

**Department of Electrical and Electronics Engineering**

**TEACHING PLAN**

Course Code	Course Title	Semester	Branches	Contact Periods/ Week	Academic Year	Date of Commencement of Semester
16EE7T03	RENEWABLE ENERGY SOURCES (R16)	VII	EEE	6	2021-2022	04-10-2021

**Course Outcomes:** After successful completion of this course, students should be able to:

- 1 Analyze solar radiation data, performance of liquid flat plate collectors and design of PVsystem sizing and classifying various maximum power point techniques.
- 2 Classification of various types of wind turbines. summarize Betz coefficient. Tip-speed ratio and selection of generators.
- 3 Determine large ,small, micro hydro systems and types of turbines, Kinetic energy equation for tidal and wave power.
- 4 Classification of various Biomass fuels, VI characteristics and Geothermal energy analysis.

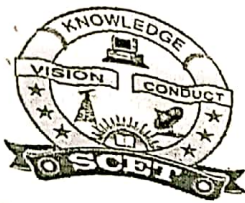
Unit	Outcome/ Bloom's Level	Topics No.	Topics/ Activity	Text Book/ Reference	Contact Hour	Delivery Method/ LMS
<b>UNIT-I FUNDAMENTALS OF ENERGY SYSTEMS</b>						
I	COURSE OUTCOME-I: Analyze solar radiation data, performance of liquid flat plate collectors and design of PVsystem sizing and classifying various maximum power point techniques.	1.1	Energy conservation Principle	T1, T2, R1	1	Chalk & Talk, PPT
		1.2	Energy scenario (world and India)	T1, T2, R1	1	Chalk & Talk, PPT
		1.3	Solar radiation	T1, T2, R1	1	Chalk & Talk, PPT
		1.4	Solar radiation : Outside earth's atmosphere	T1, T2, R1	1	Chalk & Talk, PPT
		1.5	Numerical problems	T1, T2, R1	1	Chalk & Talk, PPT
		1.6	Analysis of solar radiation data	T1, T2, R1	1	Chalk & Talk, PPT
		1.7	Geometry	T1, T2, R1	1	Chalk & Talk, PPT
		1.8	Solar radiation Measurements	T1, T2, R1	1	Chalk & Talk, PPT
		1.9	Radiation on tilted surfaces	T1, T2, R1	1	Chalk & Talk, PPT
		1.10	Numerical problems	T1, T2, R1	1	Chalk & Talk, PPT

Content beyond syllabus (if need) : World Energy Features

Mini Project (if possible)

**Total**    10

<b>UNIT-II SOLAR THERMAL SYSTEMS</b>						
		2.1	Liquid flat plate collections	T1, T2, R1	1	PPT Chalk & Talk
		2.2	Performance analysis	T1, T2, R1	1	PPT



# SWARNANDHRA COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)

Accredited by NBA, AICTE, NEW DELHI - Accredited by NAAC with "A" Grade - 3.32/4.00 CGPA

Recognized by UGC Under Sections 2(f) & 12 (B) of UGC Act 1956

Approved by AICTE, New Delhi, Permanent Affiliated to JNTU K, Kakinada

Seethampuram, NARSAPUR-534 280, W.G-Dist., Andhra Pradesh

II	<b>COURSE OUTCOME-I:</b> Analyze solar radiation data, performance of liquid flat plate collectors and design of PV system sizing and classifying various maximum power point techniques.	2.3	Transmissivity	T1, T2, R1	1	Chalk & Talk PPT		
		2.4	Absorptivity	T1, T2, R1	1	Chalk & Talk PPT		
		2.5	Product collector efficiency factor	T1, T2, R1	1	Chalk & Talk PPT		
		2.6	Collector heat removal factor	T1, T2, R1	1	Chalk & Talk PPT		
		2.7	Numerical problems	T1, T2, R1	1	Chalk & Talk PPT		
		2.8	Introduction to solar air heaters	T1, T2, R1	1	Chalk & Talk PPT		
		2.9	Concentrating collectors and solar pond	T1, T2, R1	1	Chalk & Talk PPT		
		2.10	Numerical problems	T1, T2, R1	1	Chalk & Talk PPT		
		Content beyond syllabus (if need) :-						
		Mini Project (if possible)						
				<b>Total</b>	10			
III	<b>COURSE OUTCOME-I:</b> Analyze solar radiation data, performance of liquid flat plate collectors and design of PV system sizing and classifying various maximum power point techniques.	<b>UNIT-III SOLAR PHOTOVOLTAIC SYSTEMS</b>						
		3.1	Introduction to Solar PV System	T1, T3, R1	1	Chalk & Talk PPT		
		3.2	Working principle of Solar PV System	T1, T3, R1	1	Chalk & Talk PPT		
		3.3	Applications of of Solar PV System	T1, T3, R1	1	Chalk & Talk PPT		
		3.4	Balance of system	T1, T3, R1	1	Chalk & Talk PPT		
		3.5	IV characteristics	T1, T3, R1	1	Chalk & Talk PPT		
		3.6	System design: Storage sizing, PV system sizing.	T1, T3, R1	1	Chalk & Talk PPT		
		3.7	Maximum power point techniques	T1, T3, R1	1	Chalk & Talk PPT		
		3.8	Perturb and observe (P&O) technique (or) Hill climbing technique	T1, T3, R1	1	Chalk & Talk PPT		
		3.9	Incremental conductance method	T1, T3, R1	1	Chalk & Talk PPT		
Content beyond syllabus (if need) :-		Hybrid Solar PV System						
Mini Project (if possible)								
				<b>Total</b>	10			
IV	<b>COURSE OUTCOME-II:</b> Classification of various types of wind turbines, summarize Betz coefficient. Tip-speed	<b>UNIT IV- WIND ENERGY</b>						
		4.1	Wind patterns	T1, T3, R1	1	Chalk & Talk PPT		
		4.2	Types of turbines	T1, T3, R1	1	Chalk & Talk PPT		
		4.3	Kinetic energy of wind	T1, T3, R1	1	Chalk & Talk PPT		
		4.4	Numerical problems	T1, T3, R1	1	Chalk & Talk PPT		
		4.5	Betz coefficient	T1, T3, R1	1	Chalk & Talk PPT		



# SWARNANDHRA COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)  
 Established by NBP, AICTE, NEFT DELHI & Approved by AICTE, New Delhi - 3,3116,59 CDRP  
 Recognized by UGC, Under Section 2(B) & 2(C) of UGC Act 1956  
 Approved by AICTE, New India, Patancheru Attached to JNTU V, Hyderabad  
 Seetharamapuram, NARSAPUR-534 280, W.G-Dist., Andhra Pradesh

ratio and selection of generators.	4.5	Tip speed ratio, efficiency	T1, T3, R1	1	Chalk & Talk PPT
	4.6	Power output of wind turbine	T1, T3, R1	1	Chalk & Talk PPT
	4.7	Numerical problems	T1, T3, R1	1	Chalk & Talk PPT
	4.8	Selection of generator (synchronous, induction)	T1, T3, R1	1	Chalk & Talk PPT
	4.9	Maximum power point tracking	T1, T3, R1	1	Chalk & Talk PPT

Content beyond syllabus (if need) Modes of Wind Power Generation  
 Mini Project (if possible)

**Total 10**

<b>V</b> COURSE OUTCOME-III: Determine large, small, micro hydro systems and types of turbines, Kinetic energy equation for tidal and wave power.	<b>UNIT-V HYDRO AND TIDAL POWER SYSTEMS</b>				
	5.1	Basic working principle	T1, T3, R1	1	Chalk & Talk PPT
	5.2	Classification of hydro systems: large, small, micro	T1, T3, R1	1	Chalk & Talk PPT
	5.3	Measurement of head and flow	T1, T3, R1	1	Chalk & Talk PPT
	5.4	Energy equation	T1, T3, R1	1	Chalk & Talk PPT
	5.5	Types of turbines	T1, T3, R1	1	Chalk & Talk PPT
	5.6	Numerical problems	T1, T3, R1	1	Chalk & Talk PPT
	5.7	Tidal power: Basics and Kinetic energy equation	T1, T3, R1	1	Chalk & Talk PPT
	5.8	Numerical problems	T1, T3, R1	1	Chalk & Talk PPT
	5.9	Wave power: Basics and Kinetic energy equation.	T1, T3, R1	1	Chalk & Talk PPT

Content beyond syllabus (if need) OTEC: Basics and closed and open loop Cycles  
 Mini Project (if possible)

**Total 10**

<b>VI</b> COURSE OUTCOME-IV: Classification of various Biomass fuels, VI characteristics and Geothermal energy analysis.	<b>UNIT-VI BIOMASS, FUEL CELLS AND GEOTHERMAL SYSTEMS</b>				
	6.1	Biomass Energy: Fuel classification,	T1, T3, R1	1	Chalk & Talk PPT
	6.2	Pyrolysis	T1, T3, R1	1	Chalk & Talk PPT
	6.3	Direct combustion of heat	T1, T3, R1	1	Chalk & Talk PPT
	6.4	Different digesters and sizing	T1, T3, R1	1	Chalk & Talk PPT
	6.5	Fuel cell: classification	T1, T3, R1	1	Chalk & Talk PPT
	6.6	Efficiency and VI characteristics.	T1, T3, R1	1	Chalk & Talk PPT
6.7	Geothermal: classification	T1, T3, R1	1	Chalk & Talk PPT	



# SWARNANDHRA COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)

Accredited by NBA, AICTE, NEW DELHI • Accredited by NAAC with "A" Grade - 3.32/4.00 CGPA

Recognized by UGC Under Sections 2(f) & 12 (B) of UGC Act 1956

Approved by AICTE, New Delhi, Permanent Affiliated to JNTU K, Kakinada

Seetharampuram, NARSAPUR-534 280, W.G-Dist., Andhra Pradesh

		6.8	Dry rock and aquifer	T1, T3, R1	1	PPT Chalk & Talk
		6.9	Energy analysis	T1, T3, R1	1	PPT Chalk & Talk
Content beyond syllabus (if need)			Different Phases and Process involved in Anaerobic Digestion			
Mini Project (if possible)						
<b>Total</b>					10	
<b>Cumulative Proposed Periods</b>					60	

### Text Books:

S. No	Authors, Book Title, Edition, Publisher, Year of Publication
1.	G.D Rai , Non-Conventional Energy sources, Latest Edition, Khanna Publications ,2019.
2.	S. P. Sukhatme and J. K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, 3rd Edition, TMH, New Delhi, 2012.
3.	John Twidell and Tony Weir, Renewable Energy Resources, 2 <sup>nd</sup> Edition, Taylor and Francis, 2015.
4.	John Andrews and Nick Jelly, Energy Science: Principles, Technologies and Impacts, 3rd Edition, Oxford, 2017.

### Reference Books:

S. No	Authors, Book Title, Edition, Publisher, Year of Publication
1.	Ahmed and Zobaa, Ramesh C Bansal, Handbook of renewable technology World scientific, 2 <sup>nd</sup> Edition, Singapore publications, 2011.
2.	Chetong Singh Solanki, Renewable energy technologies A practical guide for beginners, 3rd Edition, PHI, 2008.
3.	Ramesh & Kumar, Renewable Energy Technologies, 2 <sup>nd</sup> edition, Narosa Publications, 1977.

### Web Details:

1.	<a href="https://www.youtube.com/watch?v=uy9IZdKQIM">https://www.youtube.com/watch?v=uy9IZdKQIM</a>
2.	<a href="https://www.youtube.com/watch?v=mpHIZWYpKDJg">https://www.youtube.com/watch?v=mpHIZWYpKDJg</a>
3.	<a href="https://www.youtube.com/watch?v=GExTwRNkQbg">https://www.youtube.com/watch?v=GExTwRNkQbg</a>
4.	<a href="https://www.youtube.com/watch?v=OCpBNQfpKDA">https://www.youtube.com/watch?v=OCpBNQfpKDA</a>
5.	<a href="https://www.youtube.com/watch?v=ejM3VB0Z3M">https://www.youtube.com/watch?v=ejM3VB0Z3M</a>

	Name	Signature with Date
i.	Course Coordinator Mr. P. Yanna Reddy	21/10/21
	Mr. B. Bhargav Santosh	
ii.	Module Coordinator Mr. A V D Suresh	
iii.	Programme Coordinator Mr. A. Satyanarayana	

Principal