

**Syllabus for the trade**

**of**

**MECHANIC-CUM OPERATOR ELECTRONIC  
COMMUNICATION SYSTEMS**

**(SEMESTER PATTERN)**

**UNDER**

**CRAFTSMAN TRAINING SCHEME**

**Designed in 2013**

**By**

**Government of India**

**Central Staff Training and Research Institute**

**Directorate General of Employment & Training**

**Ministry of Labour & Employment EN -81,**

**Sector-V, Salt Lake City, Kolkata-700091**

List of Members of trade committee meeting for the trade of **MECHANIC-CUM OPERATOR ELECTRONIC COMMUNICATION SYSTEMS** held on 18-10-2011, at Advanced Training Institute Kolkata.

Sl.No	Name & Designation S/Shri/Smt	Organisation	Remarks
1.	N.K.Chatterjee,Director	A.T.I.Kolkata	Chairman
2.	J.Ukil. Jt.Director	A.T.I.Kolkata	Member
3.	S.P.Bhatterjee,DDT	A.T.I.Kolkata	Member
4.	G.C.Saha,ADT	A.T.I.Kolkata	Member
5.	Prasanta Kumar Paul,JE	CPWD,Kolkata	Member
6.	Saikat Dutta	Project Manager, M/s Unit Construction Co.(P) Ltd. Kolkata	Member
7.	A.K.Kolay,Asst.Engg.	CPWD,Kolkata	Member
8.	A.K.Dutta,ADT	A.T.I.Kolkata	Member
9.	A.K.Mondal,ADT	A.T.I.Kolkata	Member
10.	Sk.A.Hossain,T.O	A.T.I.Kolkata	Member
11.	Soma Das,V.I	RVTLKolkata	Member
12.	Manika Banerjee,V.I	Don Bosco,SERI	Member
13.	Subrata Saha	Representative of Govt. of W.B	Member
14.	Ajoy Kumar Hazra Choudhury	Representative of Govt. of W.B	Member
15.	Abhijit Kumar Porel	Representative of Govt. of W.B	Member
16.	Pradip Kumar Sarkar	Representative of Govt. of W.B	Member
17.	Somnath Adhikari	Consulting Engineer	Member
18.	P.K.Madavi,	CTI,Chennai	Member
19.	A.K.Neogy	CSTARI,Kolkata	Member
20.	Dilip Ghosh,	ATI ,Kolkata	Member
21.	T.K.Halder	ATLKolkata	Member
22.	D.K.Saha	ATI ,Kolkata	Member
23.	Prabhat Kumar Roy	Representative of Govt. of W.B	Member
24.	S.Rana,V.I	ATLKolkata	Member

**List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6<sup>th</sup> to 10<sup>th</sup> May'2013 at CSTARI, Kolkata.**

<b>Sl. No.</b>	<b>Name &amp; Designation</b>	<b>Organisation</b>	<b>Remarks</b>
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Mukherjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpall Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

## GENERAL INFORMATION

1. Name of the Trade **MECHANIC-CUM OPERATOR ELECTRONIC COMMUNICATION SYSTEMS**
2. NCO Code No.
3. Duration : Two years (Four Semesters)
4. Power Norms : 2.0 Kw
5. Space Norms : 80 Sq. Meter
6. Entry qualification : Passed 10<sup>th</sup> Class Examination
7. Unit Size (No. of Trainees) : 16
- 8 (a). Instructor's/ Trainer's Qualification: Degree in Electronics / Electronics and Telecommunication

Engineering from recognized engg. college/university with one year experience in the relevant field

OR

Diploma in Electronics / Electronics and Telecommunication

Engineering from recognized board of technical education with two years experience in the relevant field

OR

10<sup>th</sup> class passed + NTC/NAC in the Trade Mechanic Cum Operator Electronic Communication system Maintenance with 3 years post qualification experience in the relevant field.

- (b). Desirable qualification: Preference will be given to a candidate With Craft Instructor Certificate

Note : At Least One Instructor must have Degree/Diploma in relevant field.

**Syllabus for the Trade of "MECHANIC-CUM  
OPERATOR ELECTRONIC COMMUNICATION  
SYSTEMS" under C.T.S.**

Week No.	Trade Practical	Trade Theory	Engg. Drawing	Workshop cal. & Sc.
1.	(a) Visit to the Institute (b) Care & Safe work habits, safety precaution to be demonstrated. Institute AC distribution. (c) Elementary First Aid Practice. (d) Practice for making good earthing.	(a) Organisation of the institute of various trades & function, (b) Introduction to National Vocational Training System and different schemes and link them. (c) Types of work, responsibility to be undertaken, incentives and future (d) Safety precaution to be observed in the trade during Operation and Practice in workshop. (e) Elementary First Aid. (f) Types of Earthing and importance.	Basic Geometrical Drawing :St. Line, Triangle, Rectangle, Polygons etc.	Standard Units used in CGS, MKS, and FPS System.
2.	Visit to workshop or Industry/ organization using or manufacturing the wireless equipment and demonstrate in brief to motivate Trainees; or Video Show. Morse code demonstration and Log Book entry practice.	1. Introduction of Wireless & communication, electronics and telecommunication system. Radio Regulation & Communication, CCIR Recommendation. Introduction to Modern Wireless Communication and area of application.	Orthographic angle or projection 1 <sup>st</sup> and 3 <sup>rd</sup> . Isometric view of square and rectangular object.	-do-
3-4	Demonstrate the various Hand tools as per tool List and allow the Trainees in Group to discuss and recognize the tools. Demonstrate Simple mechanical fixtures, types of screws, washer clamps, rivets, taps, connectors, other latest design accessories used. Fitting, Threading, Drilling practice. Simple sheet metal work.	Identification, specification, uses and maintenance of hand tools.	Study the Drawings of Tools from Charts etc. Free hand sketch of Nut & Bolts.	

5-8	Identification of conductor Insulators, Break and Continuity Test. Use of Multimeter for voltage and current measurement earth resistance measurement by Earth Tester. Use of Volt Meter, Ammeter, Watt Meter and their connection in actual circuit.	Matter : Conductor, semiconductor insulators, General Electric Principles, Electronic Theory, Electrical Units, Ohm's Law, Ampere's Law, KCL and KVL Law and their application Superconductivity	Drawing of different Electrical Symbols/ simple circuits Practice.	Calculation of Voltage, Current Resistance, power using, simple circuit Drawings.
9.	Identification of different type of Resistors (Fixed & Var) calculation of Resistance using colour code, confirm through multimeter, Practice measurement by Multimeter, Calibration of Standard Resistance Demonstration of Digital and Analog Multimeter. Identification of Different type of Resistances used in a Radio Receiver. Verify Relation between Temperature and Resistance.	Resistivity, Resistance of conductors, Temperature effect, Skin effect, conductance, Resistor Parallel and series combination. Different type of Resistor, (fixed and variable) and their uses. Equivalent Resistance using Nortons and Thevinin's Theorem. Thermistor and Varistors.	Draw different symbol used for Resistance in PCC and PCB. Draw the front panel of Multimeter	Different parallel and Series circuit and equivalent Resistance Calculation.
10.	Identification of different types of indicators used, identification of Transformer primary & secondary, Testing of coil and setting. Demonstration on self and mutual inductance. Demonstration on a Radio Receiver PCB for identification of inductors used. Calibration of St. Inductance Testing of Transformers and Chokes by Resistance Analysis	Inductance, Units of inductance, inductance in series and parallel, coefficient of coupling, Hysteresis and Eddy current losses, Principle of Transformer, Construction use of core, Transformer losses, Importance of Matching, step-up, step-down, Principles, Simple calculations of Turns Ratios, Power primary and secondary. Types of cores to be used in L.F. HF/VHF. Use of Iron core, Aircore, Ferrite core Inductors, Magnetic Energy storing.	Draw the different inductance circuit symbols and transformers symbol and circuit drawing.	Equivalent Inductance Calculation, transformer Ratio, Voltage Loss etc. Calculation.
11.	Identification of types of condensers used and colour code, their testing and	Explanation of capacitance and capacitive reactance, Dielectric constants, Types of capacitor, Permittivity,	Draw the different circuit symbol used and parallel series circuit.	Calculate capacitance values, Relationship with V.C.Q.

	specification. Calibration of St. Capacitance Demonstration on a Radio Receiver PCB for identification of different type of capacitors used.	Dielectric strength, Break down voltage, capacitance in series and parallel. Storing of Energy in capacitor.		
12-13	Measurement of Low frequency signal in CRO and explain peak RMS and Average value, calculate Frequency. Different type of waves. Phases, Lissajous figure. Demonstrate the use of CRO.	Peak, RMS, Instantaneous, Average Value, Phase Difference, Vector Introduction, Reactance & Impedance, Power factor, Reactive and Resistive Power, Frequency, Time Period, Different Type of Waves, Eddy Current.	Draw the different waves, Lissajous Fig. Draw the Front Panel of CRO.	Calculate of Frequency, Period peak, RMS and Average value of Signal.
14.	Demonstration on the properties of P.M. Use of Magnetic Needle Converting a magnetic material into a Magnet by a Bar magnet.	Magnetism & Electromagnetism, Properties of magnetic Material & Ferities, Magnetic field, Magnetic Flux Density, Permeability, Magnetic Motion	Drawing for Magnetic field, Symbol of Relay and contacts.	-do-
	Preparation of Solenoid, Preparation of Electromagnet for calling Bell/ Buzzer, EM Relay, Testing of Relay, Rewinding and Repair	Force, Magnetic Effects on Electric Current, Magnetic fields, Principle of Relays, types Adjustment/ Maintenance & Common faults in Relays, their uses in communication circuits. Explanation of Induction & induced E.M.F. Faraday's Law, Lenz's Law, Left hand and Right hand rules.		
15-17	Identification of Different of Tank circuit used and design. Study of Behavior of L and R in series. Study of Behavior of C and R in series. Study of Series and Parallel Resonance and its Response curve.	Explanation of resonance, Series and parallel resonance, Circuit. elements, natural resonance, tuning, voltage, gain, Anti-resonance circuit. Uses in electronic circuits. Bandwidth 'Q' factor of coil, passive Filter circuits (LPF, HPF, BPF and BSF), SAW Selectivity, Time Constant.	Draw the Circuit Calculate frequency-Symbol of Tank Circuits, Filter etc.	Calculate frequencies.
18	Study of Different Parts of Alternator and Repair.	Alternators, Principle and Constructions, Single and three Phase A.C. System, Eddy current.	Draw the Different Symbol of different parts motor and Generator, and draw	EMF Calculation. Study and calculation

	Study of Different parts of DC Generator and Repair. Starting and Loading of Generator and regulating voltage.	D.C. Generator Principles, Commutator, Brushes and Construction, Automatic Voltage Regulation. Motor Principle, Back EMF, Speed Variation, Classification of Motors and uses, General maintenance.	actual circuit.	specification sheet of various. motors and Generators.
19	Testing of Primary and Secondary cells, Specific Gravity and Voltage measurement, Preparation Electrolyte, Charging of Battery. Demonstration on SMPS Unit Demonstration on Solar Panel.	Explanation of cells, primary & Secondary Cells, General Principles, Construction of Lead Acid, Nickel cadmium, Nickel Iron cells, Electrolyte, Initial charging & Discharging Needs & Methods, Specific Gravity, Defects & Remedies, Maintenance free Tubular battery, Solar cells, SMPS based battery charger, Lithium Cells.	Symbol of Battery and solar cell and circuit connection practice.	Calculation for V,I,R for different power source with different circuit
20-24	Demonstration of MC and MI, voltmeter, Ammeter and Watt Meter CRO, Signal Generators, multimeters, Counter etc. Servicing of Multimeter (Analog) Multimeter. Construction and Calibration of series Ohm Meter. Conversion of Milliam-meter into shunt Ohm meter. Conversion of Milliam-meter into Voltmeter and its Calibration.	Moving Coil, Moving Iron type, Different type of Transducers. VTVM, FET Multimeter, DMM etc. Frequency counter, Power meter CRO, AM/FM Signal Generator, RF Signal Generator, Function Generator Whetstone Bridge, Impedance meter.	drawing different, meter connection. Internal parts drawing practice.	Study and calculation of various parameters on specification sheets of various measuring instruments.
25	<b>(i) Project work (ii) industrial visit (optional)</b>			
26	<b>Examination</b>			



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 SYSTEMS" under C.T.S.**

<b>Week No.</b>	<b>Trade Practical</b>	<b>Trade Theory</b>	<b>Engg. Drawing</b>	<b>Workshop cal. &amp; Sc.</b>
1-10	Video Films on Semiconductor Theory. Identification of Various Study and calculation of various Semiconductor devices, Testing by Multimeter, Tester. Soldering and Desoldering Practice. Characteristic Check of Diode, Transistor. Identification of components in a PCB. (Group) Transistor biasing arrangement Application of Transistor as amplifier, Oscillator, etc and testing.	Semi-conductor Theory, Type of Devices and Symbols and uses. Characteristics of Diodes, Different type of Rectifiers along with different Filter . AF/IF Detectors. PNP and NPN Transistors, Symbols, different type of amplifiers & its classification, Oscillators, Multivibrators.	Draw the symbol of different semiconductor devices.  Different transistor biasing CIRCUIT drawing.  Different amplifier and oscillator circuit.	Voltage and Current gain calculation, frequency Calculation. Biasing voltage calculation using different circuits.  Study of component data book.

11-19

circuit Symbol and Application circuit Practice.

All Calculations related to the different application.

Characteristic Check of various Devices. Testing in actual application by using trainer. Demonstration of characteristics and applications of OPAMP by using OPAMP Trainer. Explanation of characteristics of UJT, FET, MOS, CMOS, SCR, SCS, DIAC, TRIAC, IC, SMD,

ESD, etc. and application memory devices RAM, ROM, EPROM, etc. Optical Devices, RF Devices, Crystal, PCBs Single and double Layer, PTH and Multilayer and application Electronic Component Packages. Differential Amplifier, Basic OP-AMP Circuit - -Inverting and Non-Inverting Amplifier, Integrator and Differentiator, Limitation of OP-AMP High Current, Power and Voltage application, wave shaping Circuits Active filter circuits,

Study of Manufacturer  
specification. \_\_\_\_\_

**SECOND SEMESTER Semester**

**Code No. MOE; SEM-II**

20-24	<p>Characteristic Check of different Rectifier Circuits.</p> <p>Designing and Mounting, Soldering for different.</p> <p>Rectifier circuit and Testing (Individual).</p> <p>Demonstrate a SMPS power supply unit and identify, Trace Circuit and conduct tests by CRO and Multimeter. Design a SMPS circuit and solder components and test. Demonstration of a UPS and identify circuits, trace path, test. Demonstration of battery charger and practice testing of power transformer.</p>	<p>Half wave, Full wave Rectifier Bridge Rectifier with different filter combination, HT and LT power supply, Voltage Regulation Switch Mode Power Supply (SMPS), UPS, Battery Charger, RFI/EMI filter, Isolation Transformer Electro-Optical Coupler. Fault Clearing process, Switch Gears, Reactors, HRC Fuse, Circuit Breakers, Protective Relays, Lightning arrester etc. Linear and switching regulators.</p>	<p>Different type of Rectifier circuit drawings.</p> <p>SMPS power Supply Drg. Battery charger</p>	<p>Input/out put voltage calculation, Voltage Regulation etc related to various power circuit examples. Study &amp; calculation</p> <p>of various parameters of different power supply equipment like CVT, UPS etc.</p>
25	<p><b>(i) Project work (ii) industrial visit (optional)</b></p>			
26	<p><b>Examination</b></p>			

**THIRD SEMESTER Semester Code**  
**No. MOE; SEM-III**

**Syllabus for the Trade of**  
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**COMMUNICATION SYSTEMS " under C.T.S.**

<b>Week No.</b>	<b>Trade Practical</b>	<b>Trade Theory</b>	<b>Engg. Drawing</b>	<b>Workshop cal. &amp; Sc.</b>
1-4	Soldering and de-soldering practice continue. Both manual and automatic PCB repair, handling of ESD devices, bad and good solder. Check video film for SMD soldering.	Theory of soldering, different type soldering and de-soldering technique for electronic components/SMD automatic soldering, wave soldering, DIP soldering, PCB wiring.		
5-14	Testing of GATES, FF digital logic etc. and draw the truth system trainer tables. Conduct various test for microprocessor using trainers. Conversion of analog to digital and vice versa.	Fundamentals of digital electronics, Boolean, function, coding, logic gates, flip-flops, TT, counter registers, microprocessor etc. analog to digital conversion and vice versa, multiplexer/demultiplexer, ICs.	Symbol of logic gates, FF, different Circuit using gates for various Boolean, functions, other circuit drawing practice as per theoretical topics.	Out put calculator different circuit of Boolean functions, A/D etc.
15-18	Check the output of function generator for different modulation by CRO and observe pattern. Design simple modulator circuit and testing. Analog to digital conversion sampling principle check by using model.	Basic principle of modulation, amplitude, phase and frequency modulation, digital modulation: frequency shift keying (FSK), ASK, BPSK, GPSK, etc. different type of modulator both analog and digital and their use. Pulse code modulation, PTM, PWM, PAM, FDM/TDM multiplexing.	Different modulator block diagram and circuit diagram practice.	Calculation of output frequencies, i.e. carrier, sidebands, phase etc.
19-24	Data transfer and Receive Practice, Service Documents. Demonstration on different Data communication device and their interconnectivity, Protocols, Call signal Rules.	Basic Data Communication Concept, Data Security, Modem, Email, Internet Connectivity, Data Communication through NIC, INET, GPSS, VSAT. Data Coding : ASCII, EBCDIC etc. Introduction to PC I/O Operation and instruction Interfaces and Peripherals LAN, WAN, Internetwork Processor : Bridges, Router, Hub, Gateway.	Block diagram Practice for Data Communication.	Bits, Bytes, Character, WORD, Data Speed etc. Study and calculation of section sheet of data communication equipment, PC & Modem etc.

**FOURTH SEMESTER Semester****Code No. MOE; SEM-IV**

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COMMUNICATION SYSTEMS" under C.T.S.**

<b>Week No.</b>	<b>Trade Practical</b>	<b>Trade Theory</b>	<b>Engg. Drawing</b>	<b>Workshop cal. &amp; Sc.</b>
1-2	RF-RF Response Test. Checking and setting AGC gain Margin. Field intensity Measurement. Orientation of antenna both Trans and Receive for max receive signal strength. AF-AF response Test.	Characteristic of Radio waves, Ionosphere, Troposphere, VLF, LF, MF, HF and VHF Propagation, Ground, Sky and space waves. Properties of different reflecting Layers, Skip distance, MUF, Fading, Critical Frequency, Effect of Rain and sunspot cycle, use of Day and Night Frequency, Principle of Line of sight Communication and factor affecting this. Reflection and Refraction Principle.	Reflection/Refraction Practice.	Path Loss Calculation.
3-5	Study of different type of Aerials. Installation Aerials and connecting feeder cable, establishing link. Study of Vertical Aerial and different loop aerials. Installation procedure of Dish TV antenna . Study of Different connectors and matching. Mast/Tower Construction. Hoisting Antenna. Connector connecting Practice.	Principle of Radiation, Interception of Radio Signal, Polarization of Waves, Radiation, Resistance, Bandwidth, Effective height, Ground Effects, Aerial Capacitance & Reactance, Distribution of current & Voltage in aerial, Impedance, SWR, Different type of Aerials : Dipole, Folded Dipole, Loop Aerial Unidirectional, Bidirectional and Omni directional antenna, UHF Antenna, Dish Antenna. Whip Rod Antenna. Tower Method of Coupling and matching to Tx and Rx. Multi Element Yagi Antenna, Dish Antenna, etc. Different Type of Feeder cables and Transmission Line, Wave Guide.	Drawing Practice for different Radiation pattern and Antenna.	Antenna Parameter i.e. Antenna impedance, Gain BW, Power Gain, Efficiency, Directivity etc. Study & calculation of various parameters in the specification sheet of antennas.
6-8	Identification of Different stage of a simple Radio Tx and Receiver. Identify the different components and circuit used.	Basic Radio Transmission and Reception Concept using Block Diagram RF stage, IF stage, AF Stage. Class-A, Class-B, Class-AB, Push-Pull amplifier, Feed Back, different types of	Block Diagram Different Power Amplifiers, Osc, AF/IF/RF circuit diagram Practice.	Different Transmission units : Decibel, Neper and other derived units. Calculation and conversion, Gain and

	<p>Testing of different amplifier and characteristic measurements.</p> <p>Testing of different type of microphones and constructional feature.</p> <p>Study of AFC/AGC Circuit Alignment of IFT and replacement.</p>	<p>coupling, Cascade amplifiers, Audio filter, matching transformer etc. Different Types of Microphones and speaker, their application and theory. IF Filter, IF Amplifier, AFC Circuit, AGC Circuit, IF det. etc. IFT for matching. Different Method of coupling and Matching, RF Amplifier, Mixer, Local oscillators, Filter etc. VCO, PLL.</p>		<p>Attenuation Calculation.</p>
9-11	<p>Testing and monitoring of Tx. Power and Freq. Tuning of Tank circuits at different stages, Trans, Local oscillator tuning for power and output freq. Degree of modulation setting, drive signal setting at different stages. Adjustment,</p>	<p>Transmitter Theory, Typical Transmitter used for CW, MCW, ISB, DSB, SSB, and Packet Mode, Modulators used. Function of various stages, operation and Monitoring, Metering and safety Devices, adjustment and Measurement.</p>	<p>Simple circuit diagram Practice Counter. Radio Transmitter.</p>	<p>Level and loss calculation at different Stage. Study &amp; calculation of various parameters of specification for Receiver and Transmitter.</p>
12	<p>Study of power supply Circuit used.</p>	<p>Matching circuit for antenna for Max. Power. Reflected Power and SWR measurement. Electrical Faults and alarm in transmitter. Tracing and Rectification of Practical Power supply circuit.</p>		
13-15	<p>Study of Receiver controls etc. Receiver Tuning and Receiving Signal Monitoring. Identification of different internal circuits and Component and their settings. Selectivity, fidelity, NF signal to Noise Ratio test. Power supply circuit. test. Project-Design of Radio Rx.</p>	<p>Frequency changing and detection Types of mixer, Necessity of Local oscillator and its Generation. Stages of Mixing, Image frequency rejection AM, FM &amp; Digital Signal Detectors, Demodulator/Discriminators, LNA etc Noise Selectivity, Fidelity, AF Response etc. Electronics War-fare Jamming and its remedial measure.</p>	<p>Practice for Radio Receiver circuit.</p>	<p>Level Calculation at different stage considering Loss and Gain of device used.</p>

16-18	<p>Study component location of Direction Finder.</p> <p>Study the panel of Direction Finder.</p> <p>Tuning and hearing Practice on the Direction Finder.</p> <p>Fault finding.</p> <p>Study of Auto alarm Equipment and testing. Radio Direction Finding Procedure, Class of Bearing for Fix and Mobile station.</p> <p>Sending and Receiving Message Document study in <u>organization</u>. _____</p> <p>Principle Polar Diagram Sense finding, Gonio meter, calibration and its use, Direction finder errors, Magnetic compass, Magnetic True Bearing, Radio Beacons, Basic Knowledge of Radar Beacons Echo Sounder, LORAN, Charts Space Communication and its use in future. Global Maritime Distress Safety System, Electronic Counter Measure. Global Positioning System. Localisers, Radio Range, Air Traffic Control, Radio Altimeter, Glide Path, Metrological Equipment Radar, Beacon, Instrument</p>	<p>Landing System, OMEGA Systems.</p> <p>Block diagram Practice for different systems.</p> <p>Study &amp; calculation of various parameters of specification of Navigation equipment.</p>
19-21	<p>Demonstration on</p>	<p>different type</p>

telepho  
ne Identification of  
instrum different type of Cable  
ents. and use. Jointing  
Practice.

Identifi Working principle of  
cation Different type of  
of telephone instruments,  
differen Telephone lines, Auto  
t and mechanical  
compon Exchange, Working of  
ents in EPBAX, PCO Monitor,  
the Conference Phone  
instrum System, Intercom,  
ent Telex Working  
probabl principle, FAX, PSTN  
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and ISDN.  
repairin  
g. Feature Telephones,  
Picture Telephone.

Operati  
on and Jumper wire,  
Mainte Subscriber Line cables,  
nance RF Cables, Power  
of small cables, Optical Fibre  
Interco cables, Flat Cable etc.  
m/EPB Optical Fibre Cable  
AX and System.  
console Drawing practice for  
. internal Circuit of  
Telephone Instrument.

Introdu Study & calculation of  
ction to various parameters of  
Telex specification for  
System, Telecommunication  
Demon equipment.  
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22-23	Line wire Practice with TB Termination. Demonstration on Transceiver Operation and Maintenance. Demonstration on Cordless and modbile phones, Maintenance and repair. Demonstration on cable TV and manual tracking of Antenna. Industrial visit to be arranged.	Cordless Telephone, mobile Telephone System Working Concept, and users equipment. Basic Digital enhanced cordless Telephone (DECT) Personal Handy Phone System (PHS). Introduction to Satellite Phones. UHF/VHF/HF Comm. System (Digital/Analog), Microwaves Communication System, V-SAT.	Block Diagram Practice for different System.	-do-
24	Demonstration on FM Transmitter and Receiver, Walkie-Talkie. LCD TV/DVD AND Remote Control system.	Police Wireless Equipment, Wireless System at Air Operation, Walkie-Talkie, FM Transmitter and Receiver, Air to air and Air to ground Communication. Data Modem for wireless. LCD TV/DVD AND Remote Control system.		Study & calculation of various parameters of specification for the equipment.
25	<b>Revision</b>			
26	<b>Examination</b>			

## LIST OF TOOLS AND EQUIPMENT FOR THE TRADE OF

### A. TRAINEES TOOL KITS FOR 16 TRAINEES +1 INSTRUCTOR

Sl. No.	Name of the items	Quantity
1.	Combination Plier 15 cms Insulated	17 Nos.
2.	Long nose insulated Plier 15 cms	17 Nos.
3.	Digonal Cutter 15 cms Insulated	17 Nos.
4.	End cutting Nipper Insulated	17 Nos.
5.	Tweezers 10 cms Insulated	17 Nos.
6.	IC Tweezer/Puller	17 Nos.
7.	Knob screw driver insulated 10 cms.	17 Nos.
8.	Screw Driver set of 6 Nos. Philips	17 Nos.
9.	Knife electrician 150 mm	17 Nos.
10.	Adjustable spanner/slide Wrench 15 cms	17 Nos.
11.	Wire Striper	17 Nos.
12.	Pocket Multimeter	17 Nos.
13.	Soldering Iron 25 Watt	17 Nos.
14.	Neon Tester	17 Nos.

### SHOP OUTFIT PER UNIT

Sl. No.	Name of the items	Quantity
1.	Fire extinguisher	2 Nos.
2.	First Aid Kit	1 No.
3.	Rubber Mat 180x45 x 2.5 cm.	3 Nos.
4.	Rubber Gloves Pair	8 Nos.
5.	Steel Rule 30 cm.	4 Nos.
6.	Steel Rule 60 cm.	2 Nos.
7.	Centre Punch 10 cm.	4 Nos.
8.	Spanner Set Double ended	2 Nos.
9.	Box spanner set of 8 nos.	2 sets
10.	Drill brace 10 cm. chuck with Bit set	1 No.
11.	Electric drill 6 cm. chuck with Bit set	1 No.
12.	Hack saw frame adjustable std. size	4 Nos.
13.	Hammer ball peen 250 gms.	4 Nos.
14.	Mallet/Nylon faced hammer 500 gms.	2 Nos.
15.	Files assorted smooth & rough 20 cms.	24 Nos.
16.	Needle file set of 12	2 Sets
17.	Bench Vices 5 cms. jaw	2 Nos.
18.	Bench Vices 10 cms. jaw	2 Nos.
19.	Tap set 2 mm. to 10 mm.	1 Set
20.	Dies set 2 mm. to 10 mm.	1 Set
21.	Bench Grinder (Electrical)	1 No.
22.	Heat Sink Plier	4 Nos.
23.	Watch maker Screwdriver set	4 Sets
24.	Head Phone IK. Ohm impedance	8 Nos.
25.	Allen Key	2 Sets
26.	Wire gauge	1 No.
27.	Micro-meter 0-25 mm out side	4 Nos.
28.	Vernier Caliper 20 cm.	4 Nos.
29.	Soldering iron 25 w/230 V	8 Nos.
30.	Soldering iron 10 w/230 V	8 Nos.

**"MECHANIC-CUM-OPERATOR ELECTRONIC COMMUNICATION SYSTEMS"**

31.	Soldering iron 35 w/230 V	4 Nos.
32.	Soldering iron 65 w/230 V	2 Nos.
33.	Permanent Bar Magnet type 15 cms	4 Nos.
34.	Electro Magnetic Relays assorted	1 each type.
35.	Battery lead acid 12 V/Heavy duty.	2 each type
36.	Battery charger 10 Amp. Cap.	1 No.6.12 24 tapin
37.	Hydrometer	2 Nos.
38.	Battery Life Cycle Tester	1 No.
39.	Battery Monitoring System	1 No.
40.	Rheostats various values and rating	20 Nos.
41.	Ammeters AC & DC in various ranges	10 Nos.
42.	Voltmeter DC & AC in various ranges	15 Nos.
43.	Micro-phone Assorted types	8 Nos.
44.	Loud speaker assorted 'Z' & pin	3 Nos.
45.	Loud speaker Multitester	1 No.
46.	Insulation tester DC 1000 V	1 No.
47.	Signal Generator up to 1.3 GHz.	2 Nos.
48.	Audio frequency Two Tone Generator (800 Hz and 1800 Hz.)	2 Nos.
49.	R.F. output meter 50 watt. (Power Meter)	1 No.
50.	Multimeter with high sensitivity	2 Nos.
51.	Oscilloscope 100 Mhz. (non-storage)	2 Nos.
52.	Digital LCR Q-Meter	1 No.
53.	1.1 Ghz. Digital frequency counter	1 No.
54.	Field strength meter (V.H.F.)	1 No.
55.	Digital multimeter 3% digit with transistor, diode and capacitor Testing Facility.	2 Nos.
56.	Digital Line Frequency Monitor	1 No.
57.	Liner/Digital IC Tester Micro Processor based	1 No.
58.	Variable power supply 0-50 VDC, 4A	4 Nos.
59.	Portable Digital Storage Oscilloscope 100 MHz.	1 No.
60.	Push Button Telephone set	4 Nos.
61.	Telephone Dialler (Push button, Cordless)	1 each
62.	Telephone Handset Tester	1 No.
63.	Telephone Analyser	2 Nos.
64.	PCO Monitors	2 Nos.
65.	Call Conference Unit	2 Nos.
66.	Crimping tool RJ 45	2 Nos
67.	P.C.B. Making Kit complete	2 Nos.
68.	Temperature controlled soldering Station	4 Nos.
69.	Temperature controlled desoldering Station	4 Nos.
70.	Magnifier 4" with stand for soldering Check	2 Nos.
71.	Electronic Devices Characteristic Check Model (Diode, Transistor, MOSFET, FET, Diact, Traiac, etc.)	2 Nos. (for each)
72.	Universal Micro-computer Trainer with application of Step Motor and Comm.	2 Nos.
73.	Computer and Micro-computer Trainer	1 No.
74.	Universal Logic System Trainer/Digital IC Trainer Kit	4 Nos.
75.	SMPS Trainer Kit	4 Nos.
76.	AM/FM Modular & Demodulator demonstrators	2 Nos.
77.	Pulse Code Modulation/Demodulation Demonstrator	2 Nos.
78.	Digital Communication Training System	2 Nos.

79.	Fibre Optic Trainer	2 Nos.
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**C. GENERAL EQUIPMENT INSTALLATION**  
**(Stn. To be registered as Non-Radiating Experimental Station)**

Sl. No.	Name of the items	Quantity
1.	Commercial AM/FM Radio Transmitter Demonstrator	1 No.
2	Air Craft Communication Monitoring System	1 No.
3	ADF/Time Beacon Monitoring System	1 No.
4	VOR/ILS Monitoring System	1 No.
5	Infrared Remote Control System	1 No.
6	Air Craft Band Receiver	1 No.
7	TV Trainer Kit	1 No.
8	Cable TV Receiving System (DRS)	1 set
9	Walkie Talkie Demonstration Kit	1 No.
10	Data Communication Equipment with Internet Facility Including latest Available PC and Necessary Software	1 Set.
11	Small EPABX (8 Lines or 16 Lines)	1 No.
12	Printer	1 No.
13	Fax Machine	1 No.
14	1 KVA UPS	1 No.
15	LCD TV minimum 32"	1 No
16	+12 V Solar Power Supply Panel	1 No.
17	Mobile phone different make	2 Nos

**D. FURNITURE FOR SECTION**

Sl. No.	Name of the items	Quantity
1.	Work bench wooden with sun mica Top 2.0m x 1.5m x 0.75m	4 Nos.
2.	Pegion hole locker-8 drawers.	2 Nos.
3.	Steel cupboard standard size (two with glass doors).	4 Nos.
4.	Wooden stools	16 Nos.

80.	Fibre Optic Laboratory Kits	1 set
81.	Logic Probe	4 Nos.
82.	Amplifier Trainer with variable Biasing Setting	4 Nos.
83.	RC Oscillator Trainer	4 Nos.
84.	Multivibrator (Astable/Monostable/Bistable)	2 Nos. each
85.	PA Amplifier with USB	2 Nos
86.	DVD player	2 Nos
87.	Colour TV 21"	1 No.
88.	DTH system	1 No.
89.	RF Milli Voltmeter	1 No.
90.	RF Modulation Meter	1 No.
91.	Radio Communication Analyzer	1 No.
92.	Distortion Analyzer	1 No.
93.	DTMF/CTSSS Signaling Test Kit	1 set
94.	Portable Hand Blower	1 No.
95.	Trade Related Technical Films	As required
96.	Components Storage Box	1 No.
97.	Analog and Digital Communication Trainer	2 Nos.
98.	Crimping tool RJ45	2 Nos