Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Master of Engineering Semester II

(Electrical Power System)

(With effect from Academic Year 2017-18 (CBCS))

Subject Code: MEEE205-N	Subject Title: Recent Trends in Non-Conventional Energy Systems
Pre-requisite	

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.

Teaching scheme				Total Credit	Evaluation Scheme					Total Marks
L	T	P	Total		Theory		IE Marks	CIA Marks	Pract. Marks	
Hrs	Hrs	Hrs	Hrs		Hrs	Marks				
03	00	00	03	03	03	70	30	20	-	120

B. Outline of the Course:

Sr. No	Title of the Unit	Minimum Hours
1	**Introduction**	4
2	**Solar**:	5
3	**Wind:**	6
4	**Solar Photovoltaic**	5
5	**Wind Energy**	5
6	**Fuel Cell**	5
7	**Distributed Generation**	10

Total Hours (Theory):45
Total Hours (Lab): 00
Total Hours: 45

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Detailed Syllabus

Sr. No.	Topic	Lecture Hours	Weightage(%)
1	**Introduction-** Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation.	4	10%
2	**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.	10	20%
3	**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 diode , Design and structure of PV modules , PV module power output , I-V and power curve of module.	6	15%
4	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	15%
5	**Wind Energy**- performance calculations of wind turbine, Self-Excited induction generator, Standalone performance of SEIG, Grid connected SEIG, 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	10%
6	**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%
7	**Distributed Generation**- An Introduction. Combustion Engine Generator Sets. Combustion Turbines. Photovoltaic Systems. Micro turbines. 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%
		45	**100**

C. Instructional Methods

- 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.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- 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. It may carry an importance of five marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

D. Student 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.

E. Text & Reference Books:

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