Lok Jagruti Kendra University
University with a Difference

Diploma
in
Electrical Engineering

LJ Polytechnic

Course Code: 025070503
Solar & Wind Technology

Programme / Branch Name			Diploma in Electrical Engineering			
Course Name	Solar & Wind Technology				**Course Code**	025070503
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week / Credits				Evaluation Scheme			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Th)**	**Total Marks**
4	0	2	5	50	50	50	150

Legends: L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisite

- ✓ Fundamental knowledge of electrical machines
- ✓ Basic concepts of power electronics
- ✓ Knowledge of Some topics of thermal engineering

3. Rationale

This subject is offered to emphasize the role of renewable energy technologies (especially wind and solar energy) and their potentials. The course aims to introduce the basic concepts of wind and solar energy and the preliminary analysis to estimate the energy generation from the wind and solar systems. Various components involved in the wind and solar system are covered and the control approaches to improve the performance of the systems are also included. In addition to the various applications of solar and wind energy generation systems, the course also covers the issues related to the integration of these systems in the existing network. Thus, the course is intended to provide the foundation for the solar PV and thermal as well as wind energy generation systems.

4. Objectives

- ✓ Analyze various machines such as DC and AC machines (generator, motor) and single and three-phase transformer for solar and wind applications.
- ✓ Analyze electrical machines for various characteristics related convertor in terms of power electronics
- ✓ It will develop potential to analysis of such machines for the application in power generation in industrial areas.

5. Contents

Unit No.	Topics	Sub-Topics	Learning Outcome	% Weightage	Hours
1	**Constant Speed Wind Power Plants**	1.1. Type-A WPP (Wind Power Plants): • Working Principle • Different topologies 1.2. Type-B WPP: • Working Principle • Different Types	• Explain the working principle of Type-A WPP • Explain the working principle of Type-B WPP • Compare the major differences in the maintenance of Type-A and Type-B WPPs	20	8
2	**Variable Speed Wind Power Plants**	2.1 Type-C WPP: • Working principle • Working Principle • Back to-Back control 2.2 Type-D Geared WPP: • Working principle 2.3 Type-D direct-drive WPP: • Working principle	• Explain the working principle of Type-C WPP • Describe the working principle of a back to-back power electronic controller used in Type-C WPPs • Explain the working principle of Type-D geared WPP. • Explain the need for direct drive WPPs. • Explain the working principle of a Type D direct-drive WPP.	20	8

3	**Solar Power Plant Performance**	3.1 Solar Thermal Power Plants: Working of a typical Concentrated Solar Power (CSP) plant 3.2 Solar photovoltaic (PV) Power Plants: Working of a typical Solar PV Power plant. 3.3 Types of Batteries for solar PV system.	• Explain the concept and construction of solar thermal power plants. • Describe the performance of a typical CSP plant • Explain the concept and construction of solar PV power plants. • Describe the performance of a typical solar PV power plant. • List the types of batteries • Describe the features required of a battery for solar PV system. • Explain the significance of solar PV tracking.	20	9
4	**Wind and Solar Power Quality**	4.1 Local impact of wind power on the grid 4.2 System wide impact of wind power on the grid. 4.3 Power Quality of solar PV systems 4.4 Power quality of CSP solar plant. 4.5 Power quality of solar PV power plant	• Describe the phenomenon of local impact of wind power on the grid • Explain the phenomenon of system wide impact of wind power • Differentiate the features of the power obtained from the solar PV and CSP power plant	20	9

5	**Grid Connection of Wind and Solar Power Plants**	5.1 Grid interface issues of wind power. 5.2 Grid operational issues of wind power. 5.3 Grid connection of CSP plants. 5.4 Grid connection of solar PV power plants 5.5 Wind- solar hybrid systems	• State the grid interface issues of wind power and methods to resolve them. • State the grid operational issues of wind power and methods to resolve them • State the method(s) of integrating into the grid the power obtained from a CSP plants with sketches. • State the method(s) of integrating into the grid the power obtained from solar PV power plants with sketches. • Describe with sketches and labels the concept of a grid connected wind solar hybrid system.	20	8
				Total Hours	**42**

6. List of Practical's / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills that students can acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Sr. No	Practical / Exercises	Key Competency	Hours
1	Dismantle a small planetary gearbox used in WPPs	WPP gearbox	2
2	Study of Horizontal Wind Mill.	WPP	2
3	To study of voltage and current of solar cell	Solar cell	2
4	To study solar photovoltaic system	PV system	2
5	Experiment on VI-Characteristics and Efficiency of 1kWp Solar PV System	Solar PV system	2
6	To study of designing of solar panel	Solar panel	2
7	Effect Of Temperature Variation on Photovoltaic Array	Photovoltaic Array	2
8	Effect of irradiation on a photovoltaic array	Photovoltaic Array	2

9	Assemble solar PV system with and without battery connection.	Solar PV Module	2
10	Introduction of Microgrid	Wind-Solar PV Microgrid	2
		Total Hours	20

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Chapter Name	Teaching Hours	Distribution of Topics According to Bloom's Taxonomy					
			R %	U %	App %	C %	E %	An %
1	Constant Speed Wind Power Plants	8	40	20	20	20	10	10
2	Variable Speed Wind Power Plants	8	40	20	20	20	10	10
3	Solar Power Plant Performance	9	20	20	20	15	10	15
4	Wind and Solar Power Quality	9	40	20	20	20	10	10
5	Grid Connection of Wind and Solar Power Plants	8	30	20	20	10	10	10

Legends: R-Remembering C- Creating
U- Understanding E- Evaluating
App- Applying An- Analyzing

8. Textbooks

1) Wind Power Technology, Earnest, Joshua, PHI Learning, New Delhi, 2014
2) Solar Photovoltaic: Fundamentals, Technologies and Application Solanki, Chetan Singh PHI Learning, New Delhi, 2009

9. Reference Books

3) Solar Photovoltaic: A Lab Training Module by Solanki, Chetan Singh, Arora, Brij M., Vasi Juzer, Patil, Mahesh B., Cambridge University Press, New Delhi, 2009
4) Wind Power Technology, Earnest, Joshua, PHI Learning, New Delhi, 2014

10. Open Sources (Website, Video, Movie)

1) https://onlinecourses.nptel.ac.in/
2) https://circuitglobe.com/
3) https://electrical-engineering-portal.com/
4) https://www.electrical4u.com/
5) https://tryengineering.org/profile/electrical-engineering/