

Syllabus for the Trade

Of

MECHANIC COMMUNICATION EQUIPMENT MAINTENANCE

(Semester Pattern)

Under

Craftsman Training scheme (CTS)

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-700 091.

List of members attended the Trade Committee Meeting at CSTARI, Kolkata

Sl. No.	Name & Designation	Organisation	Remarks
1.	R Senthil Kumar, JDT/HOO	CSTARI, Kolkata-91	Chairman
2.	Kalian Biswas, Manager Project	WEBEL communication system. Kolkata	Member
3.	Deepak Jain, Project Engineer	CDAC, Kolkata	Member
4.	Rupak Chatterjee, Sr. Faculty	George Telegraph Trg. Inst., Kolkata	Member
5.	Surjit Ukil, Scientific Officer	ERTL, Kolkata	Member
6.	T Mukhopadhyaya, DDT	CSTARI, Kolkata-91	Member
7.	SP Bhattacharjee, DDT	ATI, Kolkata	Member
8.	A Chakraborty, ADT	CSTARI, Kolkata-91	Member
9.	V Babu, ADT	CSTARI, Kolkata-91	Member
10.	PK Koley, TO	CSTARI, Kolkata-91	Member
11.	SB Sardar, TO	CSTARI, Kolkata-91	Member

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

Sl. No.	Name & Designation	Organisation	Remarks
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 Communication Equipment Maintenance**
2. N.C.O. Code No. :
3. Duration : One Year (Two Semester)
4. Power Norms : 2 Kw
5. Space Norms : 72 Sq. mts.
6. Entry Qualification : Passed 10th class examination under 10+2 system of education with Science and Mathematics or its equivalent.
7. Unit Size(No. of Students) : 16
- 8 A. Instructor's / Trainer's Qualification: Degree in Electrical / Electrical & Electronics Engineering from recognized engg. college /university with one year experience in the relevant field
OR
Diploma in Electrical / Electrical & Electronics Engineering from recognized board of technical education with two years experience in the relevant field
OR
10th class passed + NTC/NAC in the Trade Mechanic Communication Equipment Maintenance with 3 years post qualification experience in the relevant field.
- 8B. Desirable qualification : Preference will be given to a candidate with CIC. (Crafts Instructors Certificate)

Note: At least one instructor must have Degree/ Diploma in the relevant field.

**Syllabus for the Trade of ‘ Mechanic Communication Equipment Maintenance’
Duration Six Month**

First Semester

Semester Code: MCM: SEM I

Week no.	Trade Practical	Trade Theory	Engg. Drawing	Workshop Sc. & Calculation
1	Visit to different sections of the institute Safety precautions, Electrical safety Demonstration and operation of fire extinguishers. Demonstration of Artificial Respiration	Familiarisation with institute Accidents, safety precautions, types of fire extinguishers, Artificial respiration	Engineering drawing, its importance, Free hand letter writing, sketching of straight lines, rectangles, squares, circles, polygons etc.	Introduction to electricity supply systems
2- 4	Soldering and desoldering practice, Verify Ohm's law and Kirchoff's laws, Resistors, colour coding of resistors, resistors in series and parallel, constructing circuits and testing circuits, star & delta connections. Demonstrations of magnetic properties, inductors and capacitors in series and parallel circuits, reactance, impedance and resonance circuits. Demonstration of DC Generators/Motors, demonstration of AC Generators/motors Demonstration of transformer winding. Practicing of measuring current, voltage and resistance with measuring instruments Multimeters, LCR meters and CRO etc. Battery and battery charges.	Atomic structure, conductors, insulators, charge, potential, voltage, current and resistance, Ohm's law and Kirchoff's laws Series and parallel circuits, star & delta circuits. Magnets and magnetism, electromagnetic induction, Inductance, transformers, capacitors, reactance and impedance, resonance circuits. Generation of electricity, Faradays laws, AC/Dc Generators/motors, AC/DC circuits. Measuring instruments, multimeters, LCR meters and CRO etc. Battery and battery chargers.	Free hand sketching of tools, reading of simple drawings and concept of dimensions and dotted lines, chain lines etc. Reading of simple drawings, Free hand sketching of simple solids with dimension	Properties and uses of metals and non metals related to trade, Copper, Zinc, Tin, Aluminum, brass and bronze. Solder, Timber, rubber, different types of PVC materials used in electronic industry
5- 8	Understanding the specifications of data sheet of diodes, Testing Diodes, diode as switch and rectifies, diode characteristics, finding PN terminals, testing of half-wave and full-wave rectifiers, testing of zener diode, varactor diode, LEDs, LCDs, SCRs, Diac, Triac. Understanding the specifications of . data sheet of transistors, testing of transistors, characteristics of transistor, transistor biasing. Testing of JFET, MOSFET, testing different types of	Semiconductor theory, materials, charge carrier, intrinsic and extrinsic semiconductors, N-type and P-type semiconductors, semi conductor diodes,, classification of diodes, rectifiers, LEDs, Zener diodes, varactor diode, LCDs, SCRs, Diac and Triac. Transistors-bipolar and unipolar, JFET, MOSFET and .thir. characteristics, Amplifiers, oscillators and multivibrators ICs and Operational Amplifiers, Microphone and loud speakers.	Free hand sketches of solids viewed perpendicularly to their surface and axes. Free hand sketches' of nuts & bolts with- dimension from samples. Circuits and wiring' diagram Explanation of simple orthographic projections 1 st angle	Use of different sheets, ferrous and non ferrous. Brief description of manufacturing process of steel copper and aluminium. Metric/SI System, metric/SI and metric/St^ measurements, units of conversion factors Manufacture of plastic and resins

	<p>amplifiers, oscillators and multivibrators, testing ICs and Op-Amps, Micro phone & Loud speakers. switch and rectifies, diode characteristics, finding PN terminals, testing of half-wave and full-wave rectifiers, testing of zener diode, varactor diode, LEDs, LCDs, SCRs, Diac, Triac.</p> <p>Understanding the specifications of . data sheet of transistors, testing of transistors, characteristics of transistor, transistor biasing. Testing of JFET, MOSFET, testing different types of amplifiers, oscillators and multivibrators, testing ICs and Op-Amps, Micro phone & Loud speakers.</p>			
9 -12	<p>Testing of Logic gates, counters, logic probe, encoders and decoders, Flip Flops, analog to digital converters (ADC), digital to analog converters (DAC), designing memory cells, testing of microprocessors, microprocessors and their real world interface.</p>	<p>Decimal, binary and hexadecimal systems, conversions, logic gates, flip flops, truth tables, encoders and decoders, ADC, DAC, ALU, ROM, RAM, PROM, EPROM, their functions. Micro processor and its interface.</p>	-Do-	-Do-
13- 15	<p>Construction and Testing of AM Transmitters and receivers Construction and testing of FM transmitters and receivers Testing multiplexing and de-multiplexing Construction of Super heterodyne receivers Un-sealed twisted RJ 45 and PJ 11 connectors Different types of UTP cables, coaxial cables, BNC connector, RS 232, USB Optical fiber Communication system</p>	<p>Basic Communication Modulation, demodulation, amplitude modulation, frequency modulation and pulse modulation, AM/FM transmitters and receivers, multiplexing and de-multiplexing, super heterodyne receivers, PWM, PCM, PSK etc, UTP cables, coaxial cables, &BNC connectors, unsealed twisted cables, RJ 45 & RJ11 connectors, RS 232, USB Optical fiber Communication system</p>	<p>Explanation of simple orthographic projections 3rd angle</p>	<p>Meaning of tenacity elasticity, malleability, brittleness hardness, compressibility and ductility with examples. The weight of body, units of weights & shop problems, percentage and its application, shop problems.'</p>
16- 18	<p>Identification and tracing of different sections of telephone circuits. Fault finding, troubleshooting and servicing of intercom and telephone sets, connecting and servicing of EPABX system Fault finding, troubleshooting</p>	<p>Telegraphy, telephony and radio telephony Intercom, EPABX, Telephone, cordless telephone and cell phone sets.</p>	<p>Simple isometric drawings, isometric views . of .simple objects such as square, cube, rectangular blocks. Detailed diagram electromagnets. Familiarising and</p>	<p>Ratio and proportions, shop problems, plotting and reading of simple graphs, works unit of work, energy, power. Applied problems, algebraic symbols, addition, subtraction,</p>

	'and servicing of cordless telephone Operations of cell phone sets, fault finding and servicing of cell phone sets, IP (Internet Protocol) telephone.		sketching the details of components	multiplication and division, Standard algebraic formula $(a+b)^2$, $(a-b)^2$. simpler simultaneous equations with two unknown variables.
19- 22	Demonstration on multi-band radio receiver, study of radio circuits, micro wave, multi band Identification of RF stage, IF stage and AF stage, study of assorted band switches, practice on dial threading, study of PCB of radio circuit, Study of RF section of radio receivers, oscillator alignments, study of different band switches, fault finding and servicing of RF stage, checking selectivity and sensitivity Study of IF stage of radio receiver, study of detector stage, study of AVC/AGC, alignment of IFT, fault finding and servicing, study of audio stage, driver stage, output stage, tone and volume control, fault finding and servicing. Trouble shooting of radio receiver sets. VHF, UHF , Mobile phone.	Full explanation of radio receiver, super heterodyne principle of frequency changing, radio chain, terms used in radio transmission, ionosphere, ground wave propagation, electromagnetic waves, reflection, speed transmission, wave length. Explanation of frequency ranges, resonance, image frequency, acceptor. circuit & rejection circuit, disadvantages of RF amplification, sensitivity and selectivity, fidelity, signal to noise ratio, block diagram of radio receivers Explanation of tuning section/RF section, block diagram, antenna circuit, oscillator circuit. - Mixer stage, ".IF' generation, RF amplifier, AGC, -types of transistors used, specification of antenna & oscillator coils with types Gang condensers. Types of band switches. Used connections conditions for better selectivity and sensitivity. Explanation of IF, the importance of IF, range for MW & SW circuit analysis of IF stage. Alignment of IF stage, explanation of detection/ demodulation, RF bypass, tuning indicators with their circuit arrangement types, AVC/AGC, line importance. Explanation of audio stage, driver stage tone control volume control. Fault finding, trouble shooting and servicing of radio receivers, VHP, UHP , mobile phone.	Use of drawing instruments, 'T' square, drawing board, construction of simple figures & solids with dimensions. Use of different types of scales in inch & millimeters. Lettering numbers and alphabets	Specification gravity, balancing examples. Areas of rectangles, circles, regular polygons, Calculation of areas, volume, weight of simple solids, cubes, squares, hexagonal prisms shop problems

23- 24	<p>Demonstration of Colour TV, Identification & uses of different controls, identification & uses of different controls, Identification, study and test points of tuner, VTF, Video amplifier, synchronous circuit, sweep circuit, picture tube, sound section, fault finding, troubleshooting and servicing of colour TV system</p> <p>Colour Moniator LCD/ LED monitor and their fault findings.</p>	<p>Explanation of colour TV, Block diagram, explanation of circuit description and test points of tuner, VTF, -AGC, video amplifier, synchronization, sweep circuit, matrix, picture tube, sound section, power supply, trouble shooting and servicing of colour TV Colour monitor/LCD monitor and their fault finding</p>	<p>Drawing of various Electric circuits with BIS symbols of circuits, Series and parallel circuits, power transformer instrument transformer etc.</p>	<p>Heat and temperature thermometric scales, Fahrenheit, centigrade and their conversion Kelvin reamer Celsius. Meaning of stress, strain, modules of elasticity, ultimate strength B-11 curve.</p>
25	Project work / Industrial visit (optional)			
26	Examination			

**Syllabus for the Trade of ‘ Mechanic Communication Equipment Maintenance’
Duration Six Month**

Second Semester

Semester Code: MCM: SEM II

Week No	Trade Practical	Trade Theory	Engg. drg	Vocational Science & Calculation
1-3	Identification of switches, controls and connectors of fax machine Interconnecting fax-with accessories, sending a fax message, receive a fax message, use facsimile as a photocopier, fault finding, troubleshooting and servicing of Fax machine	Working principles of facsimile and application of facsimile Fault finding and troubleshooting of facsimile.	Symbols as per different semi conductor devices, LDR, VDR Thermister & their use in circuits Drawing of AM, and FM modulated wave at various modulation	Meaning of stress, strain, modulus of elasticity, ultimate strength B-H curve, simple problems- on lines, angles, triangles and circles. Basic Trigonometry
4-8	Microwave Radio Communication Basics of Radar, components of microwave communication system, satellite communication, concept of transponder, geostationary satellites, KU, KF band, HUB, V-sat, CMDA, GSM & Mobile technology	Microwave Radio Communication Study of microwave communication system, Radar, satellite communication, concept of transponder, geostationary satellites, KU, KF band, HUB, V-sat, CMDA, GSM & Mobile technology	Exercise on blue print reading, Connection of ammeter volt ammeter, wattmeter KWh meter with ISI symbol, circuit reading and. drawing of different stages radio receivers Drawing of Class A ' & B amplifiers, different power output stages of Push pull complementary etc..	Logarithms, use of log tables. Problems on mensuration Atmospheric pressure, pressure gauge absolute pressure properties of matter Trigonometric tables and applied problems
9-13	Familiarisation of Antenna of various types, installation of Antenna Practicing on satellite tracking, manual, motorized and remote control, receiving of polarization signals vertical and horizontal polarization, practice on measurement of output power, channel frequencies, use of dB meter etc. Distributing signals from main line installation, of splitters, tap off, finding the cable loss, power loss of different channels. Familiarisation of modulators, their alignment, adjustment of gain etc, familiarization with mixers, practice on	Wave propagation TV Communication, satellite communication system, up link, down link, C-band, S-band, Ku-band transmissions Types of antenna, dish antenna, sizes, reflections, focal length, alignment locking angles, etc, methods of tracking manual, motorized and remote control, low noise block, LNB - its position and alignment, receivers-its power output, frequency in different channels, power measurement, channel frequency cables used for transmission, their characteristics, line loss and its relation with frequencies, capacity, channel modulators, their adjacent channel modulators, channel	Drawing of UJT, FET, SCR, Traic, Diac and their ISI symbols Voltage regulator circuits Block diagram of micro processor Flow chart of micro processor Symbols of Logic gates.	Representation of forces by vectors General condition of equilibrium for series of forces on a body Plotting of graph . Simple equations, of graphs Density of' solids, liquids & simple experimental determination of center of gravity

	balancing the gain of different channels, overlapping etc. Installation of line amplifiers, power pass amplifiers, line extenders, practice of gain adjustments of various amplifiers, line loss management, practice of fault finding in cable network, rectification of faults. DTH (direct to home). Function of HD set top box and recording process.	width, Gains etc. Types of mixers, their functions, application, gain of different channels, overlapping, methods of balancing, line amplifiers, power pass amplifiers, methods of adjustments of gain for different amplifiers, wide band amplifiers Digital transmission, digital receivers, spectrum analyzers, its operation & uses, fault finding methods in cable TV network, procedure of removing snags etc. DTH		
14-17	Different types of mother boards, Expansion of slots (Display), different types of cards, HDD drive, CD Drive, Cd writer, installation of different devices, CMOS setup, partition of HD, Installation of different operating system, Network connectivity, shearing of files, folders and devices. Operating system MS Windows operating system Different operations of windows system Control panel and other accessories.	Basic definition of computer, hardware, software, firmware, live ware, representation of information inside a computer, Bit, byte, kilobyte, megabyte and gigabyte. Generations of computers, classification of computers, block diagram of computer system, input and output devices, processors, CPU, ALU, CU, different buses, Primary and secondary memory, secondary storage devices, storage and retrieval of data, concept of tracks, sectors, cylinders, boot record, disk partition, File allocation tables, system software and application software. Functions of operating system, interpreter, compiler and assembler.	Drawing of AM, FM modulated wave and various modulation Drawing of TV block diagram Drawing block diagram- ' of CRT, oscilloscope and Picture Tube Drawing of Video amplifier circuit.	Photo conductivity To calculate current in different resistive network . using diode, zener diode in FB & RB Calculation of frequency, Time period, Milli Hz, Micro Hz, Mega Hz, GHz etc.
18-21	LAN operations, installing server, clients, booting system from LAN, Partitioning the server, creating login, password, connecting nodes, installing of software, backup Troubleshooting and servicing of LAN connection.	LAN, WAN and Hub, concepts and their applications Different types; Protocols and their applications.	Drawing of AF amplifier circuit with different stages and with types of output PP Block diagram of oscillator. Symbols for different wave shapes, square, saw tooth, sine, triangular etc.	Frequency calculation of RC and LC circuits Resonance - Calculation of RC time constant AGC circuit
22-24	Operations, browsing, downloading messages, pictures from internet, sending and	Operations and applications of internet. Setting of internal modem and external modem , connecting	Block diagram of Computer • Drawing of different . types of Antenna Drawing of	Binary and hexadecimal number system Boolean algebra Truth tables

	receiving emails, sending attachments photos, pictures, invitation cards, greetings and books through internet. Setting of internal modem and external modem , connecting telephone lines and ISDN lines \ Testing and trouble shooting of internal modem and external modem Testing and trouble shooting of network terminal adopter Classification of ICP/IP configuration of Modem and Routers. Trouble shooting of internet connection Operating Router	telephone lines and ISDN lines Testing and trouble shooting of internal modem and external modem testing and trouble shooting of network terminal adopter Classification of ICP/IP configuration of Modem and Routers. Trouble shooing internet connections.	wave propagation Satellite waves etc.	and logic gates problems.
25		Revision		
26		Examination		

TRADE: MECHANIC COMMUNICATION EQUIPMENT MAINTENANCE

LIST OF TOOLS & EQUIPMENT FOR ONE BATCH OF 16 TRAINEES

SI No.	Name & Description	Quantity
1	Fire extinguishers	2 Nos
2	First Aid kit	1 No.
3	Artificial respiration chart	4 Nos.
4		4 Nos.
11	Rubber gloves pair	2 pairs
12	DC Regulated power supply (CWCC 0-30V/24 dual)	4 Nos.
13	Dual trace Oscilloscope	2 Nos.
14	Soldering Iron 25 W	4 Nos.
15	Desoldering pump	4 Nos.
16	Electric Drilling machine (portable)	2 Nos.
17	Digital Multimeter	4 Nos.
18	Analogue multimeter	4 Nos.
19	Magnifier with lighting facility	1 No.
20	Bread board	4 Nos.
21	Frequency counter	1 No.
22	Logic probe	2 Nos.
23	Watt meter (digital)	2 Nos.
24	Rheostat 10 Amps (0 to 30 Ohm)	1 No.
25	LCR meter	1 No.
26	Lead acid battery	2 Nos.
27	Hydro meter	1 No.
28	Crimping tool for VTP/RJ 45	4 Nos.
29	Crimping tool for coaxial/BNC	4 Nos.
30	Crimping tool for RJ 11	2 No.
31	Coaxial cables	As required
32	BNC cables	As required
33	UTP cable	As required
34	RS 232 & USB Connectors	2 each
35	RJ 45 Connector	8 Nos.
36	RJ 11 Connectors	8 Nos.
37	Cable tester	2 Nos.
38	LAN cable tester	2 Nos.
39	Screw driver set with tester	8 Nos.
40	Composite plier	4 Nos.
41	Round nose plier	4 Nos.
42	Tweezers	4 Nos.
43	Colour TV set (LCD / LED)	01 No
44	Colour pattern generator	1 No.
45	Field strength meter (portable)	1 No.
46	dB meter	1 No.
47	Degaussing coil	1 No.
48	DTH SET with Set top box HD and recording facility	1 No.
49	Radio receiver set (AM/FM)	4 Nos.
50	RF Generator with audio modulation facility	2 Nos.
51	Function generator	4 Nos.
52	Telephone	2 Nos.
53	Cordless telephone .	2 Nos.
54	Mobile phone (different make)	2 Nos.
55	Telephone answering machine	2 Nos.

56	Telephone analyzer	1 No.
57	Fax machine	2 Nos.
58	Satellite receiving system	1 No.'
59	Intercom system .	1 No.
60	P.A. System	1 No.
61	Microprocessor trainer kit	
62	Personal Computer with latest configuration and multimedia system	4 Nos
63	Laser printer	1 No
64	External Modem	1 No.
65	Broadband Connection	1 No
66	Optical fibre test bench & Test kit	1 No
67	Scanner	1 No.
68	DVD player	1 No.
69	Network Interface card (NIC) external	1 No.
70	Hub 8 port	1 No.
71	Router 4 port	1 No.
72	Cable TV repeaters	1 No.

C.WORKSHOP FURNITURE:

Sl. No.	Name of the items	Quantity
1	Instructor's table	1 No
2	Instructor's chair	2 Nos
3	Metal Rack 100cm x 150cm x 45cm	4 Nos
4	Computer table	4 Nos
5	Computer chair	8 Nos
6	Printer table	1 No
7	Lockers with 16 drawers standard size	1 No
8	Almirah 2.5 m x 1.20 m x 0.5 m	1 No
9	Black board/white board	1 No
10	Work benches 120.x 400 x 75 cm	4 Nos