

## Rajasthan Skill & Livelihoods Development Corporation

<b>1. Module Name</b>	<b>Maintenance &amp; Repair of Electronic Test Equipment</b>
<b>2. Sector</b>	Electronics
<b>3. Entry Qualification</b>	Minimum 10 <sup>th</sup> Pass
<b>4. Minimum Age (in years)</b>	15
<b>5. Duration</b>	<b>69 days/ 414 hrs.</b>
<b>6. Provision of Tool kit</b>	Yes
<b>7. Terminal Competency</b>	<p><b>After completion of training the trainee will be able to</b></p> <ul style="list-style-type: none"> <li>• use Multimeter;</li> <li>• test active and passive components, transformers and semiconductors;</li> <li>• undertake soldering and de soldering of components;</li> <li>• assemble and test rectifier circuits, amplifier circuits and audio power amplifier;</li> <li>• install and maintain UPS and inverter;</li> <li>• charge and test batteries;</li> <li>• check and maintain power supply;</li> <li>• use hand tools for servicing the electronic test equipment;</li> <li>• undertake servicing and cleaning of switches;</li> <li>• tighten the loose knobs, check the power cord;</li> <li>• repair the following electronic test equipment:               <ol style="list-style-type: none"> <li>1. Analog Multimeter</li> <li>2. Digital Multimeter</li> <li>3. Function Generator</li> <li>4. Signal Generator</li> <li>5. Oscilloscope and</li> </ol> </li> <li>• operate the above electronic test equipment;</li> </ul>

	<b>Approx. hrs.</b>
<b>8. Registration, Inauguration, introduction and objectives of the course</b>	2

<b>9. Course content</b>			
<b>Practical competencies</b>	<b>Approx. hrs.</b>	<b>Underpinning Knowledge (Theory)</b>	<b>Approx. hrs.</b>
• Practice procedure for electrical and personal safety measures.	2	• Electrical and personal safety, dangers and preventions.	1
• Use of Multimeter.	2	• Multimeter and its various application.	1
• Testing of active and passive components.	3	<ul style="list-style-type: none"> <li>• Basics of electricity – define DC, AC// Practical measuring units of voltage, current, resistance.</li> <li>• Types of transformers – its construction, testing.</li> </ul>	1
• Testing of transformers.	3	• Testing of proper earth using test lamp.	1

<ul style="list-style-type: none"> <li>• Testing of semiconductor components.</li> </ul>	3	<ul style="list-style-type: none"> <li>• Testing of earth using multimeter.</li> </ul>	1
<ul style="list-style-type: none"> <li>• Testing of unregulated and regulated voltages.</li> </ul>	3	<ul style="list-style-type: none"> <li>• Fuse – Types, use of fuses and its rating.</li> </ul>	1
<ul style="list-style-type: none"> <li>• Soldering and de-soldering techniques.</li> </ul>	12	<ul style="list-style-type: none"> <li>• Basic Electronics – passive and active components – testing of components, MOSFET – precautions when handling.</li> </ul>	1
<ul style="list-style-type: none"> <li>• Assemble and test rectifier circuits – half wave, full wave &amp; bridge rectifier.</li> </ul>	12	<ul style="list-style-type: none"> <li>• Application of transistor – its uses.</li> </ul>	1
<ul style="list-style-type: none"> <li>• Assemble a power amplifier circuit (common emitter, emitter follower).</li> </ul>	12	<ul style="list-style-type: none"> <li>• Op-Amp – Introduction, applications, constructions, comparators.</li> </ul>	1
<ul style="list-style-type: none"> <li>• Assemble and test an audio power amplifier (buzzer).</li> </ul>	9	<ul style="list-style-type: none"> <li>• Voltage Regulator and their types.</li> </ul>	1
<ul style="list-style-type: none"> <li>• Construct a RC – oscillator and test it.</li> </ul>	9	<ul style="list-style-type: none"> <li>• DIAC, SCR, TRIAC – application.</li> </ul>	1
<ul style="list-style-type: none"> <li>• Find the total load and select a suitable UPS/ Inverter (rating factor).</li> </ul>	3	<ul style="list-style-type: none"> <li>• Digital Electronics – gates and its application, multiplexers, demultiplexers, counter.</li> </ul>	2
<ul style="list-style-type: none"> <li>• Installation of UPS and Inverter.</li> </ul>	6	<ul style="list-style-type: none"> <li>• Electrical load their VA and watts.</li> <li>• Various types of batteries used in UPS and inverters and their maintenance.</li> </ul>	1
<ul style="list-style-type: none"> <li>• Maintenance of Battery.</li> </ul>	3	<ul style="list-style-type: none"> <li>• Single phase and three phase system, different types of inverter, UPS, Working principle, specifications, explanation with the help of block diagram, basic principle of working of power switches, testing methods, discussions of various faults, diagnosing methods, rectifying common faults.</li> </ul>	2
<ul style="list-style-type: none"> <li>• Opening &amp; dismantling an equipment and identifying the major parts, testing of major components, identifying transformers and checking, checking of power modules, Charging, discharging and testing of batteries, repairing of SMPS, simulating various faults diagnosing and rectifying it.</li> </ul>	24		
<p><b>(1) Analog Multimeter:</b></p> <ul style="list-style-type: none"> <li>• Precaution to be taken in handling an Analog Multimeter.</li> <li>• Use of various hand tools.</li> <li>• Introduction to DC Circuit, AC Circuit.</li> <li>• Familiarization with operation of controls of VOM.</li> <li>• Principle of operation of Analog Multimeter.</li> <li>• Study of DC voltage circuit</li> </ul>	36	<ul style="list-style-type: none"> <li>• Cleaning the dust, cleaning the switch contacts by switch cleaning solution.</li> <li>• Testing the fuse.</li> <li>• Testing moving coil meter assembly.</li> <li>• Test &amp; repair the DC voltage measurement circuit by doing measurement at the test points provided.</li> <li>• Test &amp; repair the AC voltage measurement circuit by doing measurement at the test points provided.</li> </ul>	18

<p>of VOM.</p> <ul style="list-style-type: none"> <li>• Study of AC voltage circuit of VOM.</li> <li>• Study of DC current circuit of VOM.</li> <li>• Study of ohms circuit of VOM.</li> <li>• Trouble shooting Analog Multimeter.</li> </ul>		<ul style="list-style-type: none"> <li>• Test &amp; repair the DC current measurement circuit by doing measurement at the test points provided.</li> <li>• Test and Repair the Resistance measurement circuit by doing measurement at the test points provided.</li> <li>• Check the battery voltage used in ohms range.</li> <li>• Check for proper operation of mechanical zero adjustment with the help of a screwdriver.</li> <li>• Repair the test leads/probes if found defective.</li> <li>• Replace the battery if required.</li> <li>• Maintaining the test leads in proper condition. Cleaning of the switches etc.</li> <li>• Replacing the open Fuse with correct rating.</li> </ul>	
<p><b>(2) Digital Multimeter:</b></p> <ul style="list-style-type: none"> <li>• Precaution to be taken in handling a Digital Multimeter.</li> <li>• Cleaning the switch contacts with switch cleaning solution.</li> <li>• Testing the display (LED display, LCD display).</li> <li>• Check the DC voltages &amp; waveforms at the test point of the IC commonly used in 3 1/2 digit Digital Multimeter.</li> <li>• Replace the defective IC.</li> <li>• Replace the Battery of the meter.</li> <li>• Maintaining the test leads in proper condition.</li> </ul>	24	<ul style="list-style-type: none"> <li>• Cleaning the dust, cleaning the switch contacts by switch cleaning solution.</li> <li>• Testing the fuse.</li> <li>• Testing the 7 segment LED display.</li> <li>• Testing the LCD display module.</li> <li>• Check the DC voltages &amp; waveforms at the test point of the IC commonly used in the test point of the IC commonly used in the 3 1/2 digit digital Multimeter.</li> <li>• Troubleshoot DC voltage, AC voltage, DC current, DC current, AC current &amp; Resistance measurement circuit by doing measurement at the test points provided.</li> <li>• Check the battery used in the digital Multimeter.</li> <li>• Repair of test leads/probes if found defective.</li> <li>• Replacing the open fuse with correct rating.</li> <li>• After repair test the digital Multimeter for its performance.</li> </ul>	18
<p><b>(3) Function Generator:</b></p> <ul style="list-style-type: none"> <li>• Precaution to be taken in handling a Function Generator.</li> <li>• Familiarization with front</li> </ul>	36	<ul style="list-style-type: none"> <li>• Familiarization with front panel control.</li> <li>• Cleaning the dust, cleaning the switch contacts by switch cleaning solution.</li> </ul>	12

<p>panel controls, switch etc.</p> <ul style="list-style-type: none"> <li>• Cleaning the dust, Cleaning the switch contacts with switch cleaning solution.</li> <li>• Identify &amp; testing a Function Generator Power supply circuit and test at the test points provided for correct output voltages.</li> <li>• Test the waveform generator circuit output waveforms at the test point provided with the help of a CRO.</li> <li>• Test the Function selector switch for its proper contacts.</li> <li>• Test the output amplifier circuit by doing voltage &amp; waveform measurement at the test points provided.</li> <li>• Service the equipment by blowing dust, cleaning all the switches, potentiometers, output terminals etc.</li> </ul>		<ul style="list-style-type: none"> <li>• Testing the fuse, Power cable &amp; ON/OFF switch.</li> <li>• Test &amp; repair the Power supply circuit, waveform generator circuit amplifier circuit by doing voltage measurement at the test points provided.</li> <li>• Effect of DC-offset control on the waveform.</li> <li>• Replacing the open Fuse with correct rating.</li> </ul>	
<p><b>(4) Signal Generator:</b></p> <ul style="list-style-type: none"> <li>• Function Generator.</li> <li>• Familiarization with front panel controls.</li> <li>• Cleaning the dust, cleaning the switch contacts with switch cleaning solution.</li> <li>• Identify Different circuit blocks of Signal before trouble shooting.</li> </ul>	24	<ul style="list-style-type: none"> <li>• Familiarization with front panel control.</li> <li>• Cleaning the dust, cleaning the switch contacts with switch cleaning solution.</li> <li>• Testing the fuse, Power cable &amp; On/Off switch.</li> <li>• Testing &amp; Signal Generator's Power supply circuit, oscillator circuit &amp; output amplifier circuit for trouble shooting.</li> <li>• Replacing the open Fuse with correct rating.</li> </ul>	12
<p><b>(5) CRO</b></p> <ul style="list-style-type: none"> <li>• Precaution to be taken in handling a CRO.</li> <li>• Familiarization with front panel controls.</li> <li>• Identify different blocks in a CRO.</li> <li>• Study &amp; Trouble shooting technique of CRO's Power supply circuit, vertical amplifier, horizontal amplifier &amp; Sweep</li> </ul>	48	<ul style="list-style-type: none"> <li>• Familiarization with front panel controls and measurements.</li> <li>• Cleaning the dust, cleaning the switch contacts by switch cleaning solution.</li> <li>• Testing the fuse, Power cable &amp; On/Off Switch.</li> <li>• Identify &amp; testing a CRO's Power supply Vertical amplifier circuit, horizontal amplifier &amp; Sweep generator circuit etc.</li> <li>• Check by feeding the CAL signal to</li> </ul>	12

<p>generator circuit etc.</p> <ul style="list-style-type: none"> <li>• Test the by doing voltage &amp; waveform measurement at the test points provided.</li> <li>• Check the proper operation of AUTO/NORMAL, LINE, CH-1 or CH-II, EXT etc.</li> <li>• Check the calibration of the CRO for accurate measurement by feeding the CAL signal to each channel.</li> <li>• Cleaning of switches, potentiometers etc.</li> <li>• Maintaining the test probes in proper condition. Test the probe with attenuation (X1, X10).</li> <li>• Time base and amplitude control.</li> <li>• Triggering, ALT-CHOP mode.</li> </ul>		<p>the channel in use for accurate measurement.</p> <ul style="list-style-type: none"> <li>• Test the circuit by doing voltage &amp; waveform measurement at the test points provided.</li> <li>• Check all functions AUTO/NORMAL LINE, CH-1 OR CH-II, EXT, selection of AC-DC-GND etc.</li> <li>• Maintaining the test probes in proper condition.</li> <li>• Use of CRO probes with &amp; without attenuation (X1, X10).</li> <li>• Replacing the open Fuse with correct rating.</li> <li>• Time base switch – its functions, operation and repair.</li> </ul>	
		<b>Entrepreneurship &amp; Soft Skills and Computer Literacy Module:</b>	0
		<ul style="list-style-type: none"> <li>• Entrepreneurship – its necessity and charms of being an entrepreneur.</li> </ul>	1
		<ul style="list-style-type: none"> <li>• Who is an entrepreneur and characteristics of a successful Entrepreneur?</li> </ul>	2
		<ul style="list-style-type: none"> <li>• How to identify Business opportunities?</li> </ul>	2
		<ul style="list-style-type: none"> <li>• Steps for setting up a small scale venture.</li> </ul>	1
		<ul style="list-style-type: none"> <li>• Institutional support for entrepreneurship (whom to contact for what)</li> </ul>	2
		<ul style="list-style-type: none"> <li>• Government (Central/ State) Schemes and assistance from Banks/ other financial institutions - Procedures and formalities for getting loan.</li> </ul>	2
		<ul style="list-style-type: none"> <li>• How to prepare Business plan?</li> </ul>	2
		<ul style="list-style-type: none"> <li>• Financial literacy-Costing, Pricing, Profitability and Break Even Analysis.</li> </ul>	2
		<ul style="list-style-type: none"> <li>• Cash management in small enterprises.</li> </ul>	2
		<ul style="list-style-type: none"> <li>• Accounting and Book Keeping</li> </ul>	2
		<ul style="list-style-type: none"> <li>• Introduction to Taxation</li> </ul>	1
		<ul style="list-style-type: none"> <li>• Shop and Establishment Act and its provisions.</li> </ul>	1

		<ul style="list-style-type: none"> <li>• Creativity, Problem solving &amp; decision making.</li> </ul>	1
		<ul style="list-style-type: none"> <li>• Common mistakes generally made by entrepreneurs.</li> </ul>	1
		<ul style="list-style-type: none"> <li>• Interaction with successful entrepreneur and success stories.</li> </ul>	2
		<ul style="list-style-type: none"> <li>• Communication and Negotiation skills.</li> </ul>	1
		<ul style="list-style-type: none"> <li>• Interpersonal skills</li> </ul>	1
		<ul style="list-style-type: none"> <li>• How to Deal with customer attitude – Effective selling.</li> </ul>	1
		<ul style="list-style-type: none"> <li>• Marketing – Basic concepts/ Skills and effective mode of advertising.</li> </ul>	1
		<ul style="list-style-type: none"> <li>• Introduction to e-commerce.</li> </ul>	2
<b>Computer Fundamentals</b> <b>Customize the Desktop Environment e.g.</b> Desktop, Start Menu, and Taskbar etc. Configuring & Migrating Files, Folders & Settings - Folder Views, Accessibility Settings	2	<b>Computer Fundamentals, MS-Office &amp; Internet</b> introduction to Computers History of Computers Components of Hardware Peripherals	1
<b>MS Word</b> Creating, Organizing & Formatting Content Collaborating – Merge, Insert, View, Edit, Track Mode etc. Formatting & Managing Documents	4	<b>Concept of Operating System –</b> Windows XP, Exploring & Configuring the Windows XP Desktop Environment-Customize the Desktop, Start Menu, and Taskbar etc. Configuring & Migrating Files, Folders	1
<b>MS Excel</b> Creating, Analyzing & Formatting Data & Content Collaborating - Insert, View, Edit etc. Managing Workbooks	3	<b>Settings - Folder Views, Accessibility Settings</b> Features of Windows XP Understanding concepts of Word processing using MS-Word Understanding concepts of Electronic spreadsheet and various types of entries in it	1
<b>MS PowerPoint</b> Creating & Formatting Content Collaborating - Track, Edit, Add, Delete Comments, Merge Managing & Delivering Presentations	3		
<b>Internet Concepts</b> Opening websites and downloading data Writing, reading and sending emails	4	<b>Understanding concepts of URL</b> Creating and Opening an E-mail account. Receiving and sending emails Searching information on Internet.	1
<b>Approx. Total Practical hours</b>	<b>290</b>	<b>Approx. Total Theory hours</b>	<b>122</b>
		<b>Grand Total (2+290+122)</b>	<b>414</b>

<b>10. Tools, Equipments and Material for a batch of 30 trainees</b>		
<b>S.No.</b>	<b>Item</b>	<b>Quantity</b>
1	Inverter / UPS Trainer	1
2	Battery Charger	1
3	Technicians tool kit comprising of all tools required in repair and maintenance of Basic electronic items	6
4	Digital Multimeter	6
5	Soldering / De-soldering temp controlled station	6
6	Clip on ammeter	6
7	Soldering gun	6
8	De-soldering Pump	6
9	SMD Soldering tools	6
10	Antistatic mat with proper grounding and wrist band	As required
11	Screw drivers of different type & sizes	6 sets
12	Pliers	6
13	Long nose plier	6
14	Watch maker's screwdriver set.	6
15	Side cutter	1
16	Brush	6
17	Adjustable spanner 6"	6
18	Tweezer	3
19	Soldering iron	6
20	Analog Multimeter	6
21	Oscilloscope	3
22	Function Generator	As per requirement

<b>S.No.</b>	<b>Item</b>	<b>Quantity</b>	<b>S.No.</b>	<b>Item</b>	<b>Quantity</b>
	<b>Hardware</b>			<b>Software:</b>	
1	Computers/Laptops	10 (one for three trainee)	6	Microsoft Windows 7/8/10 or UNIX/ LINUX or latest software	For all Systems
2	Power backup	For all Systems	7	Microsoft Office 2007/ 2010/ 2013 or latest software	For all Systems
3	Inkjet/Laser Printer (Network/USB Printer)	1	8	Antivirus Software (TVD/ Norton/ Quick Heal Total Security/ Kaspersky/ Any Popular brand)	For all Systems
4	Speaker	1	9	Internet Connection	For all Systems
5	Spare H/W components	As per requirement			