GOVERNMENT OF THE PUNJAB

TECHNICAL EDUCATION & VOCATIONAL TRAINING AUTHORITY

CURRICULUM FOR

SOLAR PHOTOVOLTAIC (PV) SYSTEM FOR POWER GENERATION

(6 – Months Course)

Revised May 2016

APPROVED
Date: 17-5-2016
Sign:

CURRICULUM SECTION
ACADEMICS DEPARTMENT
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TRAINING OBJECTIVES

Keeping in view the energy crisis being faced by the Pakistan it has become necessary to diversify the power generation at smaller scale. Solar Photovoltaic (PV) system power generation is getting increased attention. However, due to shortage of adequate work force the pace of growth is not as it should be. Through this certificate course, properly trained work force for Solar Photovoltaic (PV) system power generation will become available. This will be particularly helpful for disseminating the technology at household, small business and agricultural use.

The curriculum covers the major topics of installation / Maintenance processes such as erection of Solar Photovoltaic (PV) system, power generation panels and checking of electrical and mechanical parts' uses of various equipment / tools related to the aforementioned processes are also included in the curriculum. Moreover, main focus is on the practical training in the lab. and in the field

CURRICULUM SALIENTS

Name of Course	:	Solar Photovoltaic (PV) Systems for Power Generation
Entry Level	:	Matric / Middle with 6-Months course of Electrician, Electronics OR Matric / Middle with RPL of Electrician Trade
Duration of Course	:	6-Months
Total training hours.	:	800 Contact Hours
Training Methodology	:	Practical 80%
	:	Theory 20%
Medium of instructions	:	Urdu/English

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SKILL PROFICIENCY DETAILS:

On successful completion of this course, the trainee should be able to:-

1. Handle the hand tools safely & properly.
2. Apply different fastening methods.
3. Apply work locating devices into which the work piece is loaded.
4. Apply work holding / clamping devices.
5. Apply tools involved in parallelism checking.
6. Complete installation of Solar (PV) System
7. Check / maintenance of PV Panels
8. Check / maintenance of Charge Controllers
9. Check / maintenance of batteries.
10. Check / maintenance of inverters.
11. Connect wires / accessories according to circuit diagrams.
12. Assemble various rubber and plastic parts.
13. Apply different welding techniques.
14. Diagnose Fault & troubleshooting.

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KNOWLEDGE PROFICIENCY DETAILS:

On successful completion of this course, the trainee should be able to:-

1. Understand the solar radiation situation in Pakistan.
2. Identify the working of different type of solar cells.
3. Identify the working of different type of solar cells modules.
4. Explain the working of holding / clamping devices.
5. Explain the work locating devices.
6. Explain the use of measurement tools, necessary parts assembling of solar modules.
7. Understand the various welding processes.
8. Understand the safety and precautionary measures necessary in the assembly of Solar (PV) System
9. Explain the importance of ethical values.

SCHEME OF STUDIES

Solar Photovoltaic (PV) System for Power Generation
(6-Months Course)

S. No.	Main Topics	Theory Hours	Practical Hours	Total Hours
1.	Health & Safety Procedures	2	6	8
2.	Introduction of workshop	10	55	65
3.	Basic Electricity & Electronics Fundamentals	18	60	78
4.	Solar radiation	18	35	53
5.	Solar (PV) Panel Electrical accessories	23	35	58
6.	Solar System	18	60	78
7.	PV Modules Installation	17	50	67
8.	PV Modules Operation	15	50	65
9.	Sizing and Estimation of Solar System	15	45	60
10.	I.T Fundamentals	8	32	40
11.	Functional English	16	64	80
12.	Field training / project	0	148	148
Total		**160**	**640**	**800**

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DETAIL OF COURSE CONTENTS

Solar Photovoltaic (PV) System for Power Generation
(6-Months Course)

S. No	Subjects	Theory Hours	Practical Hours
1.	**1.1 Health & Safety Procedures** 1.1.1 Introduction & understanding the safety precautions 1.1.2 Safety about fire hazards 1.1.3 Safety about health hazards 1.1.4 Safety about natural hazards 1.1.5 Protect himself to site dangers and body protection	02	05
2.	**Introduction of workshop** 2.1 Introduction to Metal Work and Metal Working Tools 2.1.1 Kinds of Tools and Machines 2.2 Measuring tools, 2.2.1 Layout tools, Cutting tools, 2.2.2 Chisels,& Chiseling 2.2.3 Files and Filing, 2.2.4 Hacksaws and Hack sawing, 2.2.5 Fasteners 2.2.5.1 Introduction to Fasteners, Screws, Nuts, Bolts, Rivets, Types and applications of related tools 2.3 Welding Techniques 2.3.1 Welding Shop Machinery Tools and Equipment 2.3.2 Oxyacetylene gas welding 2.3.3 Arc welding 2.3.4 TIG welding 2.3.5 MIG welding 2.4 Introduction of Measurements &Drawing 2.5 Fabrication of Metal Frame Using Angle Iron and Aluminum 2.6 Introduction of Basic Plumbing 2.7 Measuring and meters 2.7.1 Use of Pyrano-meter 2.7.2 Use of volte meter 2.7.3 Use of Ampere meter 2.7.4 Use of OHM meter 2.7.5 Use of Watt meter	1 2	70

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	2.7.6 Use of Tong Tester		
3.	**Basic Electricity & Electronics Fundamentals** 3.1 Atomic Structure 3.2 Basic Principals of Electricity 3.3 Definition of Voltage, Current & Resistance 3.4 Unit of Electrical Quantities & Symbols 3.5 Basic Electrical Circuit 3.6 Introduction to Electrical Instruments 3.7 Understanding the behavior of resister / capacitors 3.8 Introduction Sami Conductors (Diodes & Transistors) 3.9 Alternating current (AC) Direct Current (DC) 3.10 Sensors (Weather, Temperature & Light)	20	80
4.	**Solar radiation** 4.1 Brief Introduction of Weather effect on Solar (PV) System 4.2 Variation of solar spectrum 4.3 Solar cells & its types 4.4 First Generation 2ndGeneration 3rdGeneration 4th Generation 4.5 Semi-conductor material theory 4.5.1 P- N junction 4.5.2 Dopping material 4.6 Wafers of solar cells 4.7 Solar Modules & its types 4.8 Modules construction 4.9 I-V characteristics of Solar cells 4.10 Series and parallel connection 4.11 Open Circuit Voltage 4.12 Short Circuit Current 4.13 Use of Pyranometers	12	40
5.	**Solar (PV) Panel Electrical accessories** Batteries & its types Dry Battery Wet Battery Use and charging of batteries B) Inverters& its types DC-AC converter Circuit analysis Joining and operation of current flow Configuration C). Charge Controller	14	40

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	1. PWM 2. MPPT 3. Hybrid Inventor		
6.	**Solar (PV) System** 6.1 Off Grid System or standalone system 6.2 Complete detail about off Grid System 6.3 On-Grid System 6.4 Types of Current Transformer & Working Principle 6.5 Types of Potential Transformer & its, Working Principle 6.6 Cable selection, Types & Current Carrying Capacity 6.7 Metering System 6.8 Types and Uses of Switches 6.9 Types and uses of Circuit Breaker	15	80
7.	**Solar (PV) modules Installation** 7.1 Pre requisite of Solar (PV) modules Installation 7.2 Checking the specification of solar (PV) modules 7.3 Configurations of solar (PV) module 7.4 Junction Checking 7.5 Types of solar (PV) Panels (Mono, Poly Thin Film) 7.6 Placement / Installation of solar (PV) panels 7.7 Arrangements of modules 7.8 Installation / orientation / adjustment 7.9 Local connection 7.10 Latitude and Altitude angles 7.11 Shading effects 7.12 Array formation 7.13 String formation	15	60

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8.	**Solar (PV) modules operation** 8.1 Maintenance of solar Panels 8.2 Maintenance of Electrical accessories 8.3 Fault diagnose & trouble shooting 8.4 Fault Detection and analysis 8.5 Logging of sheets 8.6 Preventive maintenance of electrical accessories 8.7 I-V characteristics determination 8.8 Water cleaning of Solar modules 8.9 Weather shielding analysis &necessary arrangements	15	52
9.	**Sizing & Estimation of Solar System** 9.1 Calculation of Consumed Load 9.2 Calculation of Required PV Panel 9.3 Calculation of DC Load (if required) 9.4 Calculation of AC Load 9.5 Calculation of Required Charge Controller 9.6 Calculation of Required Inventor 9.7 Calculation of Required Batteries 9.8 One or two exercises for calculate the complete solar (PV) System for domestic use 9.9 One or two exercises for calculate the complete solar (PV) System for Commercial / Industrial use	15	45
10.	**Field training / project**		148
	Total	**136**	**544**

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LIST OF PRACTICALS

1. Safety Precautions
2. Metal Work
3. Electrical Circuits
4. Electronics Circuits
5. Solar Cells and Types
6. Solar Panel Circuits
7. Batteries and Batteries Circuits
8. Charger Controller and Circuits
9. Off Grid System and Installation
10. On Grid System and Hybrid Invertors
11. Grid tie System and Invertors
12. Maintenance of Solar Accessories
13. Maintenance of Electrical Accessories
14. Sizing of Solar system
15. Solar system for domestic
16. Solar system for commercial / Industrial
17. Cutting of Engle Iron
18. Welding of Frame
19. Welding of Stand

SCHEME OF STUDIES

I.T. Fundamentals

S.No	Main Topics	Theory Hours	Practical Hours	Total Hours
1.	Introduction to Computers	2	6	8
2.	Typing - Microsoft Word	4	14	18
3.	Internet & Electronic Mail	2	12	14
Total		**8**	**32**	**40**

DETAIL OF COURSE CONTENTS

I.T Fundamentals

S. No	Detail of Topics	Theory Hours	Practical Hours
1	**Introduction to Computers** 1.1 What is a computer- Definition, functions and general features? 1.2 What is Hardware – 1.2.1 Computer parts and units 1.2.1.1 Input Unit - Keyboard, Mouse etc. 1.2.1.2 Central Processing Unit 1.2.1.3 Output Unit 1.3 What is Software – 1.3.1 Electronic Parts of a Pc it is 1.3.1.1 Software and Its types 1.3.1.2 System Software, Application software and its functions 1.4 Working with windows Operating System 1.4.1 How does windows desktops work? 1.4.2 Setting desktop, background and wall papers etc. 1.4.3 Viewing directories – List of files and folders different styles. 1.5 What are the Icons, Shortcuts and other graphic, 1.5.1 How to see computer contents on different drives etc.	2	6
2	**Typing and Word processing (MS Word)** 2.1 Proper way of typing correct and speedy - getting familiar with the keys 2.2 Where to type in computer? How to save a file? How to get it back? Where to find your saved work? 2.3 Formatting in MS Word Bold, Italic, page setup, setting shades and colors. 2.4 Working with saved work, opening and moving files.	4	14

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	2.5 How to get it printed?		
3	**Emailing and Internet Surfing** 3.1 How to go to Internet, what is required for an internet connection etc. 3.2 How to use email? How to search on web? Etc 3.3 How to make new email account, login and logout an email account etc.? 3.4 Downloading and uploading attachments etc.	2	12
	Total	**8**	**32**

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LIST OF PRACTICALS
I.T Fundamentals

S. No.	Name of Practical
1.	Turn On/Off and setting of power supply
2.	Accessing The Desktop
3.	Using of Icons and Shortcuts
4.	Setting / customizing the desktop
5.	Viewing the contents of computer – Directory
6.	Setting the view of a folder
7.	Copying, Deleting and Moving Files in a folder
8.	Working with different Applications
9.	Opening MS Word for typing
10.	First lesson of Typing A S D F
11.	Second Lesson of typing J K L ;
12.	Third Lesson U I O P
13.	Fourth Lesson R E W Q
14.	Fifth Lesson N M , .
15.	Sixth Lesson V C X Z
16.	Seventh Lesson All letter using R index Finger
17.	Eighth Lesson All letter using L index Finger
18.	Formatting in MS Word Bold, Italic etc.
19.	Page Setting/ Page Layout
20.	Using Internet
21.	Opening Email, making new account
22.	Sending Receiving Emails
23.	Downloading and uploading attachments etc.

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SCHEME OF STUDIES

Functional English

S.No	Main Topics	Theory Hours	Practical Hours	Total Hours
1.	Use of past indefinite tense	2	6	8
2.	Use of 'was' 'were' ' questions and negatives	3	6	8
3.	Explaining a situations/ analysis	2	6	8
4.	Communication in writing	2	6	8
5.	Comprehension	1	6	7
6.	Application/ C.V.	1	6	7
7.	Dialogues	1	9	10
8.	Understand vocabulary	1	3	4
9.	Writing complaints/ answers to complaints	1	9	10
10.	Interviews	2	7	10
	Total	**16**	**64**	**80**

DETAIL OF COURSE CONTENTS

Functional English

S. No	Detail of Topics	Theory Hours	Practical Hours
1	**Use of past indefinite tense** 1.1 Describing past events	2	6
2	**Use of 'was' 'were' ' questions and negatives**	2	6
3	**Explaining a situations/ analysis** 3.1 Making a plan 3.2 Visiting factory area 3.3 Giving justifications	2	6
4	**Communication in writing** 4.1 Asking for list of stationery items 4.2 Submitting report of performance of team of technicians 4.3 Submitting joining report	2	6
5	**Comprehension: practice sets**	2	6
6	**Job application/C.V.**	1	6
7	**Dialogues**	1	9
8	**Understand vocabulary**	1	3
9	**Writing complaints/ answers to complaints**	1	9
10	**Interviews**	2	7
	Total	16	64

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LIST OF PRACTICALS

Functional English

S. No.	Practical
1.	Group discussion
2.	Interviews
3.	Role play

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LIST OF LABS

Lab for Solar Photovoltaic (PV) System for Power Generation

- One Suitable Size Room for Solar Photovoltaic (PV) System for Power Generation Lab (Six months Course) for 25 Students with above attached list of tools, equipment & machinery along with following auxiliary Labs, Mechanical Lab, Welding and Fabrication Lab.

I.T Fundamentals

- Computer Lab

LIST OF MACHINERY / EQUIPMENT / TOOLS

(For a class of 25 students)

Name of Trade	Solar Photovoltaic (PV) System for Power Generation
Duration of Course	6-Months

PV Panels

S. No	Tools / Items	Specification	Quantity
1.	***Solar Panels (Mono)***		
1.1	Solar panel 05 Watt	5 Watt Crystalline with 4mm²cable 1.0m length connectors MC4 Compatible	5 Nos
1.2	Solar Panel 100 Watt	100 Watt Mono Crystalline with 4mm²cable 1.0m length connectors MC4 Compatible.	5 Nos
1.3	Solar Panel 50 Watt	50 Watt Mono Crystalline with 4mm²cable 1.0m length connectors MC4 Compatible.	5 Nos
	Total (Mono)		**15 Nos**
2.	***Solar Panels (Poly)***		
2.1	Solar Panel 05 Watt	05 Watt Poly Crystalline with 4mm²cable 1.0m length connectors MC4 Compatible.	5 Nos
2.2	Solar Panel 100Watt	100 Watt Poly Crystalline with 4mm²cable 1.0m length connectors MC4 Compatible.	5 Nos
2.3	Solar Panel 250 Watt	250 Watt Mono Crystalline with 4mm²cable 1.0m length connectors MC4 Compatible.	5 Nos
2.4	Solar Panel 50 Watt	50 Watt Poly Crystalline with 4mm²cable 1.0m length connectors MC4 Compatible.	5 Nos
	Total (Poly)		**20**
	Grand Total (Mono & Poly)		**35 Nos**

Solar Batteries

S. No	Items and Specification	Quantity
1.	Battery Dry/Gel(VRLA) Maintenance Free(Deep Cycle) 100Ah/12V	1 No
2.	Battery Lead Acid Lead Acid120 Ah 12V DC	4 Nos.
	Total	**5 Nos**

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Charge Controllers

S. No	Items and Specification	Quantity
1.	Solar Power Charge Controller MPPT (Imported)12/24/ Volt 40 Amp with charge status indicators	5
2.	Solar Power Charge Controller MPPT (Imported)12/24Volt 20 Amp with charge status indicators.	5
3.	Solar Power Charge Controller PWM (Imported) 12/24Volt 10 Amp with charge status indicators.	5
Total		**15 Nos.**

Power Invertors

S. No	Items and Specification	Quantity
1.	DC to AC Inverters(Imported) Power Inverter 24/48 Volt, 1 KVA Output 220V Frequency 50 HZ	5 Nos.
Total		**5 Nos.**

Software & Sensors

S. No	Items and Specification	Quantity
1.	Software for solar system (PV syst)	05
2.	Prayano meters different types & make	05
3.	Sensor different (weather, temperature, heat, humanity& light,	05 each
Total		**15 Nos.**

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Tool Kits:

S. No	Items and Specification	Quantity
1.	Combination Pliers, 06"	5 Nos.
2.	Flat Nose Pliers, 06"	5 Nos.
3.	Diagonal Cutter Pliers, 06"	5 Nos.
4.	Screw Driver (Flat), 6"	5 Nos.
5.	Screw Driver (Flat), 4"	5 Nos.
6.	Screw Driver (Philip), 6"	5 Nos.
7.	Screw Driver (Philip), 4"	5 Nos.
8.	Line Tester, Digital	5 Nos.
9.	Electrician Knife, 6"	5 Nos.
10.	Hacksaw , 8"	5 Nos.
11.	Pipe Wrench, 8"	5 Nos.
12.	Screw Wrench, 6"	5 Nos.
13.	Watch Maker Set, 6 Pieces	5 Nos.
14.	Compass	5 Nos.
15.	Measuring Tape, 03 M	5 Nos.
16.	Digital Multi Meter, - Measure –-AC volts up to 500-Dc volts up to 500-DC Current up to10 Amp	5 Nos.
17.	Tool Box for above mentioned items. With all above tools, Appropriate Size(Plastic)	5 Nos.
Total No. of Tool Kits Required		**5 complete Tool Kits comprises on 17 Items**

List of Equipment / Tools for Welding

S. No	Items and Specification	Quantity
1.	Tig Mig welding Machines	2
2.	Arc Welding Transformer	5
3.	Welding Screens	5
4.	Hammer 500 gms	5
5.	Chisel 8"	5
6.	Hacksaw	5
7.	Files	5
8.	Welding Helmet	5
9.	Welding Gloves	5 Pairs
10.	Try Square	5
11.	Plair monkey	5
12.	Tongs	5
13.	Steel Rule	5
14.	Measuring Tape	5
15.	Vernier Caliper	5

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Training Material

S. No	Items and Specification	Quantity
1.	Main Switch (Fuji/ ABB or Equivalent), 60 AMP, Manual,	5 Nos.
2.	Change Over, 60 AMP, Rotary type, Manual	5 Nos.
3.	Circuits Breaker (ABB/ Bosch or Equivalent), 10 AMP	5 Nos.
4.	Circuits Breaker (ABB/ Bosch or Equivalent), 06 AMP	5 Nos.
5.	DC Tong Tester Digital, AC/DC Amp up to 0-200 Amp with AC /DC Volts 0-1000	5 Nos.
6.	Digital Multi Meters, AC /DC current up to 10 A, AC /DC Voltage up to up to1000Volts, Multi Ohm range With all accessories.	5 Nos.
7.	Analog Multi meters, AC /DC current up to 10A, AC /DC Voltage up to up to1000Volts, Multi Ohm range, With all accessories	5 Nos.
8.	Battery Health Tester, 12 V, Test battery condition (Low, Medium, High)	5 Nos.
9.	Hand Crimping Tool, 3.5mm to25mm	5 Nos.
	Total	**45 Items**

COMPUTER LAB

S. No.	Tools / Equipment	Quantity
1.	**Desktop computer (Specifications as per notification issued by MIS Section, TEVTA)**	26 (1 for each student & 1 for the teacher)
2.	Printer (Laser)	01
3.	Scanner	01
4.	Internet Connection (At least 1 MB speed)	01
5.	UPS 10 KVA	01
6.	Air Conditioner 1 ½ Ton	02
7.	Multimedia Projector	01

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CONSUMABLE MATERIALS

Solar Photovoltaic (PV) System for Power Generation Training Material

S. No	Items and Specification	Quantity
1.	PVC Wire 8mm, 6mm, 4mm	1 Coil Each
2.	PVC Connectors 6mm, 4mm	25 Nos.
3.	Insulation Tape	12 Nos.
4.	PVC Duct	As per requirement
5.	Screws assorted sizes	As per requirement
6.	Welding Rod	As per requirement
7.	Engle Iron	Assorted Sizes

Functional English

S. No.	Item	Quantity
1.	Stationery	As per requirement
2.	Board Markers	As per requirement

I.T Fundamentals

S. No.	Item	Quantity
1.	Printing Paper	As per requirement
2.	Printer Toner	As per requirement

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EMPLOYABILITY OF PASS OUTS

The pass outs of this course may find job / employment opportunities in the following sectors / areas: -

1. Solar System Manufacturing (i.e. PV Panels Charge Controller, Inventors & related accessories)
2. Erection of commercial & domestic Solar System Firms
3. Small Workshops which maintain and look after Solar System

REFERENCE BOOKS

Solar Photovoltaic (PV) System for Power Generation Training Material

1. Build Your Own solar Panel, (Generate Electricity from Sun), By Philip Hurley
2. Solar Electricity (Hand Book), By Michel Boaxell
3. Photovoltaic Design and Installation (Dummies), By Ryan Mayfield

Functional English

1. High School English Grammar By Wren & Martin
2. Oxford English Grammar

I.T Fundamentals

1. Introduction to Computer by Peter Norton
2. 2007 Microsoft® Office System Step by Step by Joyce Cox, Steve Lambert and Curtis Frye
3. Internet and E-mail with Windows 7 by Studio Visual Steps

MINIMUM QUALIFICATION OF INSTRUCTOR

Solar Photovoltaic (PV) System for Power Generation Training Material

- BSc Engineering in related technology with one year related experience.

OR

- DAE / B.Tech in related technology with three years related experience.

OR

- G-II Level Certificate in related technology with Six years related experience.

Functional English

- M.A English

I.T Fundamentals

- DAE CIT/ BCS from HEC recognized university

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List of Trade Related Jargon
GENERAL VOCABULARY WORDS

Bradawl	سوا	Magnitude	مقدار
Capacitance	ظرفیت	Making	بنانا
Checking	جانچنا	Measurement	پیمائش
Components	حصے	Multiplication	ضرب
Conductance	ایصالیت	Parallel	متوازی
Conductivity	کرنٹ گزانے کی صلاحیت	Percentage	فی صد
Conductor	موصل	Plier	پلاس
Connecting	جوڑنا	Power	طاقت
Consumer	صارف	Principle	اصول
Current	برقی رو	Protective Device	حفاظتی آلہ
Cutting	کاٹنا	Removing	ختم کرنا
Decimal	اعشاریہ	Resistance	مزاحمت
Diagram	شکل	Resistivity	مزاحمت کی صلاحیت
Energy	توانائی	Reversing	سمت تبدیل کرنا
Equipment	آلات	Scissor	قینچی
Faults	نقائص	Screw Driver	پیچ کس
Files	ریتی	Semi-Conductor	نیم موصل
First Aid	ابتدائی طبی امداد	Series	سلسلہ وار
Fixing	لگانا	Soldering	ٹانکا لگانا
Hacksaw	لوہا کاٹنے والی آری	Specific Resistance	مزاحمت مخصوصہ
Hammer	ہتوڑا	Structure	ساخت
Handling	کنٹرول	Tools	اوزار
Identification	شناخت	Tracing	تلاش کرنا
Installation	لگانا	Tri square	گنیا
Insulation	حاجز تہہ	Understanding	سمجھنا
Insulation Remover	حاجز تہہ اتارنے والا آلہ	Vernier Caliper	ورنیر کیلیپر
Insulator	حاجز	Voltage	وولٹیج
Magnet	مقناطیس	Work	کام

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SPECIFIC VOCABULARY WORDS

Accessories	آلات اور سامان	Hybrid Inverter	دوغلا متبادل
Adjustment	درستگی	Industrial	صنعتی
Alternating Current	متغیر کرنٹ	Inverter	متبادل
Arrangement	ترتیب دینا	Junction	جوڑ
Array Formation	صف بندی	Laying	بچھانا
Assembling	جوڑنا	Maintenance	دیکھ بھال
Batteries	بیٹریاں	Metering	پیمائش
Cabling	کیبل بچھانا	Necessary	ضروری
Carrying Capacity	گزادنے کی صلاحیت	Off Grid System	بند گرڈ سسٹم
Charge Controller	چارج کنٹرولر	On Grid System	چالو گرڈ سسٹم
Commercial	تجارتی	Placement	مقام
Configuration	خاکہ	Poly Crystalline	پولی کریسٹیلین
Current Transformer	کرنٹ ٹرانسفارمر	Potential Transformer	پوٹینشل ٹرانسفارمر
Designing	نقشہ	Pyrometer	حرارت پیما
Diagnose	تشخیص	Sensor	محسوس کرنے والا
Direct Current	یکساں کرنٹ	Shading Effect	شیڈنگ کا اثر
Domestic	گھریلو	Sizing	سائز کے مطابق
Dry Battery	خشک بیٹری	Solar Cell	شمسی سیل
Equipment	آلات	Specification	تصریحات
Estimation	تخمینہ	String Formation	لڑی بندی
Fabrication	بنانا	Trouble Shooting	نقائص کی درستگی
Friction	رگڑ	Variation	تبدیلی
Functional	چالو حالت	Wet Battery	گیلی بیٹری

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Curriculum Revision Committee

1.	**Muhammad Mahboob Butt,** Chief Instructor, GCT Sahiwal	**Convener**
2.	**Mr. Asif Mahmood,** Deputy Manager, GSTC Gulberg-II, Lahore	**Member**

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