Solar PV Installer (Suryamitra) **Details**

* Course Id : **SCGJ/SPVIS**
* Candidate Eligibility : 10th pass + ITI Fitter, Instrumentation, Welder / Diploma (Electrical, Electronics, Civil, Mechanical,)
* No. Of NOS (If QP) : **9**
* NSQF Level : **4**
* Cost Category : **I**
* Course Duration
  + Theory duration: 115 hrs.
  + Practical duration: 185 hrs.
  + Internship/Field Training: 300 hrs.

**Trainer Qualification Work Experience**

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| **Trainer Qualification** | **Work Experience** |
| * ITI /Diploma Electrical, Electronics, Civil, Mechanical, Fitter, Instrumentation   or   * B.Tech (Civil/Mechanical /Electrical/ Instrumentation / Electronics / Electrical and Electronics Eng.)   or   * MSc Physics /M.Tech in Energy Engineering/Solar Energy   or   * Certified Solar Trainer | * Minimum 3 years of relevant industry experience for ITI /Diploma (Electrical, Electronics, Civil, Mechanical, Fitter, Instrumentation)   Or   * Minimum 2 years of relevant industry experience for B.Tech (Civil/Mechanical /Electrical/ Instrumentation / Electronics / Electrical and Electronics Eng.) |

**CONTACT DETAILS OF THE BODY SUBMITTING THE QUALIFICATION FILE**

**Name and address of submitting body:**

**MSME-Technology Development Centre**

**(Process and Product Development Centre)**

**Ministry of MSME, Govt. of India**

**Hathras Road, Foundry Nagar**

**Agra-282006**

**(0562) -2344673,2344006, 6451234**

**Name and contact details of individual dealing with the submission**

**Name : R. Panner Selvam**

**Position in the organisation : Principal Director**

**Tel number(s) : (0562)- 6451234**

**Mobile : 9760547805**

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| **Qualification Title** | **Certificate course in Solar PV Installer (Suryamitra)** |
| **Qualification Code** | **SCGJ/SPVIS** |
| **Nature and purpose of the qualification** | **Nature: Certificate Course**  **Purpose:** Learners who attain this qualification are competent in  Installation,Operation and Maintanance of Solar PV system and get a job in the Solar field  Qualified learners who attain the above skill can also become an entrepreneur. |
| **Body/bodies which will award the qualification** | **MSME-Technology Development Centre (PPDC) Agra**  **(Certificate Awarded by Sector Skill council for Green Jobs body (SCGJ))** |
| **Body which will accredit providers to offer courses leading to the qualification** | **MSME-Technology Development Centre (PPDC) Agra**  **(Certificate Awarded by Sector Skill council for Green Jobs body (SCGJ))** |
| **Body/bodies which will carry out assessment of learners** | **The assessment shall be done as per the assessment sheets devised by SCGJ and accordingly the assessment agencies in consultation with SCGJ body at each SCGJ accredited testing centres.** |
| **Occupation(s) to which the qualification gives access** | **Installation, Operation and Maintenance of Solar PV system** |
| **Licensing requirements** | **Not Applicable** |
| **Level of the qualification in the NSQF** | **Level 4** |
| **Anticipated volume of training/learning required to complete the qualification** | **600** |
| **Entry requirements and / or recommendations** | **10th pass + ITI / Diploma (Electrical, Electronics, Civil, Mechanical, Fitter, Instrumentation, Welder)**  **Age 18 years and above** |
| **Progression from the qualification** | **Job Progression:** After completing this programme, participants will be able to:  • Carry out the site survey for installation of Solar PV system  • Assess the customer’s Solar PV requirement  • Procure the Solar PV system components  • Identify and Use the Tools & tackles used for Solar PV system installation  • Install the Civil/Mechanical and Electrical components of a Solar PV system  • Test and Commission Solar PV system  • Maintain Solar PV system  • Maintain personal Health & Safety at project site |
| **Planned arrangements for the Recognition of Prior learning (RPL)** | **Yes** |
| **International comparability where known** | **Skill Council for Green Jobs(SCGJ) Level- 4**  **CNC** |
| **Date of planned review of the qualification.** | **October 2018 as per SCGJ guideline** |

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| **Formal structure of the qualification** | | | | | |
| **Title of component and identification code** | **Mandatory/ Optional** | **Estimated size (learning hours)** | **Theory hours** | **Practical hours** | **Level** |
| 1 Introduction to Solar PV Installer (Suryamitra) Course | M | 6 | 3 | 3 | 4 |
| 2. Basics of Solar energy and Electrical concepts. | M | 12 | 6 | 6 | 4 |
| 3 Basics of Solar Photovoltaic systems and its components. | M | 48 | 24 | 24 | 4 |
| 4. Identification and Use of different tools and tackles used for installation of solar PV system | M | 12 | 4 | 8 | 4 |
| 5 Site Survey for Installation of Solar PV System and asses the customer’s Solar PV Requirement. | M | 24 | 10 | 14 | 4 |
| 6. Interpretation of Drawings , Material Handling and storage of components on-site | M | 18 | 9 | 9 | 4 |
| 7. Installation and mounting structure and photovoltaic modules, battery stand and inverter stand as per drawings | M | 30 | 9 | 21 | 4 |
| 8 Installation of Electrical components of a Solar PV System. | M | 42 | 12 | 30 | 4 |
| 9. Test and Commission Solar PV system | M | 24 | 8 | 16 | 4 |
| 10. Maintain Solar Photovoltaic System | M | 54 | 18 | 36 | 4 |
| 11. Maintain Personal Health & Safety at project site | M | 12 | 6 | 6 | 4 |
| 12. Completion and Handover Documentation | M | 6 | 3 | 3 | 4 |
| 13. Industrial Visit | M | 12 | 3 | 9 | 4 |
| 14. Internship/Field training | M | 150 | - | 300 | 4 |
| **Total** | | **600** | **115** | **485** |  |

**ASSESSMENT**

**Body/Bodies which will carry out assessment:**

The assessment shall be done as per the assessment sheets devised by SCGJ and accordingly the assessment agencies in consultation with SCGJ body at each SCGJ accredited testing centres

**How will RPL assessment be managed and who will carry it out?**

*YES. Learners who have met the requirements of any Unit Standard that forms part of this qualification may apply for recognition of prior learning to the relevant Education body. The applicant must be assessed against the specific outcomes and with the assessment criteria for the relevant Unit Standards.*

**Describe the overall assessment strategy and specific arrangements which have been put in place to ensure that assessment is always valid, reliable and fair and show that these are in line with the requirements of the NSQF.**

**1. ASSESSMENT GUIDELINE:**

1. Criteria for assessment for Qualification Pack has been created based on the NOSs and performance criteria by SCGJ. Each Performance Criteria (PC) has been assigned marks proportional to its importance within NOS and weightages have also been given among the NOSs accordingly. SCGJ has laid down the proportion of marks for Skills, Theory/Knowledge and Behaviour / Attitudes for each PC.
2. The assessment of the theory/knowledge will be based on written test/viva-voce or both while skill test shall be hands on practical. Behaviour and attitude will be assessed while performing the task.
3. The assessment shall be done as per the assessment sheets devised by SCGJ and accordingly the assessment agencies in consultation with SCGJ will create unique question papers for theory/knowledge and attitude for each candidate at each SCGJ accredited testing centres (as per assessment criteria below)
4. The assessment agencies will conduct the assessment as per the guidelines given by SCGJ having unique evaluations for skill practical for every student at each SCGJ accredited testing centre based on this criteria
5. To pass the Qualification Pack, every trainee should score a minimum of 70% in the overall assessment.
6. The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

**2. ASSESSORS:**

Assessment agencies in consultation with Skill Council for Green Jobs (SCGJ body.

**3. ELIGIBILITY TO APPEAR IN THE EXAM:**

Minimum 70% attendance is compulsory for the students to appear for the assessments.

**4. MARKING SCHEME:**

**Final Exam**

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| **Sr. No.** | **Method of Assessments** | **Weightage (marks)** | **Evaluator** |
| **1** | Skill Practical | 302 | **Sector Skill Council for Green Jobs (SCGJ) agency** |
| **2** | Written test (Trade Theory) | 248 |
| **Total** | | **550** |  |

**5. PASSING MARKS:**

To pass the Qualification Pack, every trainee should score a minimum of 70% in the overall assessment as per SCGJ guideline

**6. RESULTS AND CERTIFICATION:**

The assessment results are backed by evidences collected by Sector Skill Council for Green Jobs (SCGJ) body. Successful trainees are awarded the certificates by MSME-Technology Development (PPDC), Agra

**ASSESSMENT EVIDENCE**

ASSESSMENT EVIDENCE

Assessment evidence comprises the following components document in the form of records:

Job carried out in labs/workshop

Record book/ daily diary

Answer sheet of assessment

Viva –voce

Progress chart

Attendance and punctuality

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| **Title of Component** | | **Certificate Course in Solar PV Installer (Suryamitra)** |
| **Sr. No** | **Outcomes to be assessed** | **Assessment criteria for the outcome** |
|  | Site Survey for Installation of Solar PV System | * PC1. Understand the location of Installation and optimize the route plan * PC2. Asses the site level pre-requisites for solar panel installation * PC3. Check for any shading obstacles * PC4. Decide the type of mounting to be constructed. * PC5. Inform the customer for any civil construction to be undertaken for installing the panels * PC6. Prepare a site map of the location where installation has to be carried out. * PC7. Assess the load to be run on Solar Power Plant * PC8. Prepare a load profile * PC9. Document the site survey variables and complete the checklist/site survey form |
|  | Assess the customer’s PV system requirement | * PC1. understand the work requirement and areas of operation * PC2. interact with the superior for specific instructions * PC3. plan the day’s activities based * PC4. coordinate with stores and sales team * PC5. coordinate with marketing executive to understand about the customer details and their expectations at a broad level * PC6. visit the customer and understand their requirement * PC7. ask both open ended and close end questions to customers to clearly understand their power requirement * PC8. assess the area of installation, power output expectation, budget during discussion with customer * PC9. understand any specific requirement of customers on choice of modules / inverters, place of mounting * PC10. assess the location and its potential for solar power system, e.g., location with less clouds, number of days with sunlight * PC11. analyze the layout of the area and check space for installation * PC12. understand the type of installation i.e., roof mounting or in plain and its requirements * PC13. analyze the civil structure of building and its strength for roof top mounting * PC14. evaluate the place of solar module mounting and ensure it is free of shade from trees or from existing or potential taller buildings * PC15. analyze the photovoltaic system requirement of the customer * PC16. decide whether the power system will be connected to transmission grid * PC17. analyze for producing alternate current or direct current and match customer requirement * PC18. decide on battery backup for equipment as per customer expectation * PC19. understand the functions and controls of different components of solar PV system such as modules, inverter, grounding equipment, meters, disconnect * PC20. ensure the equipment and system specification matches the customer expectation * PC21. prepare a costing sheet for installation based on the customer feedback on system requirement * PC22. understand from customer for any budget constraints * PC23. suggest for any alternatives and changes in design to suit customer’s budget * PC24. make understand the customer about market price of components of different models of power system * PC25. prepare a cost benefit analysis and inform customers on savings while installing solar power system * PC26. compare cost with other types of power generation and inform the benefits * PC27. suggest for procurement of quality and best products available in the market * PC28. evaluate the safety concerns for installation and address them * PC29. arrange trained and qualified technicians for installation * PC30. ensure the system and structure meets the local government and regulatory requirement |
|  | Procure Solar PV system components | * PC1. Prepare Bill of materials from Single Line Diagram, civil/mechanical drawings and electrical drawings * PC2. Approach stores of the company or the market to place the requirement for components as per BOM * PC3. Ensure that the quantity of modules / panels, inverter and batteries match the voltage requirement of the system * PC4. Identify and list variation in equipment specifications, if any. * PC5. Document variation and submit to design team (if required) and obtain approval or revised drawings * PC6. Arrange for tools and consumables required for mounting the solar panels * PC7. List the statutory and other requirements to dispatch the equipment at site * PC8. Ensure that all materials are QC passed * PC9. Complete all documentation w.r.t. Procurement * PC10. Plan and receive the equipment at site. * PC11.Ensure that all the components are handled and stored properly as per standard operating procedures * PC12. Check materials received as per final BOM and ensure that the correct material for the job arrives on site and is damage free * PC13. Report and document the status of material received at site and take appropriate action for replacements, if any. |
|  | Install Civil and Mechanical parts of Solar PV Power Plant | * PC1. Identify type of footing required * PC2. Locate structural footings * PC3. Arrange for tools and consumables required for civil/mechanical installation * PC4. Get the concrete forms constructed to design specifications * PC5. Install mounting posts, roof attachments and anchors * PC6. Locate structural roof members and install structural attachments * PC7. Install module support/racking frame * PC8. Plumb and Level array structure * PC9. Install supplementary structural supports * PC10. Apply corrosion protection to cut surfaces * PC11. Apply Weatherproofing to avoid any seepage and penetrations * PC12. Install tracking Power Plant * PC13. Unpack photovoltaic modules * PC14. Inspect module for physical damage * PC15. Test photovoltaic modules’ electrical output * PC16. Install the modules as per layout diagrams * PC17. Secure module wiring * PC18. Fasten modules to structure * PC19. Torque module fasteners * PC20. Install battery bank stand and battery spill containment as per drawings / manuals * PC21. Install inverter stand as per drawings / manuals |
|  | Install Electrical Components of Solar PV System | * PC1. Implement the site safety plan and Maintain clear work area. * PC2. Clarify the maximum working voltage * PC3. Select required Personal Protective Equipment (PPE) * PC4. Measure current and voltage on equipment before proceeding with work * PC5. Inspect and demonstrate the use of electrical installation toolkit * PC6.Demonstrate situational awareness * PC7.Select the location of DC combiner box * PC8. Install DC combiner box along with disconnect protections * PC9. Install DC energy meters * PC10. Confirm battery bank location and Install batteries. * PC11. Prepare battery terminals and Install battery interconnection cables. * PC12. Terminate fine stranded cables. * PC13. Test final assembled battery polarity and voltage * PC14. Install charge controller (if required) * PC15. Install inverter * PC16. Install utility required disconnects * PC17. Install AC combiner box * PC18. Connect the solar Power Plant to the Distribution box or Transformer. * PC19. Proper labelling of the components * PC20. Prepare conduit and cable routing plan * PC21. Select the correct cable type, color, and gauge * PC22. Ensure that the conduits are properly supported and secured * PC23. Install the cables for modules, inverter and other components * PC24. Terminate cables * PC25. Check cables for continuity * PC26. Proper labelling of conduits and cables * PC27. Locate underground hazards, if any * PC28. Get the grounding Power Plant installed for modules/mounting Power Plant and inverters * PC29. Get the Bonding done for all electrical equipment and apply anti – oxidant material * PC30. Confirm and install battery bank enclosure/racks. * PC31. Install battery spill containment (if required) * PC32. Install batteries and Prepare battery terminals (e.g., clean). * PC33. Install battery interconnection cables and apply anti-oxidant material |
|  | Test and Commission Solar PV system. | * PC1. Perform visual inspection * PC2. Inspect mechanical civil and electrical installation components * PC3. Verify Power Plant grounding and measure insulation resistance * PC4. Check continuity of the Power Plant and Verify polarity. * PC5. Measure DC voltages and currents for each string and array for proper operation of the system * PC6. Verify inverter operation including antiislanding performance and measure AC system values * PC7. Verify calibration of Data Acquisition System. * PC8. Verify workmanship and demonstrate proficiency in using tools * PC9. Preparation of the Inspection report and take appropriate action * PC10. Verify labelling of Solar PV system. * PC11. Initiate start up procedures as per manufacturer instructions and record energy meter reading at start up * PC12. Measure and record voltage of energy storage system * PC13. Record and repair any anomalous conditions * PC14. Document design changes, if any |
|  | Maintain solar photovoltaic system | * PC1. Understand the importance of cleaning the solar panel as dirt in panel could affect power generation * PC2. Clean solar panels from dust, bird droppings, pollen, leaves, branches, snow * PC3. Use water to clean the accumulated dust in the panel * PC4. Wipe hard stains by wiping with sponge / cotton * PC5. Undertake cleaning activity during when the sunlight is low (early morning or after sunset) to avoid interruption in power generation * PC6. Use cleaning agents such as detergents to clean the stains / dust in the aluminium framing * PC7. Clean without damaging the module by stepping on it, dropping objects, etc * PC8. Clean modules periodically as per specification\n and document the date of cleaning * PC9. Regularly inspect the solar panel system, understand the check points and check for effective functioning * PC10. Ensure that modules are clean and power output is not affected * PC11. Ensure that modules are free of any tree shading, construction or other disruption from receiving sunlight * PC12. Check all cables for loose connections and any mechanical damage * PC13. Check the output voltage of the system and compare with the expected output voltage generation * PC14. Check for any damage for the system by external elements * PC15. Ensure that electrical connections are as per specifications * PC16. Check for the conditions of mounting and its stability to hold solar panels * PC17. Identify the faults in the system when there is an interruption in power generation * PC18. Perform regular checks like looking for dust, shade, etc., which might interrupt power output * PC19. Check current output for each string and identify the string which gives an low / undesired power output * PC20. Identify the faulty module in the string by shading the modules and checking the output using ammeter reading * PC21. Perform sequentially the standard troubleshooting activity to identify faults when there is power supply interruption in the grid * PC22. Check for working conditions of fuses and circuit breakers * PC23. Check the service panel connections * PC24. Check the cables and ensure that there is no damage * PC25. Check the wire connection to inverter and identify for any damage in wire connection * PC26. Inform the inverter service technician if there is a circuit board level fault for further repair * PC27. Escalate the issue to superiors if faults cannot be identified * PC28. Clean the work area after completing the maintenance activity * PC29. Remove all the tools, consumables used from the installation area * PC30. Fill in the job completion form and get the signature of the customer * PC31. Inform customers about maintenance of solar panels * PC32. Follow company standards in documentation of maintenance activities performed * PC33. Remove any metals or jewels to avoid possibility of current shock during maintenance activity * PC34. Wear gloves while cleaning aluminium frame with sharp edges to avoid any accidents * PC35. Ensure no material damage occurs during maintenance activity * PC36. Take adequate precautionary measures while handling electrical system * PC37. Keep work area clean and organized * PC38. Adhere to relevant health and safety standards * PC39. Dispose off any waste materials in accordance with safe working practices and procedures |
|  | Maintain work Safety of Solar PV System | * PC1. Identify corporate policies required for workplace safety. * PC2. Identify requirements for safe work area and create a safe work environment. * PC3. Identify contact person when workplace safety policies are violated * PC4. Provide information about incident/violation * PC5. Identify the location of First Aid materials and administer first aid * PC6. Identify the personal protection equipment required for specific locations on-site * PC7. Identify expiry dates and wear & tear issues of specified equipment * PC8. Demonstrate safe and accepted practices for personal protection * PC9. Identify environmental hazards associated with photovoltaic installations. * PC10. Identify electrical hazards * PC11. Identify personal safety hazards or work site hazards and Mitigate hazards * PC12. Select tools, equipment and testing devices needed to carry out the work. * PC13. Demonstrate safe and proper use of required tools and equipment. * PC14. Check access from ground to work area to ensure it is safe and in accordance with requirements * PC15. Reassess risk control measures, as required, in accordance with changed work practices and/or site conditions and undertake alterations * PC16. Inspect/install fall protection and perimeter protection equipment ensuring adequacy for work and conformance to regulatory requirements. * PC17. Identify approved methods of moving tools and equipment to work area and minimize potential hazards associated with tools at heights * PC18. Select and install appropriate signs and barricades * PC19. Place tools and materials to eliminate or minimize the risk of items being knocked down * PC20. Dismantle safety Power Plant in accordance with sequence and remove from worksite to clear work area. |
|  | Customer Orientation for Solar PV System | * PC1. Record Component serial numbers and file data sheet and complete equipment warranty registration. * PC2. Record and document inspection & commissioning certificates/forms * PC3. Deliver as-built documents along with project photographs and permits. * PC4. Deliver O&M documentation and customer operation manual. * PC5. Demonstrate Start-up and shutdown procedures * PC6. Demonstrate maintenance procedures to the customers. * PC7. Demonstrate maintenance procedures and provide basic training to maintain the system * PC8. Demonstrate normal operation procedure of solar PV system. |
|  | **Means of assessment**  The assessment of the theory/knowledge will be based on written test/viva-voce or both while skill test shall be hands on practical. Behavior and attitude will be assessed while performing the task | |
|  | **Pass/Fail**  To pass the Qualification Pack, every trainee should score a minimum of 70% in the overall assessment. | |

Solar Installer (Supervisor)

Solar Technician (Senior)

Solar Technician (Junior)

**Fig. 1. Career Progression of Certificate course in Solar PV Installer “Suryamitra”**

**After completing this programme, participants will be able to:**

• Carry out the site survey for installation of Solar PV system

• Assess the customer’s Solar PV requirement

• Procure the Solar PV system components

• Identify and Use the Tools & tackles used for Solar PV system installation

• Install the Civil/Mechanical and Electrical components of a Solar PV system

• Test and Commission Solar PV system

• Maintain Solar PV system

• Maintain personal Health & Safety at project site

**Course Curriculum**

**Syllabus content with time structure**

**For the course of Certificate Course in Solar PV Installer (Suryamitra)**

**Duration: 300 hrs.**

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| --- | --- | --- | --- | --- |
| **Session Name:** Introduction to Solar PV Installer (Suryamitra) Course | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (3 hours)** | **Activity (3 hours)** |  | **Practical** | **Theory** |
| Introduction to Solar PV Installer (Suryamitra) Course | Introduction to Solar PV Installer (Suryamitra) Course | • Demonstrate general Discipline in the class room and during the training program;  • Understand the role of Solar PV Installer and job opportunities;  • Understand the advantages of doing this course;  • Acquire basic skills of communication;  • Acquire basic reading capabilities to enable reading of signs, notices and/or cautions at site. | 3 | 3 |
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| **Session Name:** Basics of Solar energy and Electrical concepts. | | | | |
| **Course competencies**  **(Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (6 hours)** | **Activity (6 hours)** |  | **Practical** | **Theory** |
| Basics of Solar energy and Electrical concepts. | Basics of Solar energy and Electrical concepts. | • Understand Ohm’s Law;  • Understand the basics of electricity and electrical concepts;  • Perform simple calculations to derive power and energy  • Explain and understand DNI, GHI and Diffused Irradiance & Irradiation;  • Assess the movement of the sun and its effect on the performance of the plant; | 6 | 6 |
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| **Session Name:** Basics of Solar Photovoltaic systems and its components | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (24 hours)** | **Activity (24 hours)** |  | **Practical** | **Theory** |
| Basics of Solar Photovoltaic systems and its components | Basics of Solar Photovoltaic systems and its components | • Understand Terminology used in the Solar Industry;  • Identify the different components of a Solar PV system and its basic operation; • Identify and understand the working of different types of Solar PV systems  • Understand and acquire know-how of different Types, sizes and specifications of , Modules, Solar Inverters, Charge Controllers, Cables, Conduits, Junction Boxes, Solar Batteries and allied accessories • Read and Interpret the manufacturing data specification sheets of different Types, sizes and specifications of , Modules, Solar Inverters, Charge Controllers, Cables, Conduits, Junction Boxes, Solar Batteries and allied accessories  • Understand and acquire know-how of different Types, sizes and specifications of foundations/ footings;  • Select the right footing/foundation as per site location including suitability of roof condition or suitability of soil | 24 | 24 |
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| **Session Name:** Identification and Use of different tools and tackles used for installation of solar PV system | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (4 hours)** | **Activity (8 hours)** |  | **Practical** | **Theory** |
| Identification and Use of different tools and tackles used for installation of solar PV system | Identification and Use of different tools and tackles used for installation of solar PV system | • Identify and acquire the know-how of the different tools & tackles used for specific purpose in an installation of Solar PV system | 8 | 4 |
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| **Session Name:** Site Survey for Installation of Solar PV System and asses the customer’s Solar PV Requirement. | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (10 hours)** | **Activity (14 hours)** |  | **Practical** | **Theory** |
| Site Survey for Installation of Solar PV System and asses the customer’s Solar PV Requirement. | Site Survey for Installation of Solar PV System and asses the customer’s Solar PV Requirement. | • Understand how to observe Sun path diagram and shading analysis;  • Understand and assess the site conditions for safe installation of Solar PV system; • Identify the load to be connected to the Solar PV system;  • Prepare load profile  • Engage with customers for any specific requirement and budget constraints;  • Calculate size of the system with basic mathematical tools; | 14 | 10 |
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| **Session Name:** Interpretation of Drawings , Material Handling and storage of components on-site | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (9 hours)** | **Activity (9 hours)** |  | **Practical** | **Theory** |
| Interpretation of Drawings , Material Handling and storage of components on-site | Interpretation of Drawings , Material Handling and storage of components on-site | • Read and Interpret the Single Line Diagram, Layout Diagrams, Civil/Mechanical and Electrical Drawings • Understand the DO’s and Don’ts of material handling; • Read and interpret the Bill of Material to verify with the delivery of components on-site. | 9 | 9 |
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| **Session Name:** Installation and mounting structure and photovoltaic modules, battery stand and inverter stand as per drawings | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (9 hours)** | **Activity (21 hours)** |  | **Practical** | **Theory** |
| Installation and mounting structure and photovoltaic modules, battery stand and inverter stand as per drawings | Installation and mounting structure and photovoltaic modules, battery stand and inverter stand as per drawings | • Understand and acquire know-how of installing the mounting structure along with structural supports and accessories for safe & weatherproof installation as per site conditions;  • Identify Tools & Tackles used for civil/mechanical installation | 21 | 9 |
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| **Session Name:** Installation of Electrical components of a Solar PV System. | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (12 hours)** | **Activity (30 hours)** |  | **Practical** | **Theory** |
| Installation of Electrical components of a Solar PV System. | Installation of Electrical components of a Solar PV System. | • Understand and acquire the know-how of installing the electrical components including inverter, batteries, junction boxes, energy meters, cables and conduits other electrical components  • Understand the Do’s and Don’ts of DC wiring;  • Identify Tools & tackles used for cable and conduit installation  • Identify and acquire knowledge of different types of Earthing and its installation; • Understand significance and types of earth faults as per standards | 30 | 12 |
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| **Session Name:** Test and Commission Solar PV system | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (8 hours)** | **Activity (16 hours)** |  | **Practical** | **Theory** |
| Test and Commission Solar PV system | Test and Commission Solar PV system | • Describe and conduct the testing of all the solar components of the Solar PV system including fault finding and analysis including continuity checks, polarity check and other commissioning activities;  • Understand Regulations & Standards for interconnection;  • Describe the Commissioning process for the Solar PV System | 16 | 8 |
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| --- | --- | --- | --- | --- |
| **Session Name:** Maintain Solar Photovoltaic System | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (18 hours)** | **Activity (36 hours)** |  | **Practical** | **Theory** |
| Maintain Solar Photovoltaic System | Maintain Solar Photovoltaic System | • Carry out maintenance activities required for each component;  • Prepare and execute Preventive maintenance schedule and reactive maintenance activities;  • Understand the Typical faults, their causes and resolution for all components; | **36** | **18** |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Session Name:** Maintain Personal Health & Safety at project site | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (6 hours)** | **Activity (6 hours)** |  | **Practical** | **Theory** |
| Maintain Personal Health & Safety at project site | Maintain Personal Health & Safety at project site | • Identify the requirements for safe work area;  • Administer first aid;  • Identify the personal protective equipment used for the specific purpose;  • Identify the hazards associated with photovoltaic installations;  • Identify work safety procedures and instructions for working at height;  • Understand Occupational health & Safety standards and regulations for installation of Solar PV system | **6** | **6** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Session Name:** Industrial Visit | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (3 hours)** | **Activity (9 hours)** |  | **Practical** | **Theory** |
| Industrial Visit | Industrial Visit | During first two months of suryamitra program, at least 3 visits to medium or large industry to know power transmission, distribution, loads, cabling etc. and one visit to 33 kVsubstations must be planned**.** | **9** | **3** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Session Name:** Internship/Field training | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (0 hours)** | **Activity (300 hours)** |  | **Practical** | **Theory** |
| Internship/Field training | Internship/Field training | Internship,different field training i:e soft skill, entrepreneurship, virtual lab training, leadership training, site visiting, behavioral training,etc | **300** | **-** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Session Name:** Completion and Handover Documentation | | | | |
| **Course competencies**  **(includes Theory and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Theory (3 hours)** | **Activity (3 hours)** |  | **Practical** | **Theory** |
| Completion and Handover Documentation | Completion and Handover Documentation | Understand and prepare the Checklist for handover of the plant;  • Prepare complete and final documentation including commissioning forms and operation procedure;  • Acquire a thorough understanding of Startup and shutdown procedure of a Solar PV system; | **3** | **3** |

**External assessments**

|  |  |  |  |
| --- | --- | --- | --- |
| **Comp. NO.** | **ASSESSABLE OUTCOME** | | **ASSESSMENT RESULT** |
|  | | | |
| 1 | | Site Survey for Installation of Solar PV System | 30 |
| 2 | | Assess the customer’s PV system requirement | 100 |
| 3 | | Procure Solar PV system components | 50 |
| 4 | | Install Civil and Mechanical parts of Solar PV Power Plant | 60 |
| 5 | | Install Electrical Components of Solar PV System | 90 |
| 6 | | Test and Commission Solar PV system. | 50 |
| 7 | | Maintain solar photovoltaic system | 100 |
| 8 | | Maintain work Safety of Solar PV System | 50 |
| 9 | | Customer Orientation for Solar PV System | 20 |
|  | | **External Assessment Result** | **550** |

**EXAMINATION**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl.No.** | **COURSE CODE** | **COURSE NAME**  **(Theory + Practical)** | **Examination Scheme** | | | | | | | | **Total Marks** |
| **Theory** | | | | **Practice** | | | |
| **Sessional** | | **Final Exam** | | **Sessional** | | **Final Exam** | |
| **Max. Marks** | **Min. to Pass** | **Max. Marks** | **Min. to Pass** | **Max. Marks** | **Min. to Pass** | **Max. Marks** | **Min. to Pass** |
| 1 | SGJ/N0101 | Site Survey for Installation of Solar PV System | - | - | 16 | 11 | - | - | 14 | 10 | 30 |
| 2 | ELE/N5903 | Assess the customer’s PV system requirement | - | - | 40 | 28 | - | - | 60 | 42 | 100 |
| 3 | SGJ/N0102 | Procure Solar PV system components | - | - | 25 | 18 | - | - | 25 | 18 | 50 |
| 4 | SGJ/N0103 | Install Civil and Mechanical parts of Solar | - | - | 26 | 18 | - | - | 34 | 24 | 60 |
| 5 | SGJ/N0104 | Install Electrical Components of Solar PV System | - | - | 39 | 27 | - | - | 51 | 36 | 90 |
| 6 | SGJ/N0105 | Test and Commission Solar PV system | - | - | 24 | 17 | - | - | 26 | 18 | 40 |
| 7 | ELE/N6001 | Maintain solar photovoltaic system | - | - | 40 | 28 | - | - | 60 | 42 | 100 |
| 8 | SGJ/N0106 | Maintain work Safety of Solar PV System | - | - | 29 | 20 | - | - | 21 | 15 | 50 |
| 9 | SGJ/N0107 | Customer Orientation for Solar PV System | - | - | 9 | 6 | - | - | 11 | 8 | 20 |

**Evidence of level**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **LEVEL** | **Process required** | **Professional knowledge** | **Professional skill** | **Core skill** | **Responsibility** |
| 3 | Person may carry out solar PV system related job in the renewable sector which may require limited range of activities routine and predictable. | Basic concepts of Trigonometry and coordinate geometry & direction and measurement, Units and symbols for irradiation and irradiance ,knowledge of basic facts of Solar PV system i:e operation, maintenance ,installation etc | Recall and demonstrate  practical skill, able to install Solar PV unit, maintenance & operation ,routine and repetitive in narrow range of application | Communication written and oral, with minimum required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment. | Under close supervision.  Some responsibility for own work within defined limit, execute Solar PV system operation. |
| Level 4 | Level 4 | Level 4 | Level 4 | Level 4 |