	Understanding
17.	State any two advantages of concentrating collectors.	BT-1	Remembering
18.	List any four applications of solar thermal energy.	BT-1	Remembering
19.	What is solar thermal energy storage?	BT-2	Understanding
20.	Differentiate between sensible heat storage and latent heat storage.	BT-1	Remembering
21.	Define the photovoltaic effect.	BT-1	Remembering
22.	What is a solar cell?	BT-1	Remembering
23.	Mention the materials commonly used for manufacturing solar cells.	BT-1	Remembering
24.	What are the main components of a Solar PV system?	BT-1	Remembering

25.	List any four applications of Solar PV systems.		BT-1	Remembering
Q.No	**PART-B (16 Marks) Questions**	**Marks**	**BT Level**	**Competence**
1	Explain the nature of solar radiation and discuss the different types of solar radiation reaching the Earth's surface.	16	BT-2	Understanding
2	Describe the methods of measuring solar radiation and sunshine duration with neat sketches of the instruments used.	16	BT-5	Evaluating
3	Explain the solar spectrum and discuss its significance in solar energy conversion.	16	BT-2	Understanding
4	Describe the construction, working principle, advantages, disadvantages, and applications of flat plate solar collectors.	16	BT-3	Applying
5	Explain the construction and working of concentrating solar collectors with suitable diagrams. Discuss their advantages and applications.	16	BT-3	Applying
6	Compare flat plate collectors and concentrating collectors with respect to construction, operating temperature, efficiency, cost, and applications.	16	BT-5	Evaluating
7	Explain various solar thermal applications such as water heating, space heating, solar cooking, drying, refrigeration, desalination, and power generation.	16	BT-2	Understanding
8	Discuss the different methods of solar thermal energy storage and explain sensible heat, latent heat, and thermochemical storage systems.	16	BT-2	Understanding
9	Explain the principle of photovoltaic conversion and discuss the photovoltaic effect in detail.	16	BT-3	Applying
10	Describe the construction, working principle, characteristics, and efficiency of a solar cell with neat sketches.	16	BT-4	Analyzing
11	Explain the construction and working of a Solar PV system. Discuss its major components and their functions.	16	BT-3	Applying

12	Discuss different types of Solar PV systems such as stand-alone, grid-connected, and hybrid systems with neat diagrams.	16	BT-4	Analyzing
13	Explain various applications of Solar PV systems in domestic, commercial, industrial, agricultural, and rural electrification sectors.	16	BT-2	Understanding
14	Compare solar thermal systems and solar photovoltaic systems based on principle, components, efficiency, applications, advantages, and limitations.	16	13	BT-4
15	Explain the factors affecting the performance and efficiency of solar cells.	16	BT-5	Evaluating
16	Discuss the recent developments and future scope of solar energy technologies in India.	16	BT-4	Analyzing
17	Explain the classification of solar collectors and discuss their performance characteristics and selection criteria for various applications.	16	BT-3	Applying
18	Discuss the advantages, limitations, environmental benefits, and economic aspects of solar energy systems.	16	BT-4	Analyzing

UNIT-III WIND ENERGY

Wind data and energy estimation – Betz limit - Site selection for windfarms – characteristics – Wind resource assessment - Horizontal axis wind turbine – components - Vertical axis wind turbine –Wind turbine generators and its performance – Hybrid systems – Environmental issues - Applications.

PART-A (2 Marks)

Q.No.	Questions	BT Level	Competence
1.	Define wind energy.	BT-1	Remembering
2.	What is meant by wind data?	BT-1	Remembering
3.	Define wind power density.	BT-2	Understanding
4.	State the factors affecting wind energy generation.	BT-2	Understanding
5.	What is wind resource assessment?	BT-1	Remembering
6.	Define Betz limit.	BT-1	Remembering
7.	State the value of Betz limit.	BT-1	Remembering
8.	Write the expression for power available in wind.	BT-1	Remembering
9.	What are the criteria for wind farm site selection?	BT-1	Remembering
10.	Define cut-in speed, rated speed, and cut-out speed of a wind turbine.	BT-2	Understanding
11.	What is a wind farm?	BT-1	Remembering
12.	List the major components of a Horizontal Axis Wind Turbine (HAWT).	BT-1	Remembering
13.	What is a Horizontal Axis Wind Turbine (HAWT)?	BT-1	Remembering
14.	What is a Vertical Axis Wind Turbine (VAWT)?	BT-1	Remembering
15.	Mention two advantages of HAWT.	BT-2	Understanding
16.	Mention two advantages of VAWT.	BT-2	Understanding
17.	Differentiate between HAWT and VAWT.	BT-1	Remembering
18.	What is the function of the nacelle in a wind turbine?	BT-1	Remembering
19.	What is the function of the gearbox in a wind turbine?	BT-2	Understanding

20.	List the types of wind turbine generators.	BT-1	Remembering
21.	Define capacity factor of a wind turbine.	BT-1	Remembering
22.	What is a hybrid renewable energy system?	BT-1	Remembering
23.	Mention any four environmental issues associated with wind energy.	BT-1	Remembering
24.	List four applications of wind energy.	BT-1	Remembering
25.	State the advantages of wind energy over conventional energy sources.	BT-1	Remembering

PART-B (16 Marks)

Q.No	Questions	Marks	BT Level	Competence
1	Explain the characteristics of wind and discuss the factors influencing wind energy generation.	16	BT-3	Applying
2	Describe the methods of wind data collection and explain wind energy estimation with suitable equations.	16	BT-5	Evaluating
3	Explain Betz's Law (Betz Limit) and derive the maximum power that can be extracted from wind.	16	BT-3	Applying
4	Discuss the criteria for selecting a suitable site for establishing a wind farm.	16	BT-6	Creating
5	Explain the methods of wind resource assessment and their importance in wind power projects.	16	BT-3	Applying
6	Describe the construction, working principle, components, advantages, disadvantages, and applications of a Horizontal Axis Wind Turbine (HAWT).	16	BT-3	Applying
7	Explain the construction and working of a Vertical Axis Wind Turbine (VAWT). Discuss its merits, demerits, and applications.	16	BT-2	Understanding
8	Compare Horizontal Axis Wind Turbines (HAWT) and Vertical Axis Wind Turbines (VAWT) with suitable diagrams.	16	BT-3	Applying

9	Explain the construction and working of wind turbine generators. Discuss different types of generators used in wind power plants.	16	BT-5	Evaluating
10	Discuss the performance characteristics of wind turbines. Explain the concepts of power curve, capacity factor, and efficiency.	16	BT-2	Understanding
11	Explain the different components of a wind turbine and describe the function of each component with a neat sketch.	16	BT-4	Analyzing
12	Discuss hybrid renewable energy systems involving wind energy. Explain their advantages, configurations, and applications.	16	BT-6	Creating
13	Explain the environmental impacts associated with wind energy projects and suggest suitable mitigation measures.	16	BT-3	Applying
14	Discuss the applications of wind energy in power generation, water pumping, battery charging, and standalone systems.	16	BT-2	Understanding
15	Explain the factors affecting the performance of wind turbines and discuss methods for improving their efficiency.	16	BT-2	Understanding
16	Discuss the current status, potential, challenges, and future prospects of wind energy development in India.	16	BT-2	Understanding
17	Explain the economic aspects of wind energy projects, including installation cost, maintenance, benefits, and limitations.	16	BT-2	Understanding
18	Describe the complete process of planning, designing, and operating a wind farm, including site assessment, turbine selection, layout, and performance evaluation.	16	BT-2	Understanding

UNIT-IV BIO-ENERGY

Bio resources – Biomass direct combustion – thermochemical conversion – biochemical conversion- mechanical conversion - Biomass gasifier - Types of biomass gasifiers – Cogeneration –- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol production - Applications.

PART-A (2 Marks)

Q.No.	Questions	BT Level	Competence
1.	Define biomass.	BT-1	Remembering
2.	What are bio-resources?	BT-2	Understanding
3.	List any four types of biomass resources.	BT-2	Understanding
4.	What is biomass energy?	BT-2	Understanding
5.	Define direct combustion of biomass.	BT-2	Understanding
6.	What is thermochemical conversion?	BT-1	Remembering
7.	What is biochemical conversion?	BT-1	Remembering
8.	What is mechanical conversion of biomass?	BT-1	Remembering
9.	Define gasification.	BT-1	Remembering
10.	What is a biomass gasifier?	BT-2	Understanding
11.	List the different types of biomass gasifiers.	BT-1	Remembering
12.	Define cogeneration.	BT-1	Remembering
13.	State any two advantages of cogeneration.	BT-2	Understanding
14.	What is carbonisation?	BT-2	Understanding
15.	Define pyrolysis.	BT-2	Understanding
16.	Differentiate between carbonisation and pyrolysis.	BT-2	Understanding
17.	What is biogas?	BT-1	Remembering
18.	List the major constituents of biogas.	BT-1	Remembering
19.	What is a biogas digester?	BT-1	Remembering
20.	Mention the different types of biogas plants.	BT-1	Remembering

21.	What is biodiesel?	BT-2	Understanding
22.	Name any four feedstocks used for biodiesel production.	BT-2	Understanding
23.	What is bioethanol?	BT-1	Remembering
24.	Mention any four feedstocks used for ethanol production.	BT-2	Understanding
25.	List any four applications of bioenergy.	BT-1	Remembering

PART-B (16 Marks)

Q.No	Questions	Marks	BT Level	Competence
1	Describe the direct combustion process of biomass. Discuss its advantages, disadvantages, and applications.	16	BT-3	Applying
2	Explain the different types of bio-resources and discuss their availability and energy potential.	16	BT-4	Analyzing
3	Explain the thermochemical conversion processes of biomass, including combustion, gasification, pyrolysis, and carbonisation.	16	BT-3	Applying
4	Discuss the biochemical conversion of biomass. Explain the processes of anaerobic digestion and fermentation with neat diagrams.	16	BT-6	Creating
5	Explain the mechanical conversion of biomass into useful fuels and discuss its applications.	16	BT-3	Applying
6	Describe the construction, working principle, advantages, disadvantages, and applications of a biomass gasifier.	16	BT-6	Creating
7	Explain the different types of biomass gasifiers with neat sketches. Compare their performance and applications.	16	BT-2	Understanding
8	Discuss the principle, advantages, limitations, and applications of cogeneration systems based on biomass.	16	BT-3	Applying
9	Explain the carbonisation process of biomass. Discuss the production, properties, and applications of charcoal.	16	BT-5	Evaluating

10	Describe the pyrolysis process of biomass and explain the products obtained, namely biochar, bio-oil, and syngas.	16	BT-4	Analyzing
11	Explain the construction and working of a biogas plant with a neat sketch.	16	BT-1	Remembering
12	Discuss the different types of biogas digesters. Compare floating drum and fixed dome biogas plants.	16	BT-5	Evaluating
13	Explain the process of biodiesel production by transesterification. Discuss the properties, advantages, and applications of biodiesel.	16	BT-2	Understanding
14	Explain the production of ethanol from biomass through fermentation. Discuss its advantages and industrial applications.	16	BT-2	Understanding
15	Compare biodiesel and ethanol with respect to feedstocks, production methods, properties, advantages, limitations, and applications.	16	BT-2	Understanding
16	Discuss the environmental, economic, and social benefits of bioenergy and explain its role in sustainable development.	16	BT-2	Understanding
17	Explain the applications of biomass energy in domestic, industrial, agricultural, and power generation sectors.	16	BT-2	Understanding
18	Discuss the recent developments, challenges, and future prospects of biomass energy technologies in India.	16	BT-2	Understanding

UNIT-V OCEAN AND GEOTHERMAL ENERGY			
Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications - Environmental impact.			
PART-A (2 Marks)			
Q.No.	**Questions**	**BT Level**	**Competence**
1.	Define small hydropower (SHP).	BT-1	Remembering
2.	Classify hydropower plants based on installed capacity.	BT-2	Understanding
3.	What are the advantages of small hydropower plants?	BT-1	Remembering
4.	Define tidal energy.	BT-2	Understanding
5.	State the principle of tidal energy conversion.	BT-1	Remembering
6.	What are the different types of tidal power plants?	BT-1	Remembering
7.	Define wave energy.	BT-1	Remembering
8.	Mention any four methods of wave energy conversion.	BT-1	Remembering
9.	What is Ocean Thermal Energy Conversion (OTEC)?	BT-1	Remembering
10.	State the basic principle of OTEC.	BT-2	Understanding
11.	Differentiate between open-cycle and closed-cycle OTEC.	BT-2	Understanding
12.	Mention any two advantages of OTEC.	BT-1	Remembering
13.	List the limitations of OTEC systems.	BT-1	Remembering
14.	Define geothermal energy.	BT-1	Remembering
15.	What are geothermal energy sources?	BT-1	Remembering
16.	List the different types of geothermal reservoirs.	BT-2	Understanding
17.	Name the different types of geothermal power plants.	BT-1	Remembering
18.	What is a dry steam geothermal power plant?	BT-1	Remembering
19.	What is a flash steam geothermal power plant?	BT-1	Remembering
20.	What is a binary cycle geothermal power plant?	BT-1	Remembering

21.	Mention any four applications of geothermal energy.	BT-2	Understanding
22.	State the advantages of geothermal energy.	BT-2	Understanding
23.	List any four environmental impacts of renewable energy projects.	BT-1	Remembering
24.	What are the environmental impacts of geothermal energy?	BT-1	Remembering
25.	Compare tidal energy and wave energy.	BT-2	Understanding

PART-B (16 Marks)

Q.No	Questions	Marks	BT Level	Competence
1	Explain the principle, components, advantages, disadvantages, and applications of small hydropower plants.	16	BT-4	Analyzing
2	Describe the working principle of tidal energy conversion. Explain different types of tidal power plants with neat sketches.	16	BT-5	Evaluating
3	Explain the generation of wave energy and discuss the various wave energy conversion devices with suitable diagrams.	16	BT-3	Applying
4	Discuss the principle of Ocean Thermal Energy Conversion (OTEC). Explain its advantages, limitations, and applications.	16	BT-6	Creating
5	Explain the construction and working of an open-cycle OTEC system with a neat diagram.	16	BT-3	Applying
6	Explain the construction and working of a closed-cycle OTEC system with a neat diagram.	16	BT-5	Evaluating
7	Compare open-cycle and closed-cycle OTEC systems based on principle, working, efficiency, advantages, disadvantages, and applications.	16	BT-2	Understanding
8	Explain the origin and occurrence of geothermal energy. Discuss the different geothermal energy sources.	16	BT-3	Applying
9	Describe the construction and working of a dry steam	16	BT-2	Understanding

	geothermal power plant with a neat sketch.			
10	Explain the working of flash steam and binary cycle geothermal power plants with suitable diagrams.	16	BT-4	Analyzing
11	Compare dry steam, flash steam, and binary cycle geothermal power plants.	16	BT-6	Creating
12	Discuss the applications of geothermal energy in electricity generation, space heating, agriculture, aquaculture, industrial processes, and tourism.	16	BT-2	Understanding
13	Explain the environmental impacts associated with small hydropower, tidal, wave, OTEC, and geothermal energy systems.	16	BT-2	Understanding
14	Discuss the advantages, limitations, and future prospects of ocean energy technologies.	16	BT-2	Understanding
15	Explain the current status and future potential of geothermal energy development in India and worldwide.	16	BT-2	Understanding
16	Discuss the role of small hydropower, tidal, wave, OTEC, and geothermal energy in achieving sustainable energy development.	16	BT-2	Understanding
17	Compare small hydropower, tidal energy, wave energy, OTEC, and geothermal energy based on resource availability, working principle, efficiency, environmental impact, and applications.	16	BT-4	Analyzing
18	Discuss the challenges, economic feasibility, technological developments, and future scope of emerging renewable energy technologies, including small hydropower, tidal, wave, OTEC, and geothermal energy.	16	BT-2	Understanding