M.E. Semester: 2
Electrical Engineering (Electrical Power System)
Subject Name: Recent Trends in Non-Conventional Energy Systems

A. Course Objective:

- To review basic concepts of power system in the field of Non-conventional energy sources.
- To address the underlying concepts for recent trends in power system for renewable energy sources.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
MEEPS-205	Recent Trends in Non-conventional energy systems.	3	0	0	3	3	3	70	30	20	00	120

C. Detailed Syllabus

SR No.	Unit No	Topic	No. of Hours	Weightage In Exam.
1	**Unit:1**	**Introduction-** Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation.	4	5%
		Solar: The sun and earth, solar radiation- availability, measurement and estimation, The sun and earth movement, angle of Sunrays, on solar collector radiation, Estimation solar radiation empirically. **Wind:** History of wind energy, Wind machine types, classification, and parameters, , general concepts of airfoils and aerodynamics, Analysis of wind flow, measurement of wind speed, Power in wind.	5	15%
2	**Unit: 2**	**Solar Photovoltaic-** Introduction to solar cells , solar cell characteristics, losses in solar cells , Model of a solar cell , emerging solar cell Technologies Solar PV modules from solar cells , Mismatching module , hot spots in the module , Bypass	6	10%

		diode , Design and structure of PV modules , PV module power output , I-V and power curve of module.		
		BOS of PV system**,** Batteries, Battery charge controllers ,DC to DC Converters , DC to AC Converters for AC loads ,Supporting structures for mounting the PV panels , MPPT, Different algorithms for MPPT, Types of PV systems. Design methodology of standalone PV system , Wire sizing in PV system, Precise sizing of PV System, Economic analysis of PV system.	5	10%
3	**Unit: 3**	**Wind Energy**- performance calculations of wind turbine, Self Excited induction generator, Stand alone performance of SEIG, Grid connected SEIG,	5	10%
		Operation principle of DFIG, Chopper fed rotor control in DFIG, Reactive power control and voltage control mechanism in stand-alone Induction generator, MPPT Scheme for wind generation.	5	20%
4	**Unit: 4**	**Fuel Cell:** Introduction to fuel cell, principle of operation of fuel cell, stack configuration. Fuel cell Performance, Polymer electrolyte fuel cell, alkaline fuel cell. phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cells, components of fuel cell, thermodynamics of fuel cell, Fuel cell systems, applications.	5	10%
5	**Unit:5**	**Distributed Generation**- An Introduction. Combustion Engine Generator Sets. Combustion Turbines. Photovoltaic Systems. Microturbines. Fuel Cells. Principles of Control of Distributed Generation Systems. Economic and Financial Aspects of Distributed Generation. The Regulatory Environment. Combined Heat and Power. Electric Power Distribution Systems. Installation and Interconnection. Fuels.	10	20%

D. Instructional Method & Pedagogy

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Two internal exams may be conducted and average of the same may be converted to equivalent of 15 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval.

E. Students Learning Outcomes

- The students will learn prospects in the field of non-conventional energy conversion.
- They will be able to identify issues related to electrical technology in the field of renewable energy sources.

F. Recommended Study Materials

Text & Reference Books:

1. G D Rai "Non-Conventional Energy Sources," Khanna Publications
2. Chetan Singh Solanki , "Solar Photo Voltaics" ,PHI learning Pvt Ltd., NewDelhi,2009
3. "Fuel Cell Handbook", EG&G Technical Services, Inc, USDept of Energy, seventh edition,2004
4. Rashid M.H, " Power Electronics Handbook" ,Academic Press,California,USA,2001
5. J. A. Duffie and W. A. Beckman "Solar Engineering of Thermal Processes," second edition, John Wiley, New York, 1991.
6. S. P Sukhatme "Solar Energy- Principle of Thermal collector and storage," Third edition, TMH publication

