GUJARAT TECHNOLOGICAL UNIVERSITY
Syllabus for Bachelor of Vocation (B.Voc.), 2nd Semester
Branch: Solar & Renewable Energy
Subject Name: Solar PV Installer (Suryamitra)
Subject Code: 1120707

Type of course: Elective

Prerequisite: None.

Rationale: The individual at work installs the Solar and PV Modules and interacts with customers to diagnose the problem and assess possible causes. Once the problem and causes have been identified, the individual rectifies minor problems or replaces faulty modules for failed parts or recommends factory repairs for bigger faults.

Teaching Scheme and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical		
L	T	P	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
0	0	15	15	0	0	100	100	200

L- Lectures; P- Practical; OJT- On Job Training; C- Credit; ESE- End Semester Examination;PA-Progressive Assessment

Course Content:

Sr. No.	Topic	No. of hours	% Weightage
01	**Introduction to Solar PV Installer Course.** Explain the role of Solar PV Installer and emerging jobs & entrepreneurial opportunities. Illustrate the advantages of doing this course. Explain the importance of basic skills for communication; along with how to work effectively with others while respecting gender and disability concerns. Explain the importance of reading and interpreting signs, notices and/or cautions at project site.	10	5
02	**Basics of Solar Energy and Electrical Concepts** Explain Ohm's Law. Explain the basics of solar energy/ electricity and electrical concepts. Explain the relevance of Diffused Normal Irradiance (DNI) and Global Horizontal Irradiance (GHI) along with differences in Irradiance & Irradiation. Illustrate the movement of the sun and assess its effect on the performance of the solar power plant.	10	5
03	**Basics of Solar Photovoltaic system and its Components** Explain various terminologies used in the solar industry. Identify the different components of a Solar PV system and explain its basic operation. Explain the working of different types of Solar PV systems. Discuss the latest and innovative technologies used in system configurations like ''Plug & Play'' or ''Behind the Meter'' energy systems. Describe the different types, sizes and specifications of modules, inverters, charge controllers, cables, conduits, junction boxes, solar batteries, and allied accessories. Explain about the manufacturing data specification sheets of different types of solar PV components.	15	7

04	**Identification and Use of different tools and tackles used for installation of solar PV system** Explain about the different tools & tackles used for specific purpose in an installation of Solar PV system. Explain the process of installing the mounting structure along with structural supports and accessories for safe & weatherproof installation as per site conditions. Identify and describe various tools & tackles used for civil/mechanical installation. Identify opportunities for material and energy conservation, along with use of environmentally friendly materials in civil/mechanical installation. Explain and show how to follow waste management practices	15	8
05	**Site Survey for Installation of Solar PV System and asses the customer's Solar PV Requirement** Describe how to observe Sun path diagram and explain the importance of shading analysis. Explain the importance of assessing various site conditions for safe installation of solar PV system. Assess the location, any site level prerequisites and optimise the route plan Identify and list the load to be connected to the Solar PV system. Describe load profile. Explain the importance of engaging with customers for any specific requirement and budget constraints while identifying opportunities for deploying innovative energy solution like ''Plug and Play'' or ''Behind the Meter'' solution, where typical civil construction work may not be required. Describe the importance of system sizing and explain its calculation with basic mathematical tools. Explain how to prepare a site map.	20	10
06	**Interpretation of Drawings, Material Handling and storage of components on-site** Explain the importance of reading and rightly interpreting Single Line Diagram (SLD), Layout Diagrams, Civil/Mechanical and Electrical Drawings. Describe the DO's and Don'ts of material handling; Explain how to read and interpret the Bill of Material to verify with the delivery of components on-site. Explain how to ensure that all the components are handled and stored properly as per standard operating procedures. Describe the importance of Preparing Bill of Materials (BoM) including for portable and innovative solutions like Plug & Play or Behind the Meter system. Explain how to approach organization's warehouse/vendors, suppliers and/or manufacturers to place the order for components as per BoM Discuss how to ensure quantity of modules / panels, inverters etc matches with the requirement of the system Identify and list any variation is material specification and design and explain how to submit the documented variation to design team (if required) for approval or revised drawings	20	10
07	**Installation of Electrical components of a Solar PV System** Discuss how to implement site safety plan and inspect & utilize electrical installation toolkit. Identify tools and tackles for electrical component installation for Solar PV Power plant. Describe the process of installing the electrical components including inverter, batteries, junction boxes, energy meters, cables, and conduits other electrical components. Explain the Do's and Don'ts of DC wiring. Identify tools	25	12

	& tackles used for cable and conduit installation. Discuss and show how to ensure that the conduits and cables are properly supported, secured, and labelled Describe the importance of Earthing for the protection of solar PV system. Explain the significance and types of earth faults as per standards Explain the de-mounting of a solar PV power plant (after commissioning).		
08	**Test and Commission Solar PV system** Describe the importance of conducting testing of all solar PV components and performing fault finding and analysis, continuity checks, polarity check and other commissioning activities. Explain how to prepare testing and inspection report Explain the concerned regulations & standards for grid interconnection. Describe the commissioning process for the solar PV system.	15	8
09	**Maintain Solar Photovoltaic Power System** Explain how to carry out maintenance activities required for each component. Discuss how to clean solar panels with water in low sunlight to remove dust, bird droppings, pollen, leaves, branches, and snow for maximum energy output from the system Explain different methods which are employed for cleaning modules/array including mechanical or robotic cleaning Explain how to prepare and execute preventive maintenance schedule and reactive maintenance activities. Explain the typical faults, their causes and resolution for all components. Explain how to ensure that modules are routinely cleaned and inspect the system Explain how to identify the faults in the system when there is an interruption in power generation Discuss how to check current output, identify faulty module and perform standard troubleshoot measure Explain how to identify faults and damages and how to escalate it to seniors Discuss and show how to remove all the tools, consumable and, document maintenance activities with jobs completion form Discuss and show how to clean the work area after completing the maintenance activity.	30	15
10	**Maintain Personal Health & Safety at project site** Explain the requirements for safe work area. Explain the importance of administering first aid. Identify the personal protective equipment used for the specific purpose. Identify the hazards associated with photovoltaic installations; Identify and report any hazards, risks, or breaches in site safety to the appropriate authority Identify work safety procedures and instructions for working at height. Explain how to use safety signs, labels, charts, and notices at workplace Explain the importance of Occupational health & Safety standards and regulations for installation of Solar PV system. Incorporate good housekeeping practices and infection control guidelines.	20	10
11	**Completion and Handover Documentation** Explain how to prepare the checklist for handover of the solar power plant. Explain how to prepare complete and final documentation including commissioning forms and operation procedure. Explain how to record component serial numbers, file data sheet and complete equipment warranty registration. Discuss to inform the customer about the type of battery used, its life of operation and to dispose battery after its useful life to a recycling facility. Discuss how to	20	10

	deliver built drawings, permits, O&M documentation, project photos and customer operation manual. Discuss work safety procedures and instructions for handling heavy components Describe start- up and shutdown procedure of a Solar PV system;		
	Total	**200**	**100**

Suggested Specification table with Marks (Practical):

Distribution of Practical Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	15	10	10	0	0

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

Reference Books:

1. Solar photo voltaic Author: Chetan singh solanki
2. Renewable energy technology Author: Chetan singh Solanki PHI School publication

Course Outcome:

After learning the course the students should be able to:

1. Understanding of functioning of major equipments of Solar PV Modules.
2. Installation of Solar PV Modules, Its Service and Maintenance.
3. Identification and rectification of problem/ causes of minor/major problems.
4. Basic health and safety practices at the workplace and identify risks and hazards at workplace, use of PPE, and apply good housekeeping practices, etc.
5. Work effectively and communicate with others and demonstrate good ethical practicesand discipline.

List of Open Source Software/learning website:

1. www.nptel.ac.in/