SYLLABUS FOR THE TRADE OF
MECHANIC-CUM-OPERATOR ELECTRONIC COMMUNICATION SYSTEMS UNDER APPRENTICESHIP TRANING SCHEME.

Period of Training:- 3 Years.

The period of training for this trade is 3 years. The first two years training should be the same as the practical operations/skills of the two years course for the ITI trainees of trade Mechanic-cum-operator Electronics Communication Systems. For the remaining period i.e. in 3rd year the shop floor training would include the operations/skills as per the syllabus for this trade.

(The syllabus for this trade should be considered as a guide for imparting apprenticeship training according to the facilities available in Industry/Establishment).

List of operations/skills to be learnt during Apprenticeship Training:

1. First Year:

   The practical training during the first year of Apprenticeship Training should have the same operations/skills as that of the first year of the two year course of the ITI in the trade of Mechanic-cum-Electronic Communication System using the Tools/Equipment prescribed for this trade.
2. Second Year:-
   The Practical training during the second year of the training should also have the same operations/skills as that of the second year of the two year course of the ITI in the trade of Mechanic-cum-operator Electronic Communication Systems. Using the Tools & Equipment prescribed for this trade.
3. Third Year:-
   In the year of Apprenticeship Training the apprentice will receive Shop Floor Training with special reference to safety, manufacturing process, general testing, and maintenance techniques of electronic components and equipment etc. He should develop his method of work, speed, accuracy and finish in jobs, which would normally consist of operations/skills already learnt by him earlier. Also, the apprentice will receive Shop Floor Training in one of the major areas of activities of the industry/establishment, which would fall in at least any one of the identified group in this syllabus.

Common Shop Floor Training (4 Months Approx.)

1. Safety: Safety precautions, first aid and artificial respiration, elements of fire fighting-various types of fire fighting equipment. Safety from Lightning and Static effect.
2. Manufacturing Techniques/Processes: The shop floor training to be given in as many manufacturing techniques/processes as possible depending upon the facilities available in the industry concerned e.g.
   (i) Soldering brazing and welding
   (ii) Wire stripping & forming
   (iii) Sheet metal working, punching and drilling
   (iv) Finishing Processes-polishing, buffing, spray painting
   (v) Electrode position of metals on non-conductors.
   (vi) Electroplating processes
   (vii) P.C.B.-single layer-multilayer
   (viii) Bakelite and plastic molding

3. General Testing
   (a) Testing of components such as :

(i) Resistors
(ii) Coils
(iii) Capacitors
(iv) Ferrite components
(v) Transducers
(vi) Crystals
(vii) Relays
(viii) Micro-switches
(ix) Plugs & sockets
(x) Active components
(xi) Plated metal parts
(xii) SMD Devices

(b) Bulk testing of Electronic Components using Test Rigs & Jigs.

(c) Use of Test Instrument such as :

(i) Insulator Tester
(ii) Transistor Tester
(iii) I..C. Tester
(iv) Logic circuit Tester
(v) Micro-Processor Tester
(vi) PLC Circuit Tester
(vii) In circuit Tester
(viii) CRO
(ix) Spectrum Analyzers
(x) Network Analyzer
(xi) Frequency Counter
(xii) High Freq. Power Meter
(xiii) RF Signal Generator
(xiv) Distortion Meter
(xv) PC Based Diagnostic Systems
(xvi) Cable Fault Locator and OTDR
(xvii) Optical fiber Splicing and Jointing Device
(xviii) PCM Channel Analyzer etc.
(xix) Wave Soldering and Dip Soldering

4. Inspection
   Step-wise and final inspection procedures and other quality control techniques.
5. Maintenance

(a) Wiring of an electronics maintenance/test bench

(b) Modern trouble shooting sequences & techniques for electronic equipment.

(c) Replacement of defective components-

1. Simple electronics circuits on chassis
2. P.C.B. circuits.
3. Hybrid circuits

(d) Care in replacement of sockets for-

1. Transistors
2. I.Cs.
3. SMD

6. Transformer & Coils
    (a) Care and maintenance of the following transformers:
        (i) Power
        (ii) A.F. – Input – driver-output
        (iii) I.F.
        (iv) R.F.

MAJOR GROUPS

(At least One Group to be covered during shop-floor training -8 months approx.)

Shop Training is assembling, aligning, testing and serving of any one or more of the following Groups.

Group – A TV and Radio Broadcasting System

Manufacturing/repairing, Maintenance, operation, Installation and Testing of following equipment used in TV and Radio Broadcasting system along with study of associated Measuring Instruments

(a) Radio Transmitter & Receiver (Transistor & IC Versions)
(b) Black & White T.V. Receiver (Transistor and IC Versions)
(c) P.A. Systems, Stereo Amplifier System etc.
(d) Color T.V. Receivers.
(e) T.V./Radio Transmission and Reception equipment.
(f) Satellite Earth Station with Antenna Tracking
(g) T.V. Studio Equipment.

Group – B Civil Aviation and Navigation Electronic communication System.

Manufacturing/repairing, Maintenance, operation, Installation and Testing of following equipment used in Navigation and Aeronautical System along with study of associated Measuring Instruments.

(a) Radar
(b) Aeronautical Equipment.
(c) Navigation Equipment.
(d) Satellite Based Communication
(e) Global Positioning System

Group –C :- Telecommunication Transmission System

Manufacturing/repairing, maintenance, operation, Installation and Testing of following Telecommunication transmission Equipment along with study of associated Measuring Instrument.

1. Open wire Carrier System
2. Co-axial System
3. Analog/Digital Radio Communication System (VHF/UHF/Microwave)
4. Multiplexing: FDM, TDM Multiplexing including Higher Order Multiplexing.
5. Optical Fiber System
6. Satellite Communication

Group – D:- Telecommunication switching System

Manufacturing/repairing, maintenance, operation, Installation and Testing of following Telecommunication switching equipment along with study of associated Measuring Instrument.

1. PSTN and ISDN: Different subscribers Instruments, Intercom equipment, EPABX, Mechanical and Electronic and Digital Exchanges.

2. Mobile Communication System: Cellular, Pager, Wireless Local Loop System. Global Positioning System. etc.
3. Data Communication System.

SYLLABUS FOR RELATED INSTRUCTION

Related Instruction should be imparted to all apprentices during the entire period of training. The syllabus given for related instruction should be considered as a guideline.
The syllabus to be taught to the apprentices in related instruction would be under the following headings:

(1) Trade Theory
(2) Technical Calculations and Estimating.
(3) Engineering Drawing.
(4) Industrial Development.

The contents of the syllabus in the above headings during first two years should be the same as the two years training course for the ITI trainees in the trade of wireless Mechanic cum Operator.

THIRD YEAR

1. Trade Theory (3 hours per week or 150 hrs. per year approx.)
   (The number of hours to be spent on the different topics in the Trade Theory has to be adjusted. The hours indicated are flexible and only intended as a guide.)
   (1) Safety at work
   Safety devices and measures in handling electrical and electronic equipment. Fire fighting equipment
   (2) Revision of the work of previous two years.
   (3) Small Motors : Constructional features, principle of operation and applications of fractional horse power motors and micro motors.
   (4) Electro Mechanical/Magnetic Devices & Components :
   Various types of relays and their applications.
   (ii) Micro switches, limit switches and other types of switches and their applications in electronic systems.
   (iii)Transformers: Input, Output, power, driver EHT & pulse transformers, their windings and applications.
   a. Plugs, sockets, multipine connectors, PCB connectors, R.F. & A.F. connectors, transistor and I.C. sockets.
   (5) Electronic Devices
   Passive Devices

Various types of resistors, their rating and performance characteristics, Various type of coils such as A.F. , I.F. and I.F. coils, various types of capacitors such as electrolytic, paper, mica. Ceramic, tantalum, polyester, strophes, oil filled etc. their performance
Ferrites: Ferrite components and their applications.
Insulators: Electrical properties of ceramic, plastic bakelite, mica and other insulting materials and their application in electronic component and systems.

Active Components:

Principal of operations and performance characteristics of devices such as, CRT, (including picture tubes), semi-conductor diodes (sneer, rectifying , detection, tunnel, switching diodes, gun diodes, aviator diode and photo diodes) thermostats, VDRs, silicon and Germanium transistors, EFTs UJT, DIACs, TRIACs etc. and integrated circuits, Surface Mount Devices. Application if the above components in common electronics equipment. Display devices-Nixie tubes, Led, LCDs etc.

(6)Electronic Modules

Operating principle, testing and maintenance of electronic modules such as :

(i)Rectifier
(ii) Amplifier modules
(iii) Detector modules
(iv) Modulator modules
(v) Oscillator modules
  (a) Sine wave
  (b) Square wave
  (c) Saw Tooth Wave
(vi) Mixer modules
(vii) Differentiating modules
(viii) Integrating modules
(ix) Logic circuit modules
(x) Multivibrator modules
(xi) Recorder modules
(xii) Timer modules
(xiii) Voltage Regulator modules
(xiv) Micro-processor modules
(xv) PLCC

(7) System Assembly:

General principles of the working and block diagrams of systems such as :
(i) TV and radio Broadcasting Equipment.
(ii) TV (Black and White)/ TV (color)
(iii) P.A. systems
(iv) Tape recorders
(v) Wireless Communication systems.
(vi) Exchange: Electronic and Digital
(vii) Telecommunication Transmission and Switching Equipment.
(viii) Navigation and Civil Aviation Radio Equipment.
(ix) Satellite Communication
(x) Radar Communication
(xi) Optical Fiber Communication

(8) Testing and Calibration:

Testing procedures for domestic and professional electronic equipments.
Calibration standards
ISI standards for various electronic equipment.
Quality testing of components and systems.

9) Maintenance and Servicing :

Trouble shooting techniques, modern techniques etc. proper use of electronic test instruments/equipment for servicing electronic systems, Use of test rigid & jigs, component substitution in handling of P.C.B. circuits using Transistors,ICs, SMDs circuit etc.

General manufacturing techniques adopted to be studied for the processes such as :
(i) Printed Circuit Boards- Layout, Manufacture etc.
(ii) Soldering Techniques, Brazing, Welding etc

(iii) Metallic and Optical Fiber Jointing Techniques
(iv) Electroplating-Anodizing, Nickel, Plating, Galvanizing etc
(v) Electro-deposition of metals on non-conductors.
(vi) Carpentry work-fret working machines. cabinet making etc
(vii) Bakelite and plastic molding
(viii) Sheet metal work – shearing, punching.
(ix) Thread cutting – use of taps and dies.
(x) Vacuum impregnating imaging

1. Review of calculation taught in the first two years.
2. Use of Logarithmic tables for all technical calculation.
3. Trigonometry – use of trigonometric tables, simple problems in basic Trigonometry.

4. Slide rule – use in technical calculation.
5. Electronic desk calculators: use in technical calculation

6. Simple calculation on

(i) Rating, efficiency etc. of smalls motors, transformers.
(ii) Rating of resistors.
(iii) Frequency response, amplification, biasing, etc. of amplifiers.
(iv) Choice of rectifier, determination of rating etc.
(ii) Simple LCR circuits, resonance and oscillators etc.
(vi) Coils, Q. factors, mutual inductance
(xi) Polishing, buffing etc.

II. Technical calculation and Est. etc.

(vii) Path loss calculation.
(viii) Antenna Height calculation antenna gain, efficiency, radiation resistance etc calculation MUF and critical frequency calculation etc.

7. Estimating the cost of

(i) Electronic communication equipment and associated Measuring Instruments.

III. Engineering Drawing

(i) Revision of previous two years work.
(ii) Blue print reading
(iv) Code of practice for general Engineering Drawings according to BIS (IS: 696-1960)
(v) Undertaking of basic tool assembly drawings.
(vi) Free-hand sketching of actual parts of simple elctrical and electronic components.

IV. Industrial Development

(i) Introduction to Lab our Laws, Factories Acted, Trade Unionism; Apprentices Acts and Rules, Indian Electricity Act.
(ii) Evaluation of Indian Electronics and Instruments Industry. Present capability of Indian Elect - Industry in the production of various electronics components, products etc.
(iii) Professional Associations and Government Agencies for promotion of Electronic Industry In India.
(iv) Procedure for setting up of industries, scope for self employment etc.

Note-I All the Tools and Equipment enlisted in the syllabus should be of standard company and should Be used while carrying out the relevant Practical if not mentioned equipment required Column.

Note-II Any institute or establishment implementing this trade may use the equipment in place of the tra Inner.

Note-III As per the Industry requirement and employment opportunity the training Institute may include The new Technology/Equipment to come in addition to the existing enlisted tool & equipment

Note-IV Institute should allot as much as project work to individual trainer for stereo-amplifier, Eliminators, commercial LED display Radio, T.V., Musical toys etc.

Note-V Industrial Visit or Computer Aided Teaching should be arranged for the equipment which are Not available in the Institute as well as latest technology if not mentioned in the Syllabus.

List of Probable Suppliers of Equipment

1. **M/S FOX Radio**
   9, Mandeville Gardens
   APT-5F, Calcutta-700091
2. **Future Tech**
   412, Cheney Trade Centre, Park Lane.
   Secundrabad (AP)-500 003
3. **M/S Siemens Ltd.**
4. **M/S Philips**
5. **M/S Punwire**
   Mohali, Chandigarh.
6. **M/S ECIL,Hyderabad**
7. **M/S Indian Telephone Industries, Bangalore**
8. **M/S Falcon Enterpries**
   C/2, 1st floor, New Satnam C.H.S.
   Parsiwada, Andheri (East), Mumbai -400099
9. **Arroue Electronics India Ltd.**
   34/4, Meanee Avenue Tank Road
   Bangalore -560-042
10. **INDE Enterprises,**
    745, Sector-8 B, Chandigarh
11. **Advance Electronics Industries Estate**
    Bhandup (W), Mumbai -400078.

12 Scientific MES-TECHNIK Pvt. Ltd.
1st floor, 14, Uday Park, New Delhi -49

LIST OF TOOLS AND EQUIPMENT FOR THE TRADE OF MECHANIC-CUM-OPERATOR ELECTRONICS COMMUNICATION SYSTEMS

SL.NO.	DESCRIPTION	QUANTITY
1	2	3
TRAINEES KITS		
1	Combination pillar 15 cams insulated	16+1
2	Lang nose insulated pillar 15 Cams	16+1
3	Diagonal cutter 15 cams insulated	16+1
4	End cutting nipper insulted	16+1
5	Tweezers 10 cams insulated	16+1
6	IC Tweezers/Puller	16+1
7	Knob screw driver insulted 10cms	16+1
8	Screw driver of 60nos Phillips	16+1
9	Knife electrician 150 mm	16+1
10	Adjustable spanner /ranch 15 cams	16+1
11	Wire striper	16+1
12	Pocket Millimeter	16+1
13	Soldering Iron 25 watt	16+1
14	Neon Tester	16+1

SHOP OUTFIT PER UNIT

SL.NO	NAME OF EQUIPMENT	QUANTITY
1	2	3
1	Fire extinguisher	2 Nose
2	First Aid Kit	
3	Rubber Mat 180 X 45 X x2.5 cm	
4	Rubber gloves pair	
5	Steel rule 30 cm	
6	Steel rule 60 cm	
7	Centre Punch 10 cm	
8	Spanner Set Double ended	2 Nos.
9.	Box spanner set of 8 nos.	2 sets
10.	Drill Brace 10 cm. chucks with bit Set.	1No.
11.	Electric drill 6 cm. chuck with bit set.	1“
12.	Hacksaw frame adjustable std size	4 “
13.	Hammer Ball peen 250 gram.	4 “
14	Mallet/Nylon faced hammer 500 grams	4 “
15.	Files assorted smooth & rough 20 cms.	24 “
16	Needle file set of 12	2 sets
17.	Bench Vices 5 cms. Jaw	2 Nos.
18.	Bench Vices 10 cms. Jaw	2 “
19.	Tap set 2 mm. to 10 mm.	1 set
20.	Dies set 2 mm. to 10 mm.	1 “
21.	Bench Grinder (Electrical)	1 No

22.	Heat Sink Pliers	4 No
23.	Watch maker Screwdriver set	4 sets
24.	Head Phone 1k.ohm impendence	8 No
25.	Allen Key	2 sets
26.	Wire gauge	1 “
27.	Micro-meter 0-25mm out side	4 Nos.
28.	Vermeer Caliper 20 cm	4 Nos.
29.	Soldering iron 25 w/230 v	8 Nos.
30.	Soldering iron 10 w/230 v	8 “
31.	Soldering iron 35 w/230 v	4 “
32	Soldering iron 65 w/230 v	2 “
33.	Permanent Bar Magnet type 15 cams	4 Nos
34.	Electro Magnetic Relays assorted	1 each type
35.	Battery lead acid 12 V/Heavy duty	2 “
36.	Battery charger 10 Amp. Cap.	1 No.6.12 24 taping
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 various range	10 “
42.	Voltmeter DC & AC various ranges	15 Nos
43.	Micro phone Assorted types	8 “
44	Loud speaker assorted “Z” & pin	3 “
45	Loud speaker Multitester	1 no

46	Insulation tester DC 1000 V	1 Nos.
47	Signal Generator upto 1.3 GHz.	2 Nos.
48	Audio frequency Two Tone Generator (800 Hz and 1800 Hz.)	2 “
49.	R.F. put-put meter 50 watt.	1 “
50	Millimeter with high sensitivity	2 Nos.
51	Oscilloscope 100 MHz. (Non-Storage)	2 “
52.	Digital LCR Q-meter	1 No
53	1.1 GHz Digital Frequency counter	1 No
54	Field Strength meter (V.H.F)	1 “
55	Digital millimeter 3 ½ digit With transistor, diode and capacitor	2 “
56	Digital Line Frequency	1 No
57	Linear/Digital IC Tester Micro processor based.	1 “
58	Variable power supplies 0-50 VDC. 4A	4 Nose
59	Portable Digital Storage Oscilloscope 100 MHz.	1 Nos
60	Push Button Telephone Tester	4 “
61	Telephone Dialer (Push button, Cordless)	1 each
62	Telephone Handset Tester	1 No
63	Telephone Analyzer	2 Nos
64	PCO monitors	2 Nos
65	Call Conference Unit	2 Nos
66	Stereo Type Tape Recorder	1 No
67	P.C.B. Making Kit complete	2 “
68	Temperature controlled soldering Station	4 Nos.
69	Temperature controlled disordering Station	4 Nose
70	Magnifier 4 “With stand for soldering Check	2 Nos

71	Electronic Devices Characteristic Checking Model (Diode, Transistor, MOSFET, FET, and Diac, Triad, etc.)	2 Nos. (for each)
72	Universal Micro-Processor 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 full system	4 Nos
75	SMPS Trainer kit	
76	AM/FM Modulator & demodulator demonstrator	2 Nos
77	Pulse Code Modulation/Demodulation	2 Nos
78	Digital Communication training system	2 Nos
79	Fiber Optic Trainer	2 Nos
80	Fiber optic Laboratory Kits	1set
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) Trainer	2 nos
85	5 Element Yagi Ant.	
86	VCR	
87	Color TV 21”	
88	OHP	
89	RF Millie Voltmeter	
90	RF Modulation Meter	
91	Radio Communication Analyzer	
92	Distortion Analyzer	
93	DTMF/CTSSS Signaling test kit	

94 Portable Related Technical Films

95 Trade Related Technical Films

96 Components storage box

97 Analog and Digital communication train

.

GENERAL INFORMATION

NAME OF THE TRADE	*:*	*Mechanic-cum-operator Electronics Communication Systems.*
ENTRY QUALIFICATION	*:*	*Passed 10 class examination under 10+2 System of Education with Science Having Physics and Math. As subject Or it's Equivalent.*
N.C.O.	*:*	
DURATION OF CRAFTSMAN TRANING	*:*	*2 Year.*
DURATION OF APPRENTICESHIP TRAINING.	*:*	*3 Year including Basic Trg.*
REBATE	*:*	*Trainees who have passed The Trade "Mechanic cum Operator Electronics Communication System " Under CTS will be Eligible to get 2 Years Examination in ATS.*
APPRENTICESHIP RATIO	*:*	*1:5.*

A c h i e v m e n t

I. After Completion of 1st Year of Training the Training should be able of to

i) Identify the Various Active and Passive Components. In Electronic Circuits.

ii) Master soldering and disordering various components.

iii) Understand the working of principles of different electronic devices/Circuits.

iv) Handle basic measuring Instruments.

II. After completion of IInd Year the trainees should be
Able to understand the working principle of Various Communication Equipment
And able to operate them.

III. After completion of 3rd Year the trainees should be able
To understand the working of various Communication
Equipment and associated measuring Instruments available
In the industry/Establishment and able to
Operate, maintain and repair them.

.

LIST OF MEMBERS PARTICIPATED IN THE TRADE COMMITTEE MEETING FOR THE TRADE OF "WIRELESS MECHANIC CUM OPERATOR"
Held on 08.05.1998 AND 05.06.98

SI. *Name*. Designation & *Organization*
S/Sri

1. *S.R .Majumdar*
   Director,CSTARI, Calcutta

2. *Col. S.B.Nag*
   Quality Assurance Defense, Calcutta
   Commissioner Road, Hastings

3. *A.K Saha.*
   Dy. General Manager, ECIL (DOE)
   Block Street, Cal. – 16

4. *M.M.Nigam*
   Sr. Manager (Engg.)M/S Philips, Block Gp,
   Sector-Vestal Lake, Calcutta – 91

5. *S.Mukherjee*
   Sr. Manager (Egg.)M/S Philips, Block GP,
   Sector-V,Salt Lake , Calcutta – 91.

6. *Gulab Chand*
   Engineer, Regional Monitoring, Headquarter (E.R)
   Min.of Communication,Gopalpur,
   24 Pgs (South) – 743382

7. *Dipankar Datta*
   Wireless Regional Monitoring Organization
   Dept. of Telecommunication, Min. of Communication

8. *N.K .Das*
   Director, NIC,Bidyut Bhavan , Salt, Calcutta – 91

9. *Indrani Majumdar*
   Chief Executive, For Radio, Calcutta – 19

10. *N.Srinivasan*
    Superintending Engineer, AIR & T.V
    Akashwani Bhavan, Calcutta – 1.

11. *S.k Arora.*
    Dy Director (Egg)
    AIR ,Akashwani Bhavan, Calcutta -1.
12. *Anjan Chaudhriy*
    Sr. Manager/s Siemens, Salt Lake , Calcutta – 91.

13. *S.Naskar*
SSO, CETE. Calcutta

14. *C.S.Murty*
ADT, Dasnagar, Calcutta

15. *Anjan Karmakar*
Project Engineer/S WEBEL Electronic
Communication System Ltd., Salt Lake , Calcutta – 91

16. *Ms. Nupur Das*
Asstt. Engineer, M/S WEBEL Electronic
Communication System Ltd. , Salt Lake, Calcutta – 91.

17. *B.C .Pal*
Dy. Director, DIT, Govt. of West Bengal
Bikash Bhavan, 10th Floor ,North Block,
Salt Lake ,Calcutta -91

18. *R.M Sinha*
Joint Director of Training, CSTARI, Calcutta-91

19 *D.P Gangly*
Joint Director of Training, CSTARI, Calcutta -91

20. *T.Mukhupadhyay*
Dy. Director of Training, CSTARI, Calcutta-91

21. *B.K.Chattarjee*
Asst. Director of Training, CSTARI, Calcutta-91

Member Secretary

1. *G.Giri*
Asst. Director of Training, CSTARI,
Calcutta-91.

Suggestion Received through Letter From

1. *DTE. DTE & IT, Punjab*
Plot No. 1, Sector 36A
Chadigarh.

2. *Fox Radio*
9, Mandeville Gradens
APT-5F , Calcutta-91.

3. *Indian Air Lines*
Calcutta.

SYLLABUS FOR THE TRADE OF MECHANIC-CUM-OPERATOR ELECTRONIC SYSTEM UNDER CRAFTSMENSHIP TRAINING SCHEME

Period of Training: 2 Years.

Note: 1. the syllabus given below is a guide for the Instructor to prepare their own schedule of Training. The portion in respect of different subjects which has been indicated against different weeks may be adjusted according to the training schedule prepared by the Instructors concerned. While teaching Engineering Drawing, emphasis should be laid on free hand sketching, blue print reading, drawing of circuits and parts related to the trade. Similarly emphasis be given on problems related to the trade according to the syllabus given and team teaching /learning should be encouraged so to develop some social and methodological competency like co-ordination, communication, systematic approach , self responsibility etc. along with technical competency.

BIS Publications for components for Radio communication are available as stands publications. The Instructors should emphasize the use of these specifications during course of teaching.

1	***2***	***3***	***4***	***5***	***6***	***7***
NO. OF WEEK	***TITLE OF TOPIC***	***THEORY***	***PRACTICAL***	***EQUIPMENT REQUIRED***	***ENGINEERING DRAWING***	***WORKSHOP SCIENCE & CALCULATION***
1	*Know your institute*	*(a) Organizations of the institute, of various trades & functions,* *(b) Introductions to national vocational trading system and different scheme link them* *© Types of work, Responcibility to be undertaken, incentives and futures.* *(d) Softy precaution to be observed trade*	*(a) Visits to the Institute* *(d) Care & safe work habits, safety precaution to be demonstrated,*	*(a) Well arranged main ac distribution room of the institute .* *(b) First aid kit first aid chart*	*Basic geometrical drawing st. line , Tri of the insti-angle,Rectangle,polygons etc.*	*Standard Units used in CGS,MNS,and FPS sys.*

		during operation and practice in workshop. *(e) Elementary first aid.* *(f) Types of Earthling and importance*	*Institute Ac distribution.* *© Elementary First aid practice* *(d) Practice of making good ear thing*			
	2	*Introduction to communication*	*Introductions of wireless & technommuctions, Radio Regulation & communication, CCIR Recommendation, Introduction to Modern wireless communication and area of application.* *National and International Radio traffic and Regulation.*	*Visit to worksho p or Industry /organiz ation using or manufa cturing the wireless equipme nt and demonst rate in brief to motivat e the trainees or video show* *More code demonst ration and log Book entry practice . sending and receivin g mores single practice to achieve*	*Well furnished workshop as per list equipment*	*DeDrthougraphicangle of projection 1st. and 3rd.* *Is* *metrics view of square and rectangular object?*

				20 wpm		
3-4	*Hand Tools*	*Identification specifications, uses and maintenance of hand tools*	*Demonstrates the various hand tools as per tool list and allow the trainees in group to discuss and recognize the tools* *Demonstrate simple mechanical fixture , types of screws , washer clamps,revits,taps ,connectors other latest design accessories used* *Fitting, threading , drilling practice* *Simple sheet metal work*	*As per Tool List*	*Study the drawing of tools from charts etc.*	*tudys the Drawing of tools from charts etc.* *nand sketch of nut & bolts.* *Fr*
5-8	*Introduction to Electricity*	*Matters: Condustor,semic aondustres ,Insulators,Gene ral electric principals , Electronics theory, Electrical units, Ohm's law, Ampere's lawks, kvl law and their application , superconductivit y*	*Identification of conductors, insulators, break and continuity test, use of millimeter for voltage and current measurement, Earth resistance measurement by earth tester.* *Use of volt meter , Ammeter , Watt meter and their connection in actual circuit*	*Analog/ Digital millimet er, Earth tester* *Voltmet er, Ammete r watt meter.*	*Drawing of different electrical symbol /simple circuits practice.*	*JJJCALCULATION of vltage,currentr nt Resistance power using simple circuit ,Dregs*
9	*Resistance*	*Regisistanvity of conductor, temperature effect , skin*	*Identification of diffent type of registers (fixed or vari.) calculation*	*Analog / Digital millimet ers*	*Draw different symbol used for*	*erent parallel and series circuit and equivalent resistance calculation*

		effect, conductance, register parallel and series combination, different types of registers(fixed and variable) and their uses equivalent resistance using nor tons and thevinins theorem *Hermiston and varieties*	*of resistance using color code, conform thought millimeter. practice measurment by millimeter calibrations of standard resistance demonstrations of digital analog millimeter* *Identification of different type of remittances of different type registrations used in a radio receiver.* *Verify lesson between temperature and resistance.*	*Radio receiver PCB mounte d with compon ents*	*resistance in PCC and PCB.* *Draw the front panel of millimeter*	
1 0	*Inductance*	*Inductance , Units of inductance , Inductance in series and parallel co-efficient of coupling , Hysterics and eddy current lesson , Principal of transferor , construction use of core, Transformer lessons , Importance of matching step-up step-down ,principal , simple*	*Identification of different type of indicators used, Identification of transformer primary or secondary, testing coil and setting.* *Demonstrations of self and mutual induct Nance* *Demonstration on a radio receiver PCB for identification inductors used* *Calibration of St. inductance testing of transformer*	*Millimet er* *Radio receiver PCB*	*Draw the different Inductance circuit symbols and transformer symbols and circuit drawing*	*Equivalent inductance calculation transformer ratio, Voltage loss etc. calculation.*

		calculation of turns rations, power primary and secondary , type of course to be used in L.F. HF/VHF . use of iron core air core ,ferrite core inductors, magnetic energy storing	*and chokes by resistance analysis*			
11	*Capacitance*	*Explanations of capacitance and capacitive resistance, dielectric constant, types of capacitor, permittivity. Dielectric strength breaks down voltage reactance in series and parallel. storing of entering in capacitor*	*Identification of type of condensers used and color code their testing and specification calibration of st. capacitance demonstrations on a radio receiver PCB for identification of different type of capacitor used.*	*----do----*	*Draw the different circuit symbol used and parallel series circuit*	*culate capacitance values relationship with V.C.O.* *(CGS MKS and their conversions*
12-13	*A.C. theory*	*Peak. RMS instantaneous , Average values phase defiance , vactor , Introduction reactance or Impedance , Power factory , Reactive and resistive power , frequency ,Time period , Diffent type of wave Eddy current*	*Measurement of low frequency signals in CRO and explain peakrms and average values calculator frequency. Different type waves. Phases ,luscious figure demonstrate of use of CRO*	*Function generator Or Oscilloscope*	*Draw the different wave Luscious fig. Draw the front panel of CRO*	*ılate for frequency period peak RMS and average values of signal.*
14.	*Electro-Magnetism*	*Magnetism & Electromagnetism, Properties of Magnetic Material*	*Demonstration on the properties of P.M. Use of Magnetic Needle.*	*Relays, Buzzer etc.*	*Drawing for Magnetic field Symbol of Relay and contacts.*	*Calculate encies.*

		&Ferrites,Magne-tic Fields, Magnetic Flux Density ,Permeability, Magnetic Moti-on,Force ,Magnetic Effect on Electric Current, Magnetic Field, Principle of Relays, type Adjustment/Main - tenancy & Common fault in Relays, their uses in Communication circuits. *Explanation of Induction &induced E.M.F Faraday's Law's Law, Left hand and Right hand rules.*	*Converting a magnetic material into a Magnet by a Bar magnet.* *Preparation of Solenoid. Preparation of Electromagnet for calling Bell/Buzzer, EM Relay. Testing of Relay, Rewinding and Repair.*			
15-17	*Resonance*	*Explanation of resonance. Series and parallel resonance,CKt.el e-ments, natural resonance. Tuning, voltage gain, Anti-resonance cut. User in electronic ckts. Bandwidth's' factor of coil, passive Filter circuits (LPF, HPF, BPF and BSF), SAW Selectivity, Time Constant.*	*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.*		*Draw the Circuit Symbol of Tank.*	*C*

18	*Motor and Genera-torn*	*Alternators,Principleand Construc-tions, Single and three Phase A.C System, Eddy current.* *D.C Generator Principles, Commentator, Brushes and Construction, Automatic Voltage Regulation.* *Motor Principle, Back EMF, Speed Variation, Classification of Motors and, General Maintenance.*	*Study Different Parts of Alternator and Repair.* *Study of Different part of DC Generator and Repair.* *Starting and Loading of Generator and regulating Voltage.*	*Motor & Generator sets and other accessories.*	*Draw the Different Symbol of different parts motor and Generator. And draw actual circuit.*	*EMF Calculation rent Symbol and Calculation ecification sheet of various motors and Generators.*
19	*Battery*	*Explanation of cells Primary & Secondary Cells General Principles, construction of Lead Acid, Nickel cadmium, Nicked Iron cells, Electrolyte, Initial charging & Discharging Needs & Methods, Specific Gravity, Defects & Remedies, Maintenance free tubular battery , Solar cells, Lithium Cells.*	*Testing of Primary and Secondary cells, Specific Gravity and Voltage measurement, Preparation Electrolyte, Charging of Battery.* *Demonstration on SMPS Unit.* *Demonstration on Solar Panel.*	*Millimeter, Sp. Gravity meter Battery. Battery Charge Battery and Cell Tester.*	*Symbol of Battery and solar cell and circuit connection practice.*	*Calculation for V, I, F for different power source with different cut.*
20-	*Measuring Instrum-ments*	*Moving Coil, Moving Iron*	*Demonstration of MC and MI,*	*MC,MI, Voltmet*	*Circuit drawing*	*Study and calculation of various parameters on*

2 3		*Type, Different Type of Transducers. VTVM,FET Multimeter,Dum etc. Frequency counter, Power meter CRO, AM/FM Signal Generator, and Function Generator Wheatstone Bridge Impedance meter.*	*Voltmeter, Ammeter and Meter CRO, Signal Generators, muleteers, Counter etc. SevicingofMultimter-(Analog) Millimeter. Construction and Calibration of series Ohm Meter.* *Conversion of Millimeter into shut ohm Meter. Conversion of Millimeter into Voltmeter and its Calibration.*	*er Ammeter, wattmeter.*	*different meter connection* *Internal Parts Drawing Practice.*	*speculations sheet of various measuring instruments.*
2 4-3 3	*Semiconductor*	*Semi-conductor Theory, Type of Device and Symbols and uses* *.Characteristics of Diodes, Different type of Rectifiers circuit along with different Filter circuit .AF/IF Detectors.* *PNP and NPN Transistors, Symbols, different type of biasing & mode application, different type of amplifiers & its classification, Oscillators,*	*Video Films on Semiconductor Theory, Identification of Various Semiconductor devices. Testing by Multimeter,Tester.* *Soldering and Disordering Practice.* *Characteristic Check of Diode, Transistor.* *Identification of components in a PCB. (Group).* *Transistor biasing*	*Multimeter,CRO, Trainer for amplifier, Oscillators, Rectifiers.*	*Draw the symbol of different semiconductor devices. Different Tran sister biasing CCT drawing. Different amplifier and oscillator circuit.*	*Voltage and Current gain Calculation frequency Calculation. Biasing voltage calculation using different ccts.* *Study of Component Data Book.*

		Mutivibrators.	*arrangement Application of Transistor as amplifier, Oscillator, SW etc. and testing.*			
3 4- 4 2	*Special Semiconductor Device* *OP-AMP*	*Explanation of characteristics of UJT,FET,MOS,CMOS,SCR,SCS,DIAC,TRI-AC,IC,SMD,ESD ,etc. and application Memory dvices:RAM,ROM,EPROM etc.Optical Device,RF Device , Crystal,PCBs Single and double Layer, PTH abd Multilayer. And application.* *Differential Amplifier, Basic OPAMP Circuit:- Inverting and NON-Inverting Amplifiers, Integrator and Differentiator, Limitation of OPAMP High current, Power and Voltage application, and wave shaping Circuits Active filter Cuts, Study of Manufacturer specifications.*	*Characteristic Check of various Devices.* *Testing in actual application by using trainer.* *Demonstration of characteristic and applications of OPAMP by using Trainer.*	*Trainer using FETCMOS, OP-AMP etc. for Different application.* *Linear/ Digital I/C Tester.*	*CCt Symbol Application circuit Practice.*	*All Calculation related to the different application.*
4 3-	*Power Supply*	*Half wave, Full wave Rectifier*	*Characteristic Check of different*	*UPS Trainer*	*Different type of*	*Input/output voltage calculation, Voltage*

46		*Bridge Rectifier with different filter combination. HT and LT power supply, Voltage Regulation Switch Mode Power Supply (SMPS), UPS. Battery Charge. 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*	*Rectifier Circuits.* *Designing and Mounting, Soldering for different Rectifier CCt and testing (Individual).* *Demonstrate a SMPS power supplying unit and identify, Trade Circuit and conduct tests by CRO and Millimeter.* *Design a SMPS CCt and solar components and test.* *Demonstration of UPS and Identify cuts, Trade Path, Test.* *Testing of power Transformer* *Project Working:+12v Eliminator Design and manufacturing.*	*(On line/off/ K Line.* *SMPS Trainer* *Battery Charger .* *Portable Digital Oscilloscope.*	*Rectifier cct dregs.* *SMPS Power* *Supply CCt Drg.* *Battery Charge.*	*Regulation etc. related to various power cct examples.* *Study & calculation of various parameters of different power supply equipment like CVT,UPS etc.*
47-50	*Solder-ng and Dislodging Technique.*	*Theory of Soldering, different type Soldering and disordering technique for electronic components/SMD Automatic Soldering, Wave Soldering, DIP*	*Soldering and disordering Practice continue. Both Manual and Automatic PCB Repair, Handling of ESD Devices, Bad & Good Solder Check Video Film for SMD*	*Temperature controlled soldering Station etc. DIP, SMD Trainer*		

		Soldering, PCS wiring.	*Soldering.*	*Kits.*		
51-52	*Holiday and Revision/Practice of Previous Topics.*					
53-62	*Digital Electronics*	*Fundamentals of Digital Electronics, Booleans Function, Coding, Logic Gates, Flip-Flops, TT, Counters Registers, Micro-Processors etc. Analog to Digital Conversion and Vice- versa, Multiplexer/Demultiplexer. ICs.*	*Testing of GATES, FF, etc. and Draw the Truth Tables.* *Conduct various Tests for Micro-processor using Trainer.*	*Symbol of Logic Gates, FF, Different cct of Booleans Functions , A/D etc.*		
63-66	*Modulat-ionTheory*	*Basic Principle pf Modulation, Amplitude, Phase and Frequency Modulation, Digital Modulation:- Frequency Shift Keying (FSK),ASK,BPSK,GPSK etc. Different type of Modulator and Demodulator both analog and Digital and their use* *Pulse Code Modulation, PTM,PWM,PAM ,FDM/TDM Multiplexing.*	*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.*	*Trainers for different Modulation Techniqueue,*	*Different Modulator Block diagram and CCt diagram Practice.*	*Calculation output frequencies, ie. Carriers, Sidebands, Phase etc…*

67-72	*Data Communication*	*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 o Operation and instruction Interfaces and Peripherals LAN, WAN, Internetwork Processor: Bridges, Router, Hum, Gateway.*	*Data transfer and Receive Practice, Service Documents.* *Demonstration on different Data communication device and their interconnectivity, Protocols, Call signal Rules.*	*Digital Communication Training System.*	*Block diagram Practice for Data COMM.*	*Bits, Bytes, Character, Word, Data Speed etc. study and calculation of specification sheet of data communication equipment PC & Modem etc.*
73-74	*Radio Wave Propagation*	*Characteristic of Radio waves, Ionosphere, Trophoshere,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 ,*	*RF-RF Response Test.* *Checking and setting AGC gain Margin.* *Field intensity Measurement* *Orientation of antenna both Trans and Receive for max receives signal strength.* *AF-AF Response Test.*	*Two sets of Radio TX/RX.*	*Reflection/Refraction Practice.*	*Path Loss Calculation*

		Principle of Line of sight Communication and factor affecting this , Reflection and Refection.				
7 5-7 6	*Aerials/Antennas*	*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. VHF Ant. Whip Rod Ant. Tower Method of Coupling and Matching to TX RX.Multi Element Yagi Anntana, Dish Ant.,etc. Different Type of Feeder cable and*	*STUDY of different type of AERIALS. Installation Aerials and connecting Link.* *Study of Vertical Aerial and different loop aerials.* *Assembling 5 Element Yagi ANT.* *Study of Different connectors and matching* *Mast/Tower Construction* *Hoisting Antenna. Connector Connecting Practice.*	*Different type of Aerials/ antenna and Matching.*	*Drawing practice for different Radiation Pattern and Antenna.*	*Antenna Parameter ie. Antenna impedance, Gain BW, Power Gain, Efficiency, Directivity.* *Study & calculation of various parameters in the specification sheet of antennas*

		Transmission Line, wave Guide.				
77-78	*Radio- Communication.* *AF STAGE* *IF STAGE* *RF STAGE*	*Basic Radio Transmission and Reception Concept using Block Diagram RF stage, IF Stage, AF stage.* *Class –A, Class-AB, Push –Pull amplifier, Feed Back, different types of coupling, Cascade amplifiers, Audio filter, matching transformer etc.* *Different Type of Microphones and speaker their application theory.* *IF Filter, IF Amplifier, AFC Circuit, IF det. etc. IFT . For matching.* *Different Method of coupling and Matching, RF Amplifier, Mixer, Local oscillators, Filter etc. VCO, PLL.*	*Identification of Different stage of a Simple Radio Tx and Receiver. Identify the different components and Circuit used.* *Testing of different type of microphones and constructional feature.* *Study of AFC/AGC Circuit Alignment of IFT and replacement.*	*AM/FM Dynamic Demonstrator. Or TV Trainer Kit.*	*Block Diagram* *Different Power Amplifier, Osc,AF/IRF CCt diagram Practice.*	*Different Transmission units:-Decibel, Nipper and other derived units Calculation and Conversion, Gain and Attenuation Calculation.*
79-82	*Radio Transmitter*	*Transmitter Theory, Typical Transmitter used for CW,MCW,ISB,DSB,SSB and*	*Testing and monitoring of Tx Power and Freq.* *Tuning of Tank circuit at different*	*Power Meter Freq. Meter/Counter*	*Simple Circuit diagram Practice.*	*Level and loss calculation at different stage* *Study $calculation of various parameters of specification for Receiver*

		Packet Mode, Modulators used. Function of various Stages, operation and Monitoring, Metering and safety Devices, adjustment and Measurement. *Study Of power supply Circuit used.*	*stages, Trans. Local oscillator tuning for power and output freq, degree of modulation setting, drive signal sting at different stages. Adjustments.* *Setting and tuning of 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 cct.*	*Radio Transmitter.*		*and Transmitter.*
83-85	*Radio Receiver*	*Frequency changing and detection Types of mixer, Necessity of Local oscillator and its Generation Stages of Mixing, Image Frequency rejection, AM,FM,& Digital Signal Detectors, Demodulator /Discriminators. LNA etc. Noise.*	*Study of Receiver controls etc* *Receiver Tuning and Receiving Signal circuits and Component and their setting.* *Seletivity,fidelity, NF Signal to Noise Radio test. Power supply cct test* *Project:-Design of radio Rx.*	*AM/FM Dynamic Demonstrator*	*Practice for Radio Receiver CCt.*	*Level Calculation at different stage considering Loss and Gain of device used.*

		Electronics Warfare Jamming and its remedial measure.				
86-89	*Maritime Navigation Aids* *Aeronautical Navigation*	*Direction Finder, Basic Principle Pole Diagram Sense fiding, Gonio meter, calibration and Its use compus, Magnetic campus. Magnetic True Bearing, Radio Beacons, and Basic Knowledge of Radar Beacons Echo Sounder: LORAN, Charts Space Communication bands its use in future.* *Global Positioning System.* *Localizers, Radio Range, Air Traffic Control, Radio Altimeter, Glide Path, Metrological Equipment Radar, Beacon. Instrument Landing System, OMEGA System.*	*Study component location of Direction Finder,* *Study the panel of Direction Finder* *Tuning and hearing Practice on the Direction Finder* *Fault finding* *Study of Auto alarm Equipment and Testing.* *Radio Direction Finding Procedure, Class of Bearing for Fix and Mobile station Sending and Receiving Message Document study in organizations*	*Industrial Visit for different syst.*	*Study & calculation of various parameters of Specification of Navigation equipment.*	
90-97	*Telecommunication*	*Working principle of different type[e of telephone*	*Demonstration on different type telephone instruments.*	*Various Telephone Instrum*	*Drawing Practice for internal Circuit of Telephone Instrument.*	

		instruments, Telephone lines, Auto and Mechanical Exchanges, Working of EPBAX, PCO Monitor, conference phone System, Intercom, Telex Working Principle, FAX, PSTN, and ISDN. *Feature Telephones, Picture Telephone*	*Identification of different Components in the instrument probable faults and repairing* *Operation and Maintenance of small Intercom/EPBAX and console.* *Introduction to Telex System, Demonstration on Electronic TelePrompTer and Practice Demonstration on PCO Call Monitor, Conference System Repairing Practice.*	*ents* *Telepho ne Analyze r. Small EPBAX, TP,* *PCO Call, Monitor , Confere nce System.* *Industri al Visit to be arrange d.*		
	Cables and Cable System	*Jumper wire, Subriber Line cables flexible Wires, Co-axial Cables RF Cables, Power cable, Optical Fiber cables, Flat Cable etc. Optical Fiber Cable System.* *Cordless Telephone, Pager, Cellular Telephone System Working Concept, and users equipment Basic Digital enhanced cordless*	*Identification of different type of Cables and use. Jointing Practice.* *Line Wire Practice with TB Termination.* *Demonstration on Tran receiver Operation and Maintenance.* *Demonstration on cable TV and manual tracking of Ant.* *Industrial vist to be arranged.*	*Industri al to be arrange d* *Fiber Optic Trainer*	*Block Diagram Practice for Different System*	

		Telephone(DECT) Personal Handy Phone System (PHS) Introduction to Satellite Phones. *VHF/VHF/HF Comm. System (Digital/Analog), Microwave system. Satellite Communication Syst,V-SAT.*				
98-99	*Other Wireless System*	*Police Wireless Equipment, Wireless System at Air Port and Their Operation ,Warlike-Talkie ,FM Transmitter and Receiver, Air to air and Air to ground Communication . Data Modem for wireless. TV/VCR Remote Control*	*Demonstration on FM Transmitter and Receiver, Walker-talkie.*	*FM Portable Transrecever hand held , TV/VCR / Remote Control.*	*Study & carination of various parameters of specification for the equipment.*	
100 *102*	*Revision India Trade Test*					

SYLLABUS FOR THE TRADE OF MECHANIC-CUM-OPERATOR ELECTRONIC COMMUNICATION SYSTEMS

Under

Craftsmen Tranining Scheme

And

APPRENTICESHIP TRANING SCHEME.

Govt. of India
Ministry of Labour (D.G.E. & T.)
Central Staff Training And Research Institute
EN. Block, Sector V , Salt Lake City
Calcutta - 700 091