## MOHAMMED SATHAK A J COLLEGE OF ENGINEERING

the various appenergy sources  At the end of the CO1 - Gain knows and the CO2 - Acquire CO3 - Get knows CO4 - Have the CO5 - Understate  Sl. No.  UNIT I - PR  1	Renewable Energy Source  OR0551  2022 - 2023  Ton solar radiation and its environmental in ications in solar energy. To learn about the e course, the students will able to, wledge to understanding the physics of solar knowledge to classify the solar energy collewledge in applying solar energy in a useful winecessary understanding in wind energy and the basics in capturing and applying other topic(s)  INCIPLES OF SOLAR RADIATION.  INCIPLES OF SOLAR RADIATION.  INCIPLES OF SOLAR RADIATION.	Course Outer ar radiation.  ctors and methodologies way.  In the second of the second	Name of thandling I Year / Ser Batch jective vabout the vas and its economic aspects of storing some services is estimated by the services of storing some services as a service services of storing some services as a service service service service services as a service service service services as a service service service service services as a service service service service service service service services as a service servic	raculty Dr. S. Y	mal Energies.		
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UNIT I - PR  I Introdu  Role a  enviro  physic  solar c  extra terrestr  solar r	INCIPLES OF SOLAR RADIAT	T1 / R2	Required 1	/ MOOC / etc )	(L1-L6)		PC
1 Introdu 2 Role a 3 enviro 4 physic 5 solar c 6 extra terrestr 8 solar r	nd Potential of new renewable source	T1 / R2		,	L1	CO1	
2 Role a 3 enviro 4 physic 5 solar c 6 extra terreste 8 solar r	nd Potential of new renewable source			ВВ	L1	CO1	
3 enviro 4 physic 5 solar c 6 extra terreste 7 terreste 8 solar r		T1 / R2	1				
4 physic 5 solar c 6 extra terreste 7 terreste 8 solar r	nmental impact of solar power		-	BB	L2	CO1	
5 solar c 6 extra to 7 terresto 8 solar r		T1 / R2	1	BB	L2	CO1	
6 extra to 7 terresto 8 solar ra	s for sun	T1 / R2	1	ВВ	L2	CO1	
7 terrestr 8 solar ra	onstant	T1 / R2	1	BB	L5	CO1	
8 solar r	errestrial solar radiation	T1 / R2	1	BB	L3	CO1	
	ial solar radiation	T1 / R2	1	BB	L3	CO1	
	adiation on tilted surface	T1 / R2	1	BB	L5	CO1	
9 instrur Sunshi	nents for measuring solar radiation and ne	T1 / R2	1	BB	L5	CO1	
10 solar e	nergy data	T1 / R2	1	BB	L5	CO1	
Suggested Acti QUIZ	vity: Assignment / Case Studies / Tuoria	ls/ Quiz / Mini Projec	s / Model D	eveloped/others Pla	anned if any		
E <b>valuation me</b> Marks out of 10							
UNIT II - SO	DLAR ENERGY COLLECTION						
11 Introdu						<del>, ,</del>	

11	Introduction	T1 / R2	1	PPT	L5	CO2	
12	Flat Plate Collectors	T1 / R2	1	BB	L5	CO2	
13	Concentrating Collectors and its types	T1 / R2	1	BB	L5	CO2	
14	Types of Collectors	T1 / R2	1	BB	L5	CO2	
15	classification of collectors	T1 / R2	1	BB	L4	CO2	
16	Orientation and Thermal Analysis	T1 / R2	1	PPT	L4	CO2	
17	Advanced Collectors	T1 / R2	1	PPT	L2	CO2	
18	Advanced Collectors	T1 / R2	1	PPT	L3	CO2	

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any QUIZ

## **Evaluation method** Marks out of 10 UNIT III - SOLAR ENERGY STORAGE AND APPLICATIONS Introduction, Different methods T1/R2PPT L2 CO3 19 sennsible, latent heat and startified storage T1 / R2 PPT L2 CO3 20 1 21 solar ponds T1 / R2 1 BBL3 CO3 T1/R2BBL3 22 solar heating techniques 1 CO3 T1 / R2 solar cooling techniques 1 BBL3 CO3 23 24 solar distillation and drying T1/R21 ВВ L3 CO3 T1/R2BBL5 Photovoltaic energy conversion 25 CO3 Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any Assignment **Evaluation method** Marks out of 10 UNIT IV - WIND ENERGY L1 Sources and potentials T1 / R2 1 BBCO4 27 Horizontal axis windmills T1/R21 BBL3 CO4 performance characteristics T1/R2PPT L5 CO4 28 1 29 vertical axis windmills, types T1/R21 PPT L3 CO4 T1 / R2 PPT performance characteristics, Betz Criteria 1 L5 CO4 30 BIO MASS: Principles of Bio-Conversion, T1 / R2 PPT L1 31 1 CO4 Anaerobic/ aerobic digestion, Types of Bio-gas 32 T1 / R2 1 BBL2 CO4 Digesters, 33 Gas yield, Combustion, Utilization T1 / R2 1 PPT 14 CO4 I.C. Engine Operation T1/R21 BBL3 CO4 34 $T1 \, / \, R2$ 1 BBL5 CO4 Economic aspects Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any MODEL DEVELOPED **Evaluation method** Marks out of 10 UNIT V - GEOTHERMAL ENERGY

Resources, Types of Wells,	T1 / R2	1	PPT	L1	CO5	
Methods of Harnessing, Potential	T1 / R2	1	PPT	L2	CO5	
OCEAN ENERGY: OTEC	T1 / R2	1	BB	L1	CO5	
Principles, Utilization	T1 / R2	1	BB	L4	CO5	
Settings, thermodynamic cycles.	T1 / R2	1	PPT	L3	CO5	
TIDAL AND WAVE ENERGY: Potential and Conveersion Techniques	T1 / R2	1	PPT	L2	CO5	
Mini- Hydel Power plants	T1 / R2	1	PPT	L3	CO5	
economics	T1 / R2	1	PPT	L5	CO5	
DIRECT ENERGY CONVERSION: Need for DEC, Carnot Cycle	T1 / R2	1	PPT	L3	CO5	
Limitations, Principles of DEC	T1 / R2	1	PPT	L5	CO5	
	Methods of Harnessing, Potential  OCEAN ENERGY: OTEC  Principles, Utilization  Settings, thermodynamic cycles.  TIDAL AND WAVE ENERGY: Potential and Conveersion Techniques  Mini- Hydel Power plants  economics  DIRECT ENERGY CONVERSION: Need for DEC, Carnot Cycle	Methods of Harnessing, Potential  T1 / R2  OCEAN ENERGY: OTEC  T1 / R2  Principles, Utilization  T1 / R2  Settings, thermodynamic cycles.  T1 / R2  TIDAL AND WAVE ENERGY: Potential and Conveersion Techniques  Mini- Hydel Power plants  T1 / R2  economics  T1 / R2  DIRECT ENERGY CONVERSION: Need for DEC, Carnot Cycle	Methods of Harnessing, Potential         T1 / R2         1           OCEAN ENERGY: OTEC         T1 / R2         1           Principles, Utilization         T1 / R2         1           Settings, thermodynamic cycles.         T1 / R2         1           TIDAL AND WAVE ENERGY: Potential and Conveersion Techniques         T1 / R2         1           Mini- Hydel Power plants         T1 / R2         1           economics         T1 / R2         1           DIRECT ENERGY CONVERSION: Need for DEC, Carnot Cycle         T1 / R2         1	Methods of Harnessing, Potential         T1/R2         1         PPT           OCEAN ENERGY: OTEC         T1/R2         1         BB           Principles, Utilization         T1/R2         1         BB           Settings, thermodynamic cycles.         T1/R2         1         PPT           TIDAL AND WAVE ENERGY: Potential and Conveersion Techniques         T1/R2         1         PPT           Mini- Hydel Power plants         T1/R2         1         PPT           economics         T1/R2         1         PPT           DIRECT ENERGY CONVERSION: Need for DEC, Carnot Cycle         T1/R2         1         PPT	Methods of Harnessing, Potential         T1/R2         1         PPT         L2           OCEAN ENERGY: OTEC         T1/R2         1         BB         L1           Principles, Utilization         T1/R2         1         BB         L4           Settings, thermodynamic cycles.         T1/R2         1         PPT         L3           TIDAL AND WAVE ENERGY: Potential and Conversion Techniques         T1/R2         1         PPT         L2           Mini- Hydel Power plants         T1/R2         1         PPT         L3           economics         T1/R2         1         PPT         L5           DIRECT ENERGY CONVERSION: Need for DEC, Carnot Cycle         T1/R2         1         PPT         L3	Methods of Harnessing, Potential         T1/R2         1         PPT         L2         CO5           OCEAN ENERGY: OTEC         T1/R2         1         BB         L1         CO5           Principles, Utilization         T1/R2         1         BB         L4         CO5           Settings, thermodynamic cycles.         T1/R2         1         PPT         L3         CO5           TIDAL AND WAVE ENERGY: Potential and Conversion Techniques         T1/R2         1         PPT         L2         CO5           Mini- Hydel Power plants         T1/R2         1         PPT         L3         CO5           economics         T1/R2         1         PPT         L5         CO5           DIRECT ENERGY CONVERSION: Need for DEC, Carnot Cycle         T1/R2         1         PPT         L3         CO5

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any

Assignment

**Evaluation method** 

Marks out of 10

Content Beyond the Syllabus Planned

1 Solar Cookers

2	Solar hear	ers, Solar d	lryers											
							Text Bool	KS						
1	Rai G.D., "Non-Conventional Energy Sources", Khanna Publishers, 2011													
2														
	Reference Books  1 Tiwari and Ghosal, "Renewable energy resources", Narosa Publishing House, 2007													
1									2004					
2					ergy Techno ystems", Wl					,				
4					energy source						10			
	reomair D	.i , biligilai	., 11.0.,	tene waste	energy source			eferences		- Delini, 20	10			
1	https://r	ptel.ac.in/	/courses/1	112/105/1	.12105051/	/								
2	https://r	ptel.ac.in/	/courses/1	115/103/1	.15103123/	<u>/</u>								
3														
4					n5DZ2CQC									
5	https://v	ww.youtu	ube.com/\	watch?v=)	Ksf6RujEB8									
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	` /	Remembe	Ü		Lower	Fixed		L4) : Ana	•				Higher	Projects /
	` '	nderstand	nng		Order Thinking	Hour Exams		L5) : Eva	Ü				Order Thinking	Mini Projects
Level 3	(L3) : A						<u> </u>	L6) : Cre				I		,
		Ma			vith Bloo								770=	m
Un	it No		Unit	Name		L1	L2	L3	L4	L5	L6	LOT	НОТ	Total
Uı	nit 1	PRINCIPI	LES OF SC	DLAR RAD	DIATION	1	3	2	-	4	-	6	4	10
Uı	Unit 2 SOLAR ENERGY COLLECTION				ON	-	1	1	2	4	-	2	6	8
Uı	Unit 3 SOLAR ENERGY STORAGE AND ITS APPLICATIONS					-	2	4	-	1	-	6	1	7
Uı	Unit 4 WIND ENERGY						1	3	1	3	-	6	4	10
Unit 5         GEOTHERMAL ENERGY         2         2         3         1         2         -         7									3	10				
		Т	otal			5	9	13	4	14	0	27	18	45
	Total Percentage   11.11   20.00   28.89   8.89   31.11   0.00   60.00   40.00   100.00													
	CO PO Mapping													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	2	-	1	-	-	-	-	2	-	-
CO2	3	3	3	-	2	-	2	-	-	-	-	2	-	-
CO3	3	3	3	-	1	-	2	-	-	-	-	1	-	-
CO4	3	3	2	-	2	-		-	-	-	-	2	-	-
CO5	3	3	2	-	2	-	1	-	-	-	-	1	-	-
Avg	3	3	3	-	2	-	2	-	-	-	-	2	-	-
	1	1	<u> </u>	<u> </u>	J	ustificatio	n for CO-l	PO mappii	ng	<u> </u>	<u>I</u>	1		<u>l</u>
	Applying	Justification for CO-PO mapping  plying the concepts of renewable energy sources strongly (PO1) helps to analyze the potential strongly (PO2). This will help in design and												
CO1	development of solution to some extent (PO3). This may help to know the modern tool usage moderately (PO5). (PO7) gives the knowledge of													
	_	ngineering solutions in society and environment weakly and (PO12) recognizes the need for life-long learning to some extent.  Applying the fundamentals and applications of solar radiation in Engineering field strongly (PO1) helps in problem analysis to greater extent (PO2).												
CO2	This may	help in des	ign and de	velopment	of solutions	strongly (F	PO3). PO5	attributes t	o the usage	of moder	tools to so	ome extent	and to asse	ess the
002		-	-		ronment and n renewable				rately (PO7	). solar rad	liation coll	ectors may	be of some	e use to
					and its applic				ering know	ledge (PO	1). This wil	ll help in p	roblem sol	ving
CO3					of solution (									
	PO7 help	s to underst	and the im	pact of sola	ar energy sto	rage to env	ironment t	o some ext	ent and PC	012 recogn	izes the nee	ed for life-	long learnii	ng weakly.
	While und	lerstanding	the nature	, properties	and applica	ation of wir	nd energy a	nd biomas	s energy to	strong Eng	gineering k	nowledge	(PO1) is de	eveloped.
CO4	While understanding the nature, properties and application of wind energy and biomass energy to strong Engineering knowledge (PO1) is developed. This will help in problem solving (PO2) strongly and design and development of solution (PO3) to some extent. HAWT help in applying appropriate techniques and tools with an understanding of the limitations (PO5) moderately. Bio mass energy may be of some use to know the life-long technological changes (PO12).													

CO5	Understand the basics of OTEC, GEOTHERMAL and their applications attributes to strong Engineering knowledge (PO1). This will help in problem solving (PO2) as well as design and development of solution (PO3) to a greater extent. Selecting suitable algorithm helps in learning the commercial (PO5) to some extent. PO7 gives the knowledge of engineering solutions in society and environment moderately. PO12 recognizes the need for lifelong learning to some extent.									
3 High level 2 Moderate level 1 Low						Low level				
Name o	& Sign of	Faculty Incharge : V.Shobana								
Name & Sign of Subject Expert : V.Shobana										
Head o	f the Depa	artment :								

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