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

COURSE PLAN

COURSE CODE: **ME1225**
COURSE TITLE: **RENEWABLE AND SUSTAINABLE ENERGY**
SEMESTER: V
ACADEMIC YEAR: 2015-16/ ODD Semester(June 2015 – Nov 2015)

SECTION DETAILS

Section	Class Room No.	DETAITS OF FACULTY MEMBERS				STUDENT CONTACT TIME
		NAME	ROOM No.	Intercom No.	E-MAIL ID	
		Mr.M.Ijas Ahmed	H502		ijasahmed.m@ktr.srmuniv.ac.in	12.30 – 1.30 pm on Thursday
		Mr.K.V. Sreejith	AB 102A		Sreejith.r@ktr.srmuniv.ac.in	

DIRECT ASSESSMENT DETAILS

Name of assessment	Marks	Topics	Tentative date	Duration
Cycle test 1	**10**	Solar and wind energy, Sources of bio mass	07.08.2015	100 minutes
Surprise test	**5**	Thermal and hydro power plants	Aug 2015	10-15 minutes
Cycle test 2	**10**	Ocean,thermal,hydro geothermal power plants and renewable energy policies up to international policies	24.08.2015	100 minutes
Attendance	**5**	-		
Model examination	**20**	Entire syllabus	12.10.2015	3 hours
End semester examination	**50**	Entire syllabus	13.11.2015	3 hours

1. EXPECTED LEARNING OUTCOMES OF THE COURSE

		L	T	P	C
ME1225	**RENEWABLE AND SUSTAINABLEENERGY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

Student outcomes	Program Educational Objectives			
	The main objective of the B.Tech in Mechanical Engineering Program is to provide a periodically-updated curriculum so that, following the completion of the program and with a few years of experience, our alumni will have the expertise to:			
	1. Practice mechanical engineering in different disciplines towards system design, realization. Manufacturing.	2. Enhance professional practice to meet the global standards with ethical and social responsibility.	3. Solve industrial, social, and environmental problems with appropriate techniques and tools.	4. Work in large cross-functional teams 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)		Design	Thermal	General		
				X			

4	Course Coordinator	

2. MAPPING BETWEEN INSTRUCTIONAL OBJECTIVES AND STUDENT OUTCOMES

INSTRUCTIONAL OBJECTIVE	STUDENT OUTCOME	JUSTIFICATION
1.Understand the solar and wind energy concepts	(a) An ability to apply knowledge of Mathematics, Science and Engineering.	The students are studying solarenergy and wind energy related systems and
	(e) An ability to identify, formulate and solve engineering problems.	Students are getting basic concepts about design of solar and wind energy systems and they are solving problems related to such technologies
2.Gain knowledge on biomass energy	(a) An ability to apply knowledge of Mathematics, Science and Engineering.	The students are studying about sources of biomass and different biomass energy conversion systems
	(e) An ability to identify, formulate and solve engineering problems.	The students are able to solve simple problems related to gasifiers
3.Gain knowledge on wave and tidal energy	a) An ability to apply knowledge of Mathematics, Science and Engineering.	The students are studying the concepts of different ocean energy conversion systems and geothermal energy conversion systems
	(e) An ability to identify, formulate and solve engineering problems.	The students are practicing simple problems related to fuel cell and MHD technologies.
4. Gain knowledge on renewable energy policies	a) An ability to apply knowledge of Mathematics, Science and Engineering.	Students are gaining knowledge on different renewable energy policies, need of renewable energy, and economic analysis of renewable energy technologies
	b) An ability to identify, formulate and solve engineering problems.	The students are able to conduct techno economic analysis of renewable energy systems and to conduct life cycle analysis of renewable
.5. Gain knowledge of sustainable energy	a) An ability to apply knowledge of Mathematics, Science and Engineering.	The Students are studying basic concepts of sustainable energy policies, clean energy etc.

	(e) An ability to identify, formulate and solve engineering problems.	The students are developing their ability to solve problems related to energy fluctuation.

ME1225	RENEWABLE AND SUSTAINABLE ENERGY	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To enable the students to understand the various renewable energy sources and sustainability.

INSTRUCTIONAL OBJECTIVES

1.	Understand the solar and wind energy sources
2.	Gain knowledge on biomass energy
3.	Gain knowledge on wave and ocean energy
4.	Gain knowledge of renewable energy policy
5.	Gain knowledge of sustainable energy

UNIT I - SOLAR AND WIND ENERGY (9 hours)

Solar radiation, 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. 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.

UNIT II - BIOMASS ENERGY (9 hours)

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

UNIT III - OCEAN, HYDRO AND GEOTHERMAL 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. Introduction to direct energy conversion systems – fuel cells and magneto hydrodynamic power generations.

UNIT IV - RENEWABLE ENERGY POLICY (9 hours)

Renewable energy policies, including feed-in tariffs, portfolio standards, policy targets, tax incentives, and biofuels mandates. International policies for climate change and energy security. Economic analysis and comparisons, Life cycle analysis, financial analysis, cost of conserved energy, and externalities. Cost assessment of supply technologies versus energy-efficiency.

UNIT V - SUSTAINABLE ENERGY (9 hours)

Sustainable energy futures, global scenarios, promising technologies, development pathways, clean coal and carbon technologies, electric vehicles, energy fluctuation and energy storage, distributed generation and smart grids.

TOTAL 45 hours

TEXT BOOKS

1. Rai.G.D, "Non-Conventional Energy Sources", Khanna Publishers, 4th edition, New Delhi, 2009.
2. Roland Wengenmayr, Thomas Buhrke," Renewable energy: Sustainable energy concepts for the future", Wiley-VCH, 1st edition, 2008.

REFERENCES

1. Godfrey Boyle, "Renewable energy", Oxford University Press, 2nd edition, 2010
2. Hans-Josef Fell, "Global cooling strategies for climate protection", CRC Press, 2012.
3. Ottmar Edenhofen, "Renewable energy sources and climate change mitigation", Cambridge University Press, 2011.
4. B.K. Hodge, "Alternative energy systems and applications", John Wiley & Sons, 2009.
5. Mark Diesendrof, "Greenhouse solutions with sustainable energy", University of New South Wales Press, 2007.

ME1225 – RENEWABLE AND SUSTAINABLE ENERGY												
	Course Designed by	**Department of Mechanical Engineering**										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-5				1-5						
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)			Professional Subjects(P)			
		--		--		--			x			
4	Approval	23rd meeting of Academic Council, May 2013										

4. LESSON PLAN

COURSE CODE/NAME : ME1225 RENEWABLE ENERGY AND SUSTAINALE ENERGY

YEAR / SEMESTER : III /V (Odd 2015-2016)

Session No.	No. of Hrs	Topics	Text/Reference books
1	1	Solar radiation,	T1, chapter 2
2	1	Types of solar thermal collectors – flat and concentrating collectors,	T1, chapter 3
3	1	Concentrating solar thermal collectors	T1, chapter 3
4	1	Solar thermal applications - Water heaters	T1, chapter 5
5	1	Dryers, stills, Refrigeration,	T1, chapter 5
6	1	Air-conditioning, solar pond,	T1, chapter 5
7	1	Central receiver power generation.	T1, chapter 5
8	1	Basic principle of wind energy conversion system,	T1, chapter 6
9	1	Wind data and energy estimation, site selection	T1, chapter 6
10	1	components of wind energy conversion systems,	T1, chapter 6
11	1	Designconsideration of horizontal axis wind mill.	T1, chapter 6
12	1	Biomass, sources of biomass	T1, chapter 7
13	1	Thermo-chemical conversion of biomass.	T1, chapter 7
14	1	Bio-chemical conversion of biomass.	T1, chapter 7
15	1	Pyrolysis, gasification.	T1, chapter 7
16	1	Combustion and fermentation.	T1, Chapter 7
17	1	Gasifiers – up draft, downdraft	T1, Chapter 7
18	1	Fluidized bed gasifiers.	T1, chapter 7
19	1	Digesters-fixed and floating digester biogas plants,	T1, Chapter 7

20	1	economics of biomass power generation	T1, Chapter 7
21	1	Wave energy conversion systems	T1, Chapter 9
22	1	Tidal energy conversion systems	T1, chapter 9
23	1	Ocean thermal energy conversion - principle, types,	T1, Chapter 9
24	1	Power plants- small, mini and micro hydro power plants.	T1, Chapter 9
25	1	Exploration of geothermal energy.	T1, Chapter 8
26	1	Geothermal power plants.	T1, Chapter 8
27	1	Introduction to direct energy conversion systems	T1, Chapter 10
28	1	Fuel cells	T1, Chapter 10
29	1	MHD power generation	T1, chapter 12
30	1	Renewable energy policies,	T2, Chapter 1
31	1	Feed-in tariffs, portfolio standards, policy targets	T2, Chapter 2
32	1	Tax incentives, and biofuels mandates.	T2, Chapter 2
33	1	International policies for climate change and energy security.	T2, Chapter 1
34	1	Economic analysis and comparisons of different policies	T2, Chapter 3
35	1	Life cycle analysis of different sources	T2, Chapter 3
36	1	Financial analysis of different policies	T2, Chapter 4
37	1	cost of conserved energy, and externalities	T2, Chapter 3
38	1	Cost assessment of supply technologies versus energy-efficiency.	T2, Chapter 5
39	1	Sustainable energy futures	T2, Chapter 6
40	1	Global scenarios, promising technologies,	T2, Chapter 6
41	1	Development pathways of sustainable energy.	T2, Chapter 6
42	1	Clean coal and carbon technologies	T2, Chapter 7
43	1	Electric vehicles,	T2, Chapter 9
44	1	Energy fluctuation and energy storage,	T1, Chapter 16
45	1	Distributed generation and smart grids.	T1, Chapter 16

TEXTBOOKS

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

T2. Roland Wengenmayr, Thomas Buhrke,” Renewable energy: Sustainable energy concepts for the future”, Wiley-VCH, 1st edition, 2008.

STAFF MEMBERS:

Mr. M.IJAS AHMED Mr. K.V.SREEJITH

HOD/MECH