

Syllabus
For the Trade
Of
MECHANIC COMMUNICATION EQUIPMENT MAINTENANCE

UNDER CTS

2004

Designed by:-

Government of India
Ministry of Labour (DGE&T)
Central Staff Training And Research Institute
EN Block, Sector-V, Salt Lake City,
Kolkata-700 091.

LIST OF MEMBERS ATTENDED TRADE COMMITTEE MEETING

Sl. No.	Name	Office	
1	S?Sri R. Senthil Kumar, JDT/HOO	CSTARI, Salt Lake, Kol.	Chairman
2	Kalyan Biswas, Manager Project	Webel Communication System Ltd. Salt Lake, Kolkata -91	Member
3	Deepak Jain, Project Engineer	CDAC, Kolkata-	Member
4	Rupak Chatterjee, Sr. Faculty of Computer H/W & Net Work	George Telegraph Trg. Instt. Kol.	Member
5	Surajit Ukil, Scientific Officer	ERTL (ER), Salt Lake, Kolkata	Member
6	T. Mukhopadhyaya, DDT	CSTARI, Salt Lake, Kolkata	Member
7	S.P. Bhattacharjee, DDT	ATI, Kilkata	Member
8	A. Chakraborty, ADT	CSTARS, Salt Lake, Kolkata.	Member
9	V. Babu, ADT	-DO-	Member
10	Sri P.K. Koley, T.O.	-DO-	Member
11	Sri S.B. Sarder, T.O.	-DO-	Member

GENERAL INFORMATION

1. Name of the Trade : Mechanic Communication Equipment Maintenance
2. N.C.O. Code No. :
3. Duration : One Year
4. Entry Qualification : Passed Class 10th Exam. Under 10 + 2 System of Education or its equivalent.

SYLLABUS FOR THE TRADE OF MECHANIC COPMMUNICATION EQUIPMENT MAINTENANCE UNDER CTS

Week No.	Practical	Theory	Engineering Drawing	Workshop calculation & Science
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 to 4	<u>Basic Electricity</u> 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.	<u>Basic Electricity</u> 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, Aluminium, brass and bronze. Solder, Timber, rubber, different types of PVC materials used in electronic industry
5 to 8	<u>Basic Electronics</u> Understanding the specifications of data sheet of diodes, Testing Diodes, diode as	<u>Basic Electronics</u> Semiconductor theory, materials, charge carrier, intrinsic and extrinsic	Free hand sketches of solids viewed perpendicularly to	Use of different sheets, ferrous and non ferrous. Brief

	<p>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.</p> <p>Testing of JFET, MOSFET, testing different types of amplifiers, oscillators and multivibrators, testing ICs and Op-Amps, Micro phone & Loud speakers.</p>	<p>semiconductors, N-type and P-type semiconductors, semi conductor diodes,, classification of diodes, rectifiers, LEDs, Zener diodes, varactor diode, LCDs, SCRs, Diac and Triac.</p> <p>Transistors-bipolar and unipolar, JFET, MOSFET and their characteristics, Amplifiers, oscillators and multivibrators</p> <p>ICs and Operational Amplifiers, Microphone and loud speakers.</p>	<p>their surface and axes. Free hand sketches of nuts & bolts with dimension from samples.</p> <p>Circuits and wiring diagram</p> <p>Explanation of simple orthographic projections 1st angle</p>	<p>description of manufacturing process of steel, copper and aluminium.</p> <p>Metric/SI system, metric/SI weight and metric/SI measurements, units of conversion factors</p> <p>Manufacture of plastic and resins</p>
9 to 12	<p><u>Digital Electronics</u></p> <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><u>Digital Electronics</u></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>		
13 to 15	<p><u>Basic Communication</u></p> <p>Construction and Testing of AM Transmitters and receivers</p> <p>Construction and testing of FM transmitters and receivers</p> <p>Testing multiplexing and demultiplexing</p> <p>Construction of Super heterodyne receivers</p> <p>Unsealed twisted RJ 45 and RJ 11 connectors</p> <p>Different types of UTP cables, coaxial</p>	<p><u>Basic Communication</u></p> <p>Modulation, demodulation, amplitude modulation, frequency modulation and pulse modulation, AM/FM transmitters and receivers, multiplexing and demultiplexing, super heterodyne receivers, PWM, PCM, PSK etc., UTP cables, coaxial cables, & BNC connectors, unsealed twisted cables, RJ 45 & RJ11 connectors, RS 232, USB</p>	<p>Explanation of simple orthographic projections 3rd angle</p>	<p>Meaning of tenacity elasticity, malleability, brittleness hardness, compressability and ductility with examples. The weight of body, units of weights & shop problems.</p>

	cables, BNC connector, RS 232, USB Optical fiber Communication system	Optical fiber Communication system		percentage and its application, shop problems.
16 to 18	<u>Telephony</u> 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 and servicing of cordless telephone Operations of cell phone sets, fault finding and servicing of cell phone sets, IP (Internet Protocol) telephone.	Telegraphy, telephony and radio telephony Intercom, EPABX, Telephone, cordless telephone and cell phone sets.	Simple isometric drawings, isometric views of simple objects such as square, cube, rectangular blocks. Detailed diagram electromagnets. Familiarising and sketching the details of components	Ratio and proportions, shop problems, plotting and reading of simple graphs, works unit of work, energy, power. Applied problems, algebraic symbols, addition, subtraction, multiplication and division, Standard algebraic formula $(a+b)^2$, $(a-b)^2$. simpler simultaneous equations with two unknown variables.
19 to 22	<u>Radio Receivers</u> 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	<u>Radio Receivers</u> 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	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	Specification gravity, balancing examples. Areas of rectangles, circles, regular polygons, Calculation of areas, volume, weight of simple solids, cubes,

	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 Walky talky	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 walky talky.	numbers and alphabets	squares, hexagonal prisms shop problems
23 to 26	<u>Television</u> Demonstration of Colour TV, Identification & uses of different controls, identification & uses of different controls, Identification, study and test points of tuner, VIF, Video	<u>Television</u> Explanation of colour TV, Block diagram, explanation of circuit description and test points of tuner, VIF, AGC, video amplifier, synchronization,	Drawing of various Electric circuits with BIS symbols of circuits, Series and parallel circuits,	Heat and temperature thermometric scales, Fahrenheit, centigrade and their

	<p>amplifier, synchronous circuit, sweep circuit, picture tube, sound section, fault finding, troubleshooting and servicing of colour TV system</p> <p>Colour Monitor LCD monitor and their fault findings.</p>	<p>sweep circuit, matrix, picture tube, sound section, power supply, trouble shooting and servicing of colour TV</p> <p>Colour monitor/LCD monitor and their fault finding</p>	<p>power transformer instrument transformer etc.</p>	<p>conversion Kelvin reamer Celsius.</p> <p>Meaning of stress, strain, modulus of elasticity, ultimate strength B-11 curve.</p>
27 & 28	<p><u>Facsimile</u></p> <p>Identification of switches, controls and connectors of fax machine</p> <p>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</p>	<p><u>Facsimile</u></p> <p>Working principles of facsimile and application of facsimile</p> <p>Fault finding and troubleshooting of facsimile.</p>	<p>Symbols as per different semi conductor devices, LDR, VDR Thermister & their use in circuits</p> <p>Drawing of AM, and FM modulated wave at various modulation</p>	<p>Meaning of stress, strain, modulus of elasticity, ultimate strength B-11 curve, simple problems on lines, angles, triangles and circles. Basic Trigonometry</p>
29 to 32	<p><u>Microwave Radio Communication</u></p> <p>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</p>	<p><u>Microwave Radio Communication</u></p> <p>Study of microwave communication system, Radar, satellite communication, concept of transponder, geostationary satellites, KU, KF band, HUB, V-sat, CMDA, GSM & Mobile technology</p>	<p>Exercise on blue print reading, Connection of ammeter voltameter, wattmeter KWh meter with ISI symbol, circuit reading and drawing of different stages radio receivers</p> <p>Drawing of Class A & B amplifiers, different power output stages of Push pull complementary etc..</p>	<p>Logarithms, use of log tables.</p> <p>Problems on mensuration</p> <p>Atmospheric pressure, pressure gauge absolute pressure properties of matter</p> <p>Trigonometric tables and applied problems</p>

33 to 36	<p><u>Cable TV</u> 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 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)</p>	<p><u>Cable TV</u> 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 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 analysers, its operation & uses, fault finding methods in cable TV network, procedure of removing snags etc. DTH</p>	<p>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.</p>	<p>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</p>
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37 to 40	<p><u>Computer</u> Different types of mother boards, Expansion of slots (Display), different types of cards, HDD drive, FDD 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.</p> <p><u>Operating system</u> Working with MS DOS, DOS commands, operating floppy disks, copying deleting, renaming files from hard disks and floppy disks, practicing dos commands, formatting Demonstration and hands on booting process. Booting computer in DOS and Windows. MS Windows operating system Different operations of windows system Control panel and other accessories.</p>	<p><u>Computer</u> 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. Familiarisation of MS DOS, windows, linux, Unix etc. Different Booting</p>	<p>Drawing of AM, FM modulated wave at various modulation Drawing of TV block diagram Drawing block diagram of CRT, Socilloscope and Picture Tube Drawing of Video amplifier circuit.</p>	<p>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.</p>
41 & 42	<p>LAN operations, installing server, clients, booting system from LAN, Partitioning the server, creating login, password, connecting nodes, installing of software, backup Trouble shooting and servicing of LAN connection.</p>	<p>LAN, WAN and Hub, concepts and their applications Different types Protocols and their applications.</p>	<p>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.</p>	<p>Frequency calculation of RC and LC circuits Resonance Calculation of RC time constant AGC circuit</p>

43 to 46	<u>Internet</u> Operations, browsing, downloading messages, pictures from internet, sending and 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	<u>Internet</u> Operations and applications of 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 internet connections.	Block diagram of Computer Drawing of different types of Antenna Drawing of wave propagation Satellite waves etc.	Binary and hexadecimal number system Boolean algebra Truth tables and logic gates problems
47	Industrial Visit			
48 to 49	Project work			
50 to 51	Revision			
52	Test			

Social Studies: The Syllabus has already been approved and is same for all trades

LIST OF TOOL & EQUIPMENT FOR THE TRADE OF MCEM
For a batch of 16 trainees

Sl No.	Name & Description	Quantity
1	Fire extinguishers	2 Nos.
2	First Aid kit	1 No.
3	Artificial respiration chart	4 Nos.
4	Work benches 120 x 400 x 75 cm	4 Nos.
5	Computer tables	4 Nos.
6	Printer tables	2 Nos.
7	Steel almirah	4 Nos.
8	Instructors table	1 No.
9	Instructors chair	1 No.
10	Computer chairs	8 Nos.
11	Rubber gloves pair	2 pairs
12	DC Regulated power supply (CWCC 0-30V/24 dual)	4 Nos.
13	Dual trace Oscilloscope 100 MHz	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	Tweezer	4 Nos.
43	Colour TV set (Different types)	4 Nos.
44	Colour pattern generator	1 No.
45	Field strength meter (portable)	1 No.
46	dB meter	1 No.
47	Degaussing coil	1 No.
48	Yagi array antenna	1 No.
49	Dish antenna	1 No.
50	Radio receiver set (AM/FM)	4 Nos.
51	RF Generator with audio modulation facility	2 Nos.
52	Function generator	4 Nos.
53	Telephone	2 Nos.
54	Cordless telephone	2 Nos.
55	Cell phone	2 Nos.
56	Telephone answering machine	2 Nos.

57	Telephone analyzer	1 No.
58	Fax machine	2 Nos.
59	Satellite receiving system	1 No.
60	Intercom system	1 No.
61	P.A. System	1 No.
62	Microprocessor trainer kit	1 No.
63	Personal Computer – Pentium IV, 4 GHz, 256 MB DDR/SD RAM, 40GB HDD, 1.44MB FDD, 52x CD Drive, 10/100 KBPS Ethernet card, 15” Colour monitor, PS2 Key board, PS2 Mouse, CD Writer	4 Nos.
64	Desk jet printer	2 Nos.
65	Modem Internal/External/DSL Modem	1 each
66	Modem for ISDN	1 No.
67	ISDN Connection	1 No.
68	Optical fibre test bench & Test kit	1 No.
69	LCD Monitor	1 No.
70	Combo driver	1 No.
71	Scanner	1 No.
72	DVD player	1 No.
73	Network Interface card (NIC) external	1 No.
74	Hub 8 port	1 No.
75	Router 4 port	1 No.
76	Cable TV repeaters	1 No.
77	Set of Box & DTH	1 No.