COURSE NAME	: ELECTRICAL POWER SYSTEM
COURSE CODE	: EP
SEMESTER	: SIXTH
SUBJECT TITLE	: RENEWABLE ENERGY SOURCES (Elective for EP)
SUBJECT CODE	:

Teaching and Examination Scheme:

Teac	hing Sch	neme	Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
04		02	03	100			25@	125

- External @ - Internal

* On Line Examination

NOTE:

- > Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)

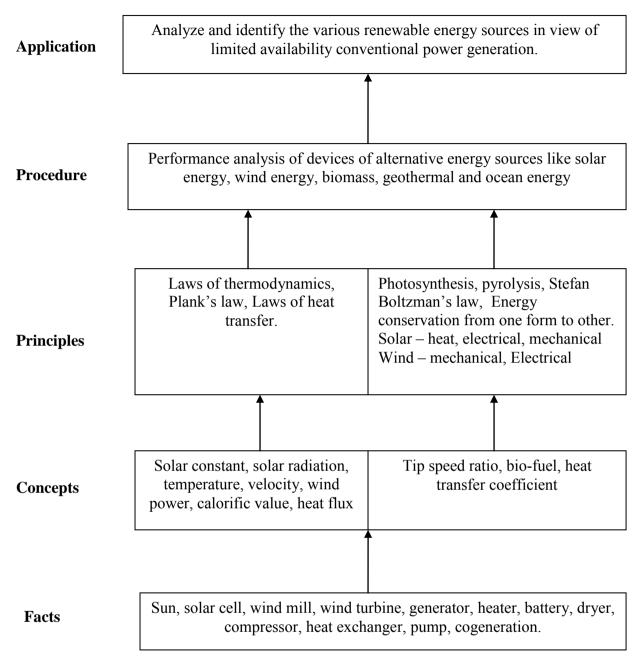
Rationale:

Energy is an important aspect in all sectors of country's economy. The energy crisis is mainly caused due to increased population, enhanced standard of living, life style, rapid urbanization. The conventional energy sources are insufficient to meet these demands and causing deleterious effects on human health and natural environment. Hence, alternative energy sources which are eco-friendly are used for fulfilling the energy demands. This subject helps the engineers to develop, operate and maintain these systems.

General Objectives:

- 1. Develop awareness for effective utilization of renewable energy sources.
- 2. Understand sustainability problem of present energy system and its potential solution.
- 3. Identify different components of all renewable energy devices.

Learning Structure:



Theory:

Specific Objectives: > > Prospects of alternate energy sources. > > Need for alternate energy sources. > Contents: 1.1 Types of Energy sources (Primary, Secondary, Supplementary). 04 08 1.2 Energy scenario in India (Energy consumption, Energy production, various sources and Their limitations). 04 08 1.3 Necessity of alternate energy sources. 1.4 Renewable Energy Sources Definition and examples 1.5 Environmental aspects of energy and sustainable development 04 Topics 2: Basics of Solar Energy Specific Objectives: > Identify instruments used for measurement of solar radiation. > > Identify instruments used for measurement of solar radiation. > Understand methods of solar radiation measurement	Topic and Contents	Hours	Marks
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Contonto			

3.1 Solar Collectors		
Classification of Solar collectors		
 Construction, working and applications of : 		
Flat plate collectors, Concentrating type collectors, parabolic		
collectors, modified flat plate collectors		
3.2 Solar heating systems	07	12
	07	12
• Principle of heat conversion		
• Types of Solar Heating systems: components, specifications,		
installation and maintenance		
3.3 Solar Cooking System		
Principle of solar cooking		
• Components, material, specification and operation of: Box type		
solar cooker, Dish type solar cooker, Advanced solar cooker		
Advantages and limitations		
3.4 Solar Furnaces: Construction, operation and specification		
3.5 Solar dryer, solar greenhouse: Construction, operation		
3.6 Solar space heating and cooling: Principle, operation, applications		
3.7 Solar PV System		
Components of Solar cell		
Construction of Solar PV module, panel	07	10
• Maximum power point tracker (MPPT)	07	12
 V-I characteristic of solar cell, efficiency of solar PV cell 		
3.8 Solar PV Applications		
Solar PV lantern: Construction, operation		
Solar Home lighting: Operation and applications Solar water guarding systems of articles a dwarts and		
• Solar water pumping system: operation, advantages		
• Functional block diagram of Photovoltaic Power Generating		
System,		
Advantages and disadvantages.		
• Solar pond: principle, working, application		
Topic 4 : Wind Energy		
Specific Objectives:		
Select the site for wind mills.		
> Identify different components of wind energy generating system		
and their functions.		
Select the type of generators used depending on wind power.		
Contents:		
4.1 Meaning of the terms: Power in the wind, Maximum power,		
Power Coefficient, forces on blades and thrust on turbines.		
Wind Energy conversion.		
4.2 Site selection consideration.	10	12
4.3 Block diagram showing basic components of Wind electric system		
and Function of each block.		
4.4 Types of Wind turbines		
4.5 Construction, working, advantages and disadvantages of horizontal		
and vertical axis wind mills,		
4.6 Wind Electric Generating Systems		
Block diagram and working of constant speed constant		

frequency system.		
• Variable speed constant frequency system.		
• Variable speed variable frequency system.		
• Salient features and characteristics of synchronous generator		
and induction generators used in wind mills.		
4.7 Area of applications of wind energy.		
<u>Topic 5 : Energy from Biomass</u> Specific Objectives:		
 Identify different bio-energy sources. 		
 Select type of biomass plant depending upon availability of 		
waste.		
 Identify different biogas plant. 		
Contents:		
5.1 Bio-energy sources.		
 Energy crops (woody crops, agriculture crops). 		
 Energy crops (woody crops, agriculture crops). Wastes (wood residues, animal waste, municipal waste). 		
 Wastes (wood residues, animal waste, municipal waste). 5.2 Methods of obtaining energy from biomass. 		
Anarobic Digestion		
Pyrolysis	1.0	10
Gasification	10	12
• Fermentation		
(Definition and brief description of each method).		
5.3 Thermal classification of biomass.		
5.4 Classification of biomass Gasifiers		
(schematic diagram and working of)		
• Fixed bed gasifier		
Fluidized bed gasifier		
5.5 Classification of biomass plants.		
 Continuous and batch type 		
• Dome and Drum type		
 Different variations in Drum type 		
• Advantages and disadvantages of Drum and dome type plants.		
(Brief description of working with schematic diagram).		
Topic 6 : Other Energy Sources		
Specific Objectives:		
 Identify different geothermal energy and geothermal sources. 		
 Identify different methods of Ocean Thermal Electric Power 		
Generation		
 List advantages and disadvantages of Tidal Power Plant 		
 Understand the operation of fuel cell and hydrogen energy 		
successive and experiences of fact containent partogen energy		
Contents:		
6.1 Concept of geothermal energy and geothermal sources		10
• Hydrothermal, geopressured, petrothermal, magma volcano:	06	10
Diagram showing typical geothermal field		
• Operation of geothermal power plant with schematic diagram		
• Advantages and disadvantages of geothermal energy.		

Total	64	100
limitations		
 Hydrogen Energy: Principle, applications, advantages, 		
 Fuel Cell: Principle, construction, operation, applications 		
6.4 Emerging technologies		
Advantages and limitations		
• Site requirement		
arrangement, Double basin arrangement		
 Operation method of utilization of Tidal Energy: Single basin 		
Locks, Power House		
• Components and their functions: Dams(Barrage), Gates and		
 Principles of Tidal Power Generation 		
6.3 Energy from Tides		
• Site selection for Ocean Thermal Electric Power Plant		
cycle / Anderson cycle, Open cycle / Claud cycle		
• Construction and operation of the plant with diagram of Closed		
6.2 Ocean Thermal Electric Power Generation:		
• Application of Geothermal energy.		

List of Assignments:

- 1. Measurement of solar radiation by solar measurement kit.
- 2. Determine the capacity of solar water heater depending upon quantity of water to be heated .State the procedure for erection
- 3. Collect information about PV cells: compare them on the basis of ratings, cost, application and life.
- 4. Search on different areas for economic applications of solar energy.
- 5. Collect information about different types of wind mills in Maharashtra state: Installed capacity, location, type and company.
- 6. Visit to any solar and Wind power plant and prepare a report mentioning, generating capacity, and specification, type of generator and wind mill used.
- 7. Collect the case studies of biomass generation and Municipal Solid waste projects in Maharashtra and write a report on it.
- 8. Collect information of potential of geothermal energy, tidal energy and wave energy in India form internet, journals and magazines
- 9. Collect information of design, operation and applications of fuel cells
- 10. Collect information from journals, magazines, and from internet related to "Recent trends in renewable energy sources". Present the seminar on the same.
- 11. Prepare a report on implementation of renewable energy for Rural electrification in India

Learning Resources:

1. Books:

Sr. No.	Author	Title	Publisher
1	G. D. Rai	Non-Conventional Energy Sources	Khanna Publications

2	S. P. Sukhatme	Solar Energy	Tata McGraw Hill
3	Abbasi	Renewable energy sources:Their impact on global warming and pollution.	РНІ
4	Dr. H. S. Mukund	Understanding Clean Energy and Fuels from Biomass	Wiley India
5	Kothari,Singal & Rajan	Renewable Energy Sources and Emerging Technologies	PHI
6	Boyle	Renewable Energy Power for Sustainable Future: Second edition	Oxford University press

Websites:

- 1. www.nptel.iitm.ac.in
- 2. www.solardyne.com
- 3. www. otherpower.com
- 4. www. solarenergy.com
- 5. www. windpower.org
- 6. www.alternativesourcesofenergy.net
- 7. www.mnre.gov.in
- 8. www. howstuffworks.com
- 9. www.mahaurja.org/com