

RTM Nagpur University-Mechanical Engineering
B.Tech. 7th Semester
Open Elective – II: Introduction to Renewable Energy Resources (BEME703T)
Syllabus (Theory)

Semester	Course Title(Subject)	Hours /Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examine	Total	
VII	Introduction to Renewable Energy Resources	3	-	-	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1.	To make the students conversant with the non-conventional energy resources, its need, and their utilization to harness the power.
2.	The students will learn the solar energy utilization with its applications.
3.	The students will understand the various methods by which energy can be generated from wind, ocean tides, Fuel Cell, Geothermal phenomenon, Biogas and MHD
Course Outcomes	
At the end of the course students will be able to	
CO1	Recognize the need of renewable energy sources.
CO2	Understand various solar thermal energy conversion systems and solar photovoltaic systems in detail.
CO3	Describe different biogas plants, bio-diesel production method and potential of hydrogen as a fuel.
CO4	Explain the working principle of Wind energy systems and ocean thermal energy conversion systems
CO5	Describe the working of Fuel cell system, Geothermal & Magneto hydro dynamic (MHD) power generation systems and Understand the principles of energy conservation.
Syllabus Open Elective – II: Introduction to Renewable Energy Resources	
Contents	
Unit I Global energy scenario, Indian energy scenario, Environmental aspects of energy utilization, conventional and non-conventional sources of energy, merits, and challenges, Solar Energy: Introduction, solar constant, spectral distribution of solar radiation, beam & diffuse radiation, advantages of solar energy Solar electrical energy conversion: Construction and working of solar cells and PV modules, different PV technologies, Photovoltaic system components and different applications	07
Unit II Solar Thermal Energy Conversion: Solar flat plate collectors: Types of collectors, liquid flat plate collectors, solar air heaters, Concentric collectors: line focusing, point focusing and non-focusing type, central receiver concept of power generations, compound parabolic collector, comparison of flat & concentric collectors. Solar Ponds, Solar Cookers, Solar energy storage, sensible, latent and thermochemical storage,	07

Unit III Energy from Biogas: - Introduction, bio gas generation, fixed dome & floating drum biogas plants, their constructional details, raw material for biogas production, factors affecting generation of biogas, digester design considerations, fuel properties of biogas and utilization of biogas. Bio Mass: Introduction, methods of obtaining energy from biomass, thermal gasification. Biodiesel: Types of biodiesel, Trans-esterification process, Properties and application	08
Unit IV Wind Energy: Wind characteristics and site selection, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Wind energy conversion systems; Types of WECS and their characteristics, components, Working of horizontal and vertical axis wind turbine machines, 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.	08
Unit V Hydrogen Energy: Properties of Hydrogen with respect to its utilization as a renewable form of energy, sources of hydrogen, production of hydrogen, electrolysis of water Fuel Cell Technology: Introduction, Principle of working, Types of fuel cells, Fuel cell efficiency Geothermal energy: Introduction, classification of geothermal systems, vapour dominated, liquid dominated system, petrothermal systems, magma resources, applications of geothermal energy.	06

References
Text Books Recommended: 1. Non-Conventional Energy Sources, G.D. Rai, Khanna publishers. 2. Non-Conventional Energy Resources: B.H. Khan, Tata McGraw Hill. 3. Solar Energy Utilization, G.D. Rai. Khannapulishers. 4. Industrial Energy Conservation, D. A. Ray, Pergaman press. Reference Books Recommended: 1. Renewable Energy Sources and Emerging Tech., Kothari. PHL. 2. Solar Energy, S.P. Shukhatme, Tata McGraw Hill Education. 3. Renewable Energy Recourses: Basic Principle and Applications: G.N. Tiwari andM.K. Ghosal, Narosa publication.