



Diploma in Solar System Maintenance

Solar energy is a largest renewable resource freely available everywhere in adequate amounts, making it one of the most promising, clean, non-pollution source. Currently a number of solar energy devices like solar cooker, solar water heater, solar photovoltaic pumps and solar photovoltaic lighting systems are gaining popularity. There is a need for generating manpower for installing and managing such solar based systems. This module is designed to train technicians who can install, maintain and promote the uses of such solar appliances.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
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1	<p>Solar PV Essentials</p> <p>Theory Duration (hh:mm) 17:00</p> <p>Practical Duration (hh:mm) 17:00</p> <p>Corresponding NOS Code ELE/N5901 KB1 to KB19 ELE/N9952 KB1 to KB2 ELE/N9953 KB1 to KB4</p>	<ul style="list-style-type: none"> • Global overview of Power Development. • Global overview of Renewable Energy Development including Solar • National overview of Power Development • National overview of Renewable Energy Development including Solar • The Need of Solar Power, Benefits, Application of Solar Energy • Solar Power Myths • Basics on solar energy and power generation systems. • Basic principles of Solar Power (Solar Photovoltaic, Solar Thermal, Dish Type, Solar Tower) • Manufacturing process for Solar Photovoltaic and Solar thermal 	<ul style="list-style-type: none"> • Projector • Different types of Solar Panels • Components of a Solar PV Installation Systems • Solar Lighting and other application systems • Inverters • Charge Controllers • Testing Equipment • Hand tools
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		<p>equipment</p> <ul style="list-style-type: none"> • Use and handling procedure of solar panels, energy storage, control and conversion • Basic electrical system and functioning of various electrical devices • AC and DC Supply essentials • Components of Solar Systems • mechanical equipment and its functioning • maintenance procedure of equipment • site survey, design and evaluation of various parameters • tools involved in installation of system • quality and process standards • occupational health and safety standards • waste management 	
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		<p>and disposal procedures and standards</p> <ul style="list-style-type: none">• importance of wearing protective clothing and other safety gear while• carrying out installation• precautions to be taken while handling different electrical and mechanical products	
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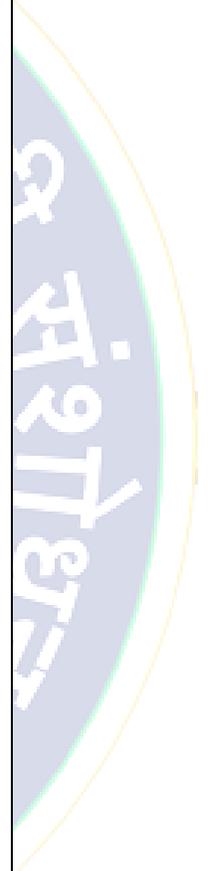


2	<p>Core and Generic skills</p> <p>Theory Duration (hh:mm) 17:00</p> <p>Practical Duration (hh:mm) 17:00</p> <p>Corresponding NOS Code ELE/N5901 SA1 to SA3 ELE/N5902 SA1 to SA3 ELE/N9952 SA1 to SA5</p>	<ul style="list-style-type: none"> • Read product and equipment manuals, installation manuals, etc. • Read warnings, instructions and other text material on product labels, components, etc. • Fill in job completion form after installation activities have been completed • To clearly communicate installation and design instructions to team • To clearly communicate customer's requirements • To communicate the constraints and quality requirements to team 	<ul style="list-style-type: none"> • Product Manuals of PV Panels • Charge Controllers • Inverters • Battery Bank • On Grid and Off Grid System components • Solar application appliances
3	Professional skills	<ul style="list-style-type: none"> • Purpose and specification of tools used in maintenance activity • How to operate/use 	<ul style="list-style-type: none"> • Hand tools • Testing tools

	<p>Theory Duration (hh:mm) 17:00</p> <p>Practical Duration (hh:mm) 17:00</p> <p>Corresponding NOS Code ELE/N5901 SB1 to SB5 ELE/N5902 SB1 to SB8 ELE/N9952 SB1 to SB4 ELE/N9953 SB1 to SB2</p>	<p>different tools such as screw driver, inspection fixtures, wire cutter, pliers, tester, spanner, etc.</p> <ul style="list-style-type: none"> • How to handle tools and equipment and maintain them in a good condition • How to interact with supervisor to understand the daily production target • How to interact with co-workers in order to coordinate work processes • Reflective thinking • Decision making • Critical Thinking 	
4	<p>Understanding the work requirement</p> <p>Theory Duration (hh:mm) 17:00</p>	<ul style="list-style-type: none"> • Understand the individual work requirement and areas of operation • Interact with the supervisor in order to understand the installation targets for the day and/or week • Understand the 	<ul style="list-style-type: none"> • Videos • PPT's • Laptop • Projector, • Projector Screen • White Board • Marker • Duster • Attendance Sheet

	<p>Practical Duration (hh:mm) 17:00</p> <p>Corresponding NOS Code ELE/N5901 PC1 to PC6</p>	<p>location of installations and optimise the route plan</p> <ul style="list-style-type: none"> • Plan the day's activities and the complete work plan for each installation • Coordinate with the various departments and persons involved in installation • Operation such as design, logistics, material handling and stores • Minimise absenteeism and report to work on time 	<ul style="list-style-type: none"> • Feedback Form • Internet
5	<p>Assessing site conditions and understanding installation requirements</p> <p>Theory Duration (hh:mm) 17:00</p>	<ul style="list-style-type: none"> • Assess the site level pre-requisites for solar panel installation • Decide on the type of mounting to be made such as roof top, open fields, small spaces • Ensure that land is levelled for flat surface mounting 	<ul style="list-style-type: none"> • Videos • PPT's • Laptop • Projector, • Projector Screen • White Board • Marker • Duster • Attendance Sheet

	<p>Practical Duration (hh:mm) 17:00</p> <p>Corresponding NOS Code ELE/N5901 PC7 to PC18</p>	<ul style="list-style-type: none"> • Decide the type of mounting accessories required for installation as per the site condition • Decide the place of installation and ensure maximum period of sunlight is captured in the area • Ensure that construction is strong to hold solar panel for 20-25 years, especially, on roof top • Inform the customer for any civil construction to be undertaken for installing the panels To be competent, the user/ individual must be able to: understand the location and mounting preference of customers, interact with customers and understand the purpose of installation and suggest alternatives 	<ul style="list-style-type: none"> • Feedback Form • Internet
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		<ul style="list-style-type: none"> • Match the voltage and power output of the type of installation designed and losses with customer's requirement • Inform customers about the approximate time required for installation and any requirements during installation • Get concurrence from the customer on the package of materials to be procured for installation based on agreed design 	
6	<p>Collecting the materials for installation and ensuring quality of material and handling</p> <p>Theory Duration (hh:mm) 17:00</p>	<ul style="list-style-type: none"> • Arrange for and collect the solar panels as per customer's requirement • Ensure that the quantity of modules / panels match the voltage requirement of the system • Arrange for mounting stands as per 	<ul style="list-style-type: none"> • Charge Controllers • Invertors • On Grid and Off Grid system components • Application Equipment • Testing Equipment

	<p>Practical Duration (hh:mm) 17:00</p> <p>Corresponding NOS Code ELE/N5901 PC19 to PC30</p>	<p>design</p> <ul style="list-style-type: none"> • Arrange for tools and consumables required for mounting the solar panels • Decide on the workforce required and arrange for team • Ensure that only company recommended quality materials are used unless specified by customer • Ensure all the materials procured are QC passed • Ensure that module is not damaged and the outer glass is not broken • Understand the material handling requirement and follow the standard operating procedure while moving them • Cover the glass module with an opaque material to ensure that there 	
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		<p>is no electricity generation before installation</p> <ul style="list-style-type: none"> • Ensure standard module handling procedure such as two people should lift a module; module should not be carried on head, etc. • Ensure that modules are stored in a way that it is not damaged by falling or by any external disturbance 	
7	<p>Organizational context</p> <p>Theory Duration (hh:mm) 17:00</p> <p>Practical Duration (hh:mm) 17:00</p> <p>Corresponding NOS Code ELE/N5901 KA1 to KA9 ELE/N5902 KA1 to</p>	<ul style="list-style-type: none"> • Company's policies on: incentives, personnel management • Company's code of conduct • importance of individual's role in the work flow • Organisation culture • Company's reporting structure • Company's documentation policy • Company's different department 	<ul style="list-style-type: none"> • Charge Controllers • Invertors • On Grid and Off Grid system components • Application Equipment • Testing Equipment



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	KA9 ELE/N9952 KA1 to KA3 ELE/N9953 KA1 to KA4	and concerned authority <ul style="list-style-type: none"> • Company's installation policy • Company's customer support policy 	
8	Understanding installation and material usage procedure and assessing mounting Theory Duration (hh:mm) 17:00 Practical Duration (hh:mm) 17:00 Corresponding NOS Code ELE/N5902 PC1 to PC14	<ul style="list-style-type: none"> • Understand the customer requirement on installation • Ensure that all appropriate materials are available during installation time • Ensure that the installation meets the local building rules and regulations • Ensure to disconnect PV module from any electric sources such as batteries, inverters, etc., before working on the module • Check that the module is defect free before installing • Ensure to take specified measures such as fire resistance, corrosion resistance for the 	<ul style="list-style-type: none"> • Charge Controllers • Invertors • On Grid and Off Grid system components • Application Equipment • Testing Equipment • Clamping Accessories for installation



		<p>module during installation</p> <ul style="list-style-type: none">• To be competent, the user/ individual must be able to:• Understand the type of mounting and other accessories required• Assess the degree of inclination and angle of tilt of PV module for the specific area, locality or region to enable the system absorb maximum annual sunlight• Ensure that sunlight falls perpendicular to the PV module to absorb maximum energy• Ensure that panels are mounted in a place where there is no shade at any time of the year• Ensure that mounting is strong to withstand wind, rain, etc.	
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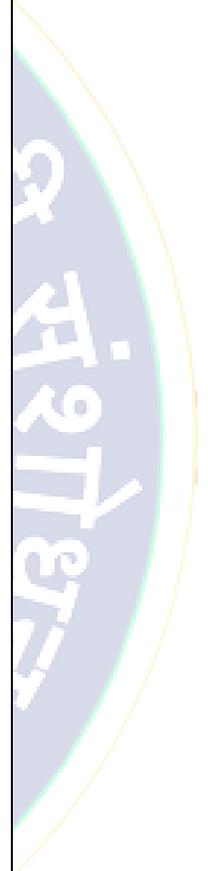


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		<ul style="list-style-type: none"> • Ensure that any special construction requirement for mounting is done by following acceptable quality standards, especially, in rooftop installations • Use approved tools for mounting • Set the mounting fixture firmly at the desired location 	
9	<p>Installing the panel and connecting the system and check for functioning</p> <p>Theory Duration (hh:mm) 16:00</p> <p>Practical Duration (hh:mm) 16:00</p> <p>Corresponding NOS Code ELE/N5902 PC15 to PC32</p>	<ul style="list-style-type: none"> • Remove packaging of the solar panel carefully • Handle the panels carefully without damaging the material • Take safety measures and wear protection gear such as gloves to avoid shock / injuries while handling modules • Cover the module with opaque material while installing to avoid any current generation • Ensure that junction 	<ul style="list-style-type: none"> • Charge Controllers • Invertors • On Grid and Off Grid system components • Application Equipment • Testing Equipment • Clamping Accessories for installation

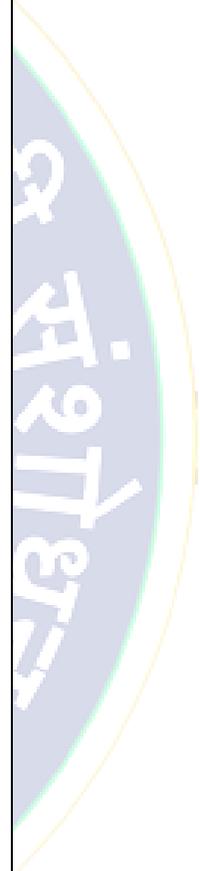


		<p>box in covered</p> <ul style="list-style-type: none">• Do not disturb or disassemble any part of the module part during installation• Take necessary precautions for fire resistance of modules• Use recommended material of solar cable and plugs for electrical connection• Install spare fuse to avoid any short circuits as per company policy• Mount the module on the fixture with the mounting rails using bolts and nuts• Ensure that the panels are mounted firmly To be competent, the user/ individual must be able to:• Use the cables to connect multiple PV modules in combination to	
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		<p>generate the desired voltage and current</p> <ul style="list-style-type: none"> • Choose type of connection, i.e., series or parallel, as per design • Use recommended cable to generate maximum voltage • Check the maximum system voltage as per the installation and follow adjustment measures accordingly to match output requirement • Ensure that the modules are grounded as specified • Connect the system and check for functioning • Escalate for any issues faced during the functioning of the system 	
10	Completing the work and following quality	<ul style="list-style-type: none"> • To be competent, the user/ individual must be able to: 	<ul style="list-style-type: none"> • Charge Controllers • Invertors • On Grid and Off

	<p>and safety procedures</p> <p>Theory Duration (hh:mm) 16:00</p> <p>Practical Duration (hh:mm) 16:00</p> <p>Corresponding NOS Code ELE/N5902 PC32 to PC43</p>	<ul style="list-style-type: none"> • Clean the work area after completing the installation activity • Remove all the tools, consumables used from the installation area • Fill in the job completion form and get the signature of the customer • Inform customers about maintenance of solar panels and procedure for cleaning of solar panels • Follow company standards in documentation of installation activities performed To be competent, the user/ individual must be able to: • Remove any metals or jewellery to avoid possibility of current shock during installation 	<p>Grid system components</p> <ul style="list-style-type: none"> • Application Equipment • Testing Equipment • Clamping Accessories for installation
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		<p>activity</p> <ul style="list-style-type: none"> • Wear all safety gears such as work shoes, cotton gloves, goggles while carrying out installation activities • Take specified precautionary measures while handling electrical system • Keep work area clean and organised • Adhere to relevant health and safety standards • Dispose of any waste materials in accordance with safe working practices and procedures 	
11	<p>Interacting with supervisor and coordinating with colleagues</p> <p>Theory Duration (hh:mm) 16:00</p>	<ul style="list-style-type: none"> • Understand and assess work requirements • Understand the targets and incentives • Understand new operating procedures and 	

	<p>Practical Duration (hh:mm) 16:00</p> <p>Corresponding NOS Code ELE/N9952 PC1 to PC17</p>	<p>constraints</p> <ul style="list-style-type: none"> • Report problems in the field • Resolve personnel issues • Receive feedback on work standards and customer satisfaction • Communicate any potential hazards at a particular location • Meet given targets • Deliver work of expected quality despite constraints • Get trained on latest technologies and updates • Receive positive feedback on behaviour and attitude shown during interaction • To be competent, the user/ individual must be able to: <ul style="list-style-type: none"> • Interact with colleagues from different functions and understand the nature of their work 	
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		<ul style="list-style-type: none"> • Receive materials from tool room or stores; deposit faulty modules and tools to stores • Pass on work allocation to colleagues in a respective geographical area • Share work according to competency and capability • Assist colleagues with resolving field problems resolve conflicts and achieve smooth workflow • Follow the company policy during cross functional interaction 	
12	Following safety procedures and participating and drills and workshops	<ul style="list-style-type: none"> • comply with safety procedures followed in the company • take adequate safety measures while handling hazardous materials or tools • take necessary 	<ul style="list-style-type: none"> • Safety equipment

	<p>Theory Duration (hh:mm) 16:00</p> <p>Practical Duration (hh:mm) 16:00</p> <p>Corresponding NOS Code ELE/N9953 PC1 to PC15</p>	<p>measures while handling electrical equipment</p> <ul style="list-style-type: none"> • escalate matters about hazardous materials or things found in the premises • follow appropriate material handling procedures to avoid any damages and injuries • Use safety materials such as gloves, goggles, masks, helmets, etc. • undertake adequate safety measures while on work to prevent accidents • ensure zero accidents in work • avoid damage of components due to negligence in ESD procedures • ensure no loss for company due to safety negligence To be competent, 	
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		<p>the user/ individual must be able to:</p> <ul style="list-style-type: none"> • participate in regular safety drills for being prepared in the event of a fire or natural calamity
	<p>Total Duration</p> <p>Theory Duration 200:00</p> <p>Practical Duration 200:00</p>	<p>Unique Equipment Required:</p> <ul style="list-style-type: none"> • Allen Key Set • Batteries • Cable Ties • Charge Controller • Connecting Wires • Digital Multimeter • Drill Machine • Lead Solder • Load (AC/DC) • MC4 Connectors • Mechanical Fixtures Required For Panel Installation • PCUs • Plier • Regulated Power Supply • Safety Gloves • Safety Helmet • Safety Shoes • Screw Driver Set • Solar Chart • Solar Conversion Kits • Solar Inverter • Solar Panels • Soldering Flux





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		<ul style="list-style-type: none">• Soldering Iron• Wire Stripper
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