SRM UNIVERSITY
(Under section 3 of UGC Act 1956)

Faculty of Engineering & Technology, SRM University, Kattankulathur – 603203
School of Mechanical Engineering

Department of Mechanical Engineering
Course plan

Course code : **ME1148** Date : **01.12.2014**
Course title : **Alternative Sources of Energy**
Semester : **4**
Academic year/Sem : **2014 - 2015 / EVEN SEM (January – May 2015)**

Section details:

Section	Room No.	Details of Faculty members				
		Name	Room No.	Inter com No	e-mail id	Student contact time
		Mr.G.Balaji	MEB305A	1803	balaji.g@ktr.srmuniv.ac.in	THU 12.30 – 1.30 pm
		Mr.N.Vijay Krishna	H314	--	vijaykrishna.n@ktr.srmuniv.ac.in	
		Mr.S.Bharath Subramaniam	H502	--	bharathsubramanian.s@ktr.srmuniv.ac.in	

Direct assessment details:

Name of assessment	Marks	Topics	Tentative date	Duration
Cycle test - I	10	Unit I - full & Unit II - up to solar thermal collectors	13.02.2015	100 minutes
Surprise test	05	Unit II – Solar Energy	02.03.2015	10 – 15 minutes
Cycle test - II	10	Unit II – From solar thermal application to solar photovoltaic power plants and Unit III - full	13.03.2015	100 minutes
Model Exam	20	Entire Syllabus	20.04.2015	3 hours
End semester exam.	50	Entire Syllabus	11.05.2015	3 hours
Attendance	05	N/A		

ME1148 ALTERNATIVE SOURCES OF ENERGY 3 0 0 3

Prerequisite - Nil

PURPOSE

To familiarize the students about the utilization of various alternative sources of energy technologies for thermal and electrical needs with environmental merits.

INSTRUCTIONAL OBJECTIVES

1. Familiarize the biomass energy conversion technologies.
2. Analyze solar energy technologies.
3. Understand the wind energy and hybrid energy systems.
4. Know concepts of hydro, ocean and geothermal energy systems.
5. Familiarize the operations of direct energy conversion systems.

UNIT I - BIOMASS **(9 hours)**

Biomass, sources of biomass, thermo-chemical and bio-chemical conversion of biomass - pyrolysis, gasification, combustion and fermentation. Gasifiers - updraft, downdraft and fluidized bed gasifiers. Digesters - Fixed and floating digester biogas plants, economics of biomass power generation.

UNIT II - SOLAR ENERGY **(9 hours)**

Solar radiation and its measurements, types of solar thermal collectors - Flat and concentrating collectors, solar thermal applications - Water heaters, dryers, stills, refrigeration, air-conditioning, solar pond, central receiver power generation, thermal energy storage systems, solar photovoltaic components and solar photovoltaic power plants.

UNIT III - WIND ENERGY **(9 hours)**

Basic principle of wind energy conversion system, wind data and energy estimation, Site selection, components of wind energy conversion systems, design consideration of horizontal axis wind mill, aerofoil theory, analysis of aerodynamic forces acting on the blade, performance of wind machines. Introduction to solar - Wind hybrid energy systems.

UNIT IV - OCEAN, HYDRO AND GEOTHREMAL ENERGY **(9 hours)**

Wave and tidal energy, ocean thermal energy conversion - Principle, types, power plants - Small, mini and micro hydro power plants. Exploration of geothermal energy, geothermal power plants, challenges - Availability, geographical distribution, scope and economics.

UNIT V - DIRECT ENERGY CONVERSION SYSTEMS **(9 hours)**

Basic principle of thermo-electric and thermo-ionic power generations, fuel cellprinciple, types, conversion efficiency, applications. Magneto hydrodynamic power generation - Principle, open cycle and closed cycles, design considerations and recent developments. Hydrogen energy - Production, storage, transportation and applications.

TOTAL : 45

TEXT BOOKS

1. Rai.G.D, "*Non-Conventional Energy Sources*", Khanna Publishers, 4th edition, New Delhi, 2009.
2. Domkundwar.V.M, Domkundwar.A.V, "*Solar energy and Non-conventional sources of energy*", Dhanpat rai & Co. (P) Ltd, 1st edition, New Delhi, 2010.

REFERENCES

1. Godfrey Boyle, "*Renewable energy*", 2nd ed, Oxford University Press, 2010.
2. Khan.B, "*Non-conventional Sources of energy*", 2nd edition, New Delhi, Tata McGraw Hill, 2009.
3. Tiwari.G.N, Ghosal.M.K, "*Fundamentals of renewable energy sources*",1st edition, UK, Alpha Science International Ltd, 2007.
4. Twidell.J.W and Weir.A.D, "*Renewable Energy Resources*",1st edition, UK, E.&F.N. Spon Ltd, 2006.

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ME1148	ALTERNATIVE SOURCES ENERGY	3	0	0	3
	Prerequisite				
	Nil				

Student outcomes	Program Educational Objectives			
	1. Apply / improve their knowledge in basic sciences for excelling in various disciplines of Mechanical Engineering with the emphasis on Design, Thermal and Manufacturing.	2. Enhance professional practice to meet the global standards with ethical and social responsibility.	3. Solve industrial, social, and environmental problems with modern engineering tools.	4. Develop skills to work in teams, think intellectually and pursue life-long learning.
(a) An ability to apply knowledge of mathematics, science and engineering	X		X	
(e) an ability to identify, formulate, and solve engineering problems	X		X	

Course designed by		Department of Mechanical Engineering										
1	Student outcome	a	B	c	d	e	f	g	h	i	j	k
		×				×						

2	Category	GENERAL (G)	BASIC SCIENCES (B)	ENGINEERING SCIENCES AND TECHNICAL ART (E)	PROFESSIONAL SUBJECTS (P)
					X

3	Broad area (for professional courses only, i.e 'under P' category)	Manufacturing	Design	Thermal	General		
				X			

4	Course Coordinator	Mr. G. Balaji

SESSION PLAN

Session No.	TITLE/DETAILS OF CHAPTER	REFERENCES
	BIOMASS	
1	Biomass, various sources of biomass	T1, chapter 7
2	Thermo-chemical and bio-chemical conversion of biomass	T1, chapter 7
3	Pyrolysis, gasification	T1, chapter 7
4	Combustion and fermentation	T1, chapter 7
5	Gasifiers – updraft and downdraft types	T1, chapter 7
6	Fluidized bed gasifiers	T1, chapter 7
7	Digester - fixed digester biogas plants	T1, chapter 7
8	Floating digester biogas plants	T1, chapter 7
9	Economics of biomass power generation	T1, chapter 7
	SOLAR ENERGY	
10	Solar radiation and its measurements	T1, Chapter 2
11	Types of solar thermal collectors - Flat type	T1, Chapter 3
12	Concentrating collectors	T1, Chapter 3
13	Solar thermal applications - Water heaters, dryers, stills	T1, Chapter 4
14	Rrefrigeration, air-conditioning	T1, Chapter 3
15	Solar pond, central receiver power generation	T1, Chapter 4 & 5
16	Thermal energy storage systems	T1, Chapter 4
17	Solar photovoltaic components	T1, Chapter 5
18	Solar photovoltaic power plants	T1, Chapter 4
	WIND ENERGY	
19	Basic principle of wind energy conversion system	T1, Chapter 6
20	Wind data and energy estimation	T1, Chapter 6
21	Site selection	T1, Chapter 6
22	Components of wind energy conversion systems	T1, Chapter 6
23	Design consideration of horizontal axis wind mill and its types	T1, Chapter 6
24	Vertical axis wind mill types	T1, Chapter 6
25	Aerofoil theory, analysis of aerodynamic forces acting on the blade	T1, Chapter 6
26	Performance of wind machines	T1, Chapter 6
27	Introduction to solar - Wind hybrid energy systems	T1, Chapter 6
	OCEAN, HYDRO AND GEOTHREMAL ENERGY	
28	Wave and tidal energy	T1, Chapter 9
29	Ocean thermal energy conversion - Principle, types- Claude cycle	T1, Chapter 9
30	Anderson cycle	T1, Chapter 9
31	Power plants – Small hydro power plants	T1, Chapter 9
32	Mini hydro power plants	T1, Chapter 9
33	Micro hydro power plants	T1, Chapter 9
34	Exploration of geothermal energy, geothermal power plants	T1, Chapter 8
35	Challenges - availability, geographical distribution	T1, Chapter 8

36	Scope and economics	T1, Chapter 8
	DIRECT ENERGY CONVERSION SYSTEMS	
37	Basic principle of thermo-electric power generation	T1, Chapter 13
38	Thermo-ionic power generation	T1, Chapter 14
39	Fuel cell principle, types	T1, Chapter 10
40	Conversion efficiency, applications	T1, Chapter 10
41	Magneto hydrodynamic power generation - Principle, open cycle	T1, Chapter 12
42	Closed cycle, design considerations and recent developments	T1, Chapter 12
43	Hydrogen energy – Production types- electrolysis	T1, Chapter 11
44	Thermo-chemical and fossil fuel method	T1, Chapter 11
45	Storage, transportation and applications	T1, Chapter 11

TEXT BOOKS

T1. Rai.G.D, "*Non-Conventional Energy Sources*", Khanna Publishers, 4th edition, New Delhi, 2009.

T2. Domkundwar.V.M, Domkundwar.A.V, "*Solar energy and Non-conventional sources of energy*", Dhanpat rai & Co. (P) Ltd, 1st edition, New Delhi, 2010.

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R4. Twidell.J.W and Weir.A.D, "*Renewable Energy Resources*",1st edition, UK, E.&F.N. Spon Ltd, 2006.

Name & Signature of the Faculty

1. Mr. G.Balaji -- G. Balaji 11/12/2014
2. Mr.N.Vijay Krishna -- N. Vijay
3. Mr.S.Bharath Subramanian -- S. Bharath Subramanian

HOD / MECHANICAL