

**Course Curricula**

**for**

**Short Term Courses based on  
Modular Employable Skills (MES)**

**in**

**Electronics Sector**



**DIRECTORATE GENERAL OF EMPLOYMENT AND TRAINING  
MINISTRY OF LABOUR & EMPLOYMENT  
GOVERNMENT OF INDIA**

**Course Curricula for Short Term Courses based on Modular  
Employable Skills (MES) in the Electronics Sector**

**CONTENTS**

1. Background .....	2
2. Frame Work for Skill Development based on Modular Employable Skills .....	2
3. Age of Participants .....	3
4. Curriculum Development Process.....	3
5. Development of Core Competencies .....	3
6. Duration of the Programmes .....	4
7. Pathways to acquire Qualification .....	4
8. Methodology.....	5
9. Instructional Media Packages .....	5
10. Assessment.....	5
11. Certificate .....	5
12. Course Matrix.....	6
13. Module.....	7
14. Basic Electronics (Repair & Maintenance of Power supply, inverters and UPS .....	7
15. Operation of clinical Equipment-Level(I) .....	9
16. Operation of ECG & ICCU Instruments-Level(I).....	11
17. Operation of X-Ray Machine & Dark room Assistance .....	13
18. Operation of Physio Therapy Equipment-Level(I) .....	14
19. Installation & Maintenance of DTH System.....	15
20. Digital Videography Editing and Mixing.....	17
21. Repair & Maintenance of washing machine and microwave oven .....	18
22. Repair & Maintenance of TV Receiver .....	20
23. Maintenance & Repair of Electronic Test Equipment.....	21
24. Repair & Maintenance of Cellular Phone .....	24
25. Repair & Maintenance of Intercom System.....	26
26. Installation & Maintenance of Electronic Equipments in Cell Phone towers .....	27
27. Repair & Maintenance PA & Audio Systems .....	28
28. Repair & Maintenance Photocopier and Fax Machine .....	29
29. Maintenance of ECG & ICCU Equipment-Level(II) .....	31
30. Maintenance of X-Ray Machine-Level(II) .....	33
31. Maintenance of Physio Therapy Equipment-Level(II) .....	35
32. List of Expert/Trade Committee Members.....	37

## Skill Development based on Modular Employable Skills (MES)

### Background

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The need for giving emphasis on the Skill Development, especially for the less educated, poor and out of school youth has been highlighted in various forums. The skill level and educational attainment of the work force determines the productivity, income levels as well as the adaptability of the working class in changing environment. Large percentage of population in India is living below poverty line. One of the important causes is lower percentage of skilled persons in the workforce

The skill development at present is taking place mostly in the informal way, i.e. persons acquire skill at the work-place when they help their parents, relatives and employers etc. Such persons do not have a formal certificate and thus earn lower wages and are exploited by employers. They have come through informal system due to socio-economic circumstances of the family and the compulsions of earning a livelihood rather than attending a formal course. While their productivity is low, their contribution to the national GDP cannot be ignored. If the country can create a system of certification which not only recognizes their skills but also provides education and training in a mode that suits their economic compulsions, it will not only benefit the workforce to earn a decent living but also contribute to the national economy by better productivity of this workforce.

Another related problem to be tackled is large number of students drop outs (About 63% of the school students drop out at different stages before reaching Class-X).

### Frame work for Skill Development based on 'Modular Employable Skills (MES)'

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Very few opportunities for skill development are available for the above referred groups (out of school youth & existing workers especially in the informal sector). Most of the existing Skill Development programmes are long term in nature. Poor and less educated persons can not afford long term training programmes due to higher entry qualifications, opportunity cost etc. Therefore, a new frame work for Skill Development for the Informal Sector has been evolved by the DGET to address to the above mentioned problems. The **key features of the new frame work for skill development** are:

- ◇ Demand driven Short term training courses based on modular employable skills decided in consultation with Industry
- ◇ Flexible delivery mechanism (part time, weekends, full time)
- ◇ Different levels of programmes (Foundation level as well as skill upgradation) to meet demands of various target groups
- ◇ Central Government will facilitate and promote training while Vocational Training (VT) Providers under the Govt. and Private Sector will provide training
- ◇ Optimum utilisation of existing infrastructure to make training cost effective.
- ◇ Testing of skills of trainees by independent assessing bodies who would not be involved in conduct of the training programme, to ensure that it is done impartially.
- ◇ Testing & certification of prior learning (skills of persons acquired informally)

The Short Term courses would be based on 'Modular Employable Skills (MES)'.

The **concept for the MES** is :

- Identification of 'minimum skills set' which is sufficient to get an employment in the labour market.
- It allows skills upgradation, multiskilling, multi entry and exit, vertical mobility and life long learning opportunities in a flexible manner.
- It also allows recognition of prior learning (certification of skills acquired informally) effectively.
- The modules in a sector when grouped together could lead to a qualification equivalent to National Trade Certificate or higher.
- Courses could be available from level 1 to level 3 in different vocations depending upon the need of the employer organisations.
- MES would benefit different target groups like :
  - Workers seeking certification of their skills acquired informally
  - workers seeking skill upgradation
  - early school drop-outs and unemployed
  - previously child labour and their family

### **Age of participants**

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The minimum age limit for persons to take part in the scheme is 14 years but there is no upper age limit.

### **Curriculum Development Process**

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Following procedure is used for developing course curricula

- Identification of Employable Skills set in a sector based on division of work in the labour market.
- Development of training modules corresponding to skills set identified so as to provide training for specific & fit for purpose
- Organization of modules in to a Course Matrix indicating vertical and horizontal mobility. The course matrix depicts pictorially relation among various modules, pre requisites for higher level modules and how one can progress from one level to another.
- Development of detailed curriculum and vetting by a trade committee and by the NCVT

(Close involvement of Employers Organizations, State Governments, experts, vocational training providers and other stake holders is ensured at each stages).

### **Development of Core Competencies**

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Possession of proper attitudes is one of the most important attribute of a competent person. Without proper attitudes, the performance of a person gets adversely affected. Hence, systematic efforts will be made to develop attitudes during the training programme.

The trainees deal with men, materials and machines. They handle sophisticated tools and instruments. Positive attitudes have to be developed in the trainees by properly guiding them and setting up examples of good attitudes by demonstrated behaviors and by the environment provided during training.

Some important core competencies to be developed are:

1. Safety consciousness and safe working practices
2. Care of equipment and tools
3. Punctuality, discipline and honesty
4. Concern for quality
5. Respect for rules and regulations
6. Concern for health and hygiene
7. Cordial relationship and Cooperation with co-workers and team Work
8. Positive attitude and behavior
9. Responsibility and accountability
10. Learn continuously
11. Communication Skills
12. Concern for environment and waste disposal

Following competencies should also be developed during level-II and higher courses:

1. Ability for planning, organizing and coordinating
2. Creative thinking, problem solving and decision making
3. Leadership
4. Ability to bear stress
5. Negotiation

### **Duration of the Programmes**

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Time taken to gain the qualification will vary according to the pathway taken and will be kept very flexible for persons with different backgrounds and experience. Duration has been prescribed in hours in the curriculum of individual module, which are based on the content and requirements of a MES Module. However, some persons may take more time than the prescribed time. They should be provided reasonable time to complete the course.

### **Pathways to acquire Qualification:**

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**Access** to the qualification could be through:

- An approved training programme; **Or**
- A combination of an approved training programme plus recognition of prior learning including credit transfer; **Or**
- The recognition of prior learning that provides evidence of the achievement of the competencies for the qualification.

## **Methodology**

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The training methods to be used should be appropriate to the development of competencies. The focus of the programme is on “performing” and not on “Knowing”. Lecturing will be restricted to the minimum necessary and emphasis to be given for ‘hands on training’.

The training methods will be individual centered to make each person a competent one. Opportunities for individual work will be provided. The learning process will be continuously monitored and feedback will be provided on individual basis.

Demonstrations using different models, audio visual aids and equipment will be used intensively.

## **Instructional Media Packages**

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In order to maintain quality of training uniformly all over the country, instructional media packages (IMPs) will be developed by the National Instructional Media Institute (NIMI), Chennai.

## **Assessment**

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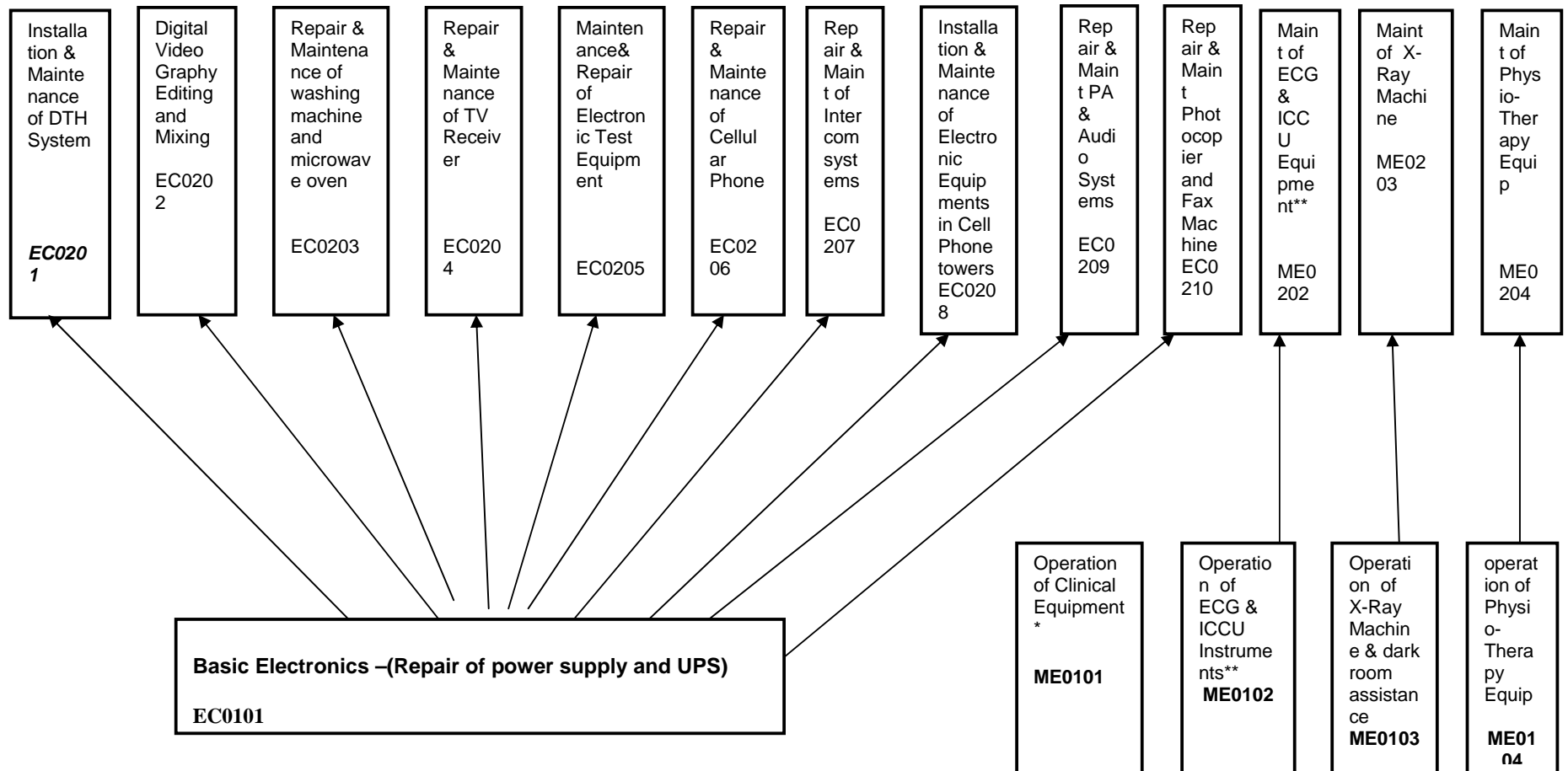
DGE&T will appoint assessing bodies to assess the competencies of the trained persons. The assessing body will be an independent agency, which will not be involved in conducting the training programmes. This, in turn, will ensure quality of training and credibility of the scheme. Keeping in view the target of providing training/testing of one million persons through out the country and to avoid monopoly, more than one assessing bodies will be appointed for a sector or an area.

## **Certificate**

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Successful persons will be awarded certificates issued by National Council for Vocational Training (NCVT).

## Course Matrix



\* on completion of this module the participant can be employed as **Medical Instrument operator** in Hospital / Diagnostic Lab

\*\* on completion of this module the participant can be employed as **Medical Instrument Service Assistant** in bio-medical department

## MODULES

### Basic Electronics -Repair and Maintenance of Power supply, Inverter and UPS

NAME	: <b>Basic Electronics -Repair and Maintenance of Power supply, Inverter and UPS</b>
SECTOR	: <b>Electronics.</b>
CODE	: <b>ELC101</b>
TERMINAL COMPETENCY	: After completion, the participant would be able to maintain and repair of Power supply, inverter and UPS.
Entry qualification	: <b>8<sup>th</sup></b> std pass with age at least 14 years.
DURATION	: 120 Hrs.
CONTENTS	:

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<ul style="list-style-type: none"> <li>• Practice procedure for electrical and personal safety measures</li> <li>• Use of multimeter</li> <li>• Testing of active and passive components</li> <li>• Testing of transformers</li> <li>• Testing of semiconductor components</li> <li>• Testing of unregulated and regulated voltages</li> <li>• Soldering and de-soldering techniques</li> <li>• Assemble and test rectifier circuits – half wave, full wave &amp; bridge rectifier</li> <li>• Assemble a power amplifier circuit (ce, emitter follower)</li> <li>• Assemble and test an audio power amplifier (buzzer)</li> <li>• Construct a RC- oscillator and test it</li> <li>• Find the total load and select a suitable UPS/Inverter (rating factor)</li> <li>• Installation of UPS and Inverters</li> <li>• Maintenance of battery</li> <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>	<ul style="list-style-type: none"> <li>• Electrical and personal safety, dangers and preventions</li> <li>• Multimeter and its various application</li> <li>• Basics of electricity – define DC, AC // practical measuring units of voltage, current, resistance. Types of transformers – its construction, testing</li> <li>• Testing of proper earth using test lamp</li> <li>• Testing of earth using multimeter</li> <li>• Fuse – types, use of fuses and its rating</li> <li>• Basic Electronics – passive and active components – testing of components, MOSFET – precautions when handling</li> <li>• Applications of transistor – its uses</li> <li>• Op-Amp – Introduction, applications, construction, comparators</li> <li>• Voltage Regulator and their types</li> <li>• DIAC, SCR, TRIAC - application</li> <li>• Digital electronics – gates and its application, multiplexers, de-multiplexers, counter</li> <li>• Electrical load their VA and watts. Various types of batteries used in UPS and Inverters and their maintenance.</li> <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>

## Equipment List ;

- i. Inverter / UPS trainer
- ii. Battery charger
- iii. Technicians tool kit
- iv. Digital multimeter
- v. Clip on ammeter
- vi. Soldering gun
- vii. Desoldering pump
- viii. Soldering / desoldering temp controlled station
- ix. SMD soldering tools
- x. Antistatic mat with proper grounding and wrist band

## Operation of Clinical Equipment (Level 1)

**Name of the Module** : Operation of Clinical Equipment (Level 1)  
**Sector** : Electronics  
**Code** : ELC112  
**Duration** : 180 Hrs  
**Entry qualification** : 8<sup>th</sup> std pass with age at least 14 years. Should be able to read and write English.  
**Terminal competency** : Should be able to “operate the clinical Instruments”

### Contents

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<ol style="list-style-type: none"> <li>1. Practice procedures for safety and health hazards measures</li> <li>2. Identify and Operate centrifuges, incubator, colorimeter, spectrophotometer, flame photometer, gamma Counter, Microscope.</li> <li>3. Perform calibration on centrifuge</li> <li>4. Perform preventive maintenance on centrifuges, incubator, colorimeter, spectrophotometer, flame photometer, gamma Counter, Microscope.</li> </ol>	<ul style="list-style-type: none"> <li>• Safety and security, health hazards</li> <li>• List out various instruments in clinical laboratory,</li> <li>• Hot plate and magnetic stirrer – operating procedure, care important specification</li> <li>• Centrifuges – construction, working principle, use, care rpm calibration, timer calibration, thermometer calibration, preventive maintenance, selection of centrifuge, various types of centrifuges.</li> <li>• Hot air oven – use, operating procedure, construction procedure, use, care, important specification</li> <li>• Incubator – use, construction, care.</li> <li>• Temperature bath: - use, construction, care.</li> <li>• Body fluids- blood, urine, CSF &amp; other body fluids</li> <li>• Colorimetry and photometry – define:               <ul style="list-style-type: none"> <li>- light wave, wavelength, unit of wavelength, monochromator, light source, cuvette, photodetector, coloured solution</li> </ul> </li> <li>• Colorimeter – use, construction, front panel controls, operating procedure, care, important specification</li> <li>• Spectrophotometer - use, construction, front panel controls, operating procedure, care, important specification</li> <li>• Flame photometer - use, construction, front panel controls,</li> </ul>

Practical Competencies	Underpinning Knowledge (Theory)
	<p>operating procedure, care, important specification</p> <ul style="list-style-type: none"> <li>• Gamma counter - use, construction, front panel controls, operating procedure, care, important specification</li> <li>• Use of pH strip</li> <li>• Microscope with oil immersion - use, construction, operating procedure, care and maintenance, important specification</li> <li>• Glucometer - use, construction, accessories, front panel controls, operating procedure, care and maintenance, important specification</li> <li>• Semi auto analyzer - use, construction, accessories, front panel controls, operating procedure, care and maintenance, important specification</li> </ul>

***List of Equipment:***

1. Hot plate and magnetic stirrer
2. Centrifuge
3. Hot air oven
4. Incubator
5. Constant temperature bath
6. Colorimeter
7. Spectrophotometer
8. Flame photometer
9. Gamma counter
10. Microscope with oil immersion
11. Glucometer
12. Stop watch
13. Semi-auto analyzer

## Operation of ECG & ICCU Instruments (Level 1)

<b>Name of the Module</b>	<b>: Operation of ECG &amp; ICCU Instruments (Level 1)</b>
<b>Sector</b>	<b>: Electronics</b>
<b>Code:</b>	<b>: ELC113</b>
<b>Duration</b>	<b>: 120 Hrs</b>
<b>Entry qualification</b>	<b>: 8<sup>th</sup> std pass with age at least 14 years.</b> <i>Should be able to read and write English</i>
<b>Terminal competency</b>	<b>: Should be able to Operate the ECG &amp; ICCU Instruments</b>

### **Contents**

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
a. Practice procedures for safety and health hazards measures b. Practice procedures for safety and health hazards measures c. Operate Single-Channel ECG recorder & Multi-Channel ECG Recorder. d. Test the ECG recorder e. Operate Cardiac Monitor, Defibrillator, Pulse Oximeter & NIBP Machine.	Programme Contents: <ul style="list-style-type: none"> <li>• Electrical and personal safety, dangers and preventions</li> <li>• Electrical and personal safety, dangers and preventions</li> <li>• Human anatomy (Basics), list out the different bioelectric signals &amp; physiological parameters, Physiology of heart, ECG signal and its component, Electrode placement, ECG Leads</li> <li>• ECG Recorder – use, types:- single channel &amp; multi-channel, manual and automatic // Technical specifications of ECG Recorders, working principle of ECG Recorders, Operation of ECG Recorder. Front Panel controls, Patient Cable, Electrode types, Programmable features of multi-channel recorder, calibration – using of 1mV control , Care and maintenance of ECG Recorders</li> <li>• ECG Monitor:- Specifications Front Panel controls , Patient Cable, Electrodes used, electrode placement, working principle, Operation, care and maintenance</li> <li>• Pulse oximetry</li> <li>• Pulse oximeter:- Specifications Front Panel controls , Patient Cable, Electrodes used, working principle, Operation, care and maintenance</li> <li>• Blood pressure measurement. - invasive and non-invasive, NIBP measurement methods</li> <li>• NIBP Machine:- Specifications, Front Panel controls , Patient Cable, cuff placement ,</li> </ul>

Practical Competencies	Underpinning Knowledge (Theory)
	working principle, Operation, care and maintenance . <ul style="list-style-type: none"> <li>• Defibrillator:- Specifications Front Panel control, Patient Cable, Electrodes used, working principle, Operation, care and maintenance</li> <li>• Precautions and prevention of transmission of diseases, minimizing infections</li> </ul>

***List of Equipment :***

1. ECG recorder – single channel (Manual)
2. ECG recorder – single channel (Automatic)
3. ECG recorder – multi channel
4. ECG Monitor
5. Pulse Oximeter
6. NIBP Machine
7. Defibrillator

## Operation of X-Ray Machine& Dark Room Assistance (Level 1)

**Name of the Module** : **Operation of X-Ray Machine& Dark Room Assistance**  
(Level 1)

**Sector** : *Electronics*

**Code** : **ELC115**

**Duration** : **120 Hrs**

**Entry qualification** : **8<sup>th</sup> std pass with age at least 14 years. Should be able to read and write English**

**Terminal competency:** *Should be able to:*

**Operate the X-Ray Machine and develop X-Ray Films**

### **Contents**

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<p>a. Practice procedures for safety and health hazards measures</p> <p>b. Familiarize with controls and operate mobile X-ray machine</p> <p>c. Familiarize with Darkroom and its stages, Able to develop x-ray films</p>	<ul style="list-style-type: none"><li>• Electrical and personal safety, dangers and preventions</li><li>• Properties of x-rays, Use of x-ray</li><li>• Precautions and safety when operating the x-ray machine, Radiation dose, effect of x-ray radiation on human/operator</li><li>• Mobile x-ray machine – list out various controls i.e. Kvp, mA, exposure time etc of x-ray machine, construction, operation</li><li>• Dark room, procedure for developing x-ray film</li><li>• Film drier –use</li></ul>

### **Resources:**

1. Mobile X-Ray Machine
2. Dark room with accessories

## Operation of Physiotherapy Equipment (Level 1)

**Name of the Module** : *Operation of Physiotherapy Equipment (Level 1)*

**Sector** : **Electronics**

**Code** : **ELC117**

**Duration** : **120 Hrs**

**Entry qualification** : **8<sup>th</sup> std pass with age atleast 14 years.**

**Terminal competency** : **Should be able to “Operate the Physiotherapy Instruments”**

### **Contents**

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
1. Practice procedures for safety and health hazards measures Prepare patient for physiotherapy treatment	<ul style="list-style-type: none"><li>• Electrical and personal safety, dangers and preventions</li><li>• Preparation of patient</li><li>• Transcutaneous electrical nerve stimulation – uses, positioning of electrodes, intensity, working of TENS, construction, front panel controls, operation procedure</li></ul>
2. Operate TENS Machine	
3. Operate Interferential therapy Instrument	<ul style="list-style-type: none"><li>• Interferential therapy – working</li></ul>
4. Operate short-wave diathermy machine	<ul style="list-style-type: none"><li>• Methods of heating the tissues – direct and indirect methods</li></ul>
5. Operate and maintain UV light system	<ul style="list-style-type: none"><li>• Short-wave diathermy – use, construction, front panel controls, operation procedure</li></ul>
6. Operate Ultrasound diathermy machine	<ul style="list-style-type: none"><li>• Ultrasound diathermy – use, construction, front panel controls, operation procedure</li><li>• Ultra violet radiation - use, construction, front panel controls, operation procedure</li></ul>

### **Resources**

1. Tens
2. Interferential Therapy Machine
3. Short-Wave Diathermy
4. Ultrasound Diathermy
5. UV Light System

## INSTALLATION AND MAINTENANCE OF DTH SYSTEMS

**NAME** : INSTALLATION AND MAINTENANCE OF DTH SYSTEMS  
**SECTOR** : ELECTRONICS  
**CODE** : ELC202  
**Duration** : 60 Hrs

**Entry qualification** : 8<sup>th</sup> std pass with age at least 14 years.

**MES Modules on Basic Electronics -Repair and Maintenance of  
 Power supply, Inverter and UPS**

### **TERMINAL COMPETENCY:**

After completion of this module participants will be able to :-

- i) identify parts and learn terminology used for DTH system.
- ii) assemble the parts of mini-dish and install independently at customers premises.
- iii) Guide the customers to operate the DTH systems installed in their residence
- iv) Learn to have effective interaction with custom

### **CONTENTS:**

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
Practice procedures for safety and health hazards measures	Electrical and personal safety, dangers and preventions
Name the various mini-dish components and their functions.	Basic satellite communication, types of satellite & its orbits, uplinks and down links, frequency spectrum, broadcast centers, area covered, polarization, EFC, symbol rate, BER, MER, C/N, etc.
Chronology to assemble the various parts of minidisk.	Specification & parts of coaxial cable, impedance and specification
Various types of connectors and cables, its specifications and connectorization procedure.	
Identify and use different tools and equipments used in DTH installation procedure & cabling procedure.	Multi-dwelling unit design, headed amplifier, line amplifier, cascaded in/out multi-switch, tap, splitter.
Site selection, installation mounting tracking for azimuth and elevation angles using SAT meter.	
Laying cable, connecting auxiliary equipments.	
Activating, setting of IRD/DIGICOM/DIGIBOX	

## RESOURCES:

- 1 Complete Assembly of mini dish
- 2 IRD/Digibox/digicom alongwith all channel package
- 3 Tool Kit (Comprising various tools added as per requirements
- 4 Special tools as compression tools, preparation tools and other tools required time to time etc.
- 5 Power drill machine Hammer type bidirectional rotation
- 6 SAT Meter
- 7 Colour TV
- 8 Inclano meter
- 9 Compass
- 10 Practice wall comprising bricks, concrete etc.
- 11 LNBF (Universal, dual, quad, quattero)
- 12 Headed amplifier, line amplifier, cascaded 2 in 4 out multi-switch, tap, splitter.

## DIGITAL VIDEOGRAPHY –EDITING AND MIXING

**NAME** : DIGITAL VIDEOGRAPHY –EDITING AND MIXING

**SECTOR** : ELECTRONICS

**CODE** :ELC203

**Entry qualification** : 8<sup>th</sup> std pass with age at least 14 years.

*MES Modules on Basic Electronics -Repair and Maintenance  
of Power supply, Inverter and UPS*

**DURATION** : 150 HOURS

### **TERMINAL COMPETENCY:**

After undergoing this course the participant will be able to:

1. Get familiarize with Digital Still and Move Camera controls.
2. Operate Digital Still and Move Cameras.
3. Capturing Still and Move Video.
4. Down loading Captured image in PC.
5. Editing & Mixing Still and Movie Video.
6. Preparing Project and creating CD.

### CONTENTS:

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
Computer fundamentals & how to operate	Practice on computers
Camera working principle, Lighting, Lens, Focusing, Aperture, Shatter and Film Speed, lens, zooming, focus	Camera Operation: Familiarizing with different controls & their setting for operation
Digital Still Camera working Principle different function advantages compared with conventional type camera	Digital still Camera operation and observing different controls and their applications
Digital Video Camera working principal. PAL Standards	Digital Video Camera operation and familiarizing with different controls and their application
Capturing and Storing methods of Digital Still Camera photographs by using PC USB port.	Installing Digital Camera Software on PC: Downloading & storing captured Photographs
Adobe Photo Shop Tools applications and their using methods for editing and mixing	Using Photo Shop tools on still images/Photographs for editing and mixing
Pinnacle Studio Editing and Mixing Software. Capturing and Storing methods of Digital Video Camera movie.	Installing Pinnacle Studio Editing and mixing software on PC. Downloading and storing captured video movie.
Methods of using video clips, transitions, titles and background sound effects.	Using Pinnacle Studio editing and mixing software for making vide project
Video project making creating MPEG movie.	Movie Project CD writing.

- RESOURCES:**
1. Still Digital Camera
  2. Digital Video Camera OF Latest standard (presently like HI-8, DV)
  3. Computers
  4. Software for video capturing (Adobe-Photoshop, pinnacle or latest)
  5. Various light sources.

## Repair and Maintenance of Washing Machine and Microwave oven

**NAME** : Repair and Maintenance of Washing Machine and Microwave oven

**SECTOR** : Electronics

**CODE** : ELC204

**DURATION** : 60 Hrs.

**Entry qualification:** :8th std pass with age at least 14 years.  
MES Modules on Basic Electronics -Repair and Maintenance of Power supply, Inverter and UPS

**TERMINAL COMPETENCY** :

After completion the participant would be able to install and repair washing machine and microwave oven.

**CONTENTS** :

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<i>Practice procedures for safety and health hazards measures</i>	<ul style="list-style-type: none"> <li>• <i>Electrical and personal safety, dangers and preventions</i></li> </ul>
<p><b>Washing machine</b> – front load &amp; top load. Installation of washing machine</p> <p>Identify the internal and external parts of washing machine Operate semi, automatic and fully automatic , fuzzy logic, neorologic washing machines Rectify the fault leading to not working of control panel switches</p>	<ul style="list-style-type: none"> <li>• Understand the functions of washing machine through block diagram</li> <li>• Working principle of motors used in washing machine and their wiring diagram</li> <li>• Study of inlet and outlet valves and their control</li> </ul>
Rectify the fault leading to not working of pulsator / agitator	
Rectify the fault leading to spin drier not working	
Rectify the fault leading to one side rotation of motor	
Rectify the fault leading to water inlet and outlet valves. Maintenance and precautions (types of detergents)	

<p><b>Microwave oven</b> Types – with grill, without grill and conventional Identify the internal and external parts of micro wave oven</p>	<ul style="list-style-type: none"> <li>• Understand the working principle of micro wave oven with the help of block diagram and by observation.,</li> </ul>
<p>Identify the different touch pad controls their functions, testing of high voltage diode</p>	
<p>Identify the HV capacitor and discharge it</p>	
<p>Rectify the fault leading to fuse blows off when cooking is initiated</p>	
<p>Rectify the fault leading to not responding of touch switches.( front panel ) Rectify the fault leading to Dead set</p>	
<p>Rectify the fault leading to long cooking time . Precautions – importance of interlocking switch in performing maintenance</p>	

**RESOURCES:**

Maintenance tool kit  
Washing machine of different makes  
Micro wave oven of different types  
Spares for micro wave oven  
Digital multimeter  
Technicians tool kit  
Hand glove  
Radiation leakage tester

## Repair & Maintenance of TV Receiver

**NAME** : Repair & Maintenance of TV Receiver  
**SECTOR** : Electronics  
**CODE** : ELC205  
**DURATION** : 180 Hrs  
**Entry qualification:** 8<sup>th</sup> std pass with age at least 14 years.  
*MES Modules on Basic Electronics -Repair and Maintenance of Power supply, Inverter and UPS*  
**TERMINAL COMPETENCY** : After completion the participant would be able to repair Television.

**CONTENTS** :

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
Installation of a TV receiver	Explain the working principle of black and white and color TV using block diagram. Explain the need and working principle of each block Detailed explanation of power supply and high voltage generation section Explanation of PT , various voltages required for PT
Check the SMPS for various output voltages	
Identify different stages and special components	
Check the EHT section for various faults by using step by step method	
Check the tuner section for various tuning problems	
Check the vertical and Horizontal section for various oscillations and drive problems.	
Simulate faults related with the micro controller and I <sup>2</sup> C sections . Fault finding in remote control TV kit replacement with suitable yoke system (vertical and horizontal deflection coils)	

**RESOURCES:**

- Television of different makes.
- Technicians tool kit
- Soldering iron
- Digital Multimeter
- Isolation transformer
- Pattern generator ( B/W & COLOUR)
- Infra Red remoter control tester

## Maintenance & Repair of Electronic Test Equipment

**Name of the course** : Maintenance & Repair of Electronic Test Equipment.  
**SECTOR** : ELECTRONICS.  
**CODE** : ELC206  
**Entry qualification** : 8<sup>th</sup> std pass with age at least 14 years.  
*MES Modules on Basic Electronics -Repair and Maintenance of Power supply, Inverter and UPS*  
**DURATION** : 240 Hrs.  
**TERMINAL COMPETENCY:**

The candidates would be able to:

- Use hand tools used for servicing the electronic test equipment.
- Operate the following electronic test equipment.
- Servicing, cleaning of switches, tighten the loose knobs, check the power cord.
- Repair the following electronic test equipment:
  1. Analog Multimeter.
  2. Digital multimeter
  3. Function Generator.
  4. Signal Generator.
  5. Oscilloscope.

### CONTENENTS:

Practical Competencies	Underpinning Knowledge (Theory)
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
(1)Analog Multimeter: <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>• Familiarisation with operation of controls of VOM.</li> <li>• Principle of operation of Analog multimeter.</li> <li>• Study of DC voltage circuit of VOM.</li> <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>• 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> <li>• Test &amp; repair the DC current measurement circuit by doing measurement at the test points provided.</li> <li>• Test &amp; 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> </ul>

	<ul style="list-style-type: none"> <li>• Replace the of 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>(2)Digital Multimeter:</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<sup>1/2</sup> digit Digital Multimeter.</li> <li>• Replace the defective IC. replace the</li> <li>• Battery of the meter.</li> <li>• Maintaining the test leads in proper condition.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Cleaning the dust, Cleaning the switch contacts by switch cleaning solution.</b></li> <li>• Testing the fuse.</li> <li>• Testing the 7 segment LED display. Testing the LCD display module.</li> <li>• Check the DC voltages &amp; waveforms at the test point of the IC commonly used in 3<sup>1/2</sup> digit digital multimeter.</li> <li>• Troubleshoot DC voltage, AC voltage, 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>
<p>(3)Function Generator:</p> <ul style="list-style-type: none"> <li>• Precaution to be taken in handling a Function Generator.</li> <li>• Familiarization with front panel controls, switch etc.</li> <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>• Familiarization with front panel control.</li> <li>• <b>Cleaning the dust, Cleaning the switch contacts by switch cleaning solution.</b></li> <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>(4)Signal Generator:</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>	<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 a 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>

**(5)CRO:**

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>• <b>Precaution to be taken in handling a CRO.</b></li><li>• <b>Familiarization with front panel controls.</b></li><li>• <b>Identify different blocks in a CRO.</b></li><li>• <b>Study &amp; Trouble shooting technique of CRO's Power supply circuit, vertical amplifier, horizontal amplifier &amp; Sweep generator circuit etc.</b></li><li>• <b>Test the by doing voltage &amp; waveform measurement at the test points provided.</b></li><li>• <b>Check for proper operation of AUTO/NORMAL, LINE, CH-1 or CH-II, EXT etc.</b></li><li>• <b>Check the calibration of the cro for accurate measurement by feeding the CAL signal to each channel.</b></li><li>• <b>Cleaning of switches, potentiometers etc.</b></li><li>• <b>Maintaining the test probes in proper condition. Test the probe with attenuation (X1, X10).</b></li><li>• <b>Time base and amplitude control</b></li><li>• <b>Triggering, ALT-CHOP mode</b></li></ul> | <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>• <b>Identify &amp; testing a CRO's Power supply Vertical amplifier circuit , horizontal amplifier &amp; Sweep generator circuit etc.</b></li><li>• Check by feeding the CAL signal to the channel in use for accurate measurement.</li><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> |
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**TOOLS & EQUIPMENT REQUIRED:**

1. Screw drivers of different types & sizes.
2. Plier.
3. Long nose plier.
4. Watch maker's screwdriver set.
5. Side cutter.
6. Brush.
7. Adjustable spanner 6".
8. Tweezer.
9. Soldering iron.
10. Analog Multimeter.
11. Digital multimeter.
12. Oscilloscope.
13. Function Generator.

## REPAIR AND MAINTENANCE OF CELLULAR PHONE

**Name** : REPAIR AND MAINTENANCE OF CELLULAR PHONE

**SECTOR** : ELECTRONICS

**CODE** :ELC207

**Entry qualification** : 1. 8<sup>th</sup> std pass with age at least 14 years.  
2. MES Modules on Basic Electronics -Repair and Maintenance of Power supply, Inverter and UPS

**DURATION** : 210hrs

**TERMINAL COMPETENCY** : Candidate will be able to repair 2G and 3G cell phones

### **CONTENTS:**

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
Operation and setting of cell phone	Introduction to various types of mobile handsets, their description, features & how to use these features. Identify the keys and their uses.
<i>Identify various components of mobile handsets</i>	Explaining of various features of mobile phones and methods of using the same.
Replace faulty parts with new parts of mobile phone that can be done without use of soldering	Fault finding and trouble shooting
Test the battery and battery charger with multimeter.	Identify the components used in a cell phone
Testing of Mic, speaker and vibrator	Function of Mic, speaker and vibrator
Soldering and desoldering of various SMD components and select suitable temperature for use.	SMD soldering methods
Soldering and desoldering of BGA Ics.	Identify BGA Ics.
Check track continuity and use jumpers for track problems.	Identify various blocks and their functions
Apply proper flux and cleaning the cell phone	Use of various solders , flux and cleaning agents.
Test and rectify the problems in antenna and antenna switch	Use of antenna and antenna switch
Identify the fault and test the display interface circuits.	Functions of display, CPU, memory
Unlock and lock various functions	Various locks used in cell phone
Identify the faults of Network section and voice section and rectify them.	Functions of the IF section, COBBA section and PA section. Complete knowledge of Block Diagram, circuit diagram, i.e., Power Section On/off circuit Net Section Charging Section Software Section

Rectify the faults related to SIM and SIM connector	SIM and SIM related problems of GSM & CDMA PHONES
Rectify the faults in Camera and camera interface circuits	Use of computer for cell phone servicing – cell phone software
Identify and Rectify the faults in Bluetooth circuits Use of anti-static mats	Camera phones its constructional details and working Bluetooth and other wireless circuits. Flashing and its need- precautions to be taken while flashing
Complete hardware and software knowledge of PDA and multimedia handsets, Window based handsets.	Knowledge of downloading of add-on software, ring tones, wall papers, themes, etc. on non-multimedia and multimedia handsets, window based handsets.

RESOURCES ( for a batch of 20 trainees):

1. SMD rework station - 10 Nos.
2. Soldering station 6V/10W - 10 Nos.
3. Magnifying lens with illumination- 5 Nos.
4. BGA soldering kit - 10 Nos.
5. Computer with Flashing Unit - 5 Nos.
6. Tweezers ( assorted size and shapes ) – 10 nos.
7. MULTIMETER ( Digital) – 4 nos.
8. ANTI-STATIC PAD
9. Software compatible with different types of handsets.
10. Screw drivers assorted size and shapes (TROX) for cell phones  
(Every trainers should have his own tool kit – set of screw drivers, blade, soldering iron, multimeter, set of pliers, cutting, nose, combination pliers)

## REPAIR AND MAINTENANCE OF INTERCOM SYSTEMS

**Name** : REPAIR AND MAINTENANCE OF INTERCOM SYSTEMS

**SECTOR** : ELECTRONICS

**CODE** :ELC208

**Entry qualification:** 8<sup>th</sup> std pass with age at least 14 years.

*MES Modules on Basic Electronics -Repair and Maintenance of  
Power supply, Inverter and UPS*

**DURATION** : 150 hrs

**TERMINAL COMPETENCY:** HE/SHE can able to setup a intercom network with EPABX and repair Electronic Push button Telephones.

### CONTENTS:

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
Test the components used in the pushbutton telephone	Identify the components used in Push button telephone
Identify the various tone signals used in the phones	Understand the various tones used in the phone circuits
Testing of microphone and speaker	Use of microphone and speaker
Testing & replacing components in the protection circuit and ringer circuit	Differentiate pulse dialing and tone dialing and their applications
Test the key pad for proper function and repair the key pad problems	Functions of the dialer circuit and speech circuit
Identify the faulty component and replace in the dialer circuit and speech circuit	Testing methods of pushbutton telephone for proper functions
Test and identify the fault in a pushbutton telephone	Use of various adaptors, connectors and sockets used in the telephone circuits
Identify and fix the various adaptors, connectors and sockets	Methods to connect the trunk line and extension line in a EPABX
Identify the terminals of trunk line and extension line and connect the extensions	Call wait, call transfer, conference facility available in a EPABX
Setting the call transfer, call wait and other facilities available on EPABX	Read wiring circuits and understand the wiring of extension circuits.
Trace the wiring and locate the fault in the extension wiring circuit	

### RESOURCES:

1. EPABX of 2+ 6 line - 1 no
2. EPABX of 2 + 10 line - 1 no
3. Pushbutton telephones - 5 Nos
4. Telephone analyzer - 1 no.
5. Crimping tool - 1 No.
6. MULTIMETER – 1 No.

## Installation & Maintenance of Electronic Equipments in Cell phone towers

**Name of the Module: Installation & Maintenance of Electronic Equipments in Cell phone towers**

**Sector** : Electronics

**Code** : ELC209

**Duration** : 240 Hrs

**Entry qualification** : 8<sup>th</sup> std pass with age atleast 14 years.

MES Modules on Basic Electronics -Repair and Maintenance of Power supply, Inverter and UPS

**Terminal competency** : Should be able to:

Install antenna

Install and Maintain Generator set, UPS

Install and maintain Base Terminal Station

### **Contents :**

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
<ul style="list-style-type: none"> <li>• Perform cable earthing</li> <li>• Feeder cable clamping</li> <li>• Feeder connector making</li> <li>• Install indoor and outdoor ladder</li> <li>• Cable routing</li> <li>• Install equipment like BTS, TMR</li> <li>• Install antenna</li> </ul>	Programme Contents: <ul style="list-style-type: none"> <li>• Feeder Cables – earthing, clamping, connector</li> <li>• Ladders used – installation of indoor and outdoor ladders</li> <li>• Base Transceiver Station (BTS)– INSTALLATION</li> <li>• Installation of transmission rack (TMR)</li> <li>• Equipment Installation and safety</li> <li>• Installation of Antenna</li> </ul>
<ul style="list-style-type: none"> <li>• Install the GSM &amp; MINILINK antenna</li> <li>• Use VSWR meter and measure the signal strength</li> <li>• Perform Microwave alignment</li> <li>• Perform the task of interconnecting the different units in a Base Transceiver Station</li> </ul>	<ul style="list-style-type: none"> <li>• Fundamentals of AC</li> <li>• Microwave spectrum - CDMA, GSM - micro wave link – wave guide</li> <li>• modem multiplexing unit</li> <li>• Switching Multiplexing Unit</li> <li>• Tributary Frame</li> <li>• Distribution Unit</li> <li>• Mini link cable and installation</li> <li>• Antenna- mini-link &amp; serving antenna, antenna maintenance</li> <li>• UPS and its maintenance</li> <li>• Generator set and its Maintenance</li> <li>• Lighting arrestor</li> <li>• Electrical wiring, cabling and routing</li> </ul>

#### *Resources:*

1. Multimeter
2. Altimeter
3. GPS meter
4. binocular
5. VSWR Meter
6. M4 crimping tool
7. BNC crimping tool
8. SMZ crimping tool
9. MAINTENANCE TOOL KIT consisting of spanners, screw drivers etc
10. clamp meter

## Repair and Maintenance of PA and Audio System

<b>NAME</b>	<b>: Repair and Maintenance of PA and Audio System</b>
<b>SECTOR</b>	<b>: Electronics.</b>
<b>CODE</b>	<b>: ELC210</b>
<b>DURATION</b>	<b>: 120 Hrs</b>
<b>Entry qualification:</b>	<b>8<sup>th</sup> std pass with age at least 14 years.</b> <i>MES Modules on Basic Electronics -Repair and Maintenance of Power supply, Inverter and UPS</i>
<b>TERMINAL COMPETENCY</b>	<b>: After completion, the participant would be able to Maintain and repair of public address systems and Audio systems</b>

### CONTENTS:

Practical Competencies	Underpinning Knowledge (Theory)
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
Identify the various types and power rating of speakers	Understand the working of microphones and speakers
Types of microphones and their applications	Types of microphones and their properties.
Construct and repair small power supplies	Power supply , ripple, filtering and power rating. Regulated power supply
Amplifier -connection with microphone and speakers	Importance of Impedance matching, types of wires used for connecting mic and speakers.
Long line connection, line transformers and their connection, phasing according to manufacturing	Pre amplifiers, their necessity, impedance matching, wire less microphones
Fault finding in pre amplifier sections	Power amplifiers, components used in power amplifier section and their functions
Fault finding in power amplifier sections, power transistor testing	Earthing and its importance
Rectification of Humming and whistling problems	Multi input amplifiers and their connctions.
<b>CD Player</b> Identify the internal parts of CD player such as Loading motor and its assembly Turntable motor and its assembly Slider motor and tracking coil Linear tracking pickup assembly Servo system and OPU Lens cleaning	Study the working principle of ACD and VCD players Study the functions of front panel controls Study the parts in mechanical section and their working Explain the loading action of CD player
Trouble shooting with the following faults.  Dead set, Tray does not open., Disc not reading, Track jumps, CD gets ejected	Study the motors used and the working of servo system Study the optical pickup unit and its working

### RESOURCES:

- PA system
- Mic – assorted types
- Speakers – assorted types and wattages
- CD/VCD players
- DVD players
- Wireless microphone (VHF)

## Repair & maintenance of Photo Copier & Fax Machine

**Name of the course** : Repair & maintenance of Photo Copier & Fax Machine.

**SECTOR** : ELECTRONICS

**CODE** : ELC211

**Entry qualification** : 8<sup>th</sup> std pass with age at least 14 years.

**MES Modules on Basic Electronics -Repair and Maintenance  
of Power supply, Inverter and UPS**

**Duration** : 120 Hrs

**TERMINAL COMPETENCY:**

1. : HE/SHE can able to repair Photo copying machine & Fax machines

**CONTENTS:**

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
<b>(a). PHOTO COPIER</b>	
Operation of a photo copier.	Principle of photo copying
Dismantling and assembling of paper feed mechanism, paper tray, Thermal unit and Toner Unit.	Photo sensitive materials- selenium etc..
Identify the various sensors used in the copier and their fixtures.	Image transfer methods
Fault finding and repairing in electrostatic high voltage unit.	Various types of sensors and their functions.
Dismantling and fitting of drum unit- cleaning of drum unit	Electrostatic charger and charging of drum assembly.
Dismantling and refitting of Carriage unit , mirror unit and light unit	Toner and its properties.
Fault finding in light unit	Paper trays, Paper feed mechanism and the sensors used for paper movement
Identify the faults and repair in the thermal unit.	Effects of light Intensity on charging the drum unit.
Control modules- understand the fault codes and identify the faulty sections.	Focusing, enlargement methods
Fault finding in control module	Functions of control module – fault codes
Periodic cleaning and servicing of copier machines	Fault finding methods and procedure for copier machines
Overall fault finding and repair a photo copier machine.	Principle of Colour Copiers
Fault finding and repair of Colour copiers	Multipurpose copy printers and heavy duty copiers.
Repairing of Jumbo copiers	
Repairing of multipurpose copy printers.	
Repairing of heavy duty copiers	
<b>(b). FAX MACHINE</b>	
Operation of a Fax machine.	Principle of Fax machine.
Telephone line access and phone connection	Properties of telephone line, ISDN line
Dismantling and assembling of paper feed mechanism, paper tray, Thermal unit and Toner Unit of Fax machine	Data reception and printing Checksum and its importance
Identify the various sensors used in the Fax machines	Scanning of paper and converting to data.

Thermal printers and Ink printers.	Printers thermal and ink , their working principles.
Identify the faults and repair in the thermal printer unit.	Paper trays, Paper feed mechanism and the sensors used for paper movement
Control modules- understand the fault codes and identify the faulty sections.	Functions of control module – fault codes
Fault finding in control module	Fault finding methods and procedure for Fax machines
Periodic cleaning and servicing of fax machines	Fault finding methods and procedure for Fax machines

RESOURCES:

1. Photo copier ( mono)
2. Photo copier colour
3. Copy printer
4. Jumbo copier
5. Fax machine
6. High voltage test unit
7. Multimeter

## Maintenance of ECG & ICCU Instruments (Level 2)

<b>Name of the Module</b>	<b>: Maintenance of ECG &amp; ICCU Instruments (Level 2)</b>
<b>Sector</b>	<b>: Electronics</b>
<b>Code</b>	<b>: ELC214</b>
<b>Duration</b>	<b>: 120 Hrs</b>
<b>Entry qualification</b>	<b>: 8<sup>th</sup> std pass with age atleast 14 years. + level 1 certification in ECG &amp; ICCU Instruments or Persons with work experience in maintenance of ECG &amp; ICCU Equipment or Certification in “BASIC ELECTRONICS” module</b>

### Terminal competency:

- Should be able to test electrical earth, test & replace faulty power chord, test patient cables, test & replace battery, charge battery
- Should be able to do performance test and study symptoms on ECG Recorders, ECG Monitors, Pulse Oximeter, and NIBP Machine.
- Should able to dismantle the equipment
- Should be able to do identify the faulty PCB's & Fuses in ECG Recorders, ECG Monitors, Pulse Oximeter, NIBP Machine and replace them
- Test components and replace faulty electronic components

### Contents:

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
a. Operate Multimeter & Measure Resistance, voltage, current b. Use tools & Perform soldering and de-soldering c. Perform power chord maintenance of equipments d. Test earth using test lamp or multimeter e. Perform cable maintenance f. Open equipment g. replace fuses which are outside the equipment	Programme Contents: <ul style="list-style-type: none"> <li>• Multimeter and its application</li> <li>• Basics of electricity – define DC, AC // practical measuring units of voltage, current, resistance.</li> <li>• Testing of earth using test lamp</li> <li>• Testing of earth using multimeter</li> <li>• fuse – types, use, testing</li> <li>• Basic Electronics – passive and active components, testing of components,</li> <li>• Op-Amp – Introduction, applications, construction, differential amplifier, biomedical amplifier, filters – integrator, differentiator, notch filters, comparators</li> <li>• Digital electronics – gates and its application, multiplexers, de-multiplexers, counters</li> </ul>
a. Test the performance of ECG Recorder , study symptoms & Identify the faulty PCB b. Test the performance of ECG Monitor, study symptoms & Identify the faulty PCB c. Test the performance of pulse oximeter, study symptoms & Identify the faulty PCB d. Test the performance of NIBP Machine, study symptoms &	<ul style="list-style-type: none"> <li>• Operation of ECG Recorders, Operation of ECG Monitors, defibrillatr, pulse oximeter, NIBP Machine</li> <li>• block diagram of ECG recorder, Common PCB's and identification of PCB's, fuses in the PCB</li> <li>• performance of ECG Recorder – study of symptoms and finding out the faulty PCB, fuses in the PCB</li> <li>• block diagram of ECG Monitor, Common</li> </ul>

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
Identify the faulty PCB e. List out the tools required for performing intermediate level maintenance f. Follow dismantling procedure open the equipment and replace the faulty board g. Remove, test and replace blown fuse in the PCB	PCB's and identification of PCB's, fuses in the PCB <ul style="list-style-type: none"> <li>• performance of ECG Monitor – study of symptoms and finding out the faulty PCB, fuses in the PCB</li> <li>• block diagram of pulse Oximeter , Common PCB's and identification of PCB's, fuses in the PCB</li> <li>• performance of Pulse Oximeter – study of symptoms and finding out the faulty PCB, fuses in the PCB</li> <li>• block diagram of NIBP Machine , Common PCB's and identification of PCB's, fuses in the PCB</li> <li>• performance of Pulse Oximeter – study of symptoms and finding out the faulty PCB, fuses in the PCB</li> </ul>

**Resources**

1. Multimeter
2. Soldering Iron
3. De-soldering gun
4. regulated power supply
5. ECG Recorder cable – single channel
6. ECG Recorder cable – Automatic
7. ECG Monitor cable
8. Pulse Oximeter cable
9. Defibrillator cables

## Maintenance of X-Ray Machine (Level 2)

<b>Name of the Module</b>	<b>: Maintenance of X-Ray Machine (Level 2)</b>
<b>Sector</b>	<b>: Electronics</b>
<b>Code</b>	<b>: ELC216</b>
<b>Duration</b>	<b>: 240 Hrs</b>
<b>Entry qualification</b>	<b>: 8th std pass with age atleast 14 years. + Level 1 certification in X-Ray Machine or Persons with work experience in maintenance of X-Ray Machine or Certification in "BASIC ELECTRONICS" module</b>

### **Terminal competency:**

- Should able to use multimeter
- Should be able to test electrical earth, test & replace faulty power chord, test high-tension cables cables, test
- Test fuse in the equipment and replace them when required
- Test switches, interlocks, magnetic relay, and circuit breakers and replace
- Maintain patient table, tube stands and tracks
- Should able to replace fused bulb in collimator
- Should be able to do performance test
- Should able to dismantle the x-ray machine
- Should able to maintain the x-ray tube housing
- Test components and replace faulty electronic components

### **Contents :**

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
a. Operate Multimeter & Measure Resistance, voltage, current b. Use line-tester, c. Perform power chord maintenance of equipments d. Test earth using test lamp or multimeter e. Replace fuse in the equipment and replace them when required f. Test switches, interlocks, magnetic relay, and circuit breakers and replace g. Maintain patient table, tube stands and tracks	Programme Contents: <ul style="list-style-type: none"> <li>• Multimeter and its application</li> <li>• Basics of electricity – define DC, AC // practical measuring units of voltage, current, resistance.</li> <li>• Use of line-tester</li> <li>• Testing of earth using test lamp</li> <li>• Testing of earth using multimeter</li> <li>• Basic Electronics – passive and active components, testing of components,</li> <li>• Op-Amp – Introduction, applications, construction, differential amplifier, biomedical amplifier, filters – integrator, differentiator, notch filters, comparators</li> <li>• Digital electronics – gates and its application, multiplexers, de-multiplexers, counters</li> <li>• Layout of a x-ray room, safety features required</li> <li>• Fuse – use, types used in X-Ray Machine, ratings</li> <li>• Switches and interlocks, relay, circuit breakers in x-ray machine</li> <li>• Power cord maintenance, changing broken 3-pin plug</li> </ul>

	<ul style="list-style-type: none"> <li>• high tension cables &amp; its precautions</li> <li>• General care and maintenance for mobile x-ray machine and stationary x-ray machine</li> </ul>
<p>h. Test the performance of X-ray Machine , test exposure timer, mille ampere testing, kilo voltage testing</p> <p>i. Test the performance using non-invasive x-ray QC device</p> <p>j. Maintaining of log book</p> <p>k. List out the tools required for performing maintenance</p> <p>l. X-ray tube housing – maintenance</p> <p>j. Replacemen of fused bulb in Collimator</p> <p>k. Follow dismantling procedure open the equipment and replace the faulty board</p>	<ul style="list-style-type: none"> <li>• Operation of X-Ray Machine</li> <li>• block diagram of x-ray machine, Common PCB's and identification of PCB's, fuses in the PCB</li> <li>• performance of x-ray machine –use of spinning top, wisconsin test tool, aluminium test wedge, dosimeter , Wisconsin test cassette</li> <li>• non-invasive x-ray QC device – use, operation</li> <li>• bucky tray and its maintenance</li> <li>• x-ray tube – types, working, rating chart, faults in x-ray tube, tube housing</li> <li>• collimator – use, construction, bulb in collimator – rating &amp; replacement</li> </ul>

**Resources**

1. x-ray machine (mobile)
2. x-ray machine (stationary)
3. performance test tools
4. non-invasive x-ray QC device

## Maintenance of Physiotherapy Equipment (Level 2)

**Name of the Module** : Maintenance of Physiotherapy Equipment (Level 2)  
**Sector** : Electronics  
**Code** : ELC218  
**Duration** : 120 Hrs  
**Entry qualification** : 8th std pass with age atleast 14 years.+ Level 1 certification in X-Ray Machine or Persons with work experience in maintenance of Physiotherapy Equipment or Certification in “BASIC ELECTRONICS” module

**Terminal competency:**

- Should able to use multimeter
- Should be able to test electrical earth, test & replace faulty power chord & cables
- Test fuse in the equipment and replace them when required
- Should be able to do identify the faulty PCB's & Fuses Tens, Tnterferential therapy Machine, short-wave diathermy, ultrasound diathermy machine
- Should able to replace fused bulb in UV light
- Test components and replace faulty electronic components

**Contents:**

<b>Practical Competencies</b>	<b>Underpinning Knowledge (Theory)</b>
<i>Practice procedures for safety and health hazards measures</i>	<i>Electrical and personal safety, dangers and preventions</i>
a. Operate Multimeter & Measure Resistance, voltage, current  b. Use tools & Perform soldering and de-soldering  c. Perform power chord maintenance of equipments  d. Test earth using test lamp or multimeter  e. Perform cable maintenance  f. Open equipment, Remove, test and replace blown fuse in the PCB	Programme Contents: <ul style="list-style-type: none"> <li>• Multimeter and its application</li> <li>• Basics of electricity – define DC, AC // practical measuring units of voltage, current, resisistance.</li> <li>• Testing of earth using test lamp</li> <li>• Testing of earth using multimeter</li> <li>• fuse – types, use, testing</li> <li>• Basic Electronics – passive and active components, testing of components,</li> <li>• Op-Amp – Introduction, applications, construction, differential amplifier, biomedical amplifier, filters – integrator, differentiator, notch filters, comparators</li> <li>• Digital electronics – gates and its application, multiplexers, de-multiplexers, counters</li> <li>• Replacement of fused lamp in UV light</li> <li>• TENS - block diagram, Common PCB's and identification of PCB's</li> <li>• Interferential Therapy Machine - block diagram, Common PCB's and identification of PCB's</li> </ul>

Practical Competencies	Underpinning Knowledge (Theory)
	<ul style="list-style-type: none"><li>• Short-wave diathermy - block diagram, Common PCB's and identification of PCB's</li><li>• Ultrasound diathermy - block diagram, Common PCB's and identification of PCB's</li></ul>

**Resources**

1. Tens
2. Interferential Therapy Machine
3. Short-Wave Diathermy
4. Ultrasound Diathermy

## List of Expert/Trade Committee Members

### CURRICULUM DEVELOPMENT FOR SHORT TERM COURSES BASED ON MODULAR EMPLOYABLE SKILLS

SECTOR/AREA: **Electronics**  
**ATI-EPI, RAMANTHAPUR, HYDERABAD-500 013**

The following members from various organizations/industries and officers of ATI-EPI, Hyderabad attended the Trade Committee Meeting on 10<sup>th</sup> May, 2006 at 10.30 a.m. in the Conference Room of the Institute for development of short term courses on Modular Employable Skills in the sector "ELECTRONICS":

S.No.	Name of the Member with Designation <b>S/Shri:</b>	Name of the Organization / Industry	Phone No.
1.	Mirza Afzal Baig, Retd., Indian Airforce,	M/s BAIG Electronics Service Centre, Hyderabad	27846544
2.	Joaquim D. Silva, Manager	M/s Program Power System, Nacharam, Hyderabad	9885083065
3.	Shiva Shanker, Service Co-ordinator	N/s ADONIS Electronics (P) Ltd., (ONIDA), Abids, Hyderabad.	55833000
4.	M. Nagarjuna Chary, Service Engineer	-do-	9392444101
5.	M. Narasimha Rao, Service Engineer (Sales & Service)	M.s SYSTRONIC, Shivam Road, Vidyanagar, Hyderabad.	27423064
6.	D. Venkateswara Rao, Service Engineer	M.s Maruthi Electronics, 1-11-152, Shamlal Buildings, Begumpet, Hyderabad.	9246347557
7.	S. Soma Sekhar, Service Engineer	M/s SAMSUNG India Electronics Ltd., Hyderabad	9849075029
8.	G. Narender Reddy	M/s PHSITECH Electronics, 101/102, Padma Plaza, Secunderabad	27537483
9.	P. Venkateshwar Rao,	-do-	-do-
10.	N. Kumar	M/s Tirumala Diagnostics, Ramanthapur, Hyderabad.	55301385
11.	Ch. Ekambareswar Rao	M/s SETWIN & EUGTECH Computers, Hyderabad	27662709 9885429536
12.	H. Somasundaram, Director	ATI – EPI, Ramanthapur, Hyderabad.	27037266
13.	R.L. Singh, Jt. Director	-do-	-do-
14.	Sri V. Subramanyam, Asst. Director	-do-	-do-
15.	N. Ramesh Babu, Asst. Director	-do-	-do-
16.	C. Shiv Kumar, Trg. Officer	-do-	-do-