GOVERNMENT OF THE PUNJAB

TECHNICAL EDUCATION & VOCATIONAL TRAINING AUTHORITY

CURRICULUM FOR

UPS REPAIR AND MAINTENANCE

(6 – MONTHS COURSE)

Revised April 2016

APPROVED
Date: 7-4-16
Sign:

CURRICULUM SECTION

ACADEMICS DEPARTMENT

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TRAINING OBJECTIVES

A UPS or an uninterruptible power supply is an electrical device to provide backup electrical power in the event of electrical power failure or when there is no electricity. UPS devices have become a household item in Pakistan ever since load shedding has become a permanent feature. Traditionally UPS devices are used to protect sensitive electrical equipment such as computers and servers from damage and to prevent data loss. The cheapest form of power backup is a UPS device. Diesel and petrol generators are very expensive both in terms of upfront costs and up keep. As a sequel of it being a necessity, it is absorbing more people into it than any other field of life these days. Now keeping in mind this fact, it is felt imperative to introduce some courses about UPS Repair and Maintenance.

UPS Repair and Maintenance is one of such course, to produce skilled manpower, able to carry out Repair and Maintenance of the UPS Systems to enhance their life& to make them more useful.

This curriculum is developed by more focusing on practical along with necessarily required theoretical knowledge as per need of the hours.

This curriculum of six months duration covers the main topics of usage of common hand tools, electronics devices ,computer applications, basic network overview, measuring instruments, formation of electronic circuits, batteries, usage of UPS systems, assembling, maintenance of UPS systems, faultfinding of UPS & their rectification to meet the need of job market.

CURRICULUM SALIENTS:

Name of the course	UPS Repair and Maintenance
Entry Level	Matric with Science or Middle with one year certificate in Electronics Home Appliance
Duration of Course	6 – Months
Total Training Hours	800 Contact Hours
Training Methodology	Practical 80% Theory 20%
Medium of Instruction	Urdu / English

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SKILL COMPETENCY DETAILS

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

1. Work according to general workshop safety rules.
2. Apply measuring instruments safely.
3. Operate the series & parallel circuit, capacitors, inductors etc.
4. Handle Transformers & batteries
5. Operate the different electronic devices like semiconductor devices, diode & their applications & bipolar transistor etc.
6. Operate the UPS properly.
7. Calculate appropriate load for a UPS System.
8. Install UPS System according to the layout.
9. Maintain UPS System.
10. Apply preventive maintenance for UPS system
11. Diagnose faults in UPS& to carryout rectification.

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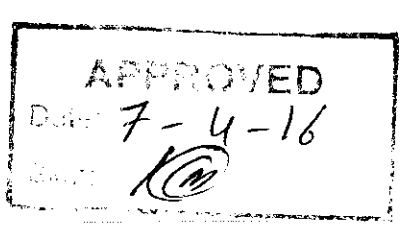
KNOWLEDGE PROFICIENCY DETAILS

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

1. Explain the safety precautions & practices in handling of electronic devices.
2. Define the atomic structures, conductors, insulators, capacitors & inductors.
3. Define the resistances, currents & voltages & laws defining their relationship.
4. Explain the measuring instruments, transformers & electronic devices.
5. Explain the battery, different types and their advantages.
6. Explain the electricity and how it interacts with magnetism.
7. Describe the formation of basic electronic circuits such as rectifiers, inverter.
8. Explain the basic concepts of inverter.
9. Describe the basic blocks of UPS.
10. Describe the types of UPS Systems.
11. Explain the function of Control Circuit.
12. Explain the formation of a UPS System.
13. Explain the techniques of Installation of a UPS system.
14. Explain the techniques for repairing of the UPS systems
15. Capable to read the block diagrams of UPS.



SCHEME OF STUDIES

UPS Repair and Maintenance
(6-Months Course)

S. No.	Main Topics	Theory Hours	Practical Hours	Total Hours
1.	Basic Electricity	25	80	105
	Basic Electronics	40	100	140
2.	Formation of Electronic Circuits	15	40	55
3.	Batteries	10	15	25
4.	Fundamentals of UPS System.	12	30	42
5.	Development of a UPS System	15	75	90
6.	Installation of UPS System	8	30	38
7.	Maintenance, Repair Methodology, Techniques and Troubleshooting	15	170	185
8.	I.T Fundamentals	8	32	40
9.	Functional English	16	64	80
Total		**164**	**636**	**800**

7-4-16

DETAIL OF COURSE CONTENTS

UPS Repair and Maintenance
(6 – Months Course)

Sr. No.	Detail of Topics	Theory Hours	Practical Hours
1.	**Basic Electricity &Electronics**	65	180
	1.1. Introduction	2	9
	1.1.1. Safety rules for quality of electrical and electronics work		
	1.1.2. Symbols for Electrical wiring		
	1.1.3. Simple Electrical Wiring Circuits		
	1.1.4. Symbols for Electronics Components		
	1.2. Measuring Instruments	4	9
	1.2.1. Introduction Safety for measuring tools and equipment		
	1.2.2. Multi-meter.(Analogue) & Multi-meter.(Digital)		
	1.2.3. Tong tester AC/DC		
	1.2.4. Oscilloscope		
	1.3. Atom, Conductor & Insulator	2	9
	1.3.1. Atomic structure Charge of proton, neutron, electrons Similar, dissimilar charges & Flow of electrons (current)		
	1.3.2. Generation of EMF (voltage) (Single Phase and Three Phase) Definition of Conductivity, Definition of Conductor & Insulator Types of conductor & insulator		
	1.3.3. Difference between Conductor,		

7-4-16

Sr. No.	Detail of Topics	Theory Hours	Practical Hours
	semiconductor and Insulator		
	1.3.4. Wire& its specifications		
	1.4. Resistance	2	9
	1.4.1. Definition of resistance, Resistance dependent material and its unit		
	1.4.2. Types of resistors		
	1.4.3. Color coding (basic & advance)		
	1.5. Ohm's Law		
	1.5.1. Ohm's law (relation between I & V when R is constant)	3	6
	1.5.2. Ohms law (relation between I & V when R is variable)		
	1.5.3. Electrical Power		
	1.6. Series and Parallel Circuits		
	1.6.1. Resistors in series and Parallel circuit	2	6
	1.6.2. Current in series and Parallel circuit		
	1.7. Capacitors		
	1.7.1. Capacitance & Types of capacitors	2	6
	1.7.2. Capacitors in D.C.& AC circuits		
	1.8. Inductors		
	1.8.1. Inductance ,Types of inductors & Inductors in Series & Parallel	2.5	6
	1.8.2. Inductors in AC & DC circuits		
	1.9. Electricity & Magnetism		
	1.9.1. Magnetism		
	1.9.2. Electromagnetism & Electromagnetic induction	2.5	6

7-4-16

Sr. No.	Detail of Topics	Theory Hours	Practical Hours
	1.9.3. Electromagnetic Relay		
	1.10. Transformers		
	1.10.1. The basic principles of Transformer		
	1.10.2. Types of Transformers	3	14
	1.10.3. Types of core		
	1.11. Semiconductor Devices		
	1.11.1. Semiconductor and Conduction in semiconductor materials		
	1.11.2. N type & P type semiconductors PN junction	4	9
	1.11.3. Biasing and Diode characteristics		
	1.11.4. Introduction of Bread Board		
	1.12. Diodes & Their Applications		
	1.12.1. Half-wave rectifier , Full-Wave rectifier & filters		
	1.12.2. Zener diode, LED		
	1.12.3. Damper Diode	4	9
	1.13. Bipolar Transistor		
	1.13.1. Basic principle & Transistor biasing		
	1.13.2. Current and voltage Gain		
	1.13.3. Transistor as an Amplifier & as Switch	4	9
	1.14. Field Effect Transistors (FET)		
	1.14.1. Construction of JFET		
	1.14.2. N channel , P channel & Types of FET	4	9
	1.14.3. MOS FET		
	1.15. Thirstier		
	1.15.1. Types of Thirstier		

Sr. No.	Detail of Topics	Theory Hours	Practical Hours
	1.15.2. Application of Thirstier		
	1.16. Integrated circuits	4	9
	1.16.1. Construction of I.C		
	1.16.2. Types of ICs		
	1.16.3. Level of Integration	4	6
	1.17. Regulated power supply		
	1.17.1. Transistorized regulated power supply(fixed) & (adjust able) using one Transistor and one Zener	4	15
	1.17.2. Integrated Regulators(7800 & 7900 Series)		
	1.18. Operational Amplifiers		
	1.18.1. The differential Amplifier		
	1.18.2. Operational amp as Inverting & Non-Inverting Amplifier	4	9
	1.18.3. Applications of OP Amplifier		
	1.19. Digital Electronics		
	1.19.1. Introduction		
	1.19.2. Basic functions of logic operation		
	1.19.3. AND, OR, & NOT operation	4	9
	1.19.4. NAND, NOR & Exclusive OR Operation		
	1.20. Soldering and De-soldering		
	1.20.1. Soldering Iron and soldering accessories		
	1.20.2. Soldering techniques and Practice	4	16
	1.20.3. De-soldering techniques and Practice		

Sr. No.	Detail of Topics	Theory Hours	Practical Hours
2.	**Formation of Basic Electronic Circuits**	**15**	**40**
	2.1. **Differential amplifier**	4	10
	2.1.1. BJT		
	2.1.2. MOSFET		
	2.2. **Inverter**	4	10
	2.2.1. Principle of Inverter		
	2.2.2. BJT Inverter		
	2.2.3. MOSFET Inverter		
	2.3. **Controller Circuits**	3	10
	2.3.1. Principle of Controller Circuit		
	2.3.2. Specifications of Control Circuit available in local market		
	2.4. **Emergency Light**	4	10
	2.4.1. Introduction		
	2.4.2. Function of Emergency Light		
	2.4.3. Circuit for Emergency Light		
3.	**Batteries Basic Concept**	**10**	**15**
	3.1. Types	3	2
	3.1.1. Primary		
	3.1.2. Secondary		
	3.1.3. Wet		
	3.1.4. Dry		
	3.2. Lead Acid Battery	4	7
	3.2.1. Construction		
	3.2.2. Charging		
	3.2.3. Condition at full charging		
	3.2.4. Maintenance		

7-4-16

Sr. No.	Detail of Topics	Theory Hours	Practical Hours
	3.3. Dry Battery	4	6
	3.3.1. Construction		
	3.3.2. Charging		
	3.3.3. Condition at full charging		
	3.3.4. Maintenance.		
4.	**Fundamentals of UPS**	12	30
	4.1. Introduction to UPS System	2	6
	4.1.1. Basic UPS System		
	4.1.2. UPS system available market		
	4.2. Types of UPS		
	4.2.1. On-Line		
	4.2.2. Off-Line	2	9
	4.3. Block Diagram		
	4.3.1. Main Blocks		
	4.3.2. Rectifier	4	6
	4.3.3. Batteries		
	4.3.4. Inverter		
	4.4. Operation of UPS		
	4.4.1. Operation of each block/unit	4	9
5.	**Development of UPS System.**	15	75
	5.1. Assemble free running M.V. using two transistor and one output transformer (Simple UPS)	2	12
	5.2. **Preparation of 500-1000 watt UPS System**		
	5.2.1 Selection of Transformer		
	5.2.2 Selection of output MOSFET		
	5.2.3 Selection of control circuit, PCB assembled		

Sr. No.	Detail of Topics	Theory Hours	Practical Hours
	5.2.4 Selection of Proper casing	10	48
	5.2.5 Voltage / current indicator		
	5.2.6 Selection of wires		
	5.2.7 Selection of Battery		
	5.2.8 Assembling of UPS		
	5.3. **Operational test of UPS System.**	3	15
6.	**Installation of UPS**	8	30
	6.1 Selection of Installation Tools/ Equipment	1	3
	6.2 Use of multi-meter for installation of UPS	0.5	3
	6.3 Operation of Tong Tester (Clamp Meter) for installation of UPS	0.5	3
	6.4 Understanding of specifications of UPS		
	6.5 Calculating the Load for UPS	1	3
	6.6 Understanding the wiring layout for the installation of UPS	1 1	4 3
	6.7 Preparing the physical conditions for the installation of UPS.	1	3
	6.8 Managing the electrical wiring requirements for the installation of UPS.	1	4
	6.9 Installing the UPS	1	4
7.	**Repair and Maintenance of UPS**	15	170
	7.1 Safety precautions regarding UPS System including personal safety.	1	6
	7.2 Preventive maintenance of UPS system	1	6
	7.3Tools and equipment for repair and maintenance	1	9
	7.4Monthly/ Quarterly Checklists	0.5	6
	7.5Annual Checklists	0.5	6
	7.6 Common UPS System Faults (detection of	1	12

Sr. No.	Detail of Topics	Theory Hours	Practical Hours
	faulty module)		
	7.7 Repairing of faulty module (detection and replacement of faulty component).	1	15
	7.8 Alignment (preset) faults of control module.	1	6
	7.9 Instruction to repair UPS system	1	18
	7.10 Repairing Techniques in steps	2	18
	7.11Instant Repairing Tips	1	6
	7.12 Inspection procedure (UPS system)	1	6
	7.13 Trouble Shooting procedure	1	15
	7.14 Repairing / replacing procedure of faulty components	1	20
	7.15 Troubleshooting different brand UPS Systems.	1	21
	Total	**140**	**540**

7-4-16

LIST OF PRACTICAL

1. Demonstrate Safety rules for quality of electrical and electronics work
2. Identify symbols for Electrical wiring and Electronics Components
3. Assemble Simple Electrical Wiring Circuits
4. Use Multi-meter.(Analogue) & Multi-meter.(Digital) for measuring electrical quantities.
5. Use Tong tester for measuring electrical quantities
6. Use Oscilloscope for observing AC signal and measuring amplitude and frequency
7. Distinguish different Wire according to their specifications
8. Calculating resistance Values through color coding (basic & advance)
9. Verify Ohm's law (by keeping R constant)
10. Verify Ohms law (by keeping V constant and R variable)
11. Measure Electrical Power by Voltmeter and ampere meter method
12. Measure Electrical Power by Wattmeter Method
13. Measure Resistors in series and Parallel circuit
14. Measure Current and voltages in series and Parallel circuit
15. Observe the operation of Capacitors in D.C.& AC circuits
16. Observe the operation of Inductors in AC & DC circuits
17. Observe the operation of Electromagnetic Relay
18. Distinguish the types of Transformers
19. Distinguish the types of core
20. Observe the Biasing of PN Junction Diode
21. Use Bread Board for assembling circuits
22. Assemble Half-wave rectifier and observe input and output wave forms
23. Assemble Full-wave rectifier and observe input and output wave forms
24. Assemble a Zener Diode Voltage regulator
25. Observe characteristics of Bipolar junction Transistor
26. Assemble an amplifier circuit with the help of Transistor and observe it operation

7-4-16

27. Assemble a switch circuit with the help of Transistor and observe it operation
28. Assemble a switch circuit with the help of MOSFET and observe it operation
29. Assemble a Light dimmer circuit with the help of TRIAC & DIAC and observe it operation
30. Assemble a relaxation oscillator circuit with the help of UJT and observe it operation
31. Differentiate between different ICs
32. Use IC Data sheet
33. Assemble a regulated power supply circuit with the help of an IC and observe it operation
34. Assemble an adjustable regulated power supply circuit with the help of an IC and observe it operation
35. Assemble an inverting amplifier circuit with the help of an 741 IC and observe it operation
36. Assemble a non- inverting amplifier circuit with the help of an 741 IC and observe it operation
37. By using two diodes develop AND Gate circuit and observe voltage at output.
38. By using two diodes develop OR Gate circuit and observe voltage at output.
39. Assemble a NOT circuit with the help of a transistor and observe its operation
40. From data sheet get pin diagram of IC and verify operation of NAND, NOR and Ex-OR gates
41. Under supervision of Instructor do soldering exercises by observing above mentioned in manual
42. Under supervision of Instructor do de-soldering exercises by observing above mentioned in manual
43. Assemble a BJT Inverter circuit and observe its operation

44. Assemble a MOSFET Inverter circuit and observe its operation
45. Assemble an Emergency Light circuit and observe its operation
46. . Demonstrate primary, secondary, wet and dry batteries.
47. Demonstrate dry cell with the help of cross-sectional view.
48. Measure the charging/discharging current of lead acid battery.
49. Measure the specific gravity of lead acid battery.
50. Measure the terminals voltages of fully charged 6 cells lead acid battery.
51. Measure the charging/discharging current of dry battery.
52. Measure the terminals voltages of fully charged 6 cells dry battery
53. Study the circuit operation of UPS regarding main supply is available or not.
54. Analyses the circuit which carried out above automation.
55. Analize the UPS under obseration that either it is on line system or off line.
56. Observe the function of inverter and battery in both above system.
57. Mearsure the battery voltage and current on its charging and discharging mode.
58. Check the in/out information of control card of UPS hith the help of multimeter.
59. Construct free running multi vibrator using two transistors and one output transformer.
60. Measure output voltage and current of above practical with the help of multi meter by installing dummy load.
61. Demonstrate the formation of transformer, analyze the characteristics of its materials i.e. core material, copper wire and measurements method of core.
62. Develop a transformer (either step up or step down).Measure its input and output voltage, also observe the effect by interchanging primary and secondary winding.
63. Test and identify the MOSFET and its pin configuration with the help of multi meter and data sheet.

64. Develop the test procedure of at least two different control card, and record your reading and observations in suitable table.
65. Study different types of wires and measure its wire gauge.
66. Verify the technical data of different batteries. Observe its construction by cross sectional view of any battery.
67. Assemble UPS carefully and neatly.
68. Check and verify all features of UPS.
69. Observe the tools and equipments / instruments for installation also note its sections.
70. Operate different types of multi meter gently, also take reading with it(specially AC/DC volts)
71. Operate different types of AC/DC tong tester gently, also take reading with it(specially AC/DC volts).
72. Calculate the load as per specification of UPS, connected it and observe its effect on UPS also note it.
73. Physically installs a portion of domestic electric wiring system in lab.
74. Physically illustrate the safety precaution regarding job.
75. Physically illustrate the safety precaution while working on live job.
76. Study and observe the function of PPE.
77. Create a chart regarding preventive maintenance of UPS.
78. Physically inspect, installed UPS system and notes it condition.
79. Check battery voltage and current with relevant instruments and note it in your note book in the form of chart.
80. Perform previous practical while UPS is in charging and discharging mode.
81. Check battery electrolyte with gravity meter and noted.
82. Prepare a chart, showing electrolyte gravity level at different time of charging/ discharging(after 1 hr-2hr-3hr------up to full charging)
83. Prepare electrolyte, and note the condition of container in which the process carried out.
84. Maintain tools kit and listed its item also describe its short description.

7-4-16

85. Analysis the multi meter and analysis the tong tester.
86. Locate and identify the different module in different UPS.
87. Measure the input and output voltage of output transformer.
88. Measure the input and output voltage of output MOSFET module.
89. Measure the input and output voltage of control card.
90. Observe and note condition of UPS on short circuit at its output socket.
91. Observe and note condition of UPS while connected with low voltage level battery.
92. Observe and note condition of UPS while subjected it in over loading condition.
93. Observe and note condition of UPS while subjected it in low main supply.
94. Observe and note the cut off voltage level of full charged battery.
95. Observe and note the voltage level at which the battery consider as empty.
96. Observe and note the charging current level at which the battery consider as empty.
97. Increase the charging current and observe its effect on battery, also noted it.
98. Observed a damage battery by its cross sectioning.
99. Determining the cause of its damaging by its analysis.
100. Install damage output MOSFET module in UPS and noted its condition.
101. Noted the condition of UPS by increasing length of cable in between battery and UPS.
102. Noted the condition of UPS on disconnection of exist fan

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.	4	14

7-4-16

	2.4 Working with saved work, opening and moving files. 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**

7-4-16

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.

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**

7-4-16

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**

7-4-16

LIST OF PRACTICALS

Functional English

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

LIST OF LABS

UPS Repair & Maintenance

- UPS repair and maintenance Lab

I.T Fundamentals

- Computer Lab

LIST OF TOOLS / MACHINERY &EQUIPMENTS

(For a Class of 25 Students)

Name of Course	UPS Repair and Maintenance
Duration of Course	6 – Months

Sr. No.	Name of Items	Quantity
1.	Power Supply 0-30 Volt, 3 A.	04 Nos.
2.	Storage box	50 Nos.
3.	Digital / Analog, Multi meter	10 Nos.
4.	Soldering Iron	25 Nos.
5.	Solder Sucker	10 Nos.
6.	Tool kits (Nose pliers, cutter plier, combination plier, wire striper, etc)	25 Nos.
7.	Tong Tester AC / DC up-to 200A	04 Nos.
8.	Oscilloscope 20 MHz	2 Nos.
9.	Magnifying Inspection Glass With Light	2 Nos.
10.	Screw Drivers Torx (shape of tip)0.25,0.5,0.75,1	10Sets. each
11.	Philips Screw Drivers 00,0,1	10 Sets. Each
12.	Flat Screw Drivers 0 to 3.5	10 Sets
13.	UPS Kits (Discrete components for assembling UPS, transformer 500/700/1000w (12+12/24+24), battery 12v/24v 120Ah, control card, MOSFET output module, casing, etc)	04 Nos.
14.	Hydrometer (Gravity meter)	01 Nos.
15.	Bread Board	25 Nos.

7-4-16

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

7 - 4 - 16

LIST OF CONSUMABLE MATERIAL

(For a Class of 25 Students)

Name of Course	UPS Repair and Maintenance
Duration of Course	6 – Months

S. No.	Name of Items	Quantity
1.	**RESISTORS (Carbon composition type 1/4 W)** 1KΩ, 3.3KΩ, 10KΩ, 15KΩ , 22KΩ, 47KΩ, 56KΩ , 82KΩ, 100KΩ, 120KΩ, 150KΩ, 330KΩ, 510KΩ	25 each
2.	RESISTORS (Carbon composition type 1/2 W) 1Ω, 10Ω, 47Ω, 180Ω, 220Ω, 270Ω, 330Ω, 370Ω, 500Ω, 1KΩ, 2.2KΩ, 3.3K, 1.8KΩ, 4.7KΩ	25 each
3.	RESISTORS (Carbon composition type 1 W) 10Ω, 100Ω, 330Ω, 1KΩ, 10KΩ, 1KΩ, 22KΩ, 120KΩ, 1MΩ, 2.2 MΩ	25 each
4.	Potentio meter 200 Ω / 2W, 10K Ω / 2W, 500 Ω / 1W, 1K Ω / 1W, 2.5K Ω / 1W	25 each
5.	DIODE 1N4001, 1N4004, 1N4007	25 each
6.	CAPACITORS (ELECTROLYTE) 10µF / 50V, 100µF / 50V, 25µF / 40V, 50µF / 40V, 0.1µF / 40V, 47µF / 40V, 0.01 µF / 40V, 0.02 µF / 40V, 470 µF / 50V, 0.022 µF, 0.22 µF, 0.1 µF, 500 µF	10 each
7.	LED (Red, White, Blue, Yellow)	100 each
8.	Solder Wire 60:40	4 lbs
9.	Soldering Flux	2 lbs
10.	**Zener Diode (1 W)** 3 V, 5V, 6V, 9V, 10V, 12V, 15V, 18V	25 each
11.	Voltage Regulator 7805, 7806, 7809, 78012, 7905, 7906, 79012	5 each
12.	**TRANSISTORS** 2SC828, 829, 2N2219A, 2N2905A	25 each
13.	UJT 2N2646	10
14.	FET BF245C	10
15.	SCR C106	10
16.	IC 741	10
17.	IC 7400, 7403, 7404, 74086, 74133, 747266	10 each
18.	Transformer 700W 12+12V	10

APPROVED
Date: 7-4-16
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19.	Control card	10
20.	Output MOSFET module 7+7	10
21.	Casing (sheet 22 swg)	10
22.	Connecting wire 40/.0076 (25 feet)	10 set
23.	Battery wire 150/.0076 (15 feet) Black & Red	10 set
24.	Battery Clip (2 in no.)	10 set
25.	Exhaust fan 12v, 4in	10
26.	On Off Switch	10
27.	Main AC Plug 30A	10
28.	Main AC Cord	10 set

FURNITURE

Sr. No.	Name of Items	Quantity
1.	White Board	1 No.
2.	Work Benches	05 Nos.
3.	Students Chair	25 Nos.
4.	Instructor Table	1 No.
5.	Instructor Chair	2 Nos.
6.	Steel Almara	1 No.

FURNITURE & EQUIPMENT FOR UPS REPAIR &MAINTENANCE LAB

Sr. No.	Name of Items	Quantity
1.	Multimedia	1 No.
2.	White Board	1 No.
3.	Stools	25 Nos.
4.	Table for Instructor	1 No.
5.	Chair for Instructor	1 No.
6.	Steel Almara	1 No.

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

7-4-16

MINIMUM QUALIFICATION OF INSTRUCTOR

- B.Sc. Engineering in Electronics/ Electrical with 1yearrelevant experience.

OR

- DAE in Electronics/ Electrical Technology with 2years experience in the relevant field.

OR

- Two years certificate of Electronics Applications (G-II Level) with 4years experience in relevant field.

Functional English

- M.A. (English)

I.T Fundamentals

- DAE CIT/ BCS from HEC recognized university

EMPLOYABILITY OF PASSOUTS

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

1. UPS companies such as Homeage, Homepower, KenWoodetc.
2. Self Employment (Entrepreneur).
3. UPS repair work shops.

REFERENCE BOOKS

UPS Repair and Maintenance

1. Fundamentals of Electronic by Thomas L. Floyd
2. Electronics Fundamentals Circuits Devices and Applications by Thomas L. Floyd
3. Power Electronics by M.H Rashid

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

7-4-16

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	ایصا لیت	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

7-4-16

SPECIFIC VOCABULARY WORDS

Accessories	آلات اور سامان	Industrial	صنعتي
Adjustment	درستگی	Integrator	تکمیل کار
Alignment	ترتیب دینا	Inverter	متبادل
Alternating Current	متغیر کرنٹ	Junction	جوڑ
Analog	مثیل	Laying	بچھانا
Arrangement	ترتیب دینا	Magnifying	بڑا کرنا
Array Formation	صف بندی	Maintenance	دیکھ بھال
Assembling	جوڑنا	Managing	انتضام
Batteries	بیٹریاں	Metering	پیمائش
Cabling	کیبل بچھانا	Methodology	طریقہ کار
Calculation	حساب کتاب	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
Definition	تعریف	Precaution	احتیاط
Designing	نقشہ	Preparation	تیاری
Development	نشو نما	Preventive	احتیاطی
Diagnose	تشخیص	Procedure	طریقہ کار
Differentiation	تفرق	Pyrometer	حرارت پیما
Digital	عددی	Replacement	تبدیلی
Direct Current	یکساں کرنٹ	Sensor	محسوس کرنے والا
Domestic	گھریلو	Shading Effect	شیڈنگ کا اثر
Dry Battery	خشک بیٹری	Sizing	سائز کے مطابق
Electro Magnetizer	برقی مقناطیس والا	Solar Cell	شمسی سیل
Equipment	آلات	Specification	تصریحات
Estimation	تخمینہ	String Formation	لڑی بندی
Functional	چالو حالت	Structure	ڈھانچہ
Fundamentals	بنیادی	Trouble Shooting	نقائص کی درستگی
Generation	نسل	Variation	تبدیلی
Hybrid Inverter	دوغلا متبادل	Wet Battery	گیلی بیٹری

Curriculum Revision Committee

1.	**Muhammad Mahboob Butt,** Chief Instructor, GCT Sahiwal	**Convener**
2.	**Mr. Imran Ashraf** Chief Instructor, GCT Multan	**Member**

Developed by Curriculum Section, Academics Department, TEVTA
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