GUJARAT TECHNOLOGICAL UNIVERSITY

BE - Semester 6
Minor Degree : Solar Energy Systems
Subject Code : N116AJ01 (w.e.f. AY 2025-26)
Subject Name : Installation and Commissioning of Solar Plant

Prerequisite : Basic Electrical Engineering, Basic Electronics.

Rationale : The photovoltaic power plant installation and commissioning are one of important aspects of off-grid and grid-tied solar photovoltaic power plants. The course is aimed to provide the knowledge and skills of the installation and commissioning, to assess the impact of shading on the performance of solar PV plants, Various MPPT algorithms, and about PV water pumping systems.

Teaching and Examination Scheme :

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	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	Orientation and Tilt of the solar PV panel, Measurement of the available area and required area for the PV plant, Temperature Dependent Output of the PV module and array, Measuring Shading at a Site.	04
2	Analyzing Shading and Calculating Insolation of the year with and without partial shading, PV Output Reduction Due to Shading, Requirement of Mechanical structure for PV Plant, Installation and commissioning of the PV Plant, Electrical earthling and safety requirement.	08
3	PV array characteristic with partial shading condition, Difficulties of the conventional MPPT tacking algorithm in partial shading conditions.	04
4	Various Maximum power point tracking (MPPT) algorithms, Comparison of various MPPT algorithm.	14
5	Water pumping principle, Hydraulic energy and power, Total dynamic head, Centrifugal and reciprocating pumps, PV and water pumping examples.	12
Total Hrs.		**42**

Suggested Specification table (Theory) :

Distribution of Theory Marks (%)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	15	10	25	30	**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. Deutsche Gesellschaft für Sonnenenergie (DGS). *Planning and installing photovoltaic systems: a guide for installers, architects and engineers*. Routledge, 2013.
2. Solanki, Chetan Singh. *Solar photovoltaics: fundamentals, technologies and applications*. Phi learning pvt. Ltd., 2015.
3. Burdick, Joseph, and Philip Schmidt. *Install your own solar panels: designing and installing a photovoltaic system to power your home*. Storey Publishing, 2017.
4. Rahman, Faz, and Wei Xu. *Advances in solar photovoltaic power plants*. Springer, 2016.

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

No.	Course Outcomes	Marks % weightage
01	Analyze the effect of tilt angle on the PV output and determine optimal tilt according to latitude and longitude	**10 %**
02	Analyze the effect of partial shading on the solar PV output to understand the procedure of installation of the PV Plant	**15 %**
03	Understand problems associated of the MPPT algorithm associated with partial shading condition	**10 %**
04	Evaluate MPPT algorithm with and without partial shading and working principle of various off-grid and grid-tied inverter	**35 %**
05	Understand the solar pumping systems	**30 %**

List of Practical :

1. To show the effect of variation in tilt angle of PV module.
2. To demonstrate the effect of shading on module output power
3. Perform the experiment of manually finding the MPP by varying the resistive load across PV panel.
4. Perform the experiment of finding the MPP by varying the duty cycle of DC-DC converter.
5. Perform the experiment with MPPT algorithm and observe V_m ,I_m, P_m and duty cycle at which MPP occurs.
6. Perform the experiment with different value of perturbation (delta D).