3ME83: RENEWABLE ENERGY SOURCES
CREDITS - 4 (LTP: 3,0,1)

Course Objective:
To illustrate renewable energy sources and its effective technologies.

Teaching and Assessment Scheme:

Teaching Scheme (Hours Per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** Energy Consumption & Standard of living, Forms of Energy, Classification of Energy Resources, Application of non-conventional energy sources, Energy scenario	4
2	**Solar Energy:** Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells & its applications	10
3	**Wind Energy:** Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; wind data and site selection considerations	4
4	**Biomass Energy:** Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.	8
5	**Geothermal Energy:** Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India **Ocean Energy:** Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. Ocean Thermal Energy-Availability, theory and working principle, performance and limitations	10
6	**Miscellaneous Technologies:** **Magneto Hydrodynamic Power Conversion:** Principle of working of MHD Power plant, performance and limitations.	6

Unit No.	Topics	Teaching Hours
	Fuel Cell: Principle of working of various types of fuel cells and their working, performance and limitations **Hydrogen Energy:** Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.	
	Total	**42**

List of References:

1. G. D. Rai, "*Non-Conventional Energy Sources*", 1th Edition, Khanna Publishers, Reprint 2010
2. S. P. Sukhatme, "*Solar Energy*",3rd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2008
3. B H Khan , " *Non-Conventional Energy Resources*", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011
4. S.Hasan Saeed and D.K.Sharma, "*Non-Conventional Energy Resources*",3rd Edition,S.K.Kataria & Sons, 2012
5. G.N.Tiwari and M.K.Ghosal, "*Renewable Energy Resource: Basic Principles And Applications*", Narosa Publishing House,2004
6. Shobh Nath Singh, "*Non-Conventional Energy Resources*", Pearson Education India; First edition (2015).

Course Outcomes (COs):

At the end of this course students will be able to …

1. Identify energy demand and relate with available energy resources.
2. Analyze solar energy technologies.
3. Outline the wind energy sources.
4. Analyze harnessing of biomass energy.
5. Outline the geothermal and ocean energies.
6. Describe magneto hydrodynamics, hydrogen energy and fuel cell technology.