Lesson Plan Course ETEE-419 (49419)		RENEWABLE ENERGY RESOURCES		Seveth Semester (MAE)		
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S.No.	Topics (from syllabus)	Lecture No.	Sub-Topics (& Reference From Text Book)	Assignment/ Quiz	Exam	Target Outcome
1	Solar Energy	Ll	Introduction, Solar Radiation: Extra Terrestrial and Terrestrial, Spectral Distribution, Solar Constant/ <i>R5 P1-4</i> , <i>P118-123</i>			
		L2	Solar Radiation at Earth's Surface: Beam and Diffuse Solar Radiation/ <i>R5 P 124</i>			
		L3	Air mass, Attenuation of Beam Radiation/ <i>R5 P-124-125, R2 P-12</i>			
2	Radiation Measurements	L4	Solar Radiation Measurements: pyrheliometer & pyranometer. Solar radiation data/ <i>R5 P125-129</i>			
3	Solar Thermal Collectors	L5	Solar Thermal System : Introduction, Principle, Conversion Methods: Natural and Technological Conversion/ <i>R5 P153-</i> <i>154</i>	Assignment I	First Term Examination	CO-ETEE - 419.1
		L6	Solar Thermal Collectors; Flat plate collectors – Liquid and Air Collector/ R5 P155-163			
		L7	Advantages; Solar Concentrating Collectors – Focusing and Non-focusing/ R5 P164-169			
		L8	Comparison of flat plate collectors and concentrating collectors/ NOTES			
4	Photo Voltaic (PV)Technology	L9	Photo Voltaic (PV)Technology: Introduction, Photovoltaic effect, Conversion efficiency, Semi Conductors as solar cell material, Solar PV system/ <i>R5 P221-223, P243-245</i>			
		L10	Solar Cell, Principle of Solar Cells, Efficiency of solar cell, Solar Cell Characteristic Applications of Solar photovoltaic, Sun Tracking: one axis tracking, two axis tracking/ <i>R5 P238- 246, P288-293, NOTES</i>			
	Wind Energy	L11	Introduction; Wind Data; Speed and Power Relations; Power			CO-ETEE - 419.2
5		L12	Wind Speed Distribution: Weibull probability distribution / NOTES			
		L13	Mode and Mean Speeds, Root Mean Cube Speed, Energy distribution / NOTES			
		L14	Wind speed prediction; Wind map of India; Wind turbines: Brief history, wind energy farm, off-shore plants./ <i>R5 P299-302, P346-348</i>			
6	Wind Turbines Types and Machines	L15	Types – Horizontal axis wind turbines, vertical axis wind turbines, elementary design principle/ <i>R5 P327-334</i>	Assignment 2		
		L16	Electric Generators: DC Machine & its characteristics / NOTES			
		L17	synchronous machines and its characteristics, induction machine & characteristics/ NOTES			
7	Hydro Power Energy	L18	Hydro Power Energy : Introduction, small, mini and micro hydropower plants and their resource assessment/ <i>R5 P466</i> - 467			
		L19	Advantages and Disadvantages of small hydro schemes/ <i>R5</i> <i>P467-468</i>			
		L20	Hydro power plant layout with major components/ R5 P468- 470			

8	Biomass Energy	L21	Biomass: Introduction, photosynthesis process, Biomass Resources, advantages & disadvantages of biomass/ <i>R5 P355- 357, P360-362</i>			
		L22	Cultivated resources, waste to biomass, terms and definition – incineration, wood and wood waste, harvesting super tree, energy forest / R5 P 361-362, NOTES			
		L23	Biomass Conversion Technologies: Thermo-chemical biomass conversion to energy, Pyrolysis, Biomass Gasification / <i>R5 P362-365, P368-372</i>			
		L24	Fermentation, aerobic and anaerobic digester; fuel properties of bio-gas / <i>R5 P364-365</i>			
9	Geothermal	L25	Geothermal : Introduction; sources; hot spring, steam ejection; working principle; advantages & disadvantages of geothermal energy; operational and environmental problem, site selection criterion/ <i>R5 P407-415</i> , <i>P428-431</i>	Assignment 3	<u>6</u>	
10	Occan Thermal	L26	Ocean and Thermal Energy: Introduction, working principle of OTEC plant / <i>R5 P456-461</i>			ETEE - 419.3
	Ocean Thermal Energy Cconversion (OTEC)	L27	Wave Energy Conversion Machines: WEC by floats, High level reservoir wave machine and Dolphin type wave machine, Problems and Limitations of OTEC Systems/ <i>R5</i> <i>P450-451, NOTES</i>			
11	Tidal Power	L28	Tidal Power: Terminology in Tidal Power Systems; Conversion and basic principle of Tidal Power / <i>R5 P435-</i> 443			
		L29	Tidal Power: Advantages, disadvantages and limitations/ R5 P438, P444			
12	Hydrogen Energy	L30	Hydrogen Energy: Properties of hydrogen; Sources and Production of Hydrogen; hydrogen storage: Gas, Liquid and Solid / <i>R5 P509-513</i>			
		L31	Hydrogen Transportation; Advantages, Disadvantages and Applications of hydrogen Energy, problems for use as fuel / <i>R5 P514-519</i>			
13	Fuel cells	L32	Fuel Cells:- Introduction with types, principle of operation and advantages / R5 P491-502			
	Grid Conectivity	L33	Wind power interconnected requirement: schematic of grid connected wind power system/ <i>NOTES</i>	Assignment 4		CO-ETEE - 419.4
14		L34	Interface requirements; Synchronization; Inrush current, synchronous operation, Load Transient / NOTES			
		L35	Introduction to LVRT; Ramp Rate and its Limitation / NOTES			
		L36	Grid interface control: frequency and voltage control; Load matching / following; Reserve Requirement / NOTES			
		L37	Impact of connection on steady state & Dynamic State / NOTES			
		L38	Interfacing of dispersed Solar energy to the grid : phase, frequency and voltage matching / <i>NOTES</i>			
		L39	Protection against islanding and Reserve Power Flow / NOTES			
		L40	Islanding : Active And Passive Techniques / NOTES			
		L41	Power Quality Issues : Harmonic distortion, Voltage Transients voltage flickers / NOTES			
		L42	Role of non conventional energy system is smart grid / NOTES			

Text Books:

[T1] Tiwari and Ghosal, "Renewable Energy Resources: Basic Principle & Application", Narosa Publication

[T2] S N Bhadra ,D, Kastha,'Wind Electrical Systems" Oxford Publication 2014

References Books:

[R2] John Twidell, "Renewable Energy Sources", Taylor and Francis

[R3] Godfrey Boyle, "Renewable Energy: Power for a Sustainable Future", Oxford University Press

[R4] Ewald F. Fuchs, "Power Conversion of Renewable Energy Systems", Springer

[R5] B. H. Khan, "Non Conventional Energy", Tata McGraw Hill

[R6] D P kothari ,"Wind energy System and applications" Narosa Pub 2014

Renewable Energy Resources	Course Outcomes		
ETEE-419 (49419)			
	Determine the need for solar energy and its applications.		
CO.ETEE-419.1			
	Utilize the technology for harnessing the wind power and		
	small, mini and micro hydro power plants.		
CO.ETEE-419.2			
	Compare Biomass, Geothermal, OTEC, Tidal and Wave		
CO.ETEE-419.3	Energy, fuel cells and hydrogen energy as an emerging source		
	Discuss the importance of grid connectivity and smart grid in		
	providing continuous power.		
CO.ETEE-419.4			