

MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI

1	Name of Course	CERTIFICATE COURSE IN SOLAR TECHNICIAN (2019-2020)												
2	Course Code	302130												
3	Max. No. of Students Per Batch	25 Student												
4	Duration	06 Month												
5	Type	Full Time												
6	No Of Days / Week	6 Days												
7	No Of Hours / Days	4 hrs.												
8	Space Required	1) Lab = 200 sq feet 2) Class Room = 200 sq feet TOTAL = 400 sq feet												
9	Minimum Entry Qualification	SSC												
10	Age Limit	Minimum 18 Years												
10	Objective Of Course	To Create skilled man power in SOLAR TECHNICIAN												
11	Employment Opportunities													
12	Teacher's Qualification	Diploma & Degree in Electrical /Electronics/with one year Experience in relevant field												
13	Training System	Training System Per Week <table><tr><td>Theory</td><td>Practical</td><td>Total</td></tr><tr><td>06 hrs</td><td>18 hrs</td><td>24 hrs</td></tr></table>							Theory	Practical	Total	06 hrs	18 hrs	24 hrs
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06 hrs	18 hrs	24 hrs												
14	Exam. System	Sr. No.	Paper Code	Name of Subject	TH/ PR	Hours	Max. Marks	Min. Marks						
		1	30213011	SOLAR TECHNICIAN (Trade Theory)	TH - I	3 hrs.	100	35						
		2	30213021	SOLAR TECHNICIAN (Trade Practical)	PR - I	6 hrs.	200	100						
				Total			300	135						

SYLLABUS FOR SOLAR TECHNICIAN FOR 6 MONTHS			
Week No.	Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
1	Apply safe working practice	1. Visit of various section of the institutes and identification of danger warning , caution and safety signs.	1.Scope of the trade.
		2. Preventive measures for electrical accidents and use of fire extinguishers.	2.Safety rules & safety signs.
		3. Practice elementary first aid and artificial respiration.	3.Types and working of fire extinguishers.
		4. Use of personal protective equipment.	4.First aid safety practice.
			5. Hazard identification and prevention.
2	Prepare profile with an appropriate accuracy as per drawing	5. Workshop practice of filing and hacksawing.	6. Response to emergencies, eg. Power failure, system failure and fire etc.
		6. Practice sawing, planning, drilling and assembling for making a wooden switchboard.	7. Concept of standards and advantages of BIS/ISI.
		7. Workshop practice on drilling, chipping , internal and external threading of different sizes.	8. Trade tools specifications.
			9. Trade tools, Electrical symbols.
3	Prepare electrical wire joints	8. Practice on skinning twisting and crimping.	10. Introduction to National, Electrical code-2011.
		9. Identify various types of cables and measure conductor size using SWG and micrometer.	11. Fundamentals of electricity.
		10. Make joints on single strand conductors.	12. Concept of current, voltage, power, resistors and capacitors.
		11. Practice in crimping and soldering of joints/Lugs.	13. Generation of D.C electricity.
			14. Electrical conductors and insulators.

4	Understand characteristics of electrical and magnetic circuits	12. Measure parameters in combinational DC circuits by applying ohm's law for different resistor values and voltage sources.	15. Differentiate between AC and DC current.
		13. Verify laws of series and parallel circuits with voltage sources.	16. Types of joints and techniques of soldering.
		14. Measure current and voltage and analyse the effects of shorts and opens in series and parallel circuit.	17. Ohm's law; simple electrical circuits and problems.
			18. Kirchhoff's laws and applications.
			19. Series and parallel circuits.
5	do	15. Verify the characteristics of series parallel combination of resistors.	20. Open and short circuits in series and parallel networks.
		16. Test AC circuit with resistive load like lamp, heater, etc.	21. Series and parallel combinations of resistors.
		17. Test AC circuit with inductive load like fan, pump, etc.	22. Comparison & advantages of DC & AC systems.
		18. Measure power , energy for logging and leading power factors in single phase circuits.	23. Sine wave, phase, & phase difference.
			24. Related terms frequency, instantaneous value R.M.S. value average value, peak factors, form factor, power factor & Impedance etc.
6	do	19. Measure current , voltage, power, energy and power factor in three phase circuits.	25. Active and Reactive power.
		20. Determine the relationship between line and phase values for star and delta connections.	26. Single phase & three phase system.
		21. Measure the power of three phase circuit for balanced and unbalanced loads.	27. Advantages of AC poly-phase system.
			28. Concept of three phase star & delta connection.
7	Assemble install and test wiring system	22. Identify various conduits and different electrical accessories.	29. Line and phase voltage, current & power in a 3 phase circuit with balanced

			and unbalanced load.
		23. Prepare test boards/extension boards and mount accessories like lamp holders , various switches , sockets ,fuses, relays , MCB ,ELCB ,MCCB ,etc.	30. I.E rules on electrical wiring.
		24. Drawing layouts and practice in PVC casing-capping conduit wiring with minimum to number of points as per IE rules.	31. Types of domestic and industrial wirings.
		25. Wire up PVC conduit wiring to control one lamp from two different places using two way switch.	32. Study of wiring accessories eg- switches, fuses 'relays' MCB, ELCB, MCCB. 'Switchgears etc.
			33. Grading of cables and current ratings.
8	do	26. Prepare different types of earthlings and measure earth resistance by earth taster/megger.	34. Principle of laying out of Domestic wirings.
		27. Practice of measuring instruments in single and three phase circuits e.g. multimeter , wattmeter energy meter , phase sequence meter and frequency meter , etc.	35. Voltage drop concept. PVC conduit and casing -capping wiring system.
		28. Test single phase energy meter for its errors.	36. Different types of wiring power, control.
			37. Importance of Earthing.
			38. Plate earthing& pipe earthing methods and IEE regulations.
9	do	29. Measure power consumption for different loads with various times of use and calculate watthour.	39. Earth resistance and Earth leakage circuit breaker.
		30. Perform OC and SC test to determine and efficiency of single phase transformer.	40. Lightning arrestor.
		31. Visit to transmission /distribution substation.	41. PMMC and Moving iron instruments.

		32. Plot sun chart and locate the sun at your location for a given time of the day.	42. Wattmeter, Pf meter, Energy meter, megger, Earth tester, frequency meter, phase sequence meter, multimeter, Tong Testor etc.
			43. Calculation of total watt hour of all loads perv day& daily average watt hour from. Twelve months electricity bill.
10	Demonstrate characteristics of photovoltaic cell , modules batteries and charge controllers	33. Find out relations between sunlight and earth motion by globe model.	44. Working principle of transformer.
		34. Observe and compare sunlight and angle of inclination during 12 hours of a day on different days.	45. Conventional energy Generation by thermal (coal, gas diesel) & hydel power plant. (small and large).
		35. Measure intensity of solar radiation using pyranometer and radiometers.	46. Advantages of high voltage transmission.
			47. Study of distribution of power and substation.
11	do	36. Analyse shadow effect on incident solar radiation and find out contributors.	48. Overhead v/s underground distribution system.
		37. Plot curve of radiation measured with respect to time for location.	49. Solar energy fundamentals.
		38. Test and LED and a photodiode to verify the photo emitting effect and light sensitivity.	50. Study of sun path (East to West, North to South and south to north movement.)
		39. Test a photo voltaic cell for different illumination levels and verify photovoltaic property.	51. Study of daily and seasonal changes of sunlight
			52. Angle of inclination of radiant light & its relation with latitude & longitude of Different locations on Earth.
12	do	40. Plot I-V curve for photovoltaic.	53. Definition of key earth – sun angles.
		41. Test photovoltaic cell in sunlight at various angles of inclination and direction.	54. Equation of time, solar constant etc.

		42. Test different rated photovoltaic modules and plot I-V curve.	55. Semiconductor properties and type, P-type & N- type, semiconductors, PN junction, etc.
			56. Conversion of solar radiation of Electricity
13	do	43. Record specification of different solar panels and compare specifications to select a panel.	57. Main Materials used to develop Solar cells (silicon, cadmium telluride's, etc.)
		44. Test different types of PV panel such as mono crystalline , poly crystalline , amorphous silicon and thin film modules , prepare a report on panels.	58. Light sensitive properties of PN junction.
		45. Determine the relation between number of (4) cells and maximum voltage per module.	59. Difference of photo electives & photo voltaic effects of a PN junction.
		46. Connect solar panels in series and measure voltage and current. Repeat with different rated panels.	60. PV cell characteristics, I-V curve, effects of temperature.
			61. Photovoltaic effect.
14	do	47. Connect solar panels in parallel and measure voltage and current. Repeat with different rated panels.	62. Photo voltaic module minimal functional specification, cells per module, max watts per module, maximum voltage at max power, maximum current at max power.
		48. Shift panels to rooftop or place of installation using safe handling practices.	63. Solar PV array; series and parallel calculation.
		49. Check the structural and area requirement for installation of 1 KW solar panel.	64. Photovoltaic cell & PV modules; types- mono crystalline, ploy crystalline, amorphous silicon & thin film PV cells & their comparison.
			65. Battery fundamentals; - storage batteries : various types of Batteries- Lead acid battery , nickel,

			cadmium battery, lithium ion battery.
			66. Battery construction, working, charge/discharge and applications.
15	do	50. Charge a solar battery rated 12 V, 100 Ah using battery charge by CV and CC method and Tabulate the observations during charging cycle.	67. Safe working with battery.
		51. Discharge a solar battery rated 12V, 100 Ah using DC load under constant current and tabulate the observation during discharging cycle.	68. Solar Rechargeable SMF Battery: energy, storage capacity specifications, voltage, ampere hour (Ah), state of charge (SOC) depth of discharge (DOD), efficiency, c-rating, cycle life self – discharge etc.
		52. Connect the charge controller (12V, 10A) with solar battery (12V, 100Ah) solar panel. (75w) & DC load (12V such as LED light 3w & 5w, DC fan & FM radio)	69. Deep Discharge And Shallow Cycle.
		53. Test the charge controller working with the above circuit and study the performance.	70. Block Diagram Of A Charge Controller.
			71. Tools Required For Working With Battery.
16	do	54. Construct home lighting system using solar panel.	72. Charge Controllers, Fuses, Blocking, Diodes, Bypass Diodes, LED Indicators, Low Voltage Disconnect, High Voltage Disconnect.
		55. Construct a home lighting system with manual control.	73. Solar DC Domestic Application: Making Of Solar Lantern Solar Day Lighting.
		56. Construct a solar lantern using solar PV panel (15w) charge controller	74. Safety In DC System.

		(6V, 5A), output control circuit for variable illumination, rechargeable battery (6V, 7Ah) and DC LED lamp (5W).	75. Quality Standards List Out The Inventory List Of Equipment And Tools For Construction Of A DC System.
17	Construct and demonstrate solar DC appliances	57. Construct a solar day lighting using manual charge controller (12V,10A), Construct a solar street light using dusk to down charge controller (12V, 10A), solar battery light (12V DC, 5w).	76. Solar Dc Industrial Application; Solar Street Light Solar Home Lighting System.
		58. Construct a solar street light using dusk to down charge controller (12V, 10A), solar battery light (12V DC, 5w).	77. Differentiate AC And DC Solar Pumps And Their PV Requirements For Various HP Capacity.
		59. Construct a solar water pump using DC pump (24V), solar panel (250w), charge controller (24v, 10A).	78. Choice Of Wires (DC Cables) Used In The Solar PV Electronic System.
		60. Connect MC4 connectors to a solar panel using crimping tool.	79. Array Junction Box (AJB) Or Combiner Box.
			80. Protection Devices In AJB
18	Connect and test panel	61. Connect the PWM controller with solar panel and solar battery and note input/ output current and battery voltage at different time intervals.	81. PWM Charge Controller
		62. Connect the MPPT controller with solar panel and solar battery and note input and output current and battery voltage, at different time intervals.	82. MPPT Charge Controller.
		63. Compare the results of the above .	83. Block Diagram Of Charge Controller.
			84. Overview Of Sequence Of Connection (Step Wise) In An Off Grid System.
19	do	64. Open PWM and MPPT charge controllers and identify components wired to understand mechanism.	85. Inverter :- Working, Front Panel Controls And Back Panel Controls Normal And Solar Inverter
		65. Connect solar panels to an array junction box .	86. Solar Charge Controller For A Normal Inverter.

		66. Connect and test a 12v DC / 230v AC normal inverter.	87. Selection Of Solar Inverter Or Power Conditioning Unit (PCU).
		67. Connect a solar panel (10w), solar charge controller (12v, 12A) solar battery and convert to a solar inverter .	88. Switching ON And Shut Down Procedure Of A Solar Inverter.
			89. Types Of Inverter :- Stand Alone, Grid Tied CMPPT/Central/ String), Micro Inverter.
20	Perform various tests and measurement pertaining to PV modules	68. Prepare a comparative chart by collecting data sheets of different solar PCU and normal inverters.	90. IEC Std Followed For Inverter In Solar Projects.
		69. Practice procedural switching 'ON' and shutdown of solar PCU.	91. System Sizing :- Selection Of Components Of The Solar Photovoltaic Electrical System
		70. Prepare bill of material for a 1KW solar PV installation.	92. Load Calculation And System Sizing.
			93. Battery Sizing.
21	do	71. Prepare bill of material for a 10KW solar PV installation.	94. Solar Panel Sizing.
		72. Measure insulation resistance and wet leakage current of PV modules.	95. Sizing Small And Medium Solar PV Projects And Their Slds.
		73. Perform Bypass Diode test- Pmax at STC and Pmax at low irradiance.	96. System Types Based On : Backup Requirements Grid Availability, Budget And Space.
		74. Measure ground Continuity, Impulse voltage Reverse current and practical discharge.	97. Site Survey: Inspection Of Field, Selection Of Site, Shadow Analysis.
			98. Types Of Roofs, Weather Monitoring.
22	do	75. Practice to undertake precautions against module breakage.	99. Solar Path Finder And Sun Path Diagram.
		76. Demonstrate hot spot on modules through audio visual aids.	100. Roof Area, Shadow Free Area, Structure, Types And Age Of The Building,

		77. Prepare a layout of roof showing open areas and occupied areas and mark obstructions that can cause shadows.	Usable Area, O&M Challenges And Integration Issues.
			101. Installation Of Solar Panels.
23	Assist in installing and commissioning of solar PV plant	78. Perform shadow analysis in the rooftop at a 1 KW solar PV plant. Use sun path diagram for the latitude and solar pathfinder.	102. Solar Panel Facing Direction.
		79. Install a roof top solar panel mounting structure for 1 KW installation that uses solar panels 250Wx 4Nos.	103. Battery Bank Wiring, Load Wiring And Distribution Panel.
		80. Wire a battery bank for 1 KW installation, using 4x 12v, 100Ah solar batteries.	104. Switching Loads, Economical Planning Of Load Distribution.
		81. Wire the above installation panels, battery etc. to a 1 KW solar PCU.	105. Inverter Wiring, Interface With The Existing Electrical System.
			106. First Inspection Report Generation
24	do	82. Perform 'On Load'test, progressively add load till full load and record observation.	107. Customer Orientation.
		83. Perform overload test and record observation.	108. Documentation And Record.
		84. Prepare a first inspection report on the solar plant installation.	109. Do's And Don't In The Installation.
			110. Types Of Installation For Solar Array Mounts Based Roof Types:• Manual Mount • Raft Lark Mounts •Pillar Or Pole Mount. •Building Integrated Mount . Ballast Roof Mounts, RCC Roof Top Mount Tracking Mounts: Manual Track • Automatic Track, Single Axis And Dual Axis Safety At Heights
25	do	85. prepare a list of Do's and Don'ts in the installation.	111. Maintenance Of A Solar Plant.

		86. Perform shutting down procedure of the above solar plant.	112. Alarms And Security.
		87. Prepare a rack mount for a titled roof.	113. SOP (Standard Operation Procedures) Of PV System.
		88. Plan and prepare a report on building integrated solar mount (07 hrs).	114. Types Of Maintenance (Preventive/ Corrective / Condition Based)
26	Perform operation and maintenance of PV system with best practices	89. Demonstrate standard operating procedures of PV system.	115. Electrical Maintenance / Solar Panel Maintenance / Battery Maintenance/Charge Controller Maintenance.
		90. Demonstrate of solar panel maintenance-: cleaning, AC Array inspection precautions while cleaning.	
		91. Demonstrate of battery maintenance-checking of electrolyte level, specific gravity using hydrometer, physical damage, terminal voltage, cleaning of battery terminals.	

List of Tools & EQUIPMENTS			
SOLAR TECHNICIAN (ELETRICAL)			
Sr.No.	Name of the Tools and Equipment	Specification	Quantity
A.TRAINEES TOOL KIT (16+1)			
1.	Measuring Steel Tape 5 meter		25 nos.
2.	Combination Plier Insulated 200 mm		25 nos.
3.	Screw Driver Insulated 4mm × 150 mm, Diamond head		25 nos.
4.	Screw Driver Insulated 6mm × 150 mm		25 nos.
5.	Electrician screw driver thin stem insulated handle 5mm × 200 mm		25 nos.

6.	Heavy Duty Screw Driver insulated 5mm × 200mm	25 nos.
7.	Electrician Screw Driver thin stem insulated handle 4mm × 250mm	25 nos.
8.	Punch Centre 9mm * 150 mm	25 nos.
9.	Knife Double Bladed Electrician 100 mm	25 nos.
10.	Neon Tester 500 v	25 nos.
11.	Steel Rule Graduated both in Metric and English Unit 300 mm with precision of 1/4 th mm	25 nos.
12.	Hammer, cross peen with handle 250 grams	25 os.
B. SHOP TOOLS 7 EQUIPEMNT -		
(i) List of Tools & Accessories		
13.	Electrical Symbol and Accessories charts	04 nos.
14.	Pipe vice Cast Iron with hardened jaw open type 100mm	2 Nos.
15.	Hand Vice 50 mm jaw	2 nos.
16.	Table Vice 100 mm jaw	2 nos.
17.	Hacksaw frame (with blade) Adjustable 300 mm Fixed 150 mm	2 nos. Each
18.	File flat 200 mm 2nd cut with handle	2 nos.
19.	File round 200 mm 2nd cut with handle	2 nos.
20.	File round 200 mm 2nd cut with handle	2 nos.
21.	Pliers long nose insulated 150 mm	4 nos.

22.	Pliers flat nose insulated 200 mm		4 nos.
23.	Pliers, round nose insulated 100 mm		4 nos.
24.	D.E. metric Spanner Double ended 6-32 mm		2 Set
25.	Gauge, wire imperial stainless steel marked in SWG & mm wire Gauge - Metric		2 nos.
26.	Portable Electric Drill Machine 0-12 mm capacity 750w, 240V with chuck and key		1 No
27.	Crimping Tool 1.5 sq mm to 16 sq mm & 16 sq mm to 95 sq mm		1 No. Each
28.	Pliers Side Cutting 150 mm		2 No.
29.	Wire stripper adjustable length		2 no
30.	Hammer, ball peen with handle		2 no.
31.	Scriber (knurled centre position)		2 no
32.	Tool kit Box/ bag portable		5 no
33.	Allen Key		1 set
34.	Scissors blade 150 mm		2 no.
35.	Electrical loads: set of Incandescent lamp, Tube light, CFL, LED light, Heater and Geyser		2 set
36.	Torque wrench 8N-m to 15N-m		1 no
37.	Pipe cutter to cut pipes Upto 5 cm. dia.		1 no.
38.	Pipe cutter to cut pipes Above 5 cm. dia.		1 no
39.	Try Square 150 mm blade		2 no
40.	Multi Meter (analog) 0 to 1000 m ohms, 2V to 500 V, 100 micro A to 10A DC and AC		1 no

41.	Load Bank (variable) Up to 1.2 KW (lamp /heater Type)		1no
42.	Out side Micrometer 0 -25 mm least count 0.01mm		2 nos.
43.	Tap set Different size		02 set Each
44.	Trolley for transportation of Batteries		02 Nos.
45.	Die for threading Different sizes		2 set
46.	Rooftop mounting Structure For 4 × 250 W solar panels mounting practice, with tilt adjustment		2 set
47.	MCCB 100Amps, triple pole		1 no
48.	ELCB and RCCB 25 Amps, double pole and 25 Amps, double pole, In 30 mA		1 Each
49.	FUSES HRC Glass Rewire Type		4 each
50.	Cables: Twisted pair Nonmetallic Sheathed cable underground Feeder Cable Ribbon cable Metallic sheathed cable multi-conductor cable coaxial cable Direct-buried cable 1 mtr each		1 each
51.	Solar cable (red) 5 square mm		As required
52.	Solar cable (Black) 5 square mm		As required
53.	Three core wire (230 V, 15 A)		As required
54.	Battery cable 7.5 sq mm		As required
55.	Resin cored solder		As required
56.	Solder wax		As required
57.	MC- 4 connector		As required
58.	Pins 5mm		As required
59.	Lugs 7.5 mm		As required

60.	Hacksaw blades 200 mm, 300 mm		As required
61.	Bolts, nuts, anchor bolts, washers, screws, other pins, lugs etc.		As required
62.	Civil work utensils Spade, mixing spoon, leveling plates		1 Set
63.	Plumbing Tools		1 Set
64.	Plumbing raw materials		As required
65.	Civil work raw materials		As required
(ii) List of Equipment			
66.	Multimeter Digital 0 to 1000 M Ohms, 2V to 700V, 100 micro A to 10A DC and AC		02 Nos.
67.	Megger Analog – 500 V		01 Nos.
68.	Hydrometer		04 Nos.
69.	Solar Insulation meter		02 Nos.
70.	Pyranometer		01 No.
71.	Purheliometer		01 No.
72.	Lux meter Lux meter LCD read out 0.05 to 7000 Lumens with battery		02 Nos.
73.	Magnetic Flux Meter 0-500 tesla		02 Nos.
74.	Tong Tester/ Clamp meter 0-100 A (Digital Type)		01 No.
75.	Soldering Iron 25 Watt, 65 Watt and 120 Watt, 230 Volt		02 Nos. Each
76.	Temperature controlled Soldering Iron 50 Watt, 230 Volt		02 Nos.
77.	Thermomerter Digital 0 C – 150 C		01 Nos.
78.	Sun Shine Recorder		02 Nos.
79.	Weather Monitoring station To monitor and record Sunshine, wind velocity, Temperature, rainfall etc. with software.		01 No.

80.	Solar cell based sunlight radiation meter For Solar power measurement up to 2000 w/square meter		02 No.
81.	Magnetic compass		04 Nos.
82.	Cut model of photo voltaic cell assembly		01 Nos.
83.	Cut model of lead acid battery		01 Nos.
84.	Lead Acid battery 12V, 40Ah, 75Ah		01 Each
85.	Lead Acid battery 12V, 100 Ah		04 Nos.
86.	Solar simulator for solar cell characteristic study To study IV curve of a solar cell of minimum 2 Watt under variable illumination, temperature and suitable load		01 No.
87.	IV Curve tester		01 No.
88.	Sun path finder		01 No.
89.	Solar energy trainer with grouping of solar cells To group (series or parallel)at least six solar cells each with minimum 2 W with suitable loads		01 No.
90.	Solar tracker demonstrator kit To study manual and automatic control of 10W solar panel in East-west and North-south and back		01 No.
91.	Solar PV e-learning software using animations for training		01 Licence
92.	Halogen lamp with stand for illumination of solar panels in lab - AC mains operated to provide 0 to 1000 watts per meter square		02 Set
93.	Motorized bench Grinder AC mains operated		01 No.
94.	Battery Charger 0-6-9-12-24-48V,30amp		01 No.

95.	Solar photovoltaic module 75W mono crystalline module 75W amorphous silicon module 250W thin film module 5W,10W,40W poly crystalline module		01 Each
96.	Solar panels 250Wp		04 Nos.
97.	Solar charger controller with Dusk to Dawn automatic switching 12V,10A		05 Nos.
98.	Solar charge controller with manual switch (day lighting) 12V,10A		05 Nos.
99.	Array junction box For connecting 250W*4 nos. solar panel with DC fuse, DC MCB, and surge suppressor protection		02 Nos.
100.	Solar lantern LED type		01 No.
101.	Solar lantern CFL type		01 No.
102.	Solar lantern assembly sets		01 No.
103.	Home light system 12V DC with FM receiver,LED bulb and mobile charger as loads		01 No.
104.	Solar cell kit		01 No.
105.	Clinometer For Angle measurement		01 No.
106.	Spirit level For floor level check		01 No.
107.	Anemometer For window speed measurement		01 No.
108.	DC table fan 12V		01 Nos.
109.	A.C. voltmeter M.I 0-500V AC		02 Nos.
110.	Voltmeter 0-30V		02 Nos.
111.	Voltmeter 0-100V		02 Nos.
112.	Ammeter MC 0-1V		02 Nos.
113.	Ammeter MC 0-5V		02 Nos.

114.	Ammeter MC centre zero 0-20V		02 Nos.
115.	Ammeter MC centre zero 0-20V		02 Nos.
116.	Power factory meter		01 No.
117.	Rheostat 1-1 Ohm, 5 Amp , -10 Ohm,5 Amp, 0-25 Ohm,1Amp, 0-100 Ohm,1Amp		01 No.Each
118.	A.C.Energy meter Single phase,10 A,240 V induction type		01 No.
119.	A.C.Energy meter Three phase,15 A,440 V induction type		01 No.
120.	Kilo Wattmeter Analog 0-1.5-3KW,preesure coil rating-240v/440v,current rating-5A/10A Analog, portable type Housed in bakelite case		02 Nos.
121.	Digital Wattmeter 230 V,1KW,50Hz		02 Nos.
122.	Phase sequence Indicator3 phase, 415 V		02 Nos.
123.	Frequency Meter 45-55 Hz		02 Nos.
124.	DC LED Lamp 3W,5W,10W		50 Each
125.	DC Pump 24V		02 Nos.
126.	PMW controller		02 Nos.
127.	MPPT charger controller		04 Nos.
128.	Inverter with Battery 1 KVA with 12 V Battery, Input-12 Volt DC, Output-220 Volt AC		01 No.
129.	Solar PCU Off grid 1 KW MPPT Sine wave solar power conditioning unit		04 Nos.
130.	Solar Grid tied inverter Demonstrator kit 300 W KW		01 No.
131.	Solar Street Light 12V,75Ah battery,75 Wp solar panel,12v,10A dusk to down charge controller,60 W LED lights and 9 m height pole all		

	dismountable		01 Nos.
132.	Solar,Wind and hybrid power plant 1 KW cumulative		01 No.
133.	Solar Traffic Light 12V,75Ah battery,75 Wp solar panel,12v,10A dusk to down charge controller,15 W LED lights with suitable colors and 9 m height pole all dismountable		01 No.
134.	Used water treatment solar plant demonstrator kit 1 Liter capacity		01 No.
135.	Solar DC Lamp 1HP		01 No.
136.	Demonstrator kit for wind generation (Wind turbine with blower) 300 W		01 No.
137.	Rechargeable battery 12 V 100 Ah		As required
138.	Rechargeable battery 12 V 7 Ah		As required
139.	Rechargeable battery 6 V 5 Ah		As required
140.	LED lights 12 V DC		As required
141.	LED lights 6 V DC		As required
C.SAFETY AND PROTECTIVE EQUIPMENT			
142.	Rubber gloves		10 Pair
14.	Cotton gloves		05 Pair
144.	Gum boots		02 Pair
145.	Safety Goggles		04 Nos.
146.	Safety Helmet		04 Nos.
147.	First aid kit		02 Nos.
148.	Fire Extinguisher CO2 2 KG		02 Nos.
149.	Fire bucket Standard size		02 Nos.
D.SHOP FLOOR FURNITURE AND MATERIALS			

150.	Working Bench 2.5 m*1.20 m*0.75 m		04 Nos.
151.	Wiring Board 3 meters*1 meters with 0.5 meter projection on the top		01 No.
152.	Instructor's Table		01 No.
153.	Instructor's Chair		02 Nos
154.	Trainee Chair		01 for Each Trainee
155.	Trainee Table for two trainee		10 Nos.
156.	Metal Rack 100cm*150cm*45cm		04 Nos.
157.	Lockers with Drawers		01 for Each Trainee
158.	Almirah 2.5m* 1.20m* 0.5m		01 No.
159.	Black Board/White Board (Minimum 4*6 feet)		01 No.

Note:-All the tools and equipment are to be procured as per BIS specification

NAME OF COURSE :- SOLAR TECHNICIAN TRADE PRACTICAL & THEORY

SYLLABUS COMMITTEE MEMBER

SR.NO.	NAME OF THE MEMBER	DESIGNATION & ORGANISATION	COMMITTEE DESIGNATION	SIGNATURE
1	SAYGAONKAR P L	PRINCIPAL, ITI AUNDH,PUNE	CHAIRMAN	
2	KOTHEKAR W V	PRINCIPAL, ITI KHED, PUNE	MEMBER	
3	KULKARNI D V	SR.TRAINING OFFICER, HI-TECH TRAINING CENTRE, AUNDH,PUNE	MEMBER	
4	MAHAJAN J S	INSTRUCTOR,(Electrician) ITI AUNDH,PUNE	MEMBER	
5	WAIKAR H C	INSTRUCTOR, (Electrician) ITI AUNDH,PUNE	MEMBER	
6	CHHATRE M S	INSTRUCTOR, (Wireman) ITI AUNDH,PUNE	MEMBER	