Model Curriculum

Solar PV Engineer (Option: Solar Water Pumping System)

SECTOR: GREEN JOBS
SUB-SECTOR: RENEWABLE ENERGY
OCCUPATION: DESIGN, INSTALLATION AND COMMISSIONING
REF ID: SGJ/Q0112, V1.0
NSQF LEVEL: 5

Skill India

SCGJ SKILL COUNCIL FOR GREEN JOBS

N·S·D·C National Skill Development Corporation
Transforming the skill landscape

Certificate

CURRICULUM COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

SKILL COUNCIL FOR GREEN JOBS

for the

MODEL CURRICULUM

Complying to National Occupational Standards of Job Role/
Qualification Pack: '**Solar PV Engineer (Option: Solar water pumping system)**'
QP No. '**SGJ/Q 0112 NSQF Level 5**'

Date of Issuance: **October 16th, 2017**

Valid up to: **September 30th, 2019**

** Valid up to the next review date of the Qualification Pack*

Authorised Signatory
(Skill Council for Green Jobs)

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Solar PV Engineer (Option: Solar Water Pumping System)

CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a "Solar PV Engineer (Option: Solar Water Pumping System)", in the "Green Jobs" Sector/Industry and aims at building the following key competencies amongst the learner

Program Name	**Solar PV Engineer (Option: Solar Water Pumping System)**		
Qualification Pack Name & Reference ID.	SGJ/Q0112, v1.0		
Version No.	1.0	**Version Update Date**	04th Aug 2017
Pre-requisites to Training	Diploma (Electrical/Electronics/ Civil/ Mechanical) or Pre-final engineering and technology candidate with 3 years of formal engineering education		
Training Outcomes	**After completing this programme, participants will be able to:** • **Prepare site feasibility study report** • **Design of solar PV power plant** • **Installation and commissioning of solar PV power plant** • **Quality Assurance of solar PV power plant & components** • **Maintain personal health & safety at project site** • **Work effectively with others** **Option:** • **Design, Installation and Commissioning of Solar Water Pumping System**		

This course encompasses 6 out of 6 Compulsory National Occupational Standards (NOS) and 1 out of 1 of "Solar PV Engineer (Option: Solar Water Pumping System)" Qualification Pack issued by "Skill Council for Green Jobs".

S. No	Module	Key Learning Outcomes	Equipment Required
1	**Introduction to Solar PV Sector in India** **Theory Duration** (hh:mm) 18:00 **Practical Duration** (hh:mm) 12:00 **Introduction Module**	• overview of solar PV technology • overview of ground mount solar sector in India • understand the various market research reports and industrial magazines present in the market • type of ground mount PV Power Plants and working principles • overview of Rooftop Solar Sector in India • type of Rooftop Solar PV Power Plants and working principles • Introduction to solar PV water pumping systems	Site Visit for Practical Learning
2	**Prepare site feasibility report** **Theory Duration** (hh:mm) 16:00 **Practical Duration** (hh:mm) 24:00 **Corresponding NOS Code** SGJ/N0109	• Identify optimum location of installations • Understand different types of Roofs and their structural load profile. • Assess the site level pre-requisites for solar panel installation both ground and roof • Decide on the type of mounting to be constructed and place of mounting as per client requirement • Check for any shading obstacles • Prepare a site map of the location where installation has to be carried out • Assess the load to be run on solar PV power plant and prepare a load profile • Estimate the capacity of solar PV power plant • Decide on battery backup as per grid availability, loads and client expectation • Assess or obtain the site specific major parameters of solar resource data like GHI, DNI, Temperature and Wind • Perform shading analysis using simulation tools. • Estimate the energy generated from the solar PV power plant using solar design softwares like PV*SOL®, PVsyst, etc. • Identify the risks associated with the specific solar project • Prepare a site Feasibility Study Report using specialized software like PV*SOL®, PVsyst, SketchUp etc.	Rooftop solar PV design software with valid license; 1 kW solar PV power plant
3.	**Design of solar PV power plant**	• efficiency, cost and typical specifications, functioning and operating principle of different types of solar PV	Rooftop solar PV design software with valid license

	Theory Duration (hh:mm) 32:00 **Practical Duration** (hh:mm) 48:00 **Corresponding NOS Code** SGJ/N0146	plants, commercially available PV cells and modules, inverters, transformers, charge controllers, battery, mounting structures, cables, junction boxes and other components • site survey reports , availability of shadow free space for installation of solar power plant • the survey equipment and the methodology of survey • electrical designs for the module/ inverters and balance of system • solar irradiation including GHI, DHI and DNI • mechanical and electrical features necessary for the long life of the PV Power Plant under a wide range of operating conditions • solar PV power plant design software such as PVSYST and PV*SOL etc. • energy simulation report and its parameters and effect on solar PV plants • review and interpret of the mounting structure and foundation design drawings • review the overall structural layout of the solar PV power plant • select solar module technology and size, based on analysis of cost, power output, quality, climatic conditions of the site, global and diffused irradiance ratio at the site, etc. • workout the total numbers of modules based on the total capacity of the plant and the capacity of selected modules • prepare the earthing design of solar module arrays • select inverter, based on compatibility with module technology, compliance with grid code and other applicable regulations, reliability, system availability, serviceability, quality, cost, DC TO AC conversion efficiency • in case of a roof top power plant, decide on specifications of the inverter to power the AC loads in the building • decide on number of inverters to be used based on the capacity and specifications of the inverter selected • finalize the inverter layout and inverter locations on the basis of total capacity • prepare the earthing design of inverters • workout number of modules in a string based on the input voltage and MPPT voltage range of the inverter	

		• workout number of strings connected to a combiner box based on minimum run of DC connecting cables to minimized DC losses • finalize the inter row distance between the solar modules on the basis of minimum inter row shading, adequate space for cleaning and maintenance of solar modules and the tilted to south at an angle that optimizes the annual energy yield • specify DC cabling material, size, type of PVC for cables connecting modules, junction boxes to the combiner boxes and combiner boxes to the inverter panels etc. • prepare the specification of DC connectors (plugs and sockets) to be used • prepare the design specifications for junction boxes/combiner including IP number • prepare the specifications for disconnects/switches • workout number of combiner boxes connected to one panel of the inverter based on the input current rating of the inverter • prepare islanding facility for grid connected power plant, in case of non-availability of grid • protect incorrect polarity, over-voltage and overload for the DC cables • decide the battery storage capacity (AH) based on the number of days autonomy required (KWH/WH) and the depth of discharge of the battery bank • decide on the specifications for the charge controller/ inverter to control the overcharging/discharging of the batteries, prepare energy generation report using simulation software	
4.	**Installation and Commissioning of solar PV power plant** **Theory Duration** (hh:mm) 24:00 **Practical Duration** (hh:mm) 60:00 **Corresponding NOS Code** SGJ/N0132	• read and interpret the design and detailed drawings of the civil, mechanical and electrical works to be carried out at site • ensure the marking of the complete layout of the plant as per design • arrange for tools and consumable required for installation • follow the schedule for each of the civil and mechanical construction activity • manage the schedule for installation of modules, inverters, transformers, power protection devices , lightning arresters, earthing systems, etc. and	1 kW solar PV power plant, Solar Power Plant Installation toolkit

		ensure installation as per the design documents • ensure the installation of cables between different components including modules, inverter and other components as per design documents • check cables for continuity • manage the installation of communication and storage system with SCADA facility/ any monitoring system • ensure installation of battery banks if required • prepare, review and report progress on daily basis to the site in-charge for further action • visually inspect the plant after installation • get pre connection connectivity and conductivity test done • verify system grounding and get the insulation resistance measured • confirm that electrical protections, disconnection and other provisions are fulfilled as per design documents • get the DC voltage and current test done for each of the module strings • measure and record all relevant parameters of energy storage system if present • ensure calibration of SCADA/any monitoring system • prepare inspection report and forward to site-in charge for further • on getting the clearance from electricity inspector, initiate startup procedures as per manufacturer's instructions • monitor the energy readings and voltages at regular intervals on start up • record and report any anomalous condition to the site in-charge for further action • prepare as-built drawings and document design changes, if any	
5.	**Quality Assurance of Solar PV power plant & components** **Theory Duration** (hh:mm) 18:00 **Practical Duration** (hh:mm) 18:00 **Corresponding NOS Code** SGJ/N0133	• check modules earmarked for power plant using a random selection as per relevant IS/IEC standards • visit manufacturing facility of inverter supplier and witness testing of a few inverters • collect documentation related to each and every equipment and submit to site in-charge • ensure proper delivery/off-load of solar equipment • check all the material and equipment	Performance testing equipment for solar PV power plant and its components, Site Visit for Practical Learning

		received at site for any physical damage • ensure specifications of the equipment and components match with what has been ordered • ensure all warrantees by manufacturers are properly signed and are in order • inspect the foundations of structures • inspect and verify cable routes and specifications as per design documents • inspect module installation • inspect the cable terminations and ensure tightness • inspect the installation of inverters, protection devices and systems • carry out visual inspection of the plant to find out defects and deficiencies • measure and record the circuit voltage and short circuit current of all the module strings and compare that with design values • carry out thermography of doubtful strings and modules to know the defects • carry out performance ratio test by continuous operation of the plant as per the industry norms and compare with designed values • collect and compile conformity, warranty documentation, performance guarantees, calibration certificates and any other relevant documentation and handover to site in-charge, certificates	
6.	**Maintain Personal Health & Safety at project site** **Theory Duration** (hh:mm) 06:00 **Practical Duration** (hh:mm) 06:00 **Corresponding NOS Code** SGJ/N0106	• 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	Safety helmet, Safety souse, Safety belt, , Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Safety Gloves
7.	**Work effectively with others** **Theory Duration** (hh:mm) 06:00 **Practical Duration** (hh:mm) 12:00	• accurately pass on information to the authorized persons who require it and within agreed timescale and confirm its receipt • assist others in performing tasks in a positive manner where required and possible • consult and assist others to maximize effectiveness and efficiency in carrying out tasks	

	Corresponding NOS Code SGJ/N0120	• display appropriate communication etiquette while working • display active listening skills while interacting with others at work • demonstrate responsible and disciplined behaviors at the workplace • escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict • identify the need for common grounds with clients, team members, etc. and negotiate in an effective manner to achieve the same • consider and respect the opinions, creativity, values, beliefs and perspectives of others • ensure collaboration and group participation to achieve common goals • promote a friendly, co-operative environment that is conducive to employee's sense of belonging • facilitate an understanding and appreciation of the differences among team members	
	Theory Duration (hh:mm) 120:00 **Practical Duration** (hh:mm) 180:00	Rooftop solar PV design software with valid license, 1 kW solar PV power plant, Solar Power Plant Installation toolkit, performance testing equipment for solar PV power plant and its components, Safety helmet, Safety souse, Safety belt, Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Safety Gloves, Site visit for practical learning	

Grand Total Course Duration: 300 **Hours, 0 Minutes**

*(This syllabus/ curriculum has been approved by **Skill Council for Green Jobs)***

OPTIONS (Optional to choose any or all or none)
OPTION 1: Solar water pumping system

S. No	Module	Key Learning Outcomes	Equipment Required
1.	**Design, Installation and Commissioning of Solar Water Pumping System** **Theory Duration** (hh:mm) 50:00 **Practical Duration** (hh:mm) 70:00 **Corresponding NOS Code** SGJ/N0134	• solar resource assessment including Direct normal irradiation, diffuse horizontal irradiation, global horizontal irradiation and albedo • knowledge of Excel and Solar simulation software like PV*SOL®, PVsyst, etc. • various type of tracking system like maximum PowerPoint Tracker (MPPT) system and their usage • type of DC/AC pumping systems usage and their operating characteristics • underground water levels, availability of water and recharging frequency of water • efficiency, cost and typical specifications, functioning and operating principle of different types of solar photovoltaic plants, commercially available PV modules, inverters, charge controllers, battery, mounting structures, cables, junction boxes and other components • analyze the water usage and level of water table at site • decide on the specifications of the pumping set and motor • decide on the capacity of PV modules • design the plan of mounting structures and foundation • oversee the preparation of the foundation for solar module mounting structure and motor pump set • ensure structure is fixed on the foundations • oversee the mounting of solar modules • oversee the connection of solar module array to pump set in case of DC pumps • oversee the installation of inverter in case of AC pumps • ensure protection system are in place • perform inspection and testing of equipment • perform start-up procedures and measure output • compare the output with design output and take corrective actions, if required	1 hp Solar water pumping system, licensed design software, Solar water pumping Installation toolkit

		• ensure connection of the solar module array to motor pump set through a Maximum Power Point Tracker (MPPT) to get maximum power from the array • install an inverter after MPPT to convert DC power to AC power in case an AC submersible motor pump set is used • ensure periodical cleaning of solar module array • periodically ensure tightness of cable connections • ensure periodic maintenance of motor pump set	

	Grand Total Duration **Minimum Duration** **300 hrs** **Theory Duration** **120:00 hrs** **Practical Duration** **180:00 hrs** **Maximum Duration** **420 hrs** **Theory Duration** **170:00 hrs** **Practical Duration** **250:00 hrs**	**Unique Equipment Required:** Rooftop solar PV design software with valid license; 1 kW solar PV power plant, Solar Power Plant Installation toolkit, performance testing equipment for solar PV power plant and its components, Safety helmet, Safety souse, Safety belt, Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, Safety Gloves, Site visit for practical learning 1 hp Solar water pumping system; licensed design software, Solar water pumping Installation toolkit

Trainer Prerequisites for Job role: "Solar PV Engineer (Option: Solar Water Pumping System)" mapped to Qualification Pack: "SGJ/Q0112, v1.0"

Sr. No.	Area	Details
1	**Description**	To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack "SGJ/Q0112, Version 1.0".
2	**Personal Attributes**	Aptitude for conducting training, and pre/ post work to ensure competent, employable candidates at the end of the training. Strong communication skills, interpersonal skills, ability to work as part of a team; a passion for quality and for developing others; well-organised and focused, eager to learn and keep oneself updated with the latest in the mentioned field.
3	**Minimum Educational Qualifications**	Any Graduate.
4a	**Domain Certification**	Certified for Job Role: "Solar PV Engineer (Option: Solar Water Pumping System)" mapped to QP: "SGJ/Q0112, Version 1.0". Minimum accepted score as per respective as per SCGJ guidelines is 80%.
4b	**Platform Certification**	Recommended that the Trainer is certified for the Job Role: "Trainer", mapped to the Qualification Pack: "MEP/Q0102" or equivalent. Minimum accepted score as per SSC is 80%.
5	**Experience**	Two years of experience in Designing and Installation of Solar PV power plants

CRITERIA FOR ASSESSMENT OF TRAINEES

Job Role Solar PV Engineer (Option: Solar Water Pumping System)

Qualification Pack SGJ/Q0112

Sector Skill Council Green Jobs

Guidelines for Assessment

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.
4. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below).
5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criterion.
6. To pass the Qualification Pack , every trainee should score a minimum of 70% of aggregate marks to successfully clear the assessment.
7. In case of *unsuccessful completion*, the trainee may seek reassessment on the Qualification Pack.

Compulsory NOS **Total Marks: 465**				**Marks allocation**	
Assessment Outcomes	**Assessment Criteria for outcomes**	**Total Marks**	**Out of**	**Theory**	**Skills Practical**
SGJ/N0109 Prepare a site feasibility study report	PC1. identify optimum location of Installations	**65**	3	1	2
	PC2. assess the site level pre-requisites for solar panel installation		10	4	6
	PC3. decide on the type of mounting to be constructed and place of mounting as per client requirement		4	2	2
	PC4. check for any shading obstacles		3	1	2
	PC5. prepare a site map of the location where installation has to be carried out		3	1	2
	PC6. assess the load to be run on Solar PV power plant and prepare a load profile		3	1	2
	PC7. estimate the capacity of Solar PV power plant		5	2	3
	PC8. decide on battery backup as per grid availability, loads and client expectation		5	2	3
	PC9. assess or obtain the site specific major parameters of solar resource data like GHI, DNI, Temperature and Wind		3	1	2
	PC10. perform shading analysis		5	2	3
	PC11. estimate the energy generated from the rooftop solar PV power plant using software like PV*SOL®, PVSYST, etc.		10	3	7
	PC12. identify the risks associated with the specific solar project		5	2	3
	PC13. prepare a site feasibility study report		6	3	3
		TOTAL	**65**	**25**	**40**

SGJ/N0146 Design of solar PV power plant	PC1. review and interpret of the mounting structure and foundation design drawings	**100**	4	1	3
	PC2. review the overall structural layout of the solar PV power plant		6	2	4
	PC3. select solar module technology and size, based on analysis of cost, power output, quality, climatic conditions of the site, global and diffused irradiance ratio at the site, etc.		6	2	4
	PC4. workout the total numbers of modules based on the total capacity of the plant and the capacity of selected modules		6	2	4
	PC5. prepare the earthing design of solar module arrays		4	2	2
	PC6. select inverter, based on compatibility with module technology, compliance with grid code and other applicable regulations, reliability, system availability, serviceability, quality, cost, DC TO AC conversion efficiency		6	2	4
	PC7. in case of a roof top power plant, decide on specifications of the inverter to power the AC loads in the building		4	2	2
	PC8. decide on number of inverters to be used based on the capacity and specifications of the inverter selected		6	2	4
	PC9. finalize the inverter layout and inverter locations on the basis of total capacity		4	2	2
	PC10. prepare the earthing design of inverters		2	1	1
	PC11. workout number of modules in a string based on the input voltage and MPPT voltage range of the inverter		2	1	1
	PC12. workout number of strings connected to a combiner box based on minimum run of DC connecting cables to minimized DC losses		4	2	2
	PC13. finalize the inter space between the solar modules on the basis of minimum inter row shading, adequate space for cleaning and maintenance of solar modules and the tilted to south at an angle that optimizes the annual energy yield		4	2	2
	PC14. specify DC cabling material, size, type of PVC for cables connecting modules, junction boxes to the combiner boxes and combiner boxes to the inverter panels etc.		6	2	4
	PC15. prepare the specification of DC connectors (plugs and sockets) to be used		4	2	2
	PC16. prepare the design specifications for junction boxes/combiner including IP number		4	2	2
	PC17. prepare the specifications for disconnects/switches		4	2	2
	PC18. workout number of combiner boxes		4	2	2

	connected to one panel of the inverter based on the input current rating of the inverter				
	PC19. prepare islanding facility for grid connected power plant, in case of non-availability of grid		4	2	2
	PC20. protect incorrect polarity, over-voltage and overload for the DC cables		4	1	3
	PC21. decide on specification of charge controller/ inverter to the control the overcharging/ discharging of batteries		4	2	2
	PC22. decide the storage battery capacity (AH) based on the number of days autonomy required (KWH/WH) and the depth of discharge of the battery bank		4	1	3
	PC23. decide on the specifications for the charge controller/ inverter to control the overcharging/discharging of the batteries, prepare energy generation report using simulation software		4	1	3
		TOTAL	**100**	**40**	**60**
SGJ/N0132 Installation and commissioning of solar PV power plant	PC1. read and interpret the design and detailed drawings of the civil, mechanical and electrical works to be carried out at site	**100**	4	2	2
	PC2. ensure the marking of the complete layout of the plant as per design		2	1	1
	PC3. arrange for tools and consumable required for installation		2	1	1
	PC4. follow the schedule for each of the civil and mechanical construction activity		8	2	6
	PC5. manage the schedule for installation of modules, inverters, transformers, power protection devices , lightning arresters ,earthing systems, etc. and ensure installation as per the design documents		8	2	6
	PC6. ensure the installation of cables between different components including modules, inverter and other components as per design documents		6	2	4
	PC7. check cables for continuity		4	1	3
	PC8. manage the installation of communication and storage system with SCADA facility/ any monitoring system		8	2	6
	PC9. ensure installation of battery banks if required		4	2	2
	PC10. prepare, review and report progress on daily basis to the site in-charge for further action		**4**	**2**	**2**
	PC11. visually inspect the plant after installation		4	2	2
	PC12. get pre connection connectivity and conductivity test done		4	2	2
	PC13. verify system grounding and get the insulation resistance measured		4	2	2
	PC14. confirm that electrical protections, disconnection and other provisions are fulfilled as per design documents		4	2	2

	PC15. get the DC voltage and current test done for each of the module strings		4	2	2
	PC16. measure and record all relevant parameters of energy storage system if present		4	2	2
	PC17. ensure calibration of SCADA/any monitoring system		4	2	2
	PC18. prepare inspection report and forward to site in-charge for further		8	2	6
	PC19. on getting the clearance from electricity inspector, initiate start up procedures as per manufacturer's instructions		4	2	2
	PC20. monitor the energy readings and voltages at regular intervals on start up		6	3	3
	PC21. record and report any anomalous condition to the site in-charge for further action		2	1	1
	PC22. document design changes, if any		2	1	1
		TOTAL	**100**	**40**	**60**
SGJ/N0133 Quality Assurance of solar PV power plant and its components	PC1. visit the module manufacturing facility of the supplier	**100**	2	1	1
	PC2. check modules earmarked for power plant using a random selection as per relevant IS/IEC standards		6	3	3
	PC3. visit manufacturing facility of Inverter supplier and witness testing of a few inverters		4	1	3
	PC4. collect documentation related to each and every equipment and submit to site in-charge		4	2	2
	PC5. ensure proper delivery/off-load of solar equipment		6	2	4
	PC6. check all the material and equipment received at site for any physical damage		6	2	4
	PC7. ensure specifications of the equipment and components match with what has been ordered		6	3	3
	PC8. ensure all warrantees by manufacturers are properly signed and are in order		6	3	3
	PC9. inspect the foundations of structures		4	1	3
	PC10. inspect and verify cable routes and specifications as per design documents		6	2	4
	PC11. inspect module installation		4	1	3
	PC12. inspect the cable terminations and ensure tightness		4	1	3
	PC13. inspect the installation of inverters, protection devices and systems		4	1	3
	PC14. carry out visual inspection of the plant to find out defects and deficiencies		6	4	2
	PC15. measure and record the circuit voltage and short circuit current of all the module strings and compare that with design values		8	3	5
	PC16. carry out thermography of doubtful strings and modules to know the defects		8	4	4
	PC17. carry out performance ratio test by continuous operation of the plant as per		8	4	4

	the industry norms and compare with designed values				
	PC18. collect and compile conformity, warranty documentation, performance guarantees, calibration certificates and any other relevant documentation and handover to site in-charge, certificates		8	2	6
		TOTAL	**100**	**40**	**60**
SGJ/N0106 Maintain personal health & safety at project site	PC1. identify corporate policies required for workplace safety	**50**	2	1	1
	PC2. identify requirements for safe work area and create a safe work environment		3	2	1
	PC3. identify contact person when workplace safety policies are violated		1	1	0
	PC4. provide information about incident/violation		1	1	0
	PC5. identify the location of first aid materials and administer first aid		2	1	1
	PC6. identify the personal protection equipment required for specific locations on-site		3	2	1
	PC7. identify expiry dates and wear & tear issues of specified equipment		2	1	1
	PC8. demonstrate safe and accepted practices for personal protection		3	2	1
	PC9. identify environmental hazards associated with the project site		2	1	1
	PC10. identify electrical hazards		4	2	2
	PC11. identify personal safety hazards or work site hazards and mitigate hazards		4	2	2
	PC12. select tools, equipment and testing devices needed to carry out the work		4	2	2
	PC13. demonstrate safe and proper use of required tools and equipment		4	2	2
	PC14. check access from ground to work area to ensure it is safe and in accordance with requirements		2	1	1
	PC15. reassess risk control measures, as required, in accordance with changed work practices and/or site conditions and undertake alterations		2	2	0
	PC16. inspect/install fall protection and perimeter protection equipment ensuring adequacy for work and conformance to regulatory requirements		4	2	2
	PC17. identify approved methods of moving tools and equipment to work area and minimize potential hazards associated with tools at heights		2	1	1
	PC18. select and install appropriate signs and barricades		2	1	1
	PC19. place tools and materials to eliminate or minimize the risk of items being knocked down		1	1	0
	PC20. dismantle plant safely in accordance with sequence and remove from worksite to clear work area		2	1	1

			TOTAL	50	29	21
SGJ/N0120 Work effectively with others	PC1.	accurately pass on information to the authorized persons who require it and within agreed timescale and confirm its receipt	50	4	2	2
	PC2.	assist others in performing tasks in a positive manner where required and possible		4	2	2
	PC3.	consult and assist others to maximize effectiveness and efficiency in carrying out tasks		4	2	2
	PC4.	display appropriate communication etiquette while working		6	3	3
	PC5.	display active listening skills while interacting with others at work		4	2	2
	PC6.	demonstrate responsible and disciplined behaviours at the workplace		4	2	2
	PC7.	escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict		3	1	2
	PC8.	identify the need for common grounds with clients, team members, etc. and negotiate in an effective manner to achieve the same		3	1	2
	PC9.	consider and respect the opinions, creativity, values, beliefs and perspectives of others		4	2	2
	PC10.	ensure collaboration and group participation to achieve common goals		6	3	3
	PC11.	promote a friendly, co-operative environment that is conducive to employee's sense of belonging		4	2	2
	PC12.	facilitate an understanding and appreciation of the differences among team members		4	2	2
			TOTAL	**50**	**24**	**26**

OPTION **Option:** Solar water pumping system					
Total Marks: 100				**Marks Allocation**	
Assessment outcomes	**Assessment Criteria for outcomes**	**Total Mark**	**Out Of**	**Theory**	**Skills Practical**
SGJ/N0134 Design, installation and commissioning of solar water pumping system	PC1. analyze the water usage and level of water table at site	**100**	6	3	3
	PC2. decide on the specifications of the pumping set and motor		6	3	3
	PC3. decide on the capacity of PV modules		6	3	3
	PC4. design the plan of mounting structures and foundation		4	2	2
	PC5. oversee the preparation of the foundation for solar module mounting structure and motor pump set		4	2	2
	PC6. ensure structure is fixed on the foundations		4	2	2
	PC7. oversee the mounting of solar modules		4	2	2
	PC8. oversee the connection of solar module array to pump set in case of DC pumps		6	3	3
	PC9. oversee the installation of inverter in case of AC pumps		4	2	2
	PC10. ensure protection system are in place		8	4	4
	PC11. perform inspection and testing of equipment		8	2	6
	PC12. perform start-up procedures and measure output		8	3	5
	PC13. compare the output with design output and take corrective actions, if required		8	4	4
	PC14. ensure connection of the solar module array to motor pump set through a Maximum Power Point Tracker (MPPT) to get maximum power from the array		3	1	2
	PC15. install an inverter after MPPT to convert DC power to AC power in case an AC submersible motor pump set is used		3	1	2
	PC16. ensure periodical cleaning of solar module array		6	3	3
	PC17. periodically ensure tightness of cable connections		6	2	4
	PC18. ensure periodic maintenance of motor pump set		6	2	4
		TOTAL	**100**	**44**	**56**