

## Session Plan

S.No	JNTU Syllabus	Details	Lecture No1	Relevant Chapters	Remarks
<b>Unit No 1 Principles of solar radiation</b>					
1	Role and potential of new and renewable source, the solar option.	Why renewable energy sources-Effect of thermal, hydro and nuclear power stations on environment,	L1	T1-Ch2,R1 –Ch4	
		global warming- Indian power scenario	L2	T1-Ch2	
2	Physics of the sun, solar constant and extraterrestrial and terrestrial radiation	Sun and solar radiation, quantum theory, solar constant and air-mass ratio	L3	T1-Ch2	
3	Solar radiation on tilted surface	Solar radiation geometry	L4,L5	T1-Ch2,R1 –Ch4	
4	Environmental effects	Advantages of solar solar power, Its effect on the environment	L6	T1-Ch2	
5	Instruments for measuring solar radiation and sun shine, solar radiation data	Measurement of solar radiation, sin shine recorder and solar radiation data	L7	T1-Ch2	
		Tutorial	L8,L9		
<b>UnitI-2Solar energy collection</b>					
6	Flat plate and concentrating collectors	Utilisation methods of solar radiation, Collection system	L10	T1-Ch3	
7	Orientation and thermal analysis	Flat plate collector, factors affecting collector efficiency	L11	T1-Ch3	
		Thermal analysis of flat plate collector, performance of flat plate collector	L12,L13	T1-Ch3	
8	Classification of concentrating collector	Concentrating collectors Various types reflecting and refracting , viz., parabolic, mirror strips profile, Fresnel lens	L14	T1-Ch3,R1-Ch5	
9	Advanced collectors	flat plate with adjustable mirrors and paraboloidal dish	L15	T1-Ch3	
		Tutorial	L16,L17		
<b>Unit 3-Solar Energy storage and applications</b>					
10	Different Methods	Storing methods by heating of water and air and storage	L18	T1-Ch4	
		Basic Equation, Thermo-chemical energy storage	L18	T1-Ch4	
11	Sensible, latent heat and stratified heat	Definitions and explanation	L19	T1-Ch4	
12	Solar pond	Solar pond	L19	T1-Ch4,R1-Ch6	
		Solar pond power house	L19	T1-Ch4,R1-Ch6	
		Solar water heating – Natural and forced circulation	L20	T1-Ch4	
		Solar space heating	L20	T1-Ch4	
		Solar space cooling	L20	T1-Ch4	

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14	Solar distillation and solar drying	Solar still- application	L21	T1-Ch4	
		Solar drying	L21	T1-Ch4	
		Solar power water pumping	L21		
15	Photo-Voltaic Energy	Fermi Level	L22	R1-Ch7	
		P Type, N type material formation and PN junction, Depletion field	L22	R1-Ch7	
		Solar cell- Voltages and stress	L23	R1-Ch7	
		Current development in solar cell	L24	R1-Ch7	
		V-I characteristics	L25	R1-Ch7	
		Equivalent Circuit	L25	R1-Ch7	
		Spectral distribution	L26	T1-Ch4	
		Insolation level and solar cell size	L26	T1-Ch4	
		Solar cell configuration and efficiency	L27	T1-Ch4	
		Determination of internal resistance and maximum power point tracking	L27	T1-Ch4	
<b>Unit 4</b>					
<b>Wind energy</b>					
16	Sources of potentials	Wind mill generator, Functioning	L28	T1-Ch6	
		Location and favorable conditions	L29	T1-Ch6	
17	Horizontal and vertical axis windmills	Types of windmills	L30	T1-Ch6	
18	Performance characteristics	Derivation for power, derivation of thrust	L31,L32	T1-Ch6, R1-Ch9	
		Tip speed ratio, solidity	L33	T1-Ch6	
17	Betz's criteria	Derivation of Betz 's efficiency	L34	T1-Ch6	
		Problems	L35		
<b>UNIT-5 -Bio -mass Principle of Bio-conversion</b>					
18	Anaerobic /aerobic digestion	Principle of operation of digesters	L36	T1-Ch7	
19	Types of bio-gas digesters, Gas yield,	Floating drum type, Fixed mode, Deenbandhu plant	L37	T1-Ch7,R1-Ch9	
20	Combustion characteristics of bio-gas	Fuel properties of bio-gas	L38	T1-Ch7	
21	Utilization for cooking	Use of bio gas in cooking	L38	T1-Ch7	
22	I.C engine operation	Production of Bio fuels	L39	T1-Ch7	
		Power generation from bio-gas	L40,41	T1-Ch7, R1-Ch9	
23	Economic aspects	Economics and Indian scenario	L41	T1-Ch7	
<b>Unit 6- Geothermal Energy</b>					
24	Resources, Types of wells	Geothermal resources: Hydro thermal resources, Geo-pressured resources, hot dry rock resources, Magma	L42	T1-Ch8	
25	Methods of harnessing the energy	Dry steam fields, wet steam fields, total flow concept system	L43,44	T1-Ch8	
26	Potential in India	Geo-thermal energy in India and abroad	L45	T1-Ch8,R1-Ch15	
		Advantages, application and environmental problems	L46,47	T1-Ch8	
<b>Unit 7-0 Ocean Energy</b>					
27	OETC, Principle utilization Setting of OETC plants	Working principle of OTEC. Efficiency of the system	L48	T1-Ch9,R1-Ch14	

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		Types of OTEC plants: Closed cycle system, Open cycle system, modified open cycle OTEC plant, Hybrid, Thermoelectric systems	L49,50	T1-Ch9,R1-ch14	
28	Thermodynamic cycles	Rankin cycle system	L51	T1-Ch9	
29	Tidal and wave energy	Tidal power and capacity calculation. Types of wave energy.	L52	T1-Ch9,R1-ch13	
30	Potential and conversion techniques	Conversion techniques	L53	T1-Ch9	
31	Mini-hydel power plants and their economics	Description of small hydro projects. Independent and subordinate schemes	L54	T1-Ch9	
<b>Unit 8- Direct Energy Conversion</b>					
32	Need for DEC	Principle of DEC, and limitations	L55	T1-Ch10	
33	Carnot cycle, limitations	Thermoelectric power generation	L56	T1-Ch10, R1-Ch16	
34	Principles of DEC	MHD principle and working ( Faraday and Hall effects)	L57	T1-Ch10	
		Carnot and Rankin Cycles	L58,59	T1-Ch10	
		Fuel Cells and their types	L60,61	T1-Ch10	

## ASSIGNMENT QUESTIONS

### UNIT-I

1.
  - i) Explain the solar spectral irradiance in detail.
  - ii) Explain the construction and operation of any two instruments used for measuring solar radiation
2.
  - i) Briefly explain the role and potential of new and renewable energy with reference India
  - ii) Briefly describe the impact of solar power on environment
3.
  - a) What is a solar constant. Differentiate direct and diffused solar radiation
  - b) Explain Extraterrestrial and terrestrial solar radiation
4.
  - a) Describe the working of any one instrument used for the measurement of solar radiation, with a neat diagram
  - b) Briefly describe the impact of solar power on environment
5.
  - a) Explain how to estimate solar radiation on tilted surface?
  - b) Explain the working of sun shine recorder with a neat sketch

### UNIT-II

1.
  - a) Explain the various configurations for the solar concentrating collectors
  - b) Explain the thermal analysis of flat plate collectors with necessary equations
2.
  - a) Differentiate flat plate collector and parabolic collector with their salient features
  - b) With the aid of neat sketch classify flat plate collectors for water/air heating
3.
  - a) Describe the basic components of flat plate collector with a neat sketch
  - b) Explain the characteristic curve of a liquid flat plate collector
4.
  - a) Explain the working of solar concentrator
  - b) Describe thermal analysis of Owen-illinois collector
5.
  - a) How concentrating collectors are different from flat plate collectors
  - b) Explain principle of working of evacuated –tube collector

### UNIT-III

1.     a) Explain any two solar heating applications  
       b) Explain the construction and operation of a solar still What is Photo voltaic cell? Discuss about its characteristics?
2.     a) Discuss in detail the various parameters to be considered in detail for the design of solar water heating systems and its efficiency  
       b) Explain the working of conventional solar still with a neat diagram
3.     Derive an expression for daily yield that can be obtained in a solar still
4.     a) Discuss in detail the various parameters to be considered in detail for the design of Solar water heating systems and its efficiency  
       b) Explain the non-convective solar ponds with its new design features
5.     a) Discuss in detail the various parameters to be considered in detail for the design of solar water heating systems and its efficiency  
       b) Draw and discuss the IV Characteristics of single crystalline solar cell

### UNIT-IV

1.     a) Explain various configurations of wind turbines in detail with neat diagram  
       b) Discuss about the performance curves of wind turbines List out the differences between horizontal and vertical wind mills  
       b) Derive an expression for axial force on the turbine blade
2.     a) Classify different wind turbines with diagram  
       b) Explain the importance of torque coefficient of a wind turbine
3.     a) describe the potential for wind power in India  
       b) Derive that the maximum power that can be extracted from a horizontal axis wind turbine is only 59%
4.     a) Explain the phenomenon of dynamic matching in wind turbine  
       b) Briefly explain the significance of Betz limit

UNIT-V

1.
  - a) Explain the process of anaerobic digestion
  - b) Explain about the energetic involve in anaerobic digestion
  - c) Explain the S.I engine operation using bio-gas
  
2.
  - a) Explain the process of production of Bio-gas from bio-mass. What are the main advantages of anaerobic digestion of biomass.
  
  - b) Discuss the present status of development of biomass energy resources in India
3.
  - a) Discuss the present status of development of biomass energy resources in India
  - b) Classify biogas digesters and explain working of any one of them
  
4.
  - a) list out the differences between Anaerobic and aerobic digestion systems
  - b) what are the applications of biogas
  
5.
  - a) Classify biogas digesters and explain working of any one of them
  - b) Write short notes on economic aspects of bio fuels

UNIT-VI

1.
  - a) Classify various geo-thermal resources
  - b) Explain the operation of various various geo-thermal systems with schematic diagrams
  - c) Discuss about the potential of geo-thermal energy in India
  
2.
  - a) What is geothermal energy? List out the geothermal regions in India.
  - b) Explain the harnessing techniques of geothermal energy.
  
3.
  - a) What is the potential of geothermal energy worldwide
  - b) Give various applications of geothermal energy.
  
4.
  - a) Briefly describe the classes of geothermal regions
  - b) Briefly write notes on social and environmental aspects of geothermal energy
  
5.
  - a) Explain the energy extraction technique from hot dry rock
  - b) What is the potential to geothermal energy in India

## UNIT-VII

1.
  - a) Explain various devices used for wave energy conversions
  - b) Discuss about various configurations of turbines used for tidal energy conversion
2.
  - a) What is the source of tidal energy? What is the minimum tidal range required for practical power plant? How much is the potential in tides.
  - b) List out the advantages and disadvantages of OTEC systems
3.
  - a) Explain the working principle of OTEC system
  - b) Describe various modes of operations of tidal schemes
4.
  - a) Classify different OTEC technologies and explain open cycle OTEC system
  - b) Explain the potential and kinetic energies associated with wave energy.
5.
  - a) What are the advantages and disadvantages of wave energy
  - b) Classify wave energy conversion devices and explain any one of them

## UNIT-VIII

1. What is fuel cell? Classify fuel cells. Explain the construction and operation of any three fuel Cells in detail
2. Explain the principle of MHD generation
3. Write short notes on i) need for DEC ii) Carnot cycle
4. Write short notes on
  - a) Principles of DEC systems
  - b) Need for DEC

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5. Write short notes on
  - a) Limitations of DEC
  - b) PV Energy conversion systems
6. Write short notes on
  - a) Carnot cycle
  - b) Biogas for IC Engines

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