



GUJARAT TECHNOLOGICAL UNIVERSITY

Minor Degree: Solar Energy Systems
Subject Code: N115AJ01

Semester – V (w.e.f. AY 2025-26)
Subject Name: Solar Energy System-II

Prerequisite: Basic Electrical Engineering, Basic Electronics

Rationale: The dc-dc converter and grid tied and off-grid inverters are now widely used in applications like off-grid and grid tied solar photovoltaic system. The course is aimed to provide exposure about connection of solar PV Modules, types of dc-dc converter and charge controller, inverter types and its comparison and control of power electronic inverter.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	0	30	0	100

Content:

Unit No	Course Content	No of Hours
1	Series and parallel interconnection, PV modules and array circuits, Photovoltaic module and array electrical characteristics, PV Power Characteristics,	04
2	PV loading techniques, Maximum power point tracking, Batteries, Working principle of solar streetlight	12
3	DC-DC Converters, Types of charge controller, Design of charge controller	16
4	PV Inverters types, Power Converters in PV Applications, Efficiency of power converters, Single stage and double stage PV inverter, Comparison of dual and single stage PV inverter	06
5	Control of PV inverter, Interfacing PV Systems with the Electric Grid	04
Total Hrs.		42

Suggested Specification table (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	35	30	10	5	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)



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Reference Books:

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan, T. M. Undeland, W.M. Robbins, "Power Electronics: Converters, Applications and Design", Wiley India Edition, 2007.
3. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
4. Solanki, Chetan Singh. *Solar photovoltaics: fundamentals, technologies and applications*. Phi learning pvt. Ltd., 2015.
5. Deutsche Gesellschaft für Sonnenenergie (DGS). *Planning and installing photovoltaic systems: a guide for installers, architects and engineers*. Routledge, 2013.

Course Outcomes: Upon completion of this course students should be able to:

No	Course Outcomes	% weightage
01	Student will learn about series and parallel connection to increase power rating of solar PV systems	10
02	Student will learn and apply MPPT technique	30
03	Student will design dc-dc converter for the solar PV systems	30
04	Evaluate the power converter efficiency.	15
05	Understand the control of PV inverter and its interfacing to the grid	15

List of Practical:

1. To demonstrate the I-V and P-V characteristics of PV Modules.
2. To demonstrate the I-V and P-V characteristics of series connected PV Modules.
3. To demonstrate the I-V and P-V characteristics of parallel connected PV Modules.
4. To draw the charging and discharging characteristics of battery.
5. To perform boost conversion operation of boost converter with varying solar input.
6. Perform the experiment to control the waveform of output voltage of inverter with 120 degrees and 180-degree conduction mode with microcontroller.
7. Observe the output waveform of the PV inverter.