

GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme	Bachelor of Technology				Branch/Spec.	Mechanical Engineering			
Semester	VIII				Version	2.0.0.0			
Effective from Academic Year		2021-22			Effective from the batch Admitted in		July 2018		
Subject code	2ME8101		Subject Name		Alternate Energy Sources				
Teaching scheme					Examination scheme (Marks)				
(Per week)	Lecture(DT)		Practical(Lab.)		Total	CE	SEE	Total	
	L	TU	P	TW					
Credit	3	0	1	0	4	Theory	40	60	100
Hours	3	0	2	0	5	Practical	30	20	50
Pre-requisites:									
Engineering Thermodynamics									
Course Objective:									
<ul style="list-style-type: none"> Describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels. Describe the main components of different renewable energy systems and compare different renewable energy technologies and choose the most appropriate based on local conditions Design renewable/hybrid energy systems that meet specific energy demands, are economically feasible and have a minimal impact on the environment Suggest the best combination of technological solutions to minimize the emission of greenhouse gases and perform simple techno-economical assessments of renewable energy systems 									
Theory syllabus									
Unit	Content							Hrs	
1	<p>INTRODUCTION: Energy demand growth and supply: Historical Perspectives; Fossil fuels: Consumption and Reserve; Environmental Impacts of Burning of Fossil fuels; Sustainable Development and Role of Renewable Energy.</p> <p>SOLAR ENERGY BASICS & SOLAR RADIATION GEOMETRY AND CALCULATIONS Extra-terrestrial and terrestrial, Solar radiation measuring instruments, Estimation of Solar Radiation, Various earth-sun angles. Solar radiation geometry - Earth-Sun angles – Solar angles. Calculation of angle of incidence - Surface facing due south, horizontal, inclined surface and vertical surface. Solar day length – Sun path diagram – Shadow determination. Estimation of Sunshine hours at different places in India. Calculation of total solar radiation on horizontal and tilted surfaces. Prediction of solar radiation availability, Local apparent time (LAT), equation of time (E).</p>							10	
2	<p>SOLAR ENERGY CONVERSION SYSTEMS: Solar Thermal Systems: Basics, Flat plate collectors-liquid and air type. Theory of flat plate collectors, selective coating, advanced collectors, Concentrators: optical design of concentrators, solar water heater, solar dryers, solar stills, Solar ponds, solar cooling and refrigeration, Solar thermal power generation. Necessity of storage for solar energy- Chemical energy storage - Thermal energy storage – Thermal Flywheels - Compressed air- Rechargeable batteries.</p> <p>SOLAR PHOTOVOLTAIC SYSTEMS: Principle of photovoltaic, conversion of solar energy, solar cells, home lighting systems, solar interns, solar PV pumps, Government policies</p>							10	

3	WIND ENERGY CONVERSION SYSTEMS: History of wind energy, Current status and future prospects, Wind energy in India. Power available in the wind, Components of Wind Energy Conversion Systems, Horizontal and Vertical axis wind turbine, Wind turbine power and torque characteristics, Tip speed ratio, Wind speed prediction and forecasting, Betz limit, Govt. Policies, Use of meteorological data for site selection, Materials of construction of wind turbines.	6
4	BIOMASS ENERGY: Biomass: Sources and Characteristics; Wet biogas plants; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems; Maintenance of gasifiers.	4
5	OCEAN ENERGY: Tidal power plants: single basin and two basis plants, Variation in generation level; Ocean Thermal Electricity Conversion (OTEC); Electricity generation from Waves: Shoreline and Floating wave systems.	4
6	GEOHERMAL ENERGY: Geothermal sites in India; High temperature and Low temperature sites; Conversion technologies- Steam and Binary systems; Geothermal power plants.	4
7	HYDROGEN ENERGY AND FUEL CELLS: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy, Basic principle of working of fuel cell.	4
8	ENERGY MANAGEMENT: Introducing energy economics, energy commodities, demand for energy, Aspects Conservation Energy Management and audit-Methodology for detailed audit, Status of energy-efficient technologies in India.	3

Practical content

The term work shall be based on experimental and analytical work on topics mentioned above

Text Books

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| 1 | Sukhatme, S.P and Nayak J. K. "Solar Energy: Principles of Thermal Collections and Storage" McGraw Hill Publishing Co, 3 rd Edition. |
| 2 | G.D. Rai, "Non -Conventional Energy Sources", Khanna Publisher, New Delhi. 2004. |

Reference Books

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| 1 | H.P. Garg, "Solar Energy Fundamentals and Applications", Tata McGraw Hill, New Delhi. 1 st Revised Edition. |
| 2 | J. A. Duffie and W.A. Beckman, Solar Engineering and Thermal Processes, John Wiley and Sons., 2013. |
| 3 | G.S Sawhney, "Non—Conventional Energy Resources", PHI Learning Pvt. Ltd., 2 nd Edition. 2012 |
| 4 | K. M. Mital, Biogas Systems, Principle and Applications. New Age International Ltd, 1996 |
| 5 | D.P Kothari ,K.C. Singal ,RakeshRanjan , Renewable Energy Sources and Emerging Technologies PHI Learning Pvt. Ltd, 2 nd Edition. |
| 6 | Chetan Singh Solanki, Solar Photovoltaics - Fundamentals, Technologies and Applications, PHI, 2008. |
| 7 | B H KHAN Non-Conventional ENERGY Resources, Tata McGraw Hill, New Delhi. 2 nd Edition. |
| 8 | Godfrey Boyle, Renewable energy, Oxford Press |
| 9 | H. S. Mukunda, Understanding Clean Energy and fuels from biomass. Wiley India Pvt. Ltd,2011 |

MOOC Link:

<https://nptel.ac.in/courses/121/106/121106014/>

<http://www.nptelvideos.in/2012/11/energy-resources-and-technology.html>

Course Outcome:

After learning this course, student should be able to

1. Design solar systems for a given energy utility by applying principles of solar energy conversion
2. Estimate the wind potential and perform power forecast analysis
3. Design bio-energy based systems for a given utility by applying principles of bio-mass to bio-energy conversion
4. Characterize different types of waste and compare various conversion technologies.
5. Compare Hydrogen with other energy resources in present context